Service Manual 2010

MG3

Version 1.0

This manual provides information on the specifications, the system introduction, the service procedures and the adjustments for the CSA7130,CSA7153 series MG3 Vehicle.

The technicians, worked for the servicing station authorized by SAIC Motor Passenger Vehicle Co., Ltd., can provide better service for the owners of MG3 vehicle based on a profound understanding this manual and related updated Service Bulletins.

You are suggested that please contact SAIC Motor Passenger Vehicle Co., Ltd., if you want to obtain related information mentioned in this manual about the brand, the parts number, and special tools etc.

SAIC Motor Passenger Vehicle Co., Ltd.

Copy Right Reserved

All information received cutoff date is January 2011

Any information contained in this manual are the property of the SAIC Motor Passenger Vehicle Co., Ltd.. No part of this manual may be copied, stored in any retrieval system, or spread by any means (including but not limited in electronic, mechanical, photocopying and recording) without written SMC authorization. This applies to all text, illustrations, and tables (not limited in above) mentioned in this manual.

How To Use This Manual

General

To assist in the use of this Manual, it is divided into sections and sub-sections. The relevant sub-section title is given at the header of each page.

There is a single Contents section at the front of the Manual, which is divided by section and sub-section. The book is numbered from page 1. The page number is given at the bottom of each page.

The individual actions of the repair operations must be followed in the sequence in which they appear. Item numbers in the illustrations refer to the relevant numbered text under the illustration.

Adjustment and repair operations include reference to Service tool numbers and the associated illustration depicts the tool in use. Adjustment and repair operations also include reference to wear limits, relevant data, torque figures, and specialist information and useful assembly details. Each adjustment or repair operation is given a unique Repair Operation number.

WARNINGS, CAUTIONS, NOTES and TIPS have the following meanings:

When encountering a WARNING, you will be asked to take a necessary action or not to take a prohibited action. If a WARNING is not heeded, the following consequences may occur:

- Serious bodily injury or death to the technician.
- Serious bodily injury or death to other technicians in the workplace area.
- Serious bodily injury to the driver and/or passenger(s) of the vehicle, if the vehicle has been improperly repaired.

CAUTION call special attention to a necessary action or to a prohibited action. If a CAUTION is not heeded, the following consequences may occur:

- Damage to the vehicle.
- Unnecessary vehicle repairs.
- Unnecessary component replacement.
- Improper operation or performance of the system or component under repair.
- Damage to any systems or components which are dependent upon the proper operation of the system or component under repair.
- Improper operation or performance of any systems or components which are dependent upon the proper operation or performance of the system or component under repair.
- Damage to fasteners, basic tools, or special tools.
- The leakage of coolant, lubricant, or other vital fluids.

NOTE statements emphasize a necessary characteristic of a diagnostic or repair procedure. NOTE statements are designed to do the following:

- Clarify a procedure.
- Present additional information for accomplishing a procedure.
- Give insight into the reason or reasons for performing a procedure in the manner recommended.
- Present information that will help to accomplish a procedure in a more effective manner.
- Present information that gives the technician the benefit of past experience in accomplishing a procedure with greater ease.

TIP: Gives helpful information.

References

References to the LH or RH side given in this Manual are made when viewing the vehicle from the rear. With the engine and gearbox assembly removed, the crankshaft pulley end of the engine is referred to as the front.

Operations covered in this Manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out. This is of particular importance where safety related items are concerned.

Dimensions

The dimensions quoted are to design engineering specification. Service limits are included where applicable.

Our company are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

Repairs and Replacements

Parts

When replacement parts are required it is essential that only our company's recommended parts are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

- Safety features and corrosion prevention treatments embodied in the vehicle may be impaired if other than SMC recommended parts are fitted.
- Torque wrench setting figures given in this Manual must be used.
- Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.
- The terms of the vehicle warranty may be invalidated by the fitting of parts other than SMC recommended parts.

All SMC recommended parts have the full backing of the vehicle warranty.

SMC Dealers are obliged to supply only SMC recommended parts.

Special tools

Special tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of special tools also helps prevent the potential for damage to components.

Some operations in the manual cannot be carried out properly without the aid of the relevant special tools.

Special tools can be obtained from the following supplier.

Shanghai Xiangzhi Industrial Development Co., Ltd

Address: 17F, Building C, No.900, Yishan Road, Shanghai

Post Code: 200233

Tel: 021-54234810

Contents

General Information 1

General Information 1

General Precautions 1
Safety Instructions 2
Environmental Precautions 3
General Fitting Instructions 5
Ball and Roller Bearings 6
Oil Seals 7
Joints and Joint Faces 8
Locking Devices 8
Screw Threads 9
Fasteners Identification 9
Flexible Pipes and Hoses 11
Fuel Handling Precautions 12
Electrical Precautions 13
Supplementary Restraint System Precautions 14
SRS Component Replacement Policy 20
Air Conditioning System Precautions 21
Air Conditioning Compressor Replacement 23

Vehicle Identification Number 24

Vehicle Identification Number 24
Other Identification Plate Location 25

Lifting & Towing 26

Lifting 26
Vehicle Rescue 27

Lubrication & Maintenance 29

Capacity 29
Fluid 29
Lubricating Fluid 30

Engine 31

Engine Mechanical-1.5 VCT 31

Specifications 31
Torque 31
Parameter 32
Description and Operation 40
System Component Layout 40
Description 56
Operation 58
Service Procedures 59
Refit and Remove of Power Assembly - MT 59
Power Assembly Replacer - AMT 61
Powertrain mounting 64
Flywheel 65
Crankshaft Belt Pulley 66
Timing chain upper cover plate 68
Timing chain lower cover plate 69
Timing Chain 71
Camshaft cover 75
Intake or exhaust camshaft 77
Mechanical tappet 79
Remove of Valve 80
Cylinder Head Assembly 82
Cylinder Head Inspection 85
Cylinder Head Gasket 91
Lower crankcase 93
Connecting rod bearing inspection 94
Piston Inspection 96
Crankshaft Inspection 98
Crankshaft Rear Oil Seal 100
Oil strainer 101
Oil Pump 103
Oil Control Value 104
Engine Oil Filter 105
Oil Pressure Inspection 106
Intake Manifold Gasket 107
Exhaust manifold Gasket 109
Special Tools 111

Engine Mechanical-1.3 BASE 113

Specifications 113
Torque 113
Parameter 114
Description and Operation 122
System Component Layout 122
Description 138
Operation 139
Service Procedures 141
Powertrain Assembly Removal and Installation - MT 141
Powertrain Assembly Removal and Installation - AMT 143
Powertrain Assembly Mounting 146
Flywheel 147
Crankshaft Pulley 148
Timing Chain Upper Cover Plate 150
Timing Chain Lower Cover Plate 151
Timing Chain 153
Camshaft Cover 157
Camshaft - Intake and Exhaust 158

Contents

Mechanical Tappet 161
Valve Removal and Installation..... 161
Cylinder Head Assembly..... 164
Cylinder Head Inspection..... 166
Cylinder Gasket 172
Lower Crankcase 174
Connecting Rod Bearing Inspection..... 175
Piston Inpection 177
Crankshaft Inspection 179
Crankshaft Rear Oil Seal..... 181
Oil Strainer 182
Oil Pump 183
Engine Oil Filter 184
Oil Pressure Inspection..... 185
Intake Manifold Gasket..... 186
Exhaust Manifold Gasket..... 188
Special Tools 191
Engine Cooling System 193
Specifications 193
Torque 193
Parameter 194
Description and Operation..... 196
System Layout 196
Description 198
Operation 199
Service Procedures..... 201
Coolant- drain and fillingup 201
System pressure test..... 202
Pressure sealing cover - pressure test..... 203
Coolant expansion tank 204
Cooling fan..... 205
Cooling fan low speed resistance..... 205
Radiator..... 206
Radiator inlet hose 207
Radiator outlet hose..... 208
Thermostat..... 208
Water Pump..... 209
Special Tools 211
Engine Fuel & Management-1.5 VCT 212
Specifications 212
Torque 212
Parameter 213
Description and Operation..... 215
System layout 215
Control diagram of system..... 216
Description and operation 218
Service Procedures..... 226
Spark Plug-1.5VCT 226
Ignition Coil 226
Engine control module (ECM) 227
Engine Coolant Temperature Sensor..... 228
Engine Oil Temperature Sensor 228
Crankshaft Position Sensor 229
Camshaft Position Sensor 229
Camshaft Phase Modulator 230
Oil Pressure Switch 230
Knock Sensor..... 231
Fuel Rail..... 231
Fuel Injector..... 232
Oxygen Sensor..... 233
Manifold Absolute Pressure Temperature Sensor 233
Charcoal Canister 234
Purge Control Valve 234
Pipe Assembly - Body Underfloor Fuel Lines..... 235
Fuel filter 236
Tank - Fuel 236
Fuel pump..... 238
Fuel System - Depressurise..... 239
Fuel System - Depressurise..... 239
Tank-Drain & Refill 240
Filler Neck..... 240
Switch - Inertia - Fuel Cut Off..... 241
Special Tools 242
Engine Fuel & Management-1.3 BASE 243
Specifications 243
Torque 243
Parameter 244
Description and Operation..... 246
System Component Layout 246
System Control Diagram..... 247
Description 249
Service Procedures..... 257
Spark Plug 257
Ignition Coil 257
Engine control module (ECM) 258
Engine Coolant Temperature Sensor..... 259
Crankshaft Position Sensor 259
Camshaft Position Sensor 260
Oil Pressure Switch 260

Contents

Knock Sensor 261
Fuel Rail 261
Fuel Injector 262
Oxygen Sensor 263
Manifold Absolute Pressure Temperature Sensor 263
Special Tools 264
Engine Manifold & Exhaust-1.5 VCT 265
Specifications 265
Torque 265
Description and Operation 266
System layout-1.5L 266
Description 270
Operation 271
Service Procedures 272
Air cleaner filter assembly 272
Air cleaner element 273
Air intake pipe assembly 273
Electronic throttle -1.5VCT 274
Front exhaust pipe assembly 274
Rear exhaust pipe assembly 275
Exhaust path heat shield 276
Fuel tank heat shield 276
Engine Manifold & Exhaust-1.3 BASE 277
Description and Operation 277
System Component Layout - 1.3L 277
Service Procedures 280
Rear Muffler Assembly - 1.3L 280
Electronic Throttle - 1.3 BASE 280
Engine Electrical System-1.5 VCT 281
Specifications 281
Torque 281
Description and Operation 282
System layout 282
Description 283
Operation 285
Service Procedures 286
Generator 286
Accessory Drive Belt 287
Accessory Drive Belt Tensioner 288
Starter Motor 288
Battery 289
Battery Tray 289
Battery Tray Front Bracket 290
Battery Tray Rear Bracket 291
Engine Electrical System-1.3 BASE 292
Specifications 292
Torque 292
Description and Operation 293
System Component Layout 293
Service Procedures 294
Generator 294
Accessory Drive Belt 295
Accessory Drive Belt Tensioner 296
Starter Motor 296

Transmission 297

Shift Lock Control-AMT 297
Specifications 297
Torque 297
Description and Operation 298
Description 298
Service Procedures 300
Selector Lever Knob - AMT 300
Selector lever assembly - AMT 300
Shift Lock Control-MT 302
Specifications 302
Torque 302
Service Procedures 303
Selector Lever Knob and Boot - Manual 303
Shift Lever Assembly — Manual 303
Automated Mechanical Transmission AMT 305
Specifications 305
Torque 305
Parameter 306
Description and Operation 308
System layout 308
Control diagram of system 319
Description 322
Operation 329
Service Procedures 335
Automated mechanical transmission assembly 335
Transmission control module (TCM) 336
Gear Shift Shaft Oil Seal - AMT 337
Automated mechanical transmission wiring harness 338
Transmission oil Draining and filling 339
Reverse Light Switch 339
LH Differential Oil Seal 340
RH Differential Oil Seal 340

Contents

AMT Transmission Dismantling 341
Drive Shaft Assembly 346
Driven Shaft Assembly 348
Differential Assembly 349
Hydraulic Fluid Topup 351
Electron Hydraulic Kit 351
Clutch speed sensor 353
Oil Pressure Sensor 353
Shift Position Sensor 354
Gear Position Sensor 355
Clutch Position Sensor 356
Accumulator 357
High Pressure Oil Tube 357
Low-pressure Oil Pipe 358
Fluid Reservoir 359
Electric Pump Assembly 360
Solenoid Valve 361
Special Tools 362
Transmission-MT 363
Specifications 363
Torque 363
Parameter 364
Description and Operation 366
System Layout Chart 366
Description 375
Operation 376
Service Procedures 378
Manual Transmission Assembly 378
Gear selecting and shifting shaft oil seal - manual 379
Transmission oil Draining and filling 380
Reverse Light Switch 381
LH Differential Oil Seal 381
RH Differential Oil Seal 382
Manual Transmission Dismantling 382
Drive Shaft Assembly 387
Driven Shaft Assembly 389
Differential Assembly 390
Special Tools 392
Clutch 393
Specifications 393
Torque 393
Parameter 394
Description and Operation 395
System Layout Chart 395
Description 398
Operation 400
Service Procedures 401
Clutch assembly 401
Clutch release bearing 403
Clutch Master Cylinder 403
Clutch slave cluster cylinder 404
Clutch line system bleeding 405
Special Tools 406
HVAC System 407
HVAC Structure 407
Specifications 407
Torque 407
Parameter 408
Description and Operation 409
System layout 409
Description 412
Operation 418
Service Procedures 420
Recovery and Refilling of Refrigerant 420
Compressor 422
Compressor inhalation hose 423
Compressor exhaust hose 424
Air conditioning hard tube assembly 425
Pressure switch 427
Condenser 427
Air conditioning case assembly 428
Evaporator Core 429
Expansion valve 430
Heater core 431
Blower Motor Assembly 431
Blower Resistor 432
Heater Water Inlet Pipe 432
Heater Water Outlet Pipe 433
Oil Cooler Hose 433
Instrument Panel Left and Right Air Outlet Ducts 434
Passenger Compartment Air Cleaner 434
HVAC-ETC 435
Specifications 435
Torque 435
Description and Operation 436
System Layout Chart 436
System Control Chart 438
Description 440
Operation 441

Contents

Service Procedures..... 442
Air Conditioning Controller Assembly - ETC..... 442
Temperature Air Door Actuator..... 443
Mode Air Door Actuator..... 443
Recirculation Door Actuator..... 444
Evaporator Core Temperature Sensor..... 444
HVAC-ATC..... 445
Specifications..... 445
Torque..... 445
Description and Operation..... 446
System Layout Chart..... 446
System Control Diagram..... 448
Description..... 450
Operation..... 451
Service Procedures..... 452
Air conditioning controller assembly - MTC..... 452
Temperature Door Cable..... 453
Mode Door Cable..... 453

Steering System..... 455

Front Wheel Steering..... 455
Specifications..... 455
Torque..... 455
Specifications..... 456
Description and Operation..... 457
System Component layout..... 457
Description..... 460
Operation..... 461
Service Procedures..... 462
Power Assisted Steering System - Pressure Test..... 462
Track Rod Ball Joint..... 463
Power Assisted Steering Rack..... 463
Power Assisted Steering Pump..... 465
Pipe - PAS Pump to Steering Rack..... 466
Return Pipe - Steering Rack..... 466
Power Steering (PAS) system Bleeding..... 467
Steering Wheel and Column..... 468
Specifications..... 468
Torque..... 468
Description and Operation..... 469
System layout..... 469
Description..... 471
Service Procedures..... 472
Steering Wheel..... 472
Steering Wheel Alignment - Adjustment..... 473
Switch Assembly - Steering Column..... 473
Steering Column..... 474
Steering Column Panel..... 475

Suspension System..... 477

Wheel Alignment..... 477
Specifications..... 477
Torque..... 477
Specifications..... 478
Description and Operation..... 479
Description..... 479
Service Procedures..... 480
Four-wheel Alignment..... 480
Front Suspension..... 481
Specifications..... 481
Torque..... 481
Specifications..... 482
Description and Operation..... 483
System Component Layout..... 483
Description..... 486
Service Procedures..... 487
Front Hub Assembly..... 487
Front Hub Bearing..... 489
Front Lower Arm Assembly..... 490
Front Lower Arm Rear Bush..... 491
Front Lower Arm Front Bush..... 491
Front Damper..... 492
Anti Roll Bar..... 494
Anti Roll Bar Bush..... 495
Anti Roll Bar Link..... 495
Front Sub Frame Assembly..... 496
Special Tools..... 498
Rear Suspension..... 500
Specifications..... 500
Torque..... 500
Specifications..... 501
Description and Operation..... 502
System Component Layout..... 502
Description..... 506
Service Procedures..... 507
Rear Damper Assembly..... 507
Rear Spring..... 507

Contents

Rear Hub Bearing 508
H Frame Assembly 509
Tires and Wheels 511
Specifications 511
Torque 511
Reference..... 512
Service Procedures..... 513
Wheel..... 513

Brake System..... 515

Brake 515
Specifications 515
Torque 515
Specifications..... 516
Description and Operation..... 517
System Component Layout 517
Description 520
Service Procedures..... 522
Low Level Indicator Switch-Brake Fluid 522
Master Cylinder and Fluid Reservoir..... 522
Vacuum Servo-Brake..... 523
Brake pedal 524
Brake lamp switch 526
Front brake caliper housing..... 527
Front brake pads 527
Front brake disc 528
Thickness and Run-Out Check-Front Brake Disc..... 529
Rear drum brake 530
Brake system bleeding..... 531
Electronic Vacuum Pump..... 532
Special Tools 536
Park Brake 537
Specifications 537
Torque 537
Specifications..... 538
Description and Operation..... 539
System Component Layout 539
Description 540
Service Procedures..... 541
Handbrake - Adjustment..... 541
Handbrake Front Cable..... 542
Handbrake Lever 543
Brake Module.....544
Specifications 544
Torque 544
Specifications..... 545
Description and Operation..... 546
System Component Layout 546
System Component Layout 547
Description 549
Operation 551
Service Procedures..... 552
ABS Modulator..... 552

Driveline/Axle..... 553

Drive Axle 553
Specifications 553
Torque 553
Description and Operation..... 554
System Component Layout 554
Description 556
Diagnostic..... 557
Diagnosis 557
Mechanical inspection 557
Service Procedures..... 558
RH Shaft & Both Joints..... 558
LH Shaft & Both Joints 559
Outer CV Joint..... 561
Inner joint..... 562
Special Tools 563

Interior Fitting..... 565

Interior Trim and Paneling 565
Specifications 565
Torque 565
Service Procedures..... 566
Front Door Interior Trim Panel..... 566
Front Door Inside Pull Handle..... 567
Rear Door Interior Trim Panel 567
Rear Door Inside Pull Handle..... 568
A Post Upper Trim Finisher..... 569
A Post Lower Trim Finisher..... 569
B Post Upper Trim Finisher 570
B Post Lower Trim Finisher..... 570
C Post Upper Trim Finisher 571
C Post Lower Trim Finisher 571
Rear Parcel Shelf..... 572
Carpet..... 572
Luggage Compartment Trim Finisher 573
Luggage Compartment Trim Sill..... 574

Contents

Headlining 574
Sun Visor 575
Bulkhead Insulation 576
Front Section Sound Insulation 577
Spectacles Box 578
Grab Handle 578
Fascia and Console 579
Specifications 579
Torque 579
Service Procedures 580
Instrument Panel (I/P) Assembly 580
Glove Box Assembly 582
Console 582
Central Upper Storage Box 583
Driver Side Lower Shield 584
Seats 585
Specifications 585
Torque 585
Description and Operation 586
System Layout 586
Description 587
Operation 588
Service Procedures 589
Front Seat 589
Back - Front Seat 589
Back Cover - Front Seat 590
Cushion - Front Seat 590
Cushion Cover - Front Seat 591
Outside Trim Panel - Driver Seat 591
Cushion - Rear Seat 592
Hinge - Rear Seat Back 592
Back - Rear Seat 593

Exterior Fitting 595

Fixed Windows 595
Service Procedures 595
Quarter Window Glass 595
Front Windshield 595
Rear Windshield 596
Bumpers, Fascias and Grille 597
Specifications 597
Torque 597
Service Procedures 598
Front Bumper 598
Front Armature 599
Rear Bumper 599
Rear Armature 600
Exterior Trim and Paneling 601
Service Procedures 601
Air Conditioning Plenum Cover Assembly 601
Front Wheelhouse Liner 601
Rear Wheelhouse Liner 602
Under Flow Duct 602
Mirrors 603
Specifications 603
Torque 603
Description and Operation 604
System Layout 604
Service Procedures 605
Exterior Rearview Mirror Assembly 605
Manual Dimming Interior Review Mirror Assembly 605
Roof 606
Specifications 606
Torque 606
Description and Operation 607
System Layout 607
System Control Diagram 609
Description 610
Operation 611
Service Procedures 612
Sunroof Assembly 612
Sunroof Glass Assembly 613
Sunroof Glass Weatherstrip 613
Track Type Sunroof Sun Visor Assembly 614
Sunroof Motor Assembly 614
Sunroof Front Drain Tube 615
Sunroof Rear Drain Tube 615
Wipers and Washer 616
Specifications 616
Torque 616
Description and Operation 617
System layout 617
Control diagram of system 620
Description 621
Operation 623
Diagnostic 626
Diagnosis 626
Service Procedures 627
Windshield Wiper Blade Assembly 627

Contents

Windshield Wiper Arm Assembly 627
Windshield wiper link mechanism assembly — with electricity 628
Windshield wiper motor 628
Wash pot assembly 629
Washer pump assembly 629
Front windshield washing nozzle 630
Rear Windshield Wiper Arm Assembly 630
Rear Windshield Wiper Link Mechanism Assembly - with Motor 631
Rear Windshield Wiper Motor 632

Lighting Systems 633

Lighting 633
Specifications 633
Torque 633
Description and Operation 634
System layout 634
Control diagram of system 635
Description 636
Operation 637
Diagnostic 639
Diagnosis 639
Service Procedures 640
Height mount brake lamp assembly 640
Front reading lamp assembly 640
Front reading lamp bulb 641

Lamps 642
Specifications 642
Torque 642
Description and Operation 643
System layout 643
Control diagram of system 644
Description 646
Operation 648
Diagnostic 650
Diagnosis 650
Service Procedures 651
Headlight assembly 651
Headlight bulb 651
Front fog lamp assembly 652
Side turn lamp assembly 652
Side turn lamp bulb 653
Tail lamp assembly 653
Tail lamp assembly bulb 654
Rear license plate lamp assembly 654
Rear license plate lamp bulb 655

Body Systems 657

Doors 657
Specifications 657
Torque 657
Description and Operation 658
System layout 658
Control diagram of system 659
Description 660
Operation 661
Service Procedures 662
Front door hinge adjustment 662
Front door striker adjustment 662
Front door assembly 663
Front door hinge assembly 663
Driver side door outside handle and lock cylinder assembly 664
Driver side door lock body assembly 664
Front seat passenger side door outside handle 665
Rear door hinge adjustment 666
Rear door striker adjustment 666
Rear door assembly 667
Rear door hinge assembly 667
Rear door outside handle 668
Rear Door Lock Body Assembly 668
Front Door Upper Molding 669
Rear door upper molding 670
Door Window Outer Weatherstrip 671
Door Glass 671
Front Door Glass Regulator 672
Rear Door Glass Regulator 672
Front Door Partition Pillar 673
Rear Door Partition Pillar 673
Power Window Switch - Driver Side 674
Power Window Switch - Other 674

Front Closures 675
Specifications 675
Torque 675
Service Procedures 676
Fender 676
Member front end panel 676
Bonnet Assembly 677
Bonnet Hinge Assembly 678

Contents

Adjustment of the Bonnet 678
Bonnet Lock Body Assembly 679
Bonnet Releasing Cable 679
Rear Closures 681
Specifications 681
Torque 681
Service Procedures 682
Tailgate assembly 682
Tailgate Gas Spring and Mounting Knob 683
Tailgate hinge assembly 684
Tailgate lock body assembly 684
Tailgate Striker 685
Tailgate Exterior Handle 685
Fuel Filler Door Assembly 686
Fuel Filler Door Release Cable Assembly 686
Tailgate Trim Panel 687
Horns 688
Specifications 688
Torque 688
Service Procedures 689
Horn 689
Body Control 690
Specifications 690
Torque 690
Description and Operation 691
System Layout 691
System Control Diagram 692
Description 693
Operation 696
Service Procedures 697
Body Control Module (BCM) 697

Body Repair 699

Body Dimension 699
General Information 699
Rear End Information 699
Front End Information 700
Bodyside Information 701
Under Body Information 702
Point to Point Dimensional Information 703
Bodyside and Roof Information 703
Under Body Information 705
Rear Floor Information 707
Rear End Information 708
Internal Information 709
Front End Information 710
Gap Information 711
Bodyside Information 711
Front End Information 712
Rear End Information 714
Fuel filler door Information 715
Sunroof Information 716
Collision Repair 717
Description and Operation 717
General Welding Precautions 717
Corrosion Prevention 722
Body Sealing 725
Repair Panel Infomation 744
Roof Panel 744
Engine Compartment Panel 746
Dash Panel 748
Bodyside Panel 749
Front Floor 751
Rear Floor 752
Rear End Panel 753
Wheel House Panel 754

Safety and Restraints 755

Vehicle Access 755
Description and Operation 755
System Component Layout 755
System Control Diagram 756
Description 758
Operation 759
Seat Belts 761
Specifications 761
Torque 761
Description and Operation 762
System Component Layout 762
System Control Diagram 763
Description 764
Operation 766
Service Procedures 767
Front Seat Belt Assembly 767
Front Seat Belt Buckle 768
Rear Seat Belt Assembly 768
Supplemental Inflatable Restraints 770
Specifications 770
Torque 770
Description and Operation 771

Contents

System Layout 771
System Control Diagram..... 772
Description 773
Operation 776
Service Procedures..... 778
Driver-side Airbag 778
Passenger Side Front Airbag..... 778
Supplemental Restraint System Diagnostic and Control Unit..... 779
Park Assistant System 780
Specifications 780
Torque 780
Description and Operation..... 781
System Component Layout 781
System Control Diagram..... 782
Description 783
Operation 784
Service Procedures..... 786
Parking Assist Unit 786
Ultrasonic Sensor 786

Information and Entertainment..... 787

Entertainment and Navigation 787
Specifications 787
Torque 787
Description and Operation..... 788
System Component Layout 788
System Control Diagram..... 789
Description 790
Operation 794
Service Procedures..... 795
Radio Antenna..... 795
Front Door Woofer 795
Rear Door Woofer..... 796
Tweeter 796
Player..... 797
Special Tools 798
Displays and Gauges.....799
Specifications 799
Torque 799
Description and Operation..... 800
System Layout 800
System Control Diagram..... 802
Description 803
Operation 810
Service Procedures..... 811
Instrument Pack 811
Glossary List 813

General Information

General Precautions

Dangerous Substances

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment.

Warning: Many liquids and other substances used in vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These liquids and substances include acid, antifreeze, brake fluid, fuel, windscreen washer additives, lubricants, refrigerants and various adhesives.

Warning: Always read carefully the instructions printed on labels or stamped on components and obey them implicitly. Such instructions are included for reasons of your health and personal safety. Never disregard them.

Synthetic Rubber

Many O-rings, seals, hoses, flexible pipes and other similar items which appear to be natural rubber, are in fact, made of synthetic materials called Fluoroelastomers. Under normal operating conditions this material is safe and does not present a health hazard. However, if the material is damaged by fire or excessive heating, it can break down and produce highly corrosive Hydrofluoric acid.

Contact with Hydrofluoric acid can cause serious burns on contact with skin. If skin contact does occur

- Remove any contaminated clothing immediately.
- Irrigate affected area of skin with a copious amount of cold water or limewater for 15 to 60 minutes.
- Obtain medical assistance immediately.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing (seamless industrial gloves, protective apron etc.).

Decontaminate and dispose of gloves immediately after use.

Lubricating Oils

Avoid excessive skin contact with used lubricating oils and always adhere to the health protection precautions.

Warning: Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.

Warning: Avoid excessive skin contact with mineral oil. Mineral oils remove the natural fats from the skin, leading to dryness, irritation and dermatitis.

Health Protection Precautions

The following precautions should be observed at all times.

- Wear protective clothing, including impervious gloves where practicable.
- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Do not put oily rags in pockets.
- Avoid contaminating clothes (particularly those next to the skin) with oil.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds.
- Apply barrier creams before each work period to help prevent lubricating oil from contaminating the skin.
- Wash with soap and water to ensure all oil is removed (proprietary skin cleansers and nail brushes will help).
- Use moisturisers after cleaning; preparations containing lanolin help replace the skin's natural oils which have been removed.
- Do not use petrol/gasoline, kerosene, diesel fuel, oil, thinners or solvents for cleaning skin.
- Where practicable, degrease components prior to handling.
- If skin disorders develop, obtain medical advice without delay.
- Wear eye protection (e.g. goggles or face shield) if there is a risk of eye contamination. Eye wash facilities should be provided in close vicinity to the work area.

Safety Instructions

Jacking

Caution: It is best to use the lift when working under the vehicle. Be sure to hold the wheels with chocks and apply parking brake.

Always use the recommended jacking points.

Always ensure that any lifting apparatus has sufficient load capacity for the weight to be lifted.

Ensure the vehicle is standing on level ground prior to lifting or jacking.

Apply the parking brake and chock the wheels.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Do not leave tools, lifting equipment, spilt oil, etc. around or on the work bench area. Always keep a clean and tidy work area.

Brake Shoes and Pads

Always fit the correct grade and specification of brake linings. When renewing brake pads and brake shoes, always replace as complete axle sets.

Brake Hydraulics

Observe the following recommendations when working on the brake system:

- Ensure that hoses run in a natural curve and are not kinked or twisted.
- Ensure that hoses run in a natural curve and are not kinked or twisted.
- Fit brake pipes securely in their retaining clips and ensure that the pipe cannot contact a potential chafing point.
- Containers used for brake fluid must be kept absolutely clean.
- Do not store brake fluid in an unsealed container, it will absorb water and in this condition would be dangerous to use due to a lowering of its boiling point.
- Do not allow brake fluid to be contaminated with mineral oil, or put new brake fluid in a container which has previously contained mineral oil.
- Do not re-use brake fluid removed from the system.
- Always use clean brake fluid or a recommended alternative to clean hydraulic components.
- After disconnection of brake pipes and hoses, immediately fit suitable blanking caps or plugs to prevent the ingress of dirt.
- Only use the correct brake fittings with compatible threads.
- Observe absolute cleanliness when working with hydraulic components.

Cooling System Caps and Plugs

expansion tank caps and coolant drain or bleed screws when the engine is hot, especially if it is overheated. To avoid the possibility of scalding, allow the engine to cool before attempting removal.

Environmental Precautions

General

This section provides general information which can help to reduce the environmental impacts from the activities carried out in workshops.

Emissions to Air

Many of the activities that are carried out in workshops emit gases and fumes which contribute to global warming, depletion of the ozone layer and/or the formation of photochemical smog at ground level. By considering how the workshop activities are carried out, these gases and fumes can be minimised, thus reducing the impact on the environment.

Exhaust Fumes

Running car engines is an essential part of workshop activities and exhaust fumes need to be ventilated to atmosphere. However, the amount of time engines are running and the position of the vehicle should be carefully considered at all times, to reduce the release of poisonous gases and minimise the inconvenience to people living nearby.

Solvents

Some of the cleaning agents used are solvent based and will evaporate to atmosphere if used carelessly, or if cans are left unsealed. All solvent containers should be firmly closed when not needed and solvent should be used sparingly. Suitable alternative materials may be available to replace some of the commonly used solvents. Similarly, many paints are solvent based and the spray should be minimised to reduce solvent emissions.

Refrigerant

Discharge and replacement of these materials from air conditioning units should only be carried out using the correct equipment.

Engines:

Always adhere to the following.

- Don't leave engines running unnecessarily;
- Minimise testing times and check where the exhaust fumes are being blown.

Materials:

- Keep lids on containers of solvents;
- Only use the minimum quantity;
- Consider alternative materials;
- Minimise over-spray when painting.

Gases:

- Use the correct equipment for collecting refrigerants;
- Don't burn rubbish on site.

Discharges to Water

Oil, petrol, solvent, acids, hydraulic oil, antifreeze and other such substances should never be poured down the drain and every precaution must be taken to prevent spillage reaching the drains.

Handling of such materials must take place well away from the drains and preferably in an area with a kerb or wall around it, to prevent discharge into the drain. If a spillage occurs it should be soaked up immediately. Having a spill kit available will make this easier.

Checklist

Always adhere to the following disposal and spillage prevention instructions.

- Never pour anything down a drain without first checking that it is environmentally safe to do so, and that it does not contravene any local regulations.
- Store liquids in a walled area;
- Protect bulk storage tanks from vandalism by locking the valves;
- Transfer liquids from one container to another in an area away from open drains;
- Ensure lids are replaced securely on containers;
- Make sure that taps on liquid containers are secure and cannot be accidentally turned on;
- Have spill kits available near to points of storage and handling of liquids.

Spill Kits

Special materials are available to absorb a number of different substances. They can be in granular form, ready to use and bought in convenient containers for storage. Disposal of used spill-absorbing material is dealt with in 'Waste Management' section.

Land Contamination

Oils, fuels and solvents etc. can contaminate any soil that they are allowed to contact. Such materials should never be disposed of by pouring onto soil and every precaution must be taken to prevent spillage reaching soil. Waste materials stored on open ground could also leak, or have polluting substances washed off them that would contaminate the land. Always store these materials in suitable robust containers.

Checklist

Always adhere to the following.

- Don't pour or spill anything onto the soil or bare ground;
- Don't store waste materials on bare ground, see 'Spillage prevention' list.

Local Issues

A number of environmental issues will be of particular concern to residents and other neighbours close to the site. The sensitivity of these issues will depend on the proximity of the site and the layout and amount of activity carried on at the site.

Car alarm testing, panel beating, hammering and other such noisy activities should, whenever possible, be carried out indoors with doors and windows shut or as far away from houses as possible.

Be sensitive to the time of day when these activities are carried out and minimise the time of the noisy operation, particularly in the early morning and late evening.

Another local concern will be the smell from the various materials used. Using less solvent, paint and petrol could help prevent this annoyance.

Local residents and other business users will also be concerned about traffic congestion, noise and exhaust fumes, be sensitive to these concerns and try to minimise inconvenience from deliveries, customers and servicing operations.

Checklist

Always adhere to the following.

- Identify where the neighbours who are likely to be affected are situated;
- Minimise noise, smells and traffic nuisance;
- Prevent litter by disposing of waste in the correct manner;
- Have waste containers emptied regularly.

Waste Management

One of the major ways that pollution can be reduced is by the careful handling, storage and disposal of all waste materials that occur on sites. This means that it is necessary to not only know what the waste materials are, but also to have the necessary documentation and to know local regulations that apply.

Handling and Storage of Waste

They should be stored in such a way as to prevent the escape of the material to land, water or air.

They must also be segregated into different types of waste e.g. oil, metals, batteries, used vehicle components. This will prevent any reaction between different materials and assist in disposal.

Disposal of Waste

Disposal of waste materials must only be to waste carriers who are authorised to carry those particular waste materials and have all the necessary documentation. The waste carrier is responsible for ensuring that the waste is taken to the correct disposal sites.

Dispose of waste in accordance with the following guidelines.

- Fuel, hydraulic fluid, anti-freeze and oil: keep separate and dispose of to specialist contractor.
- Refrigerant: collect in specialist equipment and reuse.
- Detergents: safe to pour down the foul drain if diluted.
- Paint, thinners: keep separate and dispose of to specialist contractor.
- Components: send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- Small parts: reuse any suitable parts, dispose of the remainder in ordinary waste.
- Metals: can be sold if kept separate from general waste.
- Tyres: keep separate and dispose of to specialist contractor.
- Packaging: compact as much as possible and dispose of in ordinary waste.
- asbestos material keep separate and dispose of to specialist contractor.
- Oily and fuel wastes (e.g. rags, used spill kit material): keep separate and dispose of to specialist contractor.
- Air filters: keep separate and dispose of to specialist contractor.
- Rubber/plastics: dispose of in ordinary waste.
- Hoses: dispose of in ordinary waste.
- Batteries: keep separate and dispose of to specialist contractor.
- Airbags - explosives: keep separate and dispose of to specialist contractor.
- Electrical components: send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- Catalysts: can be sold if kept separate from general waste
- Used spill-absorbing material: keep separate and dispose of to specialist contractor.

General Fitting Instructions

Component Removal

Whenever possible, clean components and surrounding area before removal.

- Blank off openings exposed by component removal.
- Immediately seal fuel, oil or hydraulic lines when apertures are exposed; use plastic caps or plugs to prevent loss of fluid and ingress of dirt.
- Close the open ends of oilways exposed by component removal with tapered hardwood plugs or conspicuous plastic plugs.
- Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
- Clean bench and provide marking materials, labels and containers before dismantling a component.

Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when brake, fuel or hydraulic system parts are being worked on. A particle of dirt or a cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oilways and fluid passages with an air line. Ensure that any O-rings used for sealing are correctly replaced or renewed, if disturbed during the process.
- Use marking ink to identify mating parts and ensure correct reassembly. Do not use a centre punch or scriber to mark parts, they could initiate cracks or distortion in marked components.
- Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
- Attach labels to all parts which are to be renewed, and to parts requiring further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
- Do not discard a part due for renewal until after comparing it with a new part, to ensure that its correct replacement has been obtained.

Cleaning Components

Always use the recommended cleaning agent or equivalent. Ensure that adequate ventilation is provided when volatile degreasing agents are being used. Do not use degreasing equipment for components containing items which could be damaged by the use of this process.

General Inspection

All components should be inspected for wear or damage before being reassembled.

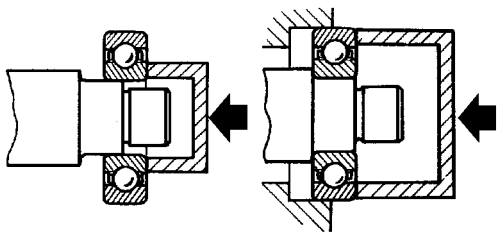
- Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal an incipient failure.
- When a component is to be checked dimensionally against recommended values, use the appropriate measuring equipment (surface plates, micrometers, dial gauges etc.). Ensure the measuring equipment is calibrated and in good serviceable condition.
- Reject a component if its dimensions are outside the specified tolerances, or if it appears to be damaged.
- A part may be refitted if its critical dimension is exactly to its tolerance limit and it appears to be in satisfactory condition. Use 'Plastigauge' for checking bearing surface clearances.

Ball and Roller Bearings

General

When removing and installing bearings, ensure that the following practices are observed to ensure component serviceability.

- Remove all traces of lubricant from bearing under inspection by cleaning with a suitable degreasant; maintain absolute cleanliness throughout operations.
- Hold inner race of bearing between finger and thumb of one hand and spin outer race to check that it revolves absolutely smoothly. Repeat, holding outer race and spinning inner race.
- Rotate outer ring gently with a reciprocating motion, while holding inner ring; feel for any check or obstruction to rotation. Reject bearing if action is not perfectly smooth.
- Lubricate bearing with generous amounts of lubricant appropriate to installation.
- Inspect shaft and bearing housing for discoloration or other markings which indicate movement between bearing and housing.
- Ensure that shaft and housing are clean and free from burrs before fitting bearing.
- If one bearing of a pair shows an imperfection, it is advisable to replace both with new bearings; an exception could be if the faulty bearing had covered a low mileage, and it can be established that damage is confined to only one bearing.
- Never refit a ball or roller bearing without first ensuring that it is in a fully serviceable condition.
- When hub bearings are removed or displaced, new bearings must be fitted; do not attempt to refit the old hub bearings.
- When fitting a bearing to a shaft, only apply force to the inner ring of the bearing. When fitting a bearing into a housing, only apply force to the outer ring of the bearing.
- In the case of grease lubricated bearings (e.g. hub bearings) fill the space between bearing and outer seal with the recommended grade of grease before fitting seal.
- Always mark components of separable bearings (e.g. taper roller bearings) when dismantling, to ensure correct reassembly. Never fit new rollers in a used outer ring; always fit a complete new bearing assembly.



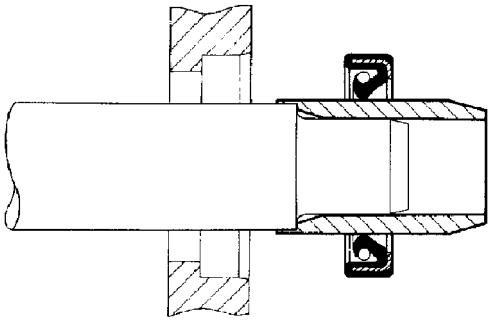
S003040

Oil Seals

General

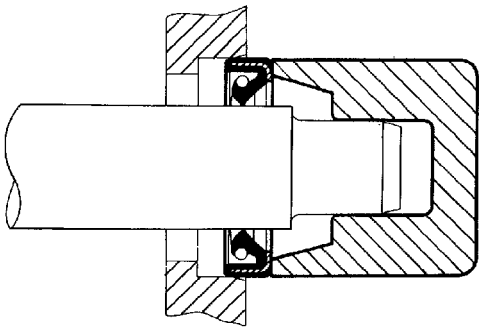
Always renew oil seals which have been removed from their working location (whether as an individual component or as part of an assembly). NEVER use a seal which has been improperly stored or handled, such as hung on a hook or nail.

- Carefully examine seal before fitting to ensure that it is clean and undamaged.
- Ensure the surface on which the new seal is to run is free of burrs or scratches. Renew the component if the original sealing surface cannot be completely restored.
- Protect the seal from any surface which it has to pass when being fitted. Use a protective sleeve or tape to cover the relevant surface.
- Lubricate the sealing lips with a recommended lubricant before use to prevent damage during initial use. On dual lipped seals, smear the area between the lips with grease.
- If a seal spring is provided, ensure that it is fitted correctly. Place lip of seal towards fluid to be sealed and slide into position on shaft. Use fitting sleeve where possible to protect sealing lip from damage by sharp corners, threads or splines. If a fitting sleeve is not available, use plastic tube or tape to prevent damage to the sealing lip.



S003041

- Grease outside diameter of seal, place square to housing recess and press into position using great care, and if possible a 'bell piece' to ensure that seal is not tilted. In some cases it may be preferable to fit seal to housing before fitting to shaft. Never let weight of unsupported shaft rest in seal.



S003042

- Use the recommended service tool to fit an oil seal. If the correct service tool is not available, use a suitable tube approximately 0.4 mm (0.015 in.) smaller than the outside diameter of the seal. Use a hammer VERY GENTLY on drift if a suitable press is not available.
- Use the recommended service tool to fit an oil seal. If the correct service tool is not available, use a suitable tube approximately 0.4 mm (0.015 in.) smaller than the outside diameter of the seal. Use a hammer VERY GENTLY on drift if a suitable press is not available.

Joints and Joint Faces

General

Fit joints dry unless specified otherwise.

- Always use the correct gaskets as specified.
- When sealing compound is used, apply in a thin uniform film to metal surfaces; take care to prevent sealing compound from entering oilways, pipes or blind tapped holes.
- If gaskets and/or sealing compound is recommended for use; remove all traces of old sealing compound prior to reassembly. Do not use a tool which will damage the joint faces and smooth out any scratches or burrs using an oil stone.
- Prior to reassembly, blow through any pipes, channels or crevices with compressed air.

Locking Devices

General

Always replace locking devices with one of the same design.

Tab Washers

Always release locking tabs and fit new locking washers. Do not re-use locking tabs.

Locking Nuts

Always use a backing spanner when loosening or tightening locking nuts, brake and fuel pipe unions.

Roll Pins

Always fit new roll pins of an interference fit in the hole.

Circlips

Always fit new circlips of the correct size for the groove.

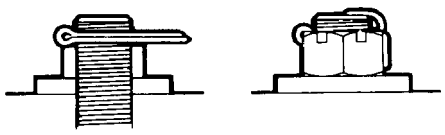
Keys and Keyways

Remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.

Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

Split Pins

Always fit new split-pins of the correct size for the hole in the bolt or stud.



S003043

Screw Threads

General

Metric threads to ISO standards are used.

Damaged nuts, bolts and screws must always be discarded. Cleaning damaged threads with a die or tap impairs the strength and fit of the threads and is not recommended.

Always ensure that replacement bolts are at least equal in strength to those replaced.

Castellated nuts must not be loosened to accept a split-pin, except in recommended cases when this forms part of an adjustment.

Do not allow oil or grease to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.

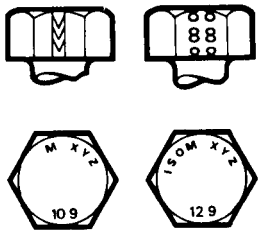
Always tighten a nut or bolt to the recommended torque figure. Damaged or corroded threads can affect the torque reading.

To check or re-tighten a bolt or screw to a specified torque figure, first loosen a quarter of a turn, then re-tighten to the correct torque figure.

Oil thread lightly before tightening to ensure a free running thread, except in the case of threads treated with sealant/lubricant, and selflocking nuts.

Fasteners Identification

Bolt Identification

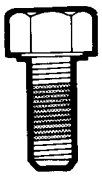


S003044

An ISO metric bolt or screw made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the bolt head.

In addition to marks identifying the manufacturer, the top of the bolt head is also marked with symbols indicating the strength grade, e.g. 8.8; 10.9; 12.9; 14.9. As an alternative, some bolts and screws have the M and strength grade symbol stamped on the flats of the hexagon.

Encapsulated Bolts and Screws



S003045

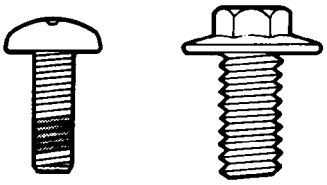
Encapsulated bolts and screws have a microencapsulated locking agent pre-applied to the thread. They are identified by a coloured section which extends 360° around the thread. The locking agent is released and activated by the assembly process and is then chemically cured to provide the locking action.

Unless a specific repair procedure states otherwise, encapsulated bolts may be reused providing the threads are undamaged and the following procedure is adopted:

- Remove loose adhesive from the bolt and housing threads.
- Ensure threads are clean and free of oil and grease.
- Apply an approved locking agent.

An encapsulated bolt may be replaced with a bolt of equivalent specification provided it is treated with an approved locking agent.

Self-locking Bolts and Screws



S003046

Self-locking bolts and screws, i.e. nylon patched or trilobular thread can be reused providing resistance can be felt when the locking portion enters the female thread.

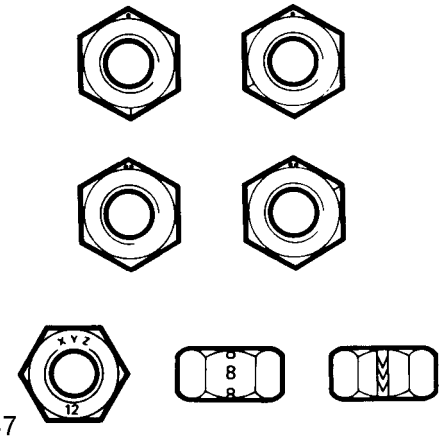
Nylon patched bolts and screws have a locking agent pre-applied to the threads. They are identified by the presence of a coloured section of thread which extends for up to 180° around the thread.

Trilobular bolts (i.e. Powerlok) have a special thread form which creates a slight interference with the thread of the hole or nut into which it is screwed.

DO NOT reuse self-locking fasteners in critical locations (e.g. engine bearings, flywheel). Always use the correct replacement self-locking nut, bolt or screw.

DO NOT fit non self-locking fasteners in applications where a self-locking nut, bolt or screw is specified.

Nut Identification A



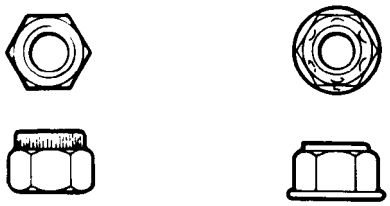
S003047

A nut with an ISO metric thread is marked on one face or on one of the flats of the hexagon with the strength grade symbol 8, 12, or 14. Some nuts with a strength grade 4, 5 or 6 are also marked and some have the metric symbol M on the flat opposite the strength grade marking.

When tightening a slotted or castellated nut, never loosen it to insert a split pin except where recommended as part of an adjustment. If difficulty is experienced, alternative washers or nuts should be selected, or the washer thickness reduced.

Where bearing preload is involved, nuts should be tightened in accordance with special instructions.

Self-locking Nuts



S003048

Self-locking nuts, e.g. nylon insert or deferred thread nuts, can be reused providing resistance can be felt when the locking portion of the nut passes over the thread of the bolt or stud.

Where self-locking nuts have been removed, it is advisable to replace them with new ones of the same type.

Don't use non self-lock nuts in the area where self-lock nuts must be used.

Flexible Pipes and Hoses

General

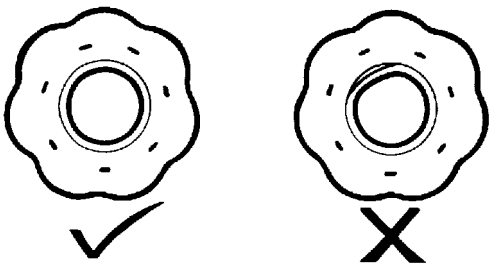
When removing and installing flexible hydraulic pipes and hoses, ensure that the following practices are observed to ensure component serviceability.

- Clean end fittings and the area surrounding them as thoroughly as possible.
- Obtain appropriate plugs or caps before detaching hose end fittings, so that the ports can be immediately covered to prevent the ingress of dirt.

  Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any faulty hoses.
- When refitting a hose, ensure that no unnecessary bends are introduced, and that hose is not twisted before or during tightening of union nuts.
- Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
- Absolute cleanliness must be observed with hydraulic components at all times.

  After any work on hydraulic systems, carefully inspect for leaks underneath the vehicle while a second operator applies maximum brake pressure to the brakes (engine running) and operates the steering.

Fuel System Hoses



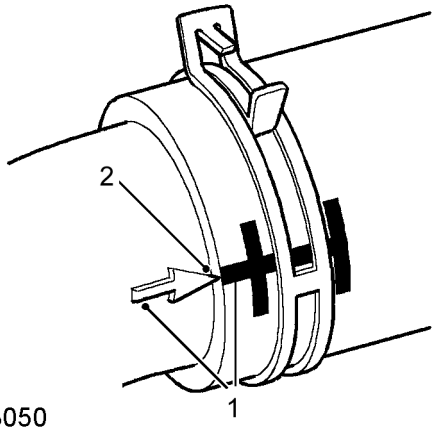
S003049

All fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. If any of the fuel system hoses have been disconnected, it is imperative that the internal bore is inspected to ensure that the viton lining has not become separated from the armoured outer sleeve. A new hose must be fitted if separation is evident.

Cooling System Hoses

The following precautions MUST be followed to ensure that integrity of cooling hoses and their connections to system components are maintained.

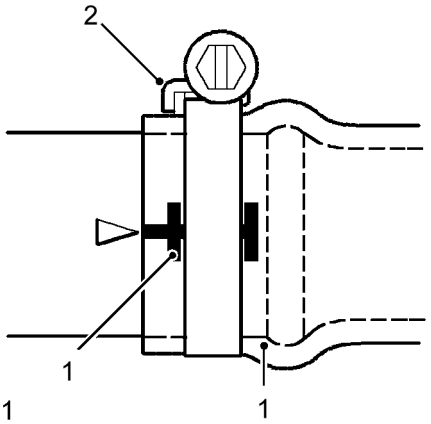
Hose Orientation and Connection



S003050

Correct orientation of cooling hoses is important in ensuring that the hose does not become fatigued or damaged through contact with adjacent components. Where 'timing' marks (1) are provided on the hose and corresponding connection, these must be used to ensure correct orientation. Hoses must be pushed fully onto their connection points. Usually, a moulded form (2) on the stub pipe provides a positive indicator.

Hose Clip



S003051

Markings (1) are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub as shown. Worm drive clips should be oriented with the crimped side of the drive housing (2) facing towards the end of the hose, or the hose may become pinched between the clip and the stub pipe retaining lip. Worm drive clips should be tightened to 3 Nm unless otherwise stated. Ensure that hose clips do not foul adjacent components.

Heat Protection

Always ensure that heatshields and protective sheathing are in good condition. Replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components, such as the exhaust manifold and the Exhaust Gas Recirculation (EGR) pipe. Hoses will relax and deflect slightly

when hot; ensure this movement is taken into account when routing and securing hoses.

Fuel Handling Precautions

General

Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. The vapour is heavier than air and will always fall to the lowest level. The vapour can be easily distributed throughout a workshop by air currents; consequently, even a small spillage of fuel is potentially very dangerous.

The following information provides basic precautions which must be observed if fuel is to be handled safely. It also outlines other areas of risk which must not be ignored. This information is issued for basic guidance only, if in doubt consult your local Fire Officer.

Always have a fire extinguisher containing FOAM, CO2, GAS or POWDER close at hand when handling or draining fuel or when dismantling fuel systems. Fire extinguishers should also be located in areas where fuel containers are stored.

Always disconnect the vehicle battery before carrying out dismantling or draining work on a fuel system.

Whenever fuel is being handled, drained or stored, or when fuel systems are being dismantled, all forms of ignition must be extinguished or removed; any lead lamps must be flameproof and kept clear of spillage.

Warning: No one should be permitted to repair components associated with fuel without first having specialist training.

Warning: Do not remove fuel system components while the vehicle is over a pit.

Fuel Tank Draining

Fuel tank draining should be carried out in accordance with the procedure outlined in the FUEL DELIVERY section of this manual and observing the following precautions

Warning: Do not remove fuel system components while the vehicle is over a pit. Extraction or draining of fuel must be carried out in a well ventilated area.

The capacity of containers must be more than adequate for the amount of fuel to be extracted or drained. The container should be clearly marked with its contents and placed in a safe storage area which meets the requirements of local authority regulations.

Fuel Tank Removal

When the fuel line is secured to the fuel tank outlet by a spring steel clip, the clip must be released before the fuel line is disconnected or the fuel tank is removed. This procedure will avoid the possibility of fumes in the fuel tank being ignited when the clip is released.

As an added precaution, fuel tanks should have a 'FUEL VAPOUR' warning label attached to them as soon as they are removed from the vehicle.

Fuel Tank Repairs

No attempt should be made to repair a plastic fuel tank. If the structure of the tank is damaged, a new tank must be fitted.

Body Repairs

Plastic fuel pipes are particularly susceptible to heat, even at relatively low temperature, and can be melted by heat conducted from some distance away.

When body repairs involve the use of heat, all fuel pipes which run in the vicinity of the repair area must be removed, and the tank outlet plugged.

Warning: If welding is to be carried out in the vicinity of the fuel tank, the fuel system must be drained and the tank removed before welding commences.

Electrical Precautions

General

The following guidelines are intended to ensure the safety of the operator while preventing damage to the electrical and electronic components fitted to the vehicle. Where necessary, specific precautions are detailed in the individual procedures of this manual.

Equipment

Prior to commencing any test procedure on the vehicle ensure that the relevant test equipment is working correctly and any harness or connectors are in good condition. It is particularly important to check the condition of the lead and plugs of mains operated equipment.

Polarity

Never reverse connect the vehicle battery and always ensure the correct polarity when connecting test equipment.

High Voltage Circuits

Whenever disconnecting live HT circuits always use insulated pliers and never allow the open end of the HT lead to contact other components, particularly ECUs. Exercise caution when measuring the voltage on the coil terminals while the engine is running, high voltage spikes can occur on these terminals.

Connectors and Harnesses

The engine compartment of a vehicle is a particularly hostile environment for electrical components and connectors:

- Always ensure electrically related items are dry and oil free before disconnecting and connecting test equipment.
- Ensure disconnected multiplugs and sensors are protected from being contaminated with oil, coolant or other solutions. Contamination could impair performance or result in catastrophic failure.
- Never force connectors apart using tools to prise apart or by pulling on the wiring harness.
- Always ensure locking tabs are disengaged before disconnection, and match orientation to enable correct reconnection.
- Ensure that any protection (covers, insulation etc.) is replaced if disturbed.

Having confirmed a component to be faulty:

- Switch off the ignition and disconnect the battery.
- Remove the component and support the disconnected harness.
- When replacing the component keep oily hands away from electrical connection areas and push connectors home until any locking tabs fully engage.

Battery Disconnection

Before disconnecting the battery, disable the alarm system and switch off all electrical equipment.

Caution: To prevent damage to electrical components, always disconnect the battery when working on the vehicle's electrical system. The ground lead must be disconnected first and reconnected last.

Caution: Always ensure that battery leads are routed correctly and are not close to any potential chafing points.

Battery Charging

Always ensure any battery charging area is well ventilated and that every precaution is taken to avoid naked flames and sparks.

Disciplines

Remove the handset prior to making any connection or disconnection in the system to prevent electrical surges caused by disconnecting 'live' connections damaging electronic components.

Ensure hands and work surfaces are clean and free of grease, swarf, etc. Grease collects dirt which can cause electrical tracking (shortcircuits) or high resistance contacts.

When handling printed circuit boards, treat with care and hold by the edges only; note that some electronic components are susceptible to body static.

Connectors should never be subjected to forced removal or refit, especially inter-board connectors. Damaged contacts can cause short-circuit and open-circuit fault conditions.

Prior to commencing test, and periodically during a test, touch a good vehicle body earth to discharge static charge. Some electronic components are vulnerable to the static electricity that may be generated by the operator.

Electrical Multiplugs Lubricate

In order to prevent corrosion, Some multiplugs under bonnet and carpet is wiped special lubricate in factory. If these is destroyed in maintaining, repair and replacing process, special lubricate should be newly wiped

Supplementary Restraint System Precautions

General Precautions

The SRS system contains components which could be potentially hazardous to the service engineer if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of**SRS** components fitted to the vehicle.

Warning: Always follow the 'SRS Precautions' and the correct procedures for working on SRS components. Persons working on SRS systems must be fully trained and have been issued with copies of the Safety guidelines.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

Warning: The airbag module contains sodium azide which is poisonous and extremely flammable. Contact with water, acid or heavy metals may produce harmful or explosive compounds. Do not dismantle, incinerate or bring into contact with electricity, before the unit has been deployed.

Warning: Always replace a seat belt assembly that has withstood the strain of a severe vehicle impact, or if the webbing shows signs of fraying.

Warning: Always disconnect the vehicle battery before carrying out any electric welding on a vehicle fitted with an SRS system.

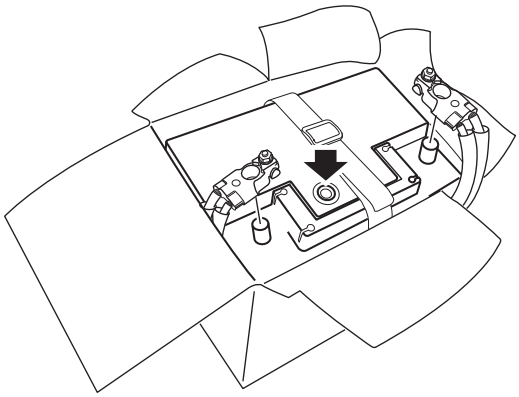
Caution: Do not expose an airbag module or seat belt pre-tensioner to heat exceeding 85° C.

It should be noted that these precautions are not restricted to operations performed when servicing the**SRS** system, the same care must be exercised when working on ancillary systems and components located in the vicinity of the**SRS** components; these include, but are not limited to:

- *Steering system* steering wheel airbag, rotary coupler.
- *Front fascia* passenger front airbag.
- *Interior trim***ICS** Head Curtain Airbags ('A'-post trim, 'B'-post upper trim, grab handles, headlining above front doors ;**SRS** Electronic Control Unit (ECU) (beneath centre console); side impact crash sensors (under carpet beneath front seats)
- *Seats* side (thorax) airbags.
- *Electrical system*–**SRS** harnesses, link leads and connectors.

Making the System Safe

Before working on, or in the vicinity of**SRS** components, ensure the system is rendered safe by performing the following procedures:



S003092

- Remove the handset from the docking station.
- Disconnect both battery leads, earth lead first.
- Wait 10 minutes for**SRSECU** the **SRSECU**back-up power circuit to discharge.

The**SRS** system uses energy reserve capacitors to keep the system active in the event of electrical supply failure under crash conditions. It is necessary to allow the capacitor sufficient time to discharge (10 minutes) in order to avoid the risk of accidental deployment.

Caution: Disconnect the battery before starting the SRS operation. Disconnect the battery negative terminal first. DO NOT disconnect the battery in the reverse order.

Installation

In order to ensure system integrity, it is essential that the **SRS**system is regularly checked and maintained**SRS** so that it is ready for effective operation in the event of a collision. Carefully inspect **SRS**components before installation. **SRS** Do not install a part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.

Warning: The integrity of the SRS system is critical for safety reasons.

Ensure the following precautions are always adhered to:

- Never install used **SRS**components from another vehicle**SRS** or attempt to repair an**SRS** component.
- Never use the **SRS** parts without a clear identification**SRS** label.
- Never use an airbag or**SRS ECU**that has been dropped.
- When repairing an **SRS**system only use **SRS**genuine new parts.
- Never apply electrical power to an **SRS**component unless instructed to do**SRS** so as part of an approved test procedure.
- Ensure the bolts are tightened to the correct torque. Always use new fixings**SRS** when replacing **SRS** components.
- Ensure the **ECU** is always installed correctly. **SRS ECU**.**SRSECU** There must not be any gap between the **ECU**and the bracket to which it is mounted.**SRSECU** An incorrectly mounted **ECU**could cause the system to malfunction.
- Do not supply power to the **ECU** are connected.**SRS** before all **SRS**components **SRSECU** before all **SRS** components.

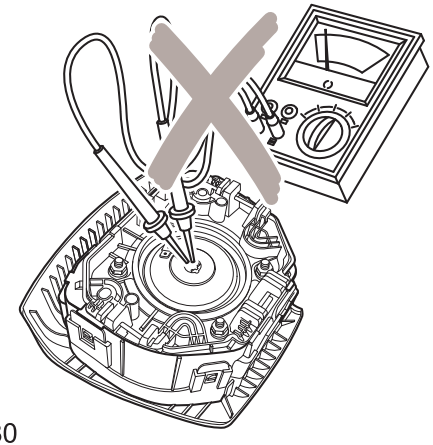
Caution: Ensure SRS components are not contaminated with oil, grease, detergent or water.

Caution: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

Caution: Following seat belt pretensioner deployment, the seat belts can still be used as conventional seat belts, but will need to be replaced as soon as possible to re-establish full SRS protection.

Caution: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

SRS Component Testing Precautions



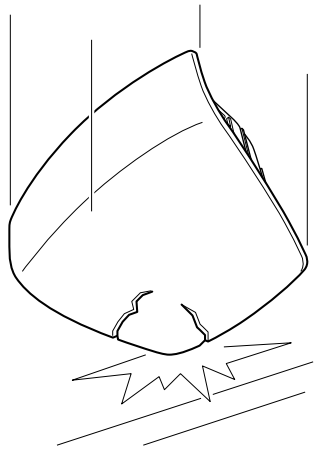
S003080

The**SRS** components are triggered using relatively low operating currents, always adhere to the following precautions:

Warning: Do not use a multimeter or other general purpose test equipment on SRS system components or accidental deployment may occur. Only use the recommended diagnostic equipment to diagnose system faults.

Warning: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS system components. It may cause accidental deployment and personal injury.

Handling and Storage



S003081

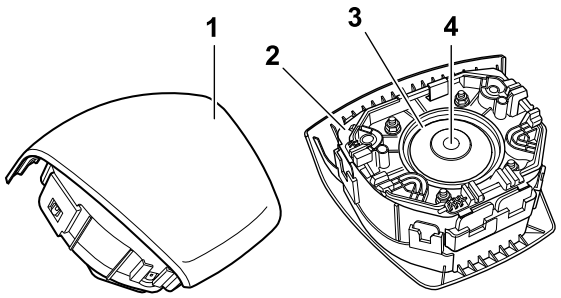
Always comply with the following handling precautions.

Warning: The SRS components are sensitive and potentially hazardous if not handled correctly; always comply with the following handling precautions:

- ***ECU and airbag must be stored in a cabinet in a dry room at normal room temperatures not exceeding 85° C. Ensure that heating, fire, water and other chemical corrosive substances cannot contaminate the stored SRS components.***
- ***For safety reasons, do not store inflammable goods close to the area where the SRS components are stored.***
- ***Keep new airbag module in the original packaging, until just before fitting.***
- ***The storage area must comply with all legal requirements. It must have suitable fire extinguishers or other fire extinguishing equipment.***
- ***Never drop an SRS component. The airbag diagnostic control unit is a particularly shock sensitive device and must be handled with extreme care.***
- ***Never wrap your arms around an airbag module. If an airbag module has to be carried, hold it by the cover, with the cover uppermost and the base away from your body.***
- ***Never transport airbag modules or seat belt pre-tensioners in the cabin of a vehicle.***

Warning: Never attach anything to an airbag cover or any trim componentcovering an airbag module. Do not allow anything to rest on top of an airbag module.

Caution: Do not apply grease or cleaning solvents to seat belt pretensioner units, component failure could result.



S003082

Warning: Store the airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with enough force to cause serious injury.

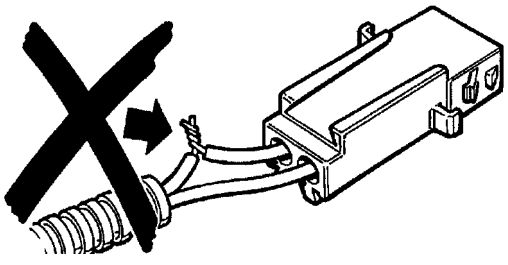
Warning: Airbag modules and seat belt pre-tensioners are classed as explosive devices. For overnight and longer term storage, they must be stored in a secure steel cabinet which has been approved as suitable for the purpose and has been registered by the local authority.

Warning: When recovering the seat belt pretensioner, DO NOT aim the piston pipe at yourself or others. Keep the pistons facing the ground. Hold the case instead of the seat belt.

Warning: Store the airbag module or seat belt pre-tensioners in a designated storage area.

Caution: Improper handling or storage can internally damage the airbag module, making it inoperative. If you suspect the airbag module has been damaged, install a new module and refer to theDeployment/Disposal Procedures for disposal of the damaged module.

SRS Harnesses and Connectors

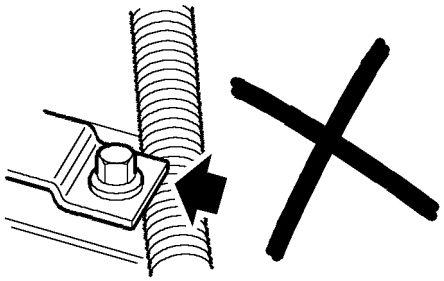


S003005

Always observe the following precautions**SRS** with regards to **SRS** system electrical wiring:

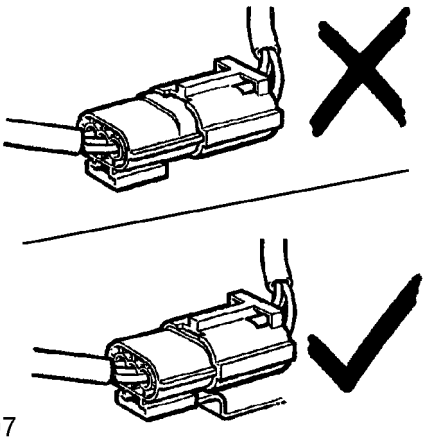
- Never attempt to modify, splice or repair**SRS** wiring.
- Never install electronic equipment (such as a mobile telephone, two-way radio or in-car entertainment system) in such a way that it could generate electrical interference in the airbag harness. Seek specialist advice when installing such equipment.

Note: SRS system wiring can be identified by a special yellow outer sleeve protecting the wires (black with yellow stripe protective coverings are sometimes used).



S003006

Warning: Always ensure SRS wiring is routed correctly. Be careful to avoidtrapping or pinching the SRS wiring. Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible points of chafing.



S003007

Precautions for Vehicle Owners

For the airbag to work effectively and protect vehicle owners, follow the precautions listed below.

Driver and passengers must use seat belts correctly. Correctly using the seat belts can protect the body and reduce injuries in the event of an accident.

Never fit any accessory that obstructs or impairs the operation of the seat belt pretensioners or airbags.

Do not place any object on the steering wheel or instrument panel that could penetrate an inflating airbag or be a thrown item likely to cause injury.

Never fit cover on seat which fitting side airbag.

Children under 12 years old should not sit in the front seat.

Only genuine accessory parts are allowed to be installed.

Only authorised people can remove airbag modules, **ECU SRS** system wiring harness and connectors.**SRSECU**and**SRS** system wiring harness and connectors.

If the airbag and seat belt pre-tensioner are deployed during an accident,**SRSECU** must be replaced and discarded.

Every **SRS** system on every car **SRS** has been paired and identified,**SRS** illegally adding or modifying the **SRS** system and the wiring harness could injure people.

Modifying the vehicle structure or **SRS** system is strictly not allowed**SRS** and may cause wrong airbag deployment or failure to deploy when required.

Rotary Coupler Precautions

Caution: Always follow the procedure for fitting and checking the rotary coupler as instructed in the SRS repairs section. Comply with all safety and installation procedures to ensure the system functions correctly.

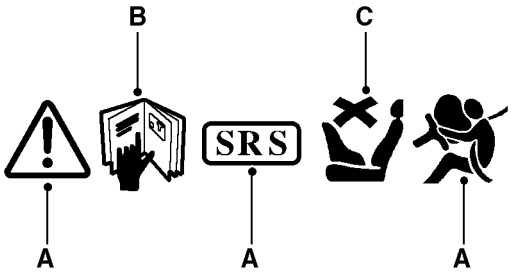
Observe the following precautions:

- Do not unlock and rotate the rotary coupler when it is removed from the vehicle.
- Do not turn the road wheels when the rotary coupler is removed from the vehicle.
- Always ensure the rotary coupler is removed and installed in its centred position and with the front road wheels in the straight ahead position - procedure.**SRS** refer to the **SRS** repair section for the correct removal and installation
- If a new rotary coupler is being installed, ensure the locking tab holding the coupler's rotational position is not broken; units with a broken locking tab should not be used.

Warning Labels

Warning symbols are displayed at various positions in the vehicle.**SRS** components have additional warning labels displayed on them to indicate that particular care is needed when handling them. These include airbag modules,**SRS ECU**, seat belt pre-tensioners and the rotary coupler.

The following warning symbols may be displayed at various locations on the vehicle:



S003008

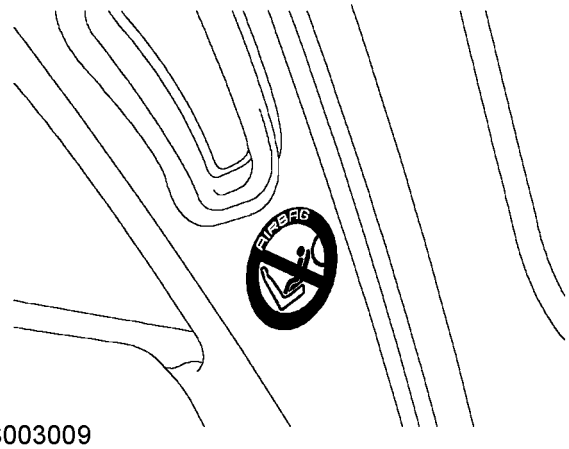
A The need for caution when working in close proximity to **SRS**components.**SRS** in close proximity to **SRS** components.

B Refer to the publication where the procedures,**SRS** instructions and advice can be found (usually Workshop Manual or Owner's Handbook) for working on the **SRS** system.

C Do not use rear facing child seats in the front passenger seat if the vehicle is fitted with a passenger airbag.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

The following list indicates possible locations and content for warning labels. Exact positions and content may vary dependent on model year, legislation and market trends.

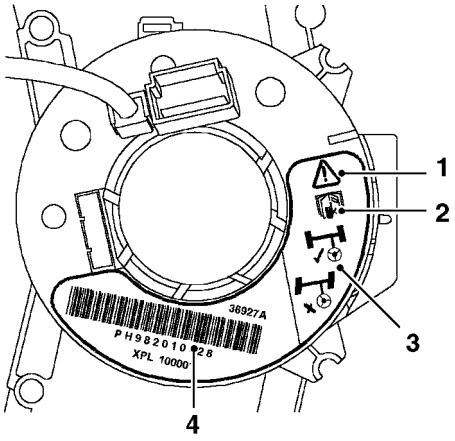


S003009

Do not use rear facing child seat in front passenger seat of vehicles fitted with passenger airbag.

Rotary Coupler

1. The need for caution when working**SRS** in close proximity to **SRS** components.
2. Refer to Workshop Manual for detailed instructions.
3. Ensure the wheels are in the straight ahead position before removal and refitting.
4. Bar code. The code number must be recorded if the rotary coupler is to be replaced.



S003011

Bar Codes

Bar codes**SRS** are fitted to **SRS** system components and components**SRS** which are critically related to **SRS**operation. The code number(s) must be recorded if the component is to be replaced.

Components featuring bar codes include the following:

- Driver's front airbag module – label attached to rear of module housing
- Passenger front airbag module – label attached at side of module housing
- **SRSECU** Included**SRSECU** on label on top of **ECU**
- Rotary coupler – several labels on front face

Vehicle Recovery

Towing SRS Components Not Deployed

Normal towing procedures are unlikely to cause an airbag to deploy. However, as a precaution, remove the handset from the docking station and then disconnect both battery leads. Disconnect the negative '-' lead first.

Towing SRS Components Not Deployed

Once the drivers airbag has been deployed, the vehicle must have a suspended tow. However, as a precaution remove the handset from the docking station and then disconnect both battery leads. Disconnect the negative - lead first.

SRS Components Deployed

If a vehicle is to be scrapped and contains an undeployed airbag module, the module must be manually deployed.

Always observe the following precautions:

Warning: Only personnel who have undergone the appropriate training should undertake deployment of airbag and seat belt pre-tensioner modules.

Warning: A deployed airbag or seat belt pre-tensioner is very hot, DO NOT return to a deployed airbag module until at least 30 minutes have elapsed since deployment.

Warning: Only use approved deployment equipment, and only deploy SRS components in a well-ventilated designated area. Ensure SRS components are not damaged or ruptured before deployment.

Warning: Contact with chemicals from deployed and damaged SRS components could present a health hazard, wear protective clothing when handling. DO NOT eat, drink or smoke when handling SRS components.

Warning: Deployment of airbag modules and seat belt pre-tensioners can cause injury to personnel in the close vicinity of the deploying unit. In case of injury seek urgent medical advice. Possible sources of injury include:

- ***impact - due to inflating airbag or pretensioner operation causing component 'kick'.***
- ***hearing - due to noise produced by deploying airbags and seat belt pretensioner units.***
- ***burns - hot component parts and gases.***
- ***irritation to eyes and lungs - from deploying gases or combustion residue.***

Warning: Ensure the SRS component to be deployed is securely fastened to its mounting.

Warning: Compliance with the following precautions MUST be ensured:

- ***Only use deployment equipment approved for the intended purpose.***
- ***Before commencing deployment procedure, ensure the deployment tool functions properly.***
- ***Deployment of airbag/pre-tensioner modules should be performed in a well ventilated area which has been designated for the purpose.***
- ***Ensure airbag/pre-tensioner modules are not damaged or ruptured before attempting to deploy.***
- ***Notify the relevant authorities of intention to deploy airbag and pretensioner units.***
- ***When deploying airbag and seat belt pre-tensioner units, ensure that all personnel are at least 15 metres away from the deployment zone.***
- ***When deploying seat belt pretensioners in the vehicle, ensure the pre-tensioner unit is fully secured to its fixing point.***
- ***When removing deployed airbag and seat belt pre-tensioner modules, wear protective clothing. Use gloves and seal deployed units in a plastic bag.***
- ***Following deployment of any component of the SRS system within the vehicle, all SRS components must be replaced. DO NOT re-use or salvage any parts of the SRS system.***
- ***Do not lean over airbag modules or seat belt pre-tensioner units when connecting deployment equipment.***

SRS Component Replacement Policy

Impacts Which Do Not Deploy the Airbags or Pre-tensioners

Check for structural damage in the area of the impact, paying particular attention to bumper armatures, longitudinals, crash cans and bracketry.

Impacts Which Deploy the Airbags or Pre-tensioners

The replacement and inspection policy is dependent on the type and severity of the crash condition **SRS** . The following guidelines are the minimum that should be exercised as a result of the deployment of specific **SRS** components:

Front Airbag Deployment (driver and passenger)

If the front airbags are deployed, the following parts must be replaced:

- Driver airbag module
- Passenger airbag module
- Flyleads (where applicable) connecting **SRS** front airbag modules to **SRS** harness
- Seat belt pre-tensioners
- Driver's seat belt retractor
- Rotary coupler
- **SRS ECU**

In addition, the following should be inspected for damage and replaced as necessary:

- Front passenger's seat belt retractor (webbing, tongue latching, 'D' loop, body anchorage point)
- Rear seat belt buckles (webbing, buckle covers, body anchorage and tongue latching function)
- Fascia moulding adjacent to passenger airbag module
- Steering wheel (if damage is evident)
- Front seat frames and head restraints (if there is evidence of damage to the seat frame or cushion pan)
- Steering column (if adjustment is lost or there are signs of collapse)
- Seat belt automatic height adjusters on 'BC' posts
- Rear seat belt escutcheons in parcel shelf trim

Side (Thorax) Airbags

If the side (thorax) airbags are deployed, the following parts must be replaced, on the side of the vehicle on which the deployment occurred:

- Seat (thorax) airbag module
- Seat squab foam
- Seat squab cover
- Front seat belt buckle pre-tensioners
- **SRS ECU**
- Side impact crash sensors (both sides of vehicle)

In addition, the following should be inspected for damage and replaced as necessary:

- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- Front seat frame (if there is evidence of external or airbag deployment damage to seat frame)
- 'BC' post internal finishers and fixings
- Door casings
- Seat belt automatic height adjusters on 'B' post
- Rear seat belt escutcheons in parcel shelf trim

Inflatable Curtain Structure (ICS) Airbags Modules

If the Inflatable Curtain Structure airbag modules are deployed, the following parts must be replaced, (**ICS**) on the side of the vehicle for which deployment occurred:

- **ICS** airbag module
- Link lead between airbag gas generator **SRS** and **SRS** harness
- Airbag retaining clips above window aperture
- 'A' post internal finisher
- Front seat belt pre-tensioners
- **SRS ECU**
- Side impact crash sensors (both sides of vehicle)

In addition, the following should be inspected for damage and replaced as necessary:

- Headlining
- **ICS** mounting brackets
- Alarm sensor
- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- 'BC' post upper finisher and fixings
- Door casing
- Seat belt automatic height adjusters on 'B' post
- Rear seat belt escutcheons in parcel shelf trim

Rear Impacts

Rear impacts may cause the seat belt pretensioners to deploy. If this occurs, all pretensioner units must be replaced. In addition, the following components should be inspected for damage and replaced as necessary:

- Front seat frames
- Seat belt automatic height adjusters on 'B'- post
- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- Rear seat belt escutcheons in parcel shelf trim
- **SRS ECU**

Periodic Replacement of SRS Components

The performance of the propellants within airbags and pre-tensioners will deteriorate over a period of time. As a result, it is essential that the airbags and pre-tensioners are periodically replaced to maintain occupant safety. Airbags, seat belt pre-tensioners and the rotary coupler should be replaced at 12 year intervals.

Air Conditioning System Precautions

General

The air conditioning system contains fluids and components which could be potentially hazardous to the service engineer or the environment if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of the air conditioning operating conditions and components fitted to the vehicle.

Where necessary, additional specific precautions are detailed in the relevant sections of this Manual which should be referred to prior to commencing repair operations.

The refrigerant used in the air conditioning system is HFC-134a (Hydrofluorocarbon) R134a.

Warning: Servicing must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

Warning: R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing, consisting of face protection, heat-proof gloves, rubber boots and rubber apron or waterproof overalls, must be worn when carrying out operations on the air conditioning system.

Remedial Actions

If an accident involving R134a should occur, conduct the following remedial actions:

- If liquid R134a enters the eye, do not rub it. Gently run large quantities of eye wash over affected eye to raise the temperature. If an eye wash is not available, cool, clean water may be used to flush the eye. After rinsing, cover the eye with a clean pad and seek immediate medical attention.
- If liquid R134a is splashed onto the skin, run large quantities of water over the affected area to raise the temperature. Implement the same action if the skin comes in contact with discharging cylinders. Wrap the contaminated body parts in blankets (or similar materials) and seek immediate medical attention.
- If the debilitating effects of inhalation of R134a vapour is suspected, seek fresh air. If the affected person is unconscious, move them away from the contaminated area to fresh air and apply artificial respiration and/ or oxygen and seek immediate medical attention.

Warning: Due to its low evaporating temperature, R134a must be handled with care. R134a splashed on any part of the body will cause immediate freezing of that area. Also, refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.

Service Precautions

Observe the following precautions when handling components used in the air conditioning system:

- Air conditioning units must not be lifted by their hoses, pipes or capillary lines.
- Hoses and lines must not be subjected to any twist or stress; the efficiency of the system will be impaired by kinks or restrictions. Ensure that hoses are correctly positioned before tightening couplings, and ensure that all clips and supports are utilised.
- Flexible hoses should not be positioned close to the exhaust manifold (less than 100 mm) unless protected by heat shielding.
- Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of components and panels may transmit noise and so must be eliminated.
- The appropriate torque wrench must be used when tightening refrigerant connections to the stipulated value. An additional spanner must be used to hold the union to prevent twisting of the pipe when tightening connections.
- Before connecting any hose or pipe, ensure that refrigerant oil is applied to the seat of the new O-rings, BUT NOT to the threads of the connection.
- All protective plugs must remain in place to seal the component until immediately prior to connection.
- Ensure components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters it.
- Components must not remain uncapped for longer than 15 minutes. In the event of a delay, the caps must be fitted.
- When disconnecting, immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.
- The receiver/drier contains desiccant which absorbs moisture. It must be positively sealed at all times. A receiver/drier that has been left uncapped must not be used, fit a new unit.
- The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.
- Whenever the refrigerant system is opened, the receiver/drier must be renewed immediately before evacuating and recharging the system.
- Use alcohol and a clean lint-free cloth to clean dirty connections.
- Ensure that all new parts fitted are marked for use with R134a.

Refrigerant Oil

Refrigerant oil easily absorbs water and must not be stored for long periods. Do not pour unused refrigerant oil back into the container. Always use an approved refrigerant oil.

When replacing components in the A/C system, drain the refrigerant oil from the component being replaced into a graduated container. On assembly, add the quantity of refrigerant oil drained to the new component.

Compressor

A new compressor is sealed and pressurised with Nitrogen gas. When fitting a new compressor, slowly release the sealing cap; gas pressure should be heard to vent as the seal is broken.

Caution: Do not remove the cap(s) until immediately prior to connecting the air conditioning pipes to the compressor.

Rapid Refrigerant Discharge

If the air conditioning system is involved in accident damage and the system is punctured, the refrigerant will discharge rapidly. The rapid discharge of refrigerant will also result in the loss of most of the oil from the system. The compressor must be removed and all the remaining oil in the compressor drained and refilled as instructed in the air conditioning section of this manual.

Precautions for Refrigerant Recovery, Recycling and Recharging

When the air conditioning system is recharged, any existing refrigerant is first recovered from the system and recycled. The system is then charged with the required weight of refrigerant and volume of refrigerant oil.

Warning: Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerant is high enough for safe use in the air conditioning system.

Warning: Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SAE J1991. Other equipment may not recycle refrigerant to the required level of purity.

Warning: A R134a Refrigerant Recovery Recycling Recharging Station must not be used with any other type of refrigerant.

Warning: Refrigerant R134a from domestic and commercial sources must not be used in motor vehicle air conditioning systems.

Caution: The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted.

Air Conditioning Compressor Replacement Replacement Instructions

A new compressor is supplied filled with a full charge of refrigerant oil. The new compressor must be drained and a calculated quantity of oil added before fitting. To calculate the quantity of oil to be added, carry out the following procedure:

1. Remove the filler/drain plug from the old compressor.
2. Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to ensure the compressor is completely drained.
3. Record the quantity of oil drained, discard the oil.
4. Remove the filler/drain plug from the new compressor.
5. Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to ensure the compressor is completely drained.
6. Add the same amount of oil drained from the old compressor to the new compressor.
7. Discard the remaining oil drained from the new compressor.
8. Fit and tighten the compressor filler/drain plug.

Vehicle Identification Number

Vehicle Identification Number

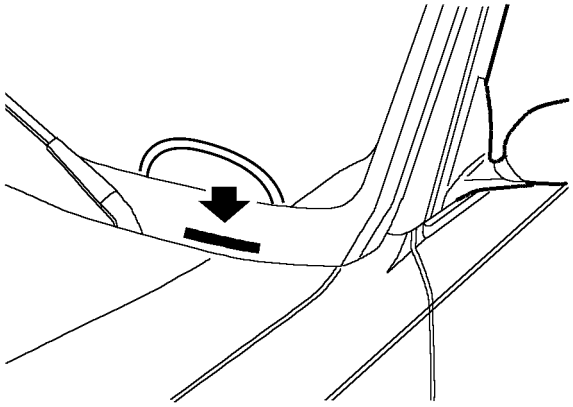
Vehicle Identification Number (VIN)

For example: LSJZ14E3XAS000011

LSJ	Vehicle manufacturer's code
Z1	Style/Model
4	Body structure 4 = five-door, etc
E	Engine E = 1.5VCT Gasoline Engine
3	Occupant protection device 3 = Seat belts, driver and front passenger's front airbags
X	Check digit, with any number from 0-9 or letter X
A	Vehicle production year A=2010
S	Assembly plant S=Shanghai Lingang China
Six digits	Production sequence number

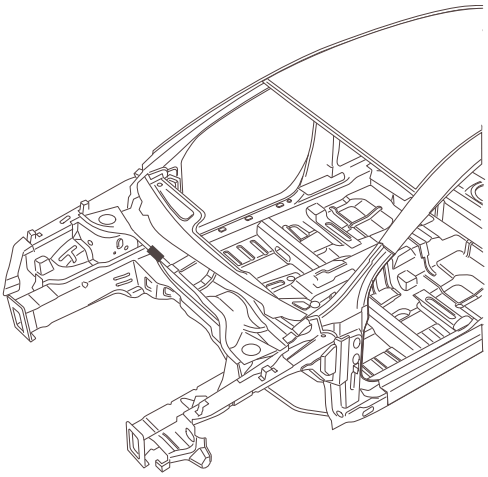
VIN Also printed in the following locations:

on the plane behind the lower left corner of the windshield

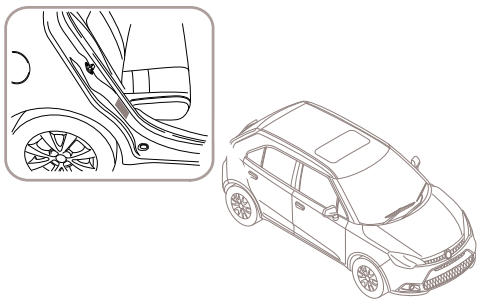


S003020

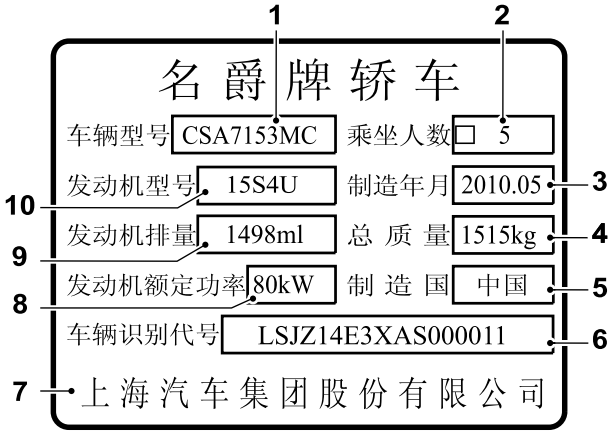
on the top of the support platform of the right side front suspension.



Vehicle Identification Plate Location



Vehicle Identification Plate is located on the outside of the right side C Post.

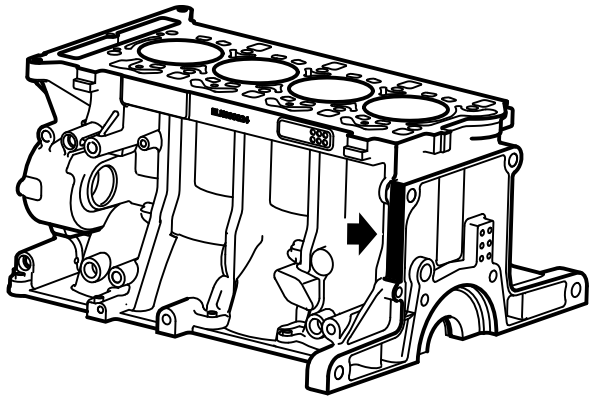


Vehicle Identification Plate includes the following information:

1. Vehicle Model
2. The Number of Passengers
3. Manufacturing Date
4. Total Mass
5. Manufacturing Country
6. Vehicle Identification Number **VIN**
7. Manufacturing Company
8. Rated Power of Engine
9. Engine Displacement
10. Engine Model

Other Identification Plate Location

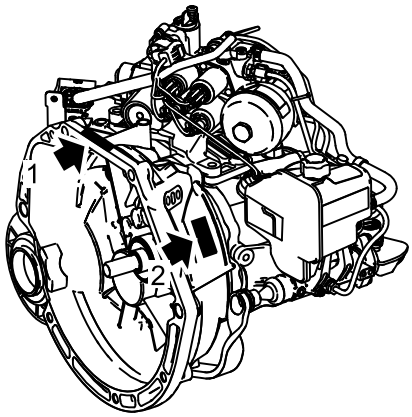
Engine Number



S003029

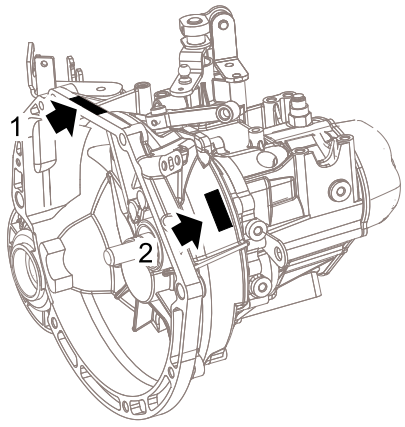
Identification Plate is stamped on the engine block, arrows indicate the location shown in Figure.

Automated Mechanical Transmission Number



Identification Plate is stamped on the upper surface of the transmission housing, as shown in figure (1), where the label is attached to the transmission housing side, as shown in figure (2).

Manual Transmission Number



Identification Plate is stamped on the upper surface of the transmission housing, as shown in figure (1), where the label is attached to the transmission housing side, as shown in figure (2).

Lifting & Towing

Lifting

Lifting instructions

Before lifting the vehicle off the ground, please note the following points:

- The ground for parking should be level and solid.
- Pull the hand brake securely.
- Select G gear or N gear for the transmission.

To avoid damage to the lower part of the vehicle body, we must comply with the following support programs:

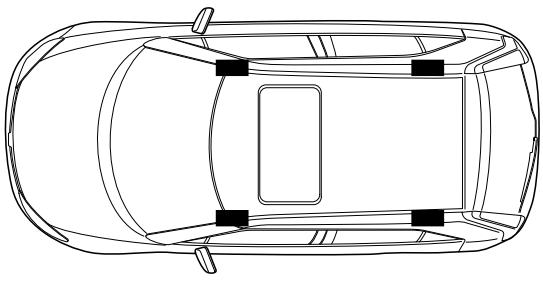
Do not put jack or axle bracket under the following components:

- body structure member
- bumper
- fuel lines
- brake lines
- front suspension arm
- steering coupling mechanism
- rear suspension
- fuel tank
- Engine oil pan
- transmission housing
- rear traction hole

Note: Jacking and supporting the front of the vehicle should only be done under the customer front jacking points and/or the jacking bracket on the front section of the front subframe.

Vehicles' front and rear supporting points

The jack arranged in a vehicle is only for emergency wheel changes and should not be used for other purposes.



To replace the wheel with the vehicle jack, be sure to put the jack on the firm and level ground and under the supporting point in the vicinity of the wheels to be removed. Note that jack's round head must be placed in the corresponding grooves of the floor.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Hydraulic Jack

The hydraulic jacks used must have the carrying capacity of at least 1500 kg (3,300 lbs).

Warning: Do not commence work on the underside of the vehicle until suitable safety supports have been positioned under the sill reinforced brackets.

Warning: Always chock the wheels when jacking.

Lift and support vehicle

Front supporting point of the hydraulic jack

Front: put the head of the jack under the front central support bracket of the front subframe to lift the front of the vehicle.

Side: put the head of the jack on the lifting points of the vehicle front and rear door sills (see the figures of vehicle lifting points).

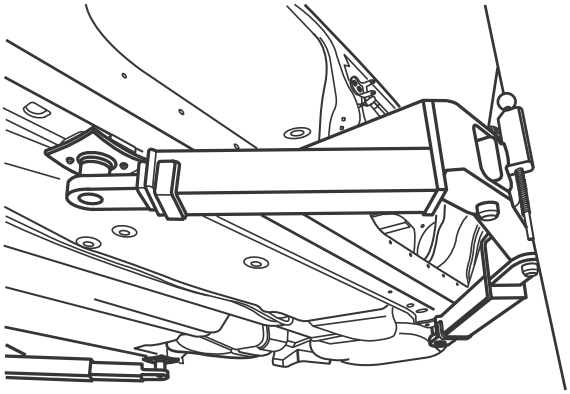
Caution: Only use a jack with a domed head at the sill jacking points. The domed head of the jack fits into the corresponding recess in the sill plate.

Caution: Do not jack or support the vehicle on any other points than those indicated. Failure to comply is likely to result in damage to the body or chassis components.

Warning: Do not commence work on the underside of the vehicle until suitable safety supports have been positioned under the sill reinforced brackets.

Warning: Always chock the wheels when jacking.

Column hoist



S003031

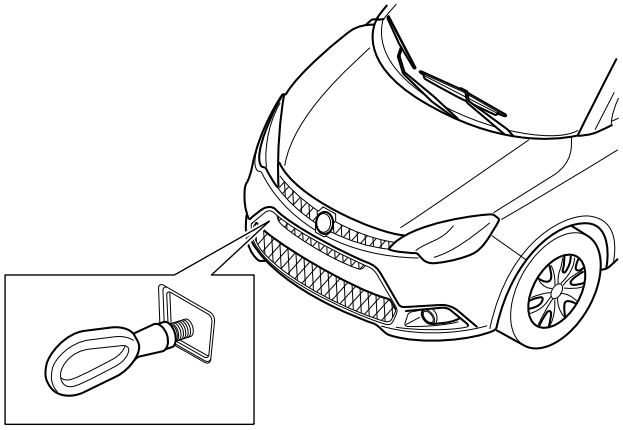
Put the mat under the door sill lifting points.

Vehicle Rescue

Rescue Instructions

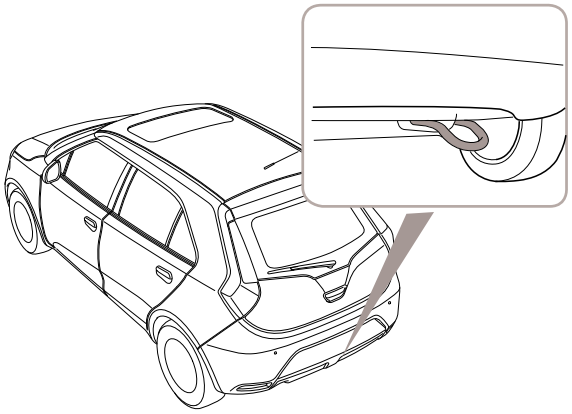
It is recommended to use the rescue trailer or two-wheel emergency rescue vehicles. During emergency, tow with front traction point.

Front Tow Hole



The front of vehicle is fit with a removable tow hook, which is to be used during the rescue. Front tow hooks are usually placed in the vehicle toolbox, and should be put back after use. When fitting the towing hooks, first remove the towing hook cover on the right side of the front bumper and then fit the towing hook into the refit area of the front bumper assembly (buffer beam).

Rear Tow Hook



The fixed rear tow hook can only be used for towing light vehicles. The traction point of the vehicle equipped with manual transmission can be used for the rear towing. However, the rescue utilizing the vehicle rear tow hook should only use the soft rope, while the hard trailer can not be used, otherwise deformation of the rear bumper will result.

Caution: A rear suspended tow must not be used for vehicles with an automatic transmission, as serious damage will be caused to the transmission.

Manual Transmission

Perform the four-wheel traction with traction holes from the front.

Before the beginning of the traction, release the hand brake, and put the selector lever in neutral gear, ignition switch in the open position. Traction speed should not exceed 50km/h.

Ensure the following precautions are prepared:

In order to ensure that vehicle still has the steering capability while being towed, it is necessary to insert the ignition key, and put it in the "ON" position, and kept in this state during the movement of the vehicle.

- When the transmission or drive shaft has problems, towing of vehicles cannot be conducted.
- Ensure that the selector lever is in neutral, and the parking brake has also been released.
- If the engine is not running while towing the vehicle, exercise caution over the operation of the brake and steering.

Caution: If the transmission case occurs malfunction and the transmission fluid level is too low or the towing distance is above 30 miles (50 km), the four wheels of the vehicle cannot be towed absolutely.

Automated Mechanical Transmission

Before the flameout of the engine, put the selector lever in the N position, and ensure the transmission is shifted into the neutral gear. Or even if the ignition key is in position 2, when the shift rod is put into N gear, the message centre will also show N, but in fact the transmission is not in neutral gear maybe. If the vehicle needs a trailer can not be linked into the N gear before flameout because of a fault, then lift the driving wheels to conduct the towing, or it may cause serious damage to the engine or transmission.

In order to ensure that the vehicle still has the steering capability while being towed, it is necessary to insert the ignition key, and put it in the "ON" position, and when the vehicle moves, kept this state during the towing process.

When vehicles equipped with a mechanical automatic transmission are towed with four-wheel traction from the front, you must pay attention to the following points:

Warning: When the vehicle is being towed.

- ***The selector must be at 'N'.***
- ***The vehicle must not be towed at speeds greater than 50 km/h (30 mph) or for a distance exceeding 50 km (30 miles).***
- ***Do not tow if the gearbox or a drive shaft is faulty.***
- ***Ensure the gear lever is in neutral and the parking brake is released.***
- ***Remember that greater effort than normal will be necessary to operate the brakes and steering if the vehicle is being towed without the engine running.***

Caution: Do not tow on four wheels if the gearbox or drive shafts are touching the body or frame.

Note: A vehicle with an automatic transmission cannot be started by towing or pushing.

Lubrication & Maintenance

Capacity

Fluid Capacity

The following capacity values are approximate values of the fluids which should be added to the corresponding system.

Component / System	Capacity
Fuel Tank:	
Available	43.8 ± 1.5 L
Dry Fill	45 ± 1.5 L
Engine - 1.5L	
Engine Oil and Filter Replacement	4.5 L
Transmission Fluid:	
Drain and Refill	1.8 L
Dry Fill	2.0 L
Cooling System - 1.5L Engine	
Expansion Tank	0.9 L
Cooling System	4.75 L
Brake System Brake Fluid	
Dry Fill	0.65 - 0.7 L
Reservoir Tank of Windshield Washer	2.5 L

Fluid

Fuel

Be sure to use the following recommended fluids:

Gasoline Engine

Use 93# gasoline**RON** or high quality unleaded gasoline better than 93#. Do not use gasoline containing methanol.

Antifreeze

Use the mixture of 50% water and 50%**OAT**. Antifreeze containing organic acid technology(**OAT**) preservatives, coolant for using in summer or antifreeze based on ethylene glycol (not containing methanol) are used to protect the cooling system. Only use**OAT** the antifreeze that contains preservatives.

Do not use other types of antifreeze to top up or fill the cooling system. In case of emergency, if this type of antifreeze is unavailable, you may only use pure water as a substitute to fill the cooling system, but note that this will lead to the reduction of frost protection capacity. You must restore the proper concentration of antifreeze as soon as possible.

When the examination time listed in the maintenance service checklist is due, the cooling system should be drained, cleaned, and then the correct amount of antifreeze is added to the system.

After filling antifreeze, put a warning label on the visible location of the vehicle, indicating the type of antifreeze in the cooling system, to ensure the correct type of antifreeze for the next filling.

Antifreeze Concentration

The concentration of the antifreeze should not be less than 50% of the volume, to ensure anti-corrosion properties of the coolant. It is recommend that the concentration of antifreeze should not exceed 60%, or cooling effect will be reduced.

The recommended antifreeze capacity in the following table will provide frost protection to -37 ℃ ~ -40 ℃.

Engine - 1.5L

Concentration	50%
Antifreeze Capacity	5.65 L

Brake Fluid / Clutch Fluid

Only DOT4 brake fluid may be used.

PAS Fluid

Use the fluid that meets Dexron III specification.

Lubricating Fluid

General

The engine and other lubrication systems should be filled up with high-performance lubricating fluids to extend life.

Caution: Always use a high quality oil of the correct viscosity range in the engine. The use of oil of the incorrect specification can lead to high oil and fuel consumption and ultimately to damaged components.

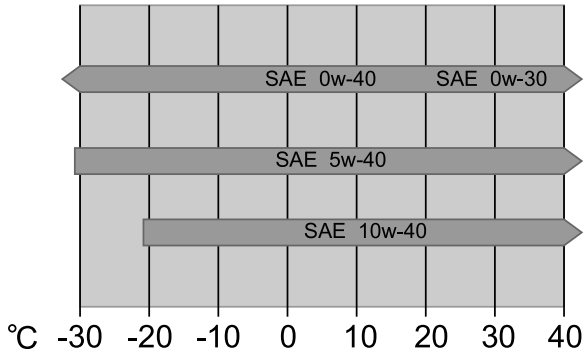
Using the oil containing additives, which meets the recommended specifications, not only can reduce the corrosive acids formed through combustion, but also can prevent the formation of residues; these residues may clog oil passages. Other oil additives can not be used.

Repair and maintenance must be performed at specified intervals.

Engine Oil

The 5W/30 oil that meets ACEA A3/B3 specification must be used.

Refer to the following table for the viscosity/temperature range of the engine oil:



Ambient temperature range

Transmission Fluid

Failure to use the specified transmission fluid may cause serious damage to the transmission.

Use MTF94 oils to charge or fill up it.

General grease

Use the FN745/94 grease produced by Fuchs.

Bonnet Lock Body

Use the FN745/94 grease produced by Fuchs.

Lock, lock body and hinge

Do not apply grease to the fixed end of the torsion spring, however the rotating end is preferentially recommended to apply the Kluber Isoflex Topas L32CN grease.

Washer Fluid

Use QX-35 washer fluid.

Engine Mechanical-1.5 VCT

Specifications

Torque

Description	Value
Bolt - transmission mounting bracket bush to transmission mounting	90–110Nm
Nut - transmission bracket to transmission mounting	90–110Nm
Bolt - engine mounting to engine	40–50Nm
Bolt - tie bar lower to transmission	55–65Nm
Bolt - slave cylinder bracket to rear housing	40–50Nm
Nut - exhaust manifold to exhaust front pipe	45–55Nm
Bolt - transmission mounting to body	55–65Nm
Bolt - engine mounting to engine mounting bracket	90–110Nm
Bolt - flywheel to crankshaft	(32–38)Nm+60°±2°
Bolt - torsion vibration damper to crankshaft	(60±2)Nm+120°±2°
Bolt - cover upper front to cylinder head	8–12Nm
Bolt - cover lower front to cylinder block and crankcase lower	8–12Nm
Bolt - chain guide rail and chain tensioner rail	22–28Nm
Bolt - chain guide rail upper to cylinder head front cam bearing	8–12Nm
Bolt - timing chain tensioner to cyclinder head	77-83Nm
Bolt - camshaft sprocket to camshaft	(25±3)Nm+45°±2°
Bolt - VCT unit to camshaft	70–80Nm
Bolt - oil pump procket to oil pump	22–28Nm
Bolt - cam bearing cap to cylinder head	8–12Nm
Bolt - ignition coil	8–12Nm
Bolt - cylinder head to cylinder block	(30±2)Nm+90°+(90°+45°)±2°
Bolt - patch cylinder head to cylinder block	10–12Nm
Bolt - ocv to cylinder head	5–7Nm
Bolt - thermostat to cylinder head	8–12Nm
Bolt - alternator to cylinder head	40–50Nm
Spark plugs	20–30Nm
Bolt - cover upper front to cylinder head	8–12Nm
Bolt - crankcase lower to cylinder block	22–30Nm
Bolt - bearing cap to cylinder block	(20±2)Nm+ 90°+45° ±2°
Bolt - connecting rod	(18±2)Nm+90°±2°
Bolt - bearing cap to cylinder block	8–12Nm
Bolt - oil pump to crankcase lower	8–12Nm
Bolt - windage tray to crankcase lower	8–12Nm
Oil filter	16–18Nm
Plug - crankcase lower	35–40Nm

Parameter

1.5VCT-general

Model	1.5-liter gasoline engine, 16 valves, double overhead camshaft, variable intake cam timing
Cylinder arrangement	4-cylinder, inline type, transverse mounted, the first cylinder in the front of the engine
Cylinder port diameter	75mm
Stroke	84.8mm
Displacement	1498 cm^3
Ignition order	1-3-4-2
Compression ratio	10.5:1
Rotation direction	Viewed from the front of the engine, it is a clockwise direction
Rated power	80 kW@6000 rev/min
Maximum torque	135Nm@4500 rev/min
Idle speed	750±50 rev/min
The highest speed of the engine	7000 rev/min
Weight (excluding the oil, PAS, A/C, clutch assembly)	116 kg (MT)

1.5VCT-crank

Crankshaft	
Crankshaft End Play	0.205±0.1 mm
Limit of the maintenance value	0.34mm
Main shaft journal diameter:	
Grade A	53.690-53.700mm
Grade B	53.680-53.690mm
Main shaft journal tolerance:	
Grade 0	49.993-50,000mm
Grade 1	49.992-49.984mm
Crankshaft journal diameter of the connecting rod	48,000-47.984mm
Maximum out-of-roundness	0.008mm
Main bearing shells:	
Quantity	Five pieces respectively for the upper and lower portions
Model	Steel backing layer, alloy steel, with oil passages on the upper half of the bearing shells.
Thrust plates	The left and right thrust plates on the third main bearing shell both have half-sheet washers, fitting the thrust surface.
Thrust washer thickness	2.810-2.855mm
Bearing Clearance	0.020-0.054mm

1.5VCT-cylinder block and piston

Cylinder block:	
Material	Cast iron, HT250
Cylinder liner type	Reticulate honed cylinder liner from the processing platform
Cylinder liner diameter	74.985-75,000mm
Fixed size of cylinder block:	

	Cylinder diameter	Maximum diameter of the piston skirt	Supporting cylinder clearance
Normal size	74.985-75.000	74.941-74.959	0.026-0.059
A(+0.5)	75.485-75.500	75.441-75.459	0.026-0.059
B(+1.0)	75.985-76.000	75.941-75.959	0.026-0.059
C(+1.5)	76.485-76.500	76.441-76.459	0.026-0.059

Connecting rod:	
Model	Broken connecting rod due to expansion, material C70S6
The distance between the centers	143.7±0.05 mm
Piston pin type	Semi-floating
Loaded connecting rod	Interference
Length	51.7-52.0mm
Bearing shell of the connecting rod:	
Clearance	0.020-0.071mm
Axial float	0.100-0.246mm
Piston:	
Model	Aluminum alloy, graphite surface treatment, offsetting toward the piston pin on thermal expansion
Piston diameter:	74.941-74.959mm
Tolerance of the piston pin bore	0.009-0.020mm
Maximum ovality	0.002mm
Piston ring:	
Model:	Two gas rings, one oil ring
The first gas ring	The outer circle is of partial barrel surface, with nitrogen surface treatment
The second gas ring	Nose shape, phosphate surface treatment
Oil ring	Springs undergo nitriding treatment, and blades undergo phosphate treatment after nitriding
The tolerance of piston ring to ring groove:	
The first gas ring	0.040-0.080mm
The second gas ring	0.030-0.062mm
Oil ring	0.015-0.045mm

Cutout clearance of piston ring on assembly (measured at 20mm from the cylinder sleeve port) The first gas ring The second gas ring Oil ring	 0.25-0.40mm 0.37-0.57mm 0.10-0.60mm
The ambient width of the piston The first gas ring The second gas ring Oil ring	 0.970-0.990mm 1.170-1.190mm 1.880-1.980mm

1.5VCT-cylinder head and valve

Cylinder head	
Material	Aluminum alloy
Cylinder head bent - Maximum	0.05mm
Cylinder head height New Smoothness limit	 118.95-119.05mm 0.20mm
Camshaft:	
Model	The double overhead camshaft directly acting on the mechanical tappet
Bearing	Five ones for each camshaft, in linear arrangement
Driving	Driven by the chain at crankshaft gear
Camshaft end play: Limit of the maintenance value	0.06-0.19mm 0.30mm
bearing clearance: Limit of the maintenance value	For front end, it is 0.025-0.066 mm; for back end, it is 0.024-0.066 mm 0.15mm
Mechanical tappet:	
Model	Mechanical tappet, directly driven by camshaft
Outer diameter of mechanical tappet	f 29.964 mm-f 29.980 mm
Valve timing:	
Intake valve Turned on Shut off Maximum lift	 22°ATDC 68°ABDC 7.7mm
Exhaust valve: Turned on Shut off Maximum lift	 45°BBDC 11°ATDC 8.2mm
Valve: Valve stem diameter: Intake valve Exhaust valve	 f 5.952-f 5.967 mm f 5.947-f 5.962 mm
Clearance from valve stem to valve guide: Intake valve Exhaust valve	 0.033-0.073mm 0.038-0.078mm

Matching height of valve stem:	
New intake valve	50.021-50.881
New exhaust valve	49.925-50.785
Limit of the maintenance value	0.26mm
Valve head diameter:	
Intake valve	f 29.2-f 29.4 mm
Exhaust valve	f 24.0-f 24.2 mm
Valve seat width	
Intake valve	1.0mm-1.4mm
Exhaust valve	1.4 mm-1.8 mm
Angle of the valve seat surface - the intake valve and exhaust valve	For gas intake, it is 150°, 90°, 60° For gas exhaust, it is 150°, 90°, 60°
Angle of the valve surface - the intake valve and exhaust valve	45°
Valve clearance	Intake valve: 0.11-0.19 mm
	Exhaust valve: 0.20-0.28 mm
valve spring:	
Free length	50.0mm
Refit length	37.0 mm
Assembly Load	250±12.5Nm
Intake valve open load	442±18Nm
Exhaust valve open load	464±18Nm

Lubrication

Lubrication: Model	 Cast aluminum lower crankcase
Fluid pump models: Meshing clearance of inner and outer rotors End clearance between the rotor and the pump cover	Chain-driven rotary pump 0.03-0.11mm 0.05-0.086mm
Free length of pressure discharge valve spring	67.95±1mm
Oil filter	Rotary full-flow oil filter
Cut-off pressure of 3500 rev/min pressure discharge valve	0.54-0.658Mpa

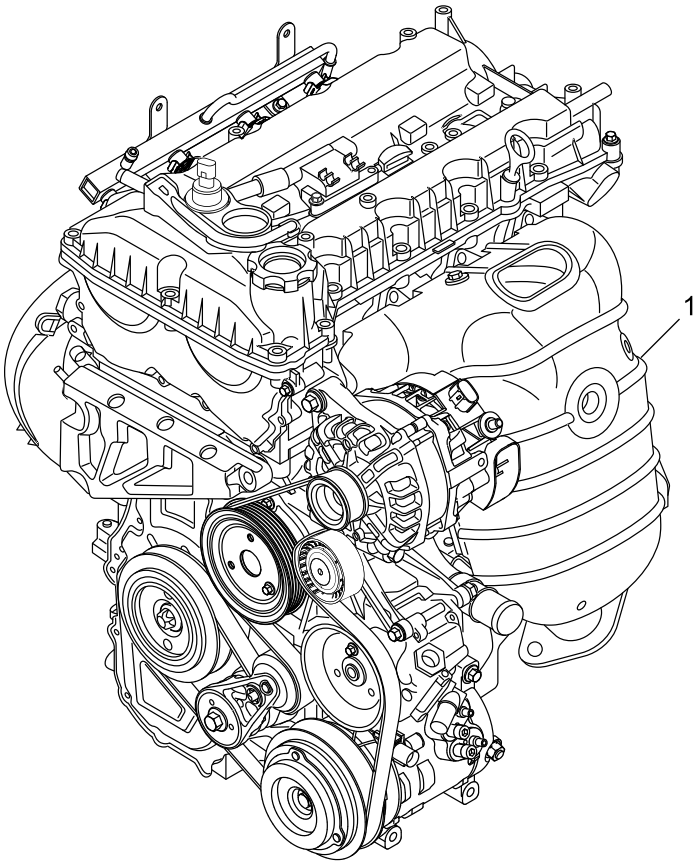
The use frequency of bolts

Part number	Name	Use frequency
BLT200010	Bolt - main bearing cap	Once
90004180	Screw - crankshaft sensor signal wheel	Once
BLT200011	Bolt - connecting rod	Once
90003592	Bolt - oil pump to oil pan	Once
90003620	Stud - intake manifold to cylinder head	Once
BLT200019	Cylinder head bolt	Once
99000007	Bolt - cylinder head to cylinder block	Once
BLT200025	Bolt - camshaft sprocket	Once
BLT200012	Bolt - crankshaft shock absorber	Once
90004291	Bolt - front cover to cylinder head	Once
90000433	Bolt - lower front cover to cylinder block	Once
BLT200013	Bolt - automatic range flywheel to crankshaft	Once
BLT200013	Bolt-flywheel	Once
BLT200015	Bolt-tensioner	Once
90000829	Hexagon flange bolts - exhaust manifold	Once

Description and Operation

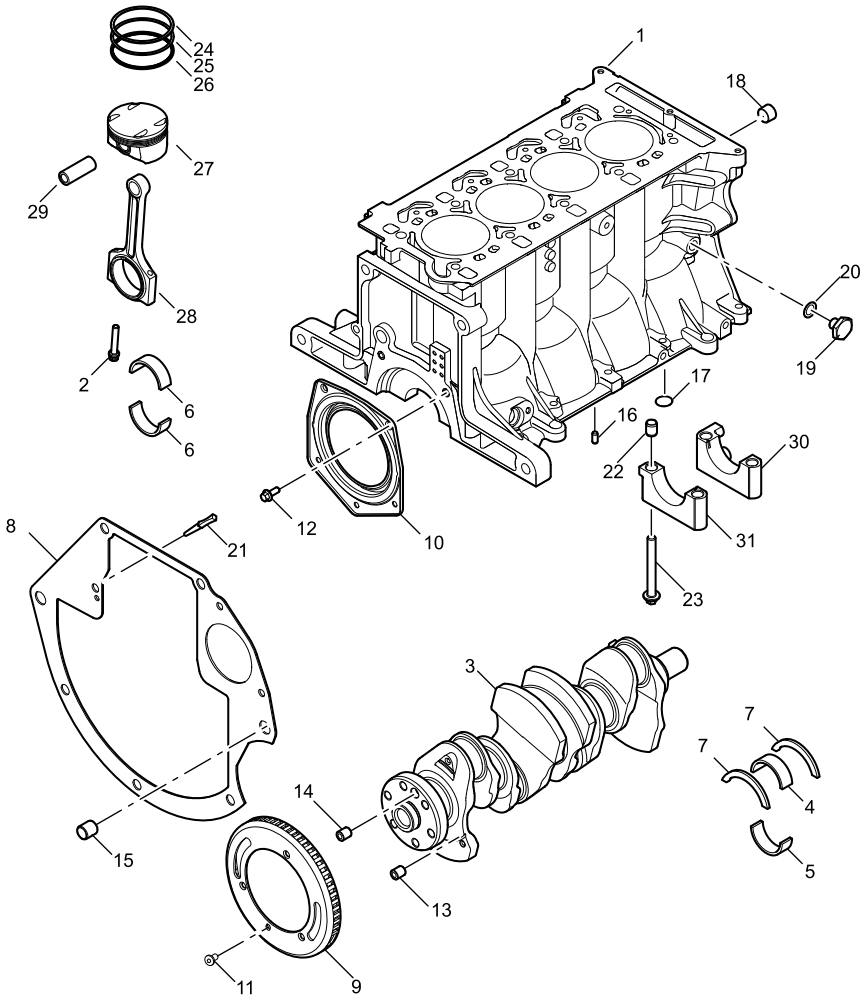
System Component Layout

NSE Engine Component Layout



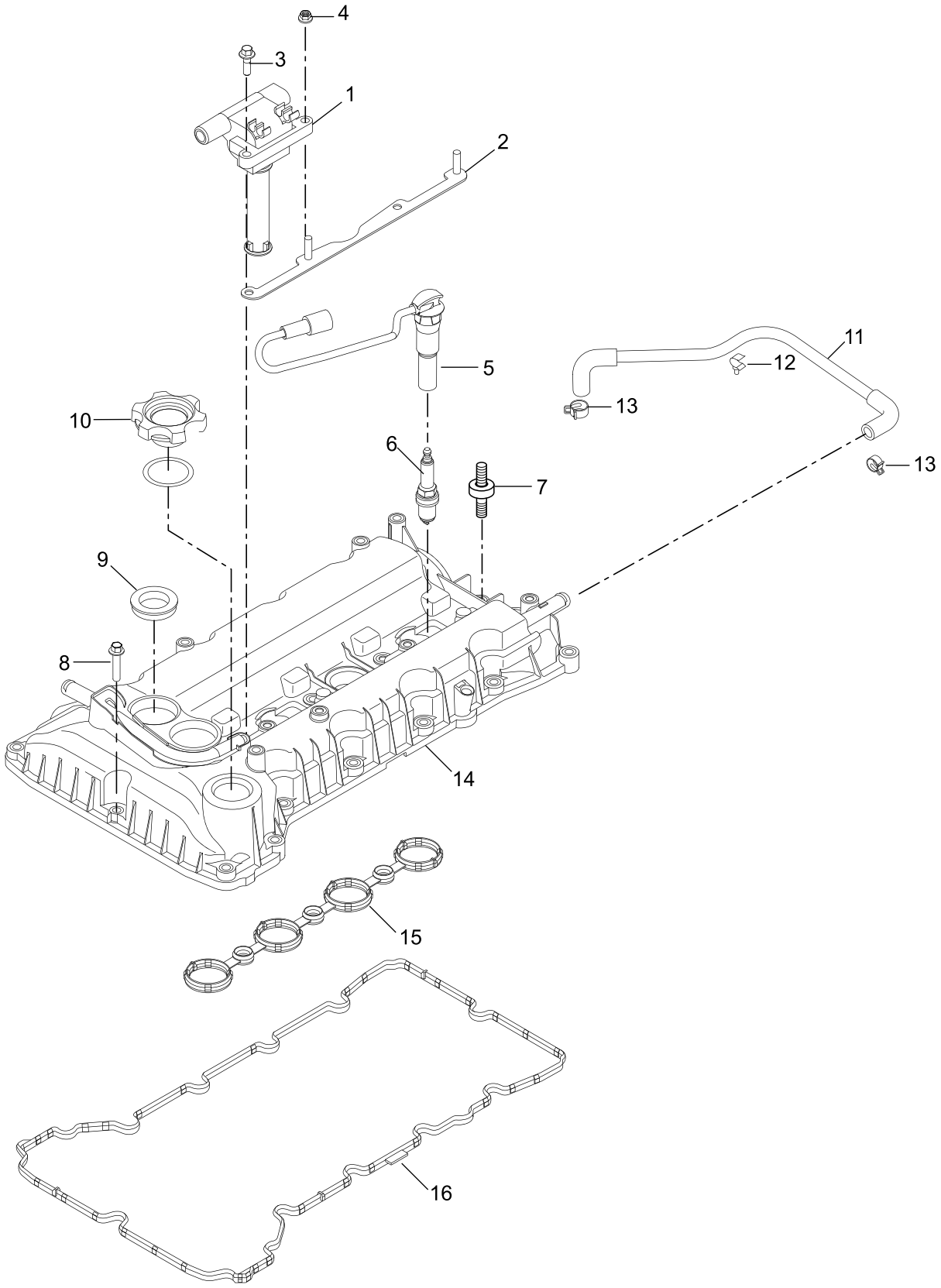
1. 1.5VCT Engine

Cylinder Block Component Exploded View



1. Cylinder Block
2. Bolt - Link
3. Crankshaft Assembly
4. Main Bearing (Top)
5. Main Bearing (Bottom)
6. Large Link End Rod Bearing
7. Main Bearing Thrust Plate
8. Block Rear Cover Panel
9. Crankshaft Sensor Encoder Wheel
10. Crankshaft Rear Oil Seal
11. Screw - Crankshaft Sensor Encoder Wheel
12. Bolt - Crankshaft Rear Oil Seal
13. Positioning Pin - Crankshaft Sensor Encoder Wheel
14. Positioning Pin - Between Crankshaft and Flywheel
15. Positioning Pin - Body to Transmission
16. Positioning Pin - Block to Oil Pan
17. O Ring - Lower Crankcase to Block (Fluid Passages)
18. Blockage - Fluid Passages
19. Plug - Oil Pressure Switch
20. Shim - Block Fluid Passage Blockage
21. Blockage - Timing Hole
22. Positioning Pin - Main Bearing Cap
23. Bolt - Main Bearing Cap
24. The First Ring
25. The Second Ring
26. The Third Ring
27. Piston
28. Link
29. Piston Pin
30. Main Bearing Cap
31. Main Bearing Cap

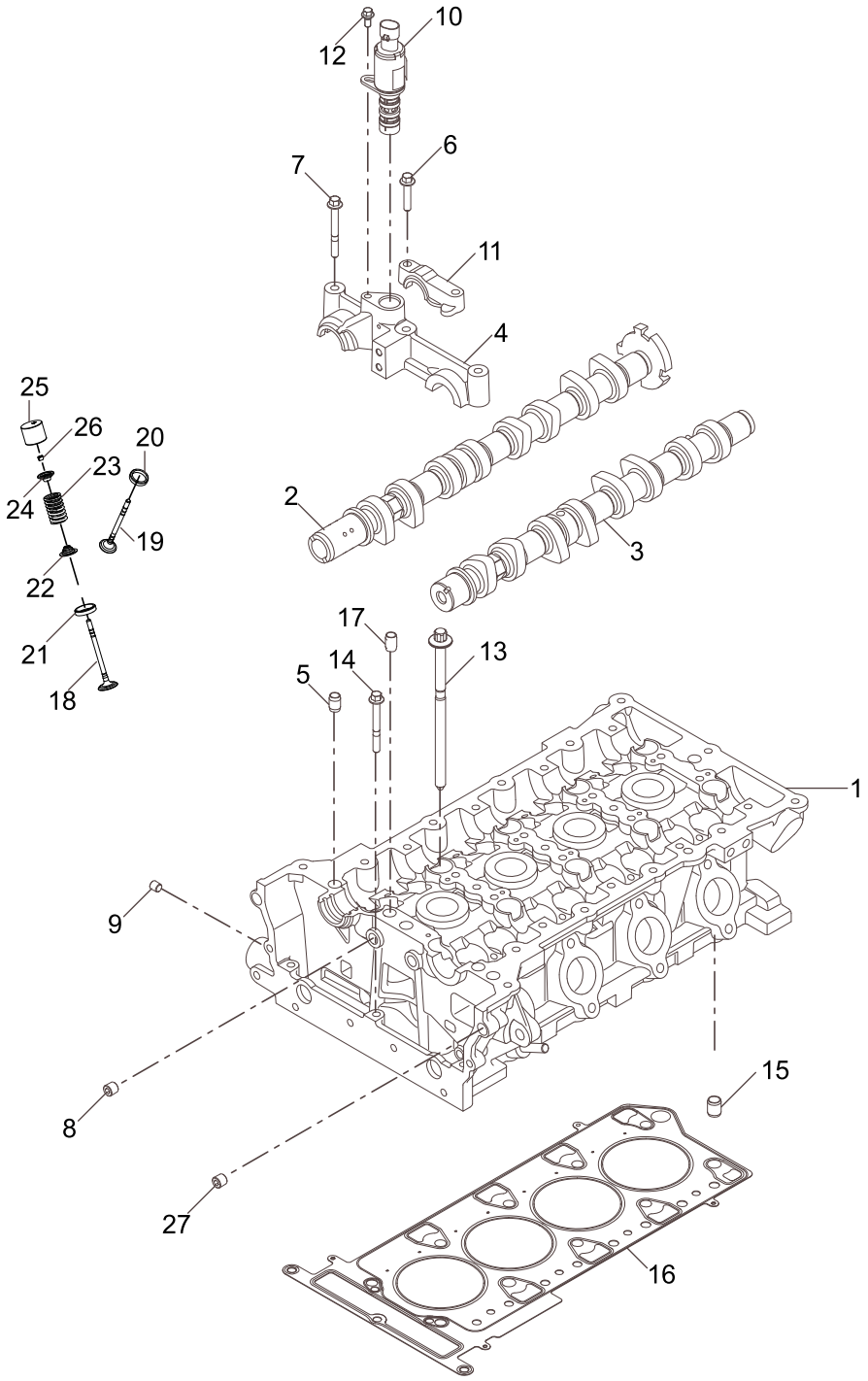
Camshaft Cover Exploded View



1. Ignition Coil
2. Ignition Coil Support
3. Bolt - High-voltage Coil
4. Nut - Ignition Coil
5. High-voltage Coil
6. Spark Plug

7. Stud - Camshaft Cover
8. Bolt - Camshaft Cover
9. Seal - Oil Control Valve Body
10. Fuel Filler Cap
11. Full Load Breather Pipe Assembly
12. C-Clamp - Full Load Breather Pipe
13. Clamp
14. Camshaft Cover
15. Seal - Camshaft Cover (Inside)
16. Seal - Camshaft Cover (Outside)

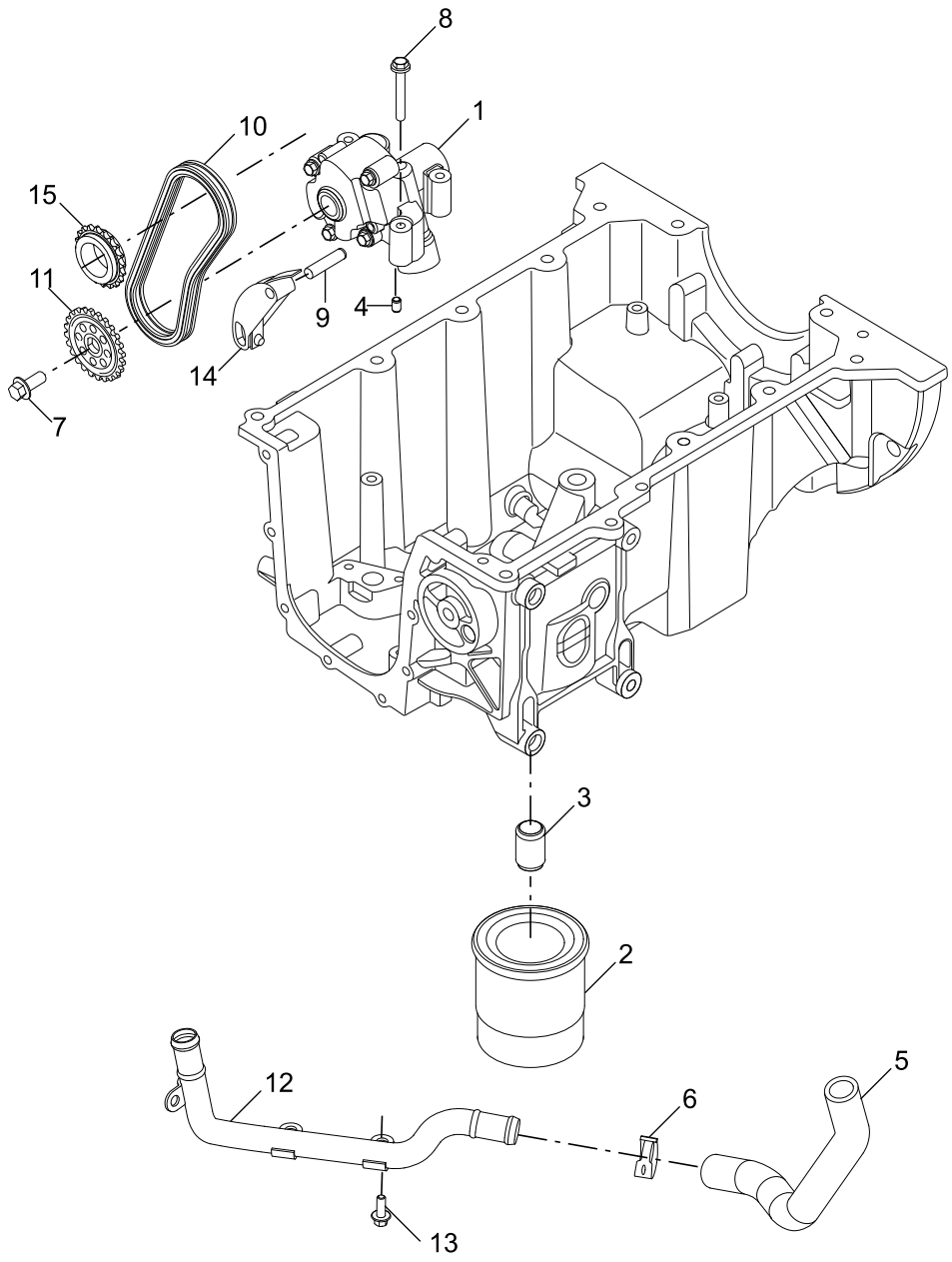
Cylinder Head Exploded View



1. Cylinder Head
2. Intake Camshaft
3. Exhaust Camshaft
4. Camshaft Front Bearing Cap Assembly
5. Positioning Pin - Camshaft Front Bearing Cap to Cylinder Head
6. Bolt - Camshaft Bearing Cap to Cylinder Head
7. Bolt - Front Cam Bearing Cap
8. Fluid Passage Blockage
9. Fluid Passage Blockage
10. Oil Control Valve
11. Camshaft Rear Bearing Cap
12. Bolt - Oil Control Valve
13. Cylinder Head Bolt
14. Bolt - Cylinder Head to Block
15. Positioning Pin - Cylinder Head to Block
16. Cylinder Head Shim
17. One-way Valve

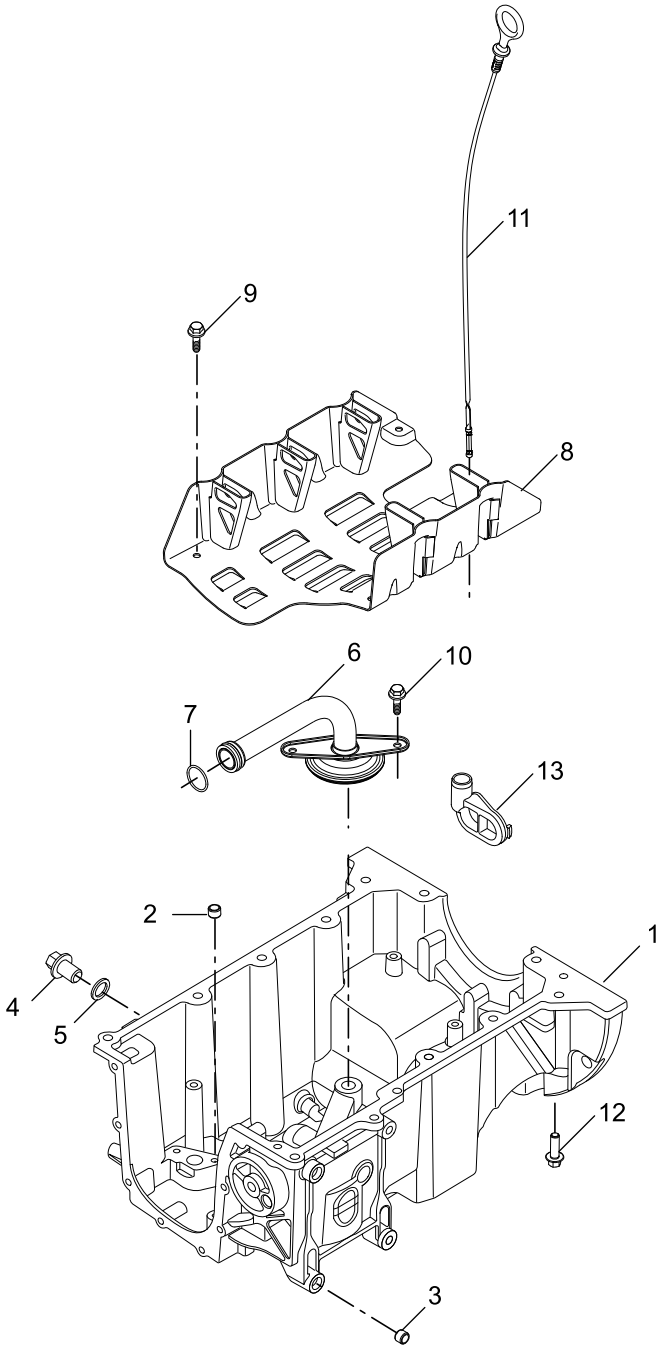
18. Intake Air Valve
19. Exhaust Air Valve
20. Exhaust Air Valve Seat
21. Intake Air Valve Seat
22. Valve Stem Seal
23. Valve Spring
24. Valve Spring Seat
25. Tappet
26. Valve Lock Clip
27. Fluid Passage Blockage

Oil Pump, Oil Filter Exploded View



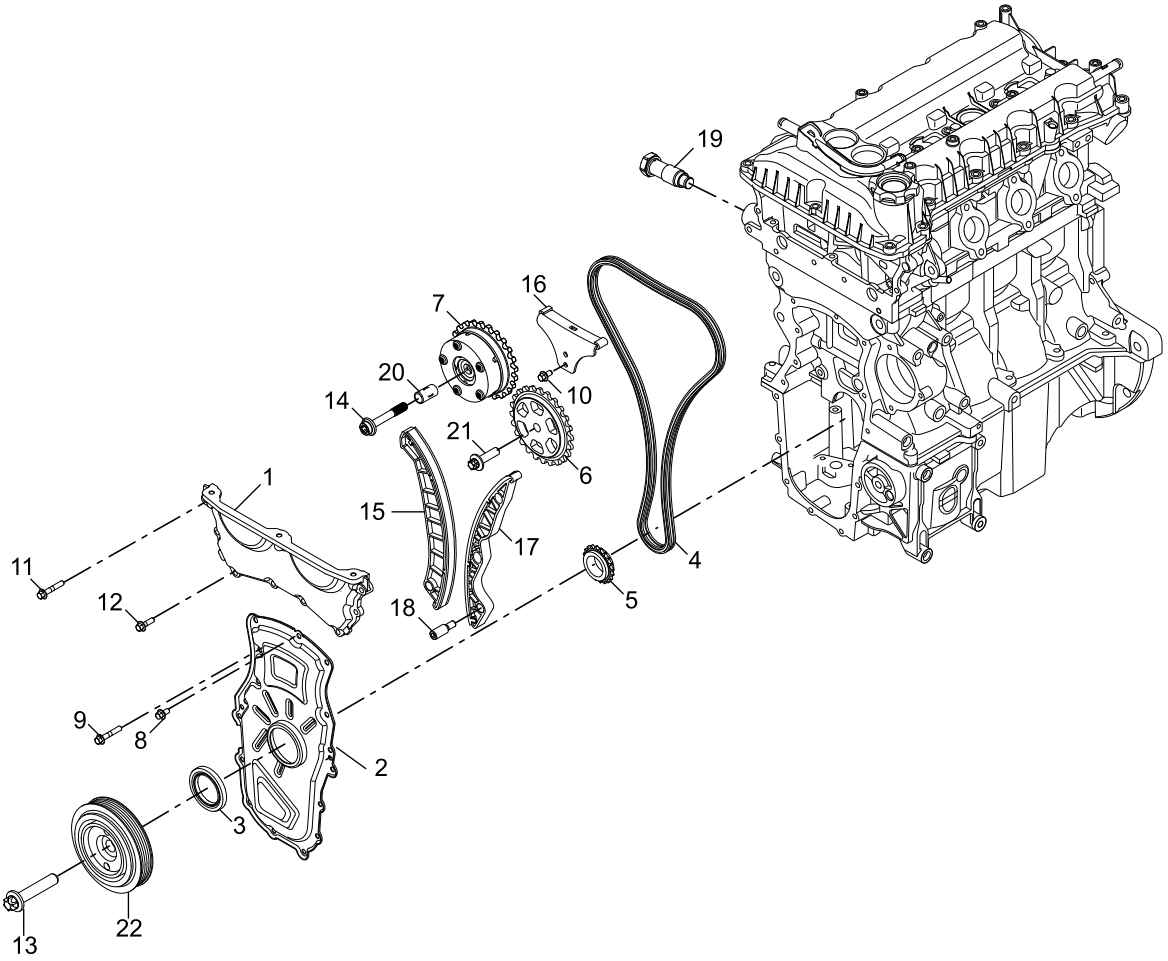
1. Oil Pump
2. Oil Filter
3. Oil Filter Mounting Stud
4. Location Pin - Oil Pump to Lower Crank Case
5. Oil Cooler Hose
6. Clamp - Oil Cooler Hose
7. Bolt - Oil Pump Sprocket
8. Bolt - Oil Pump to Lower Crank Case
9. Pin - Oil Pump Chain Tensioner
10. Oil Pump Chain
11. Oil Pump Sprocket
12. Heater Return Pipe Assembly
13. Bolt - Heater Return Pipe to Lower Crank Case
14. Oil Pump Chain Tensioner
15. Crankshaft Sprocket - Oil Pump Drive

Lower Crankcase Exploded View



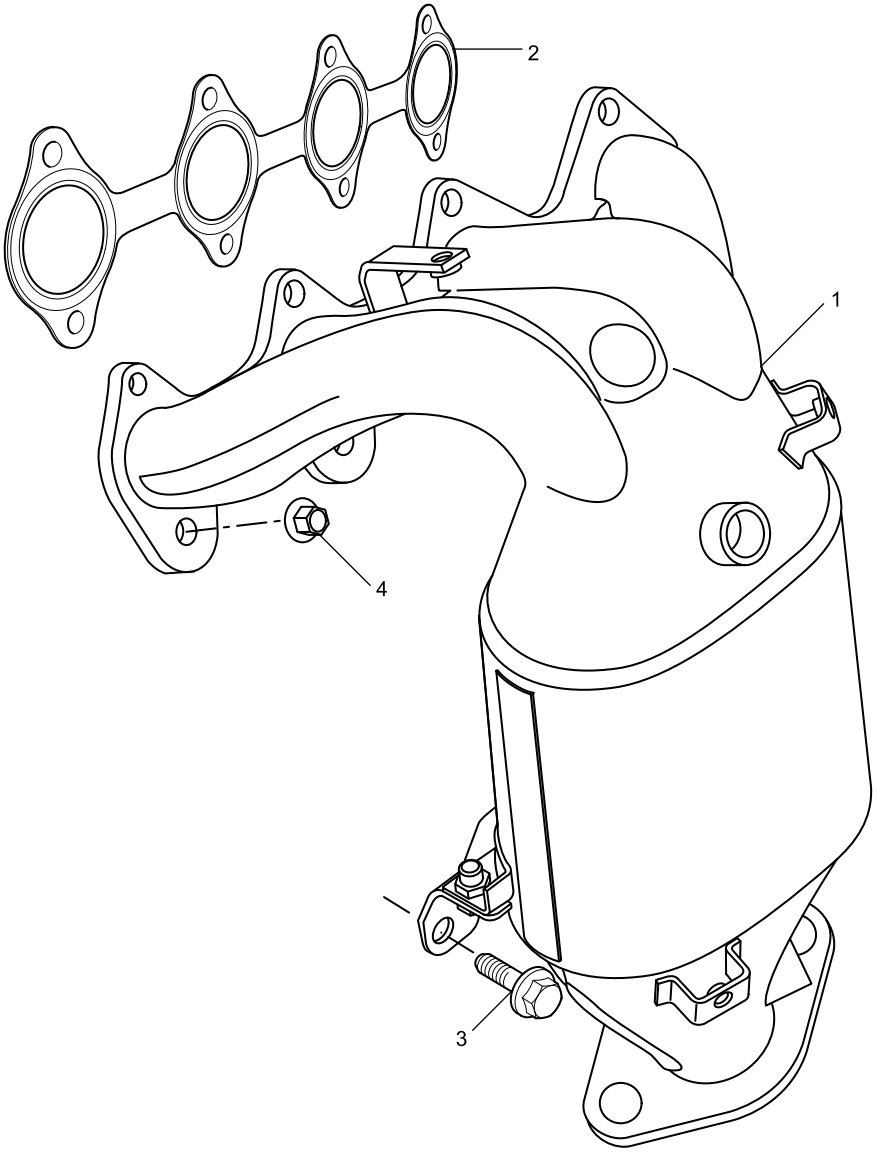
1. Lower Crank Case
2. Location Pin - Lower Crank Case
3. Pin Bush - A/C Compressor to Lower Crank Case
4. Drain Plug
5. Washer - Drain Plug
6. Suction Tube Assembly
7. O-ring - Suction Tube to Oil Pump
8. Oil Baffle
9. Bolt - Oil Baffle
10. Bolt - Suction Tube to Lower Crank Case Assembly
11. Oil Dipstick
12. Bolt - Lower Crank Case to Cylinder Block
13. Plug

Timing Chain System Exploded View



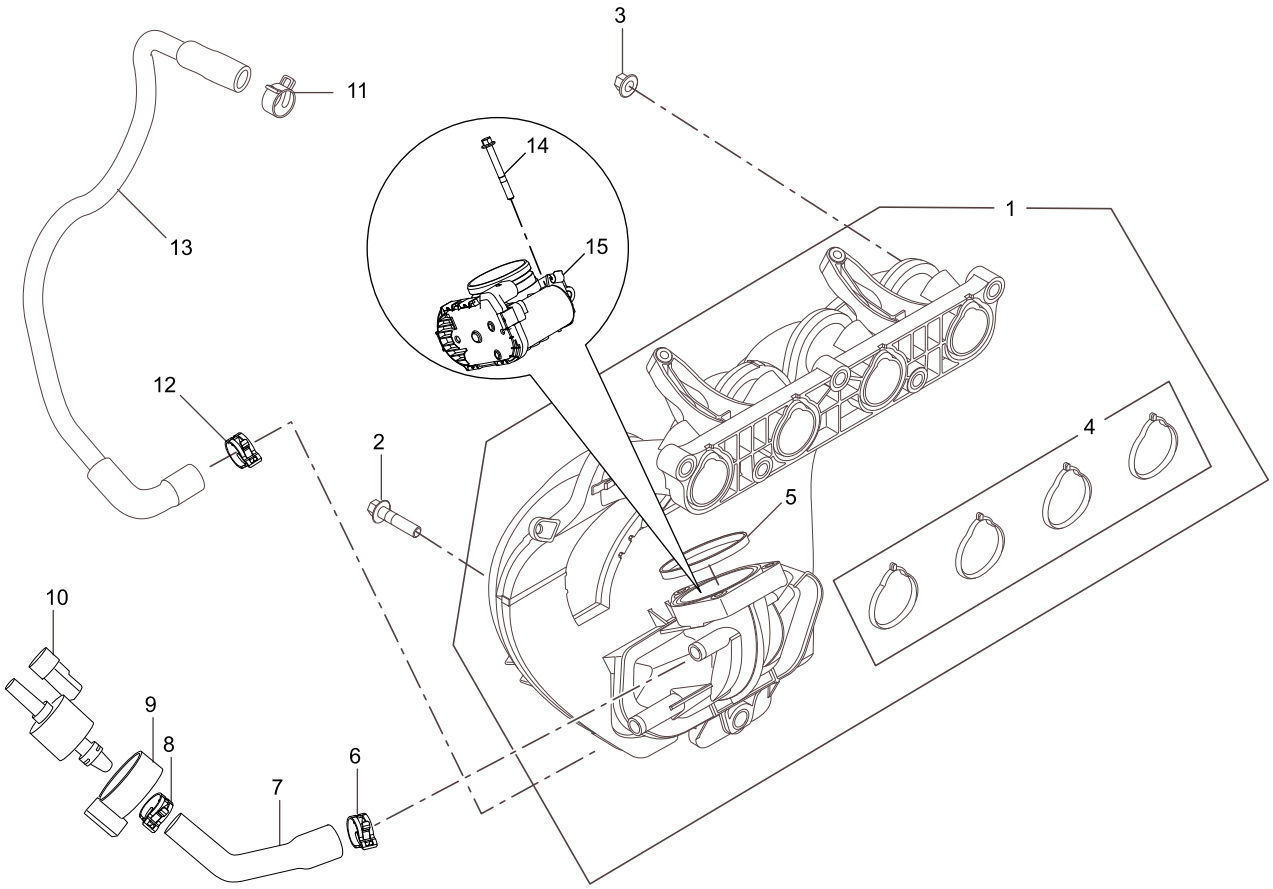
1. Upper Front Cover
2. Lower Front Cover
3. Crankshaft Front Oil Seal
4. Timing Chain
5. Crankshaft Sprocket - Timing Drive
6. Exhaust Camshaft Sprocket
7. Intake Phase Modulator
8. Bolt - Lower Front Cover to Cylinder Block
9. Bolt - Lower Front Cover to Cylinder Block
10. Bolt - Sprocket Upper Guide Rail to Cylinder Head Front Bearing Cap
11. Bolt - Upper Front Cover to Cylinder Head
12. Bolt - Upper Front Cover to Cylinder Head
13. Bolt - Crankshaft Damper
14. Bolt - Intake Phase Modulator
15. Tensioner Rail
16. Upper Guide Rail
17. Chain Guide Rail
18. Bolt - Chain Tensioner Pulley to Cylinder Block
19. Timing Hydraulic Tensioner
20. Oil Control Bushing
21. Bolt - Camshaft Sprocket
22. Crankshaft Damper

Exhaust Manifold Exploded View



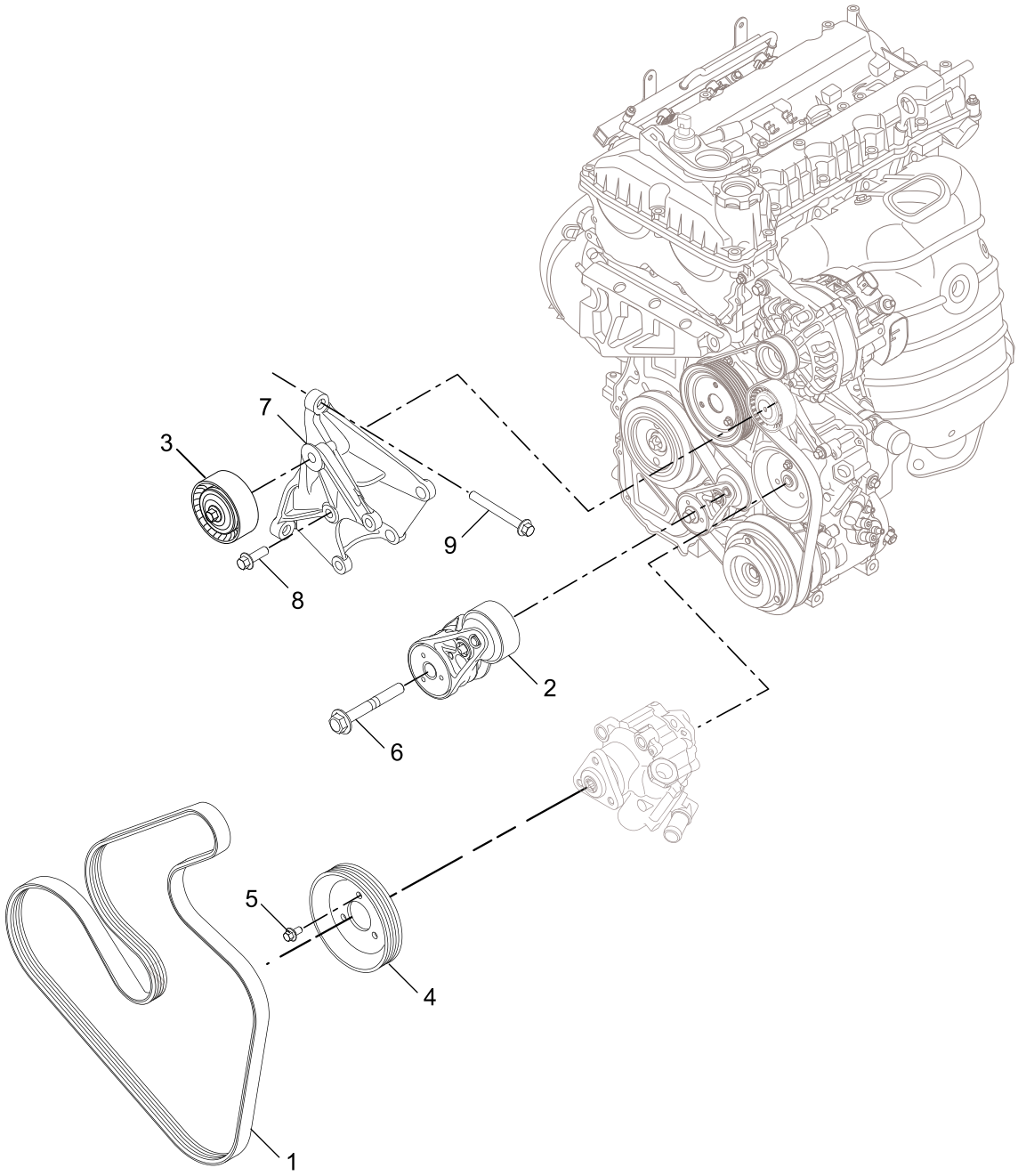
1. Exhaust Manifold
2. Exhaust Manifold Shim
3. Bolt
4. Nut

Intake Manifold Exploded View



1. Intake Manifold
2. Bolt
3. Nut
4. Intake Manifold Gasket - Cylinder Head Side
5. Intake Manifold Gasket - Throttle Valve Side
6. Tube Clamp - Canister Solenoid Valve Connector Tube
7. Connector Tube - Canister Solenoid Valve to Intake Manifold
8. Tube Clamp - Canister Solenoid Valve Connector Tube
9. Canister Solenoid Valve Rubber Boot
10. Canister Solenoid Valve
11. Clamp
12. Clamp
13. Partial Load Breather Tube Assembly
14. Bolt - Throttle Body
15. Throttle Body

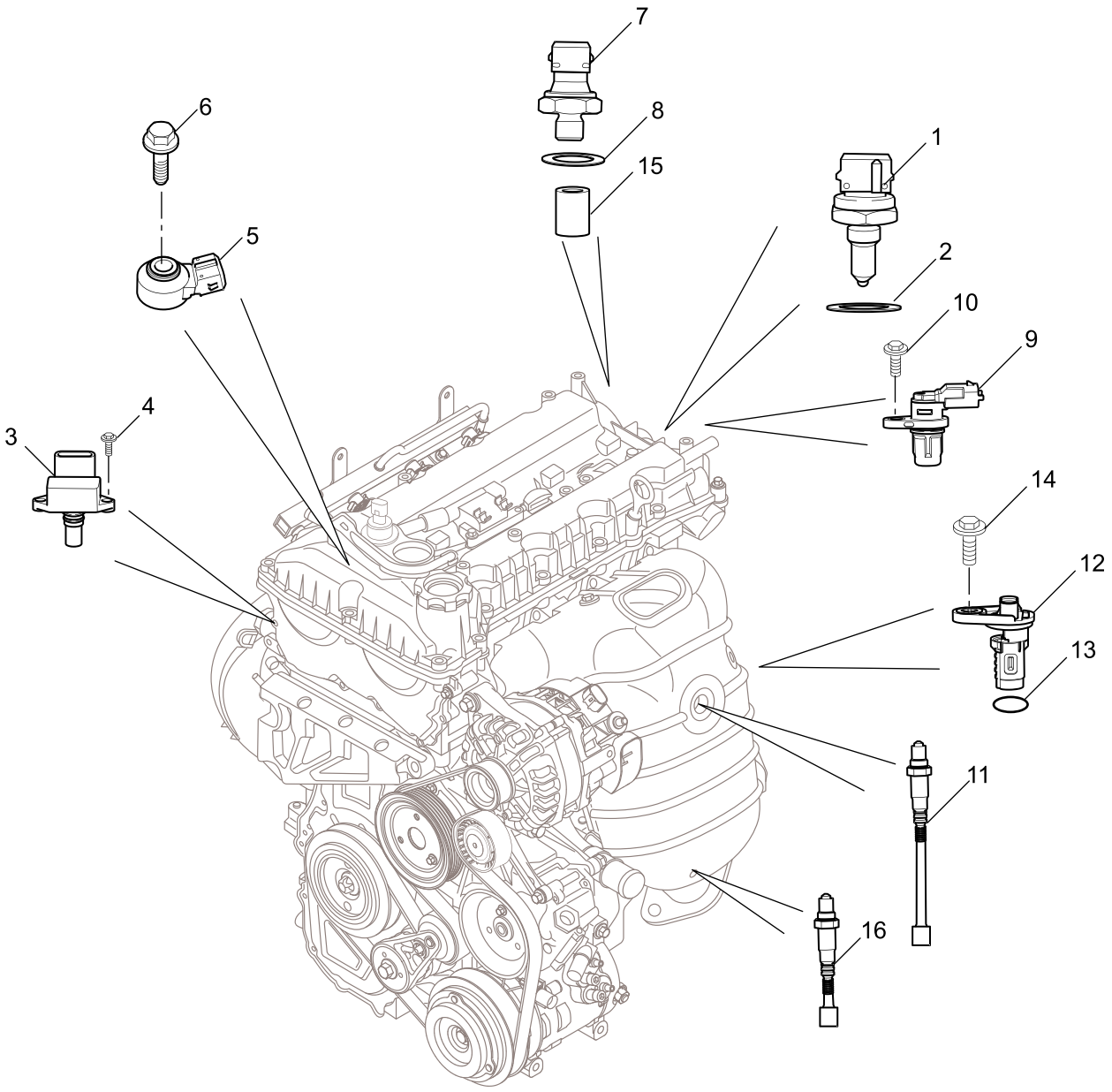
Accessory Belt System



1. Accessory Belt
2. Accessory Belt Tensioner
3. PAS Pump Idler
4. Pulley - PAS Pump
5. Bolt - PAS Pump Pulley
6. Bolt - Tensioner

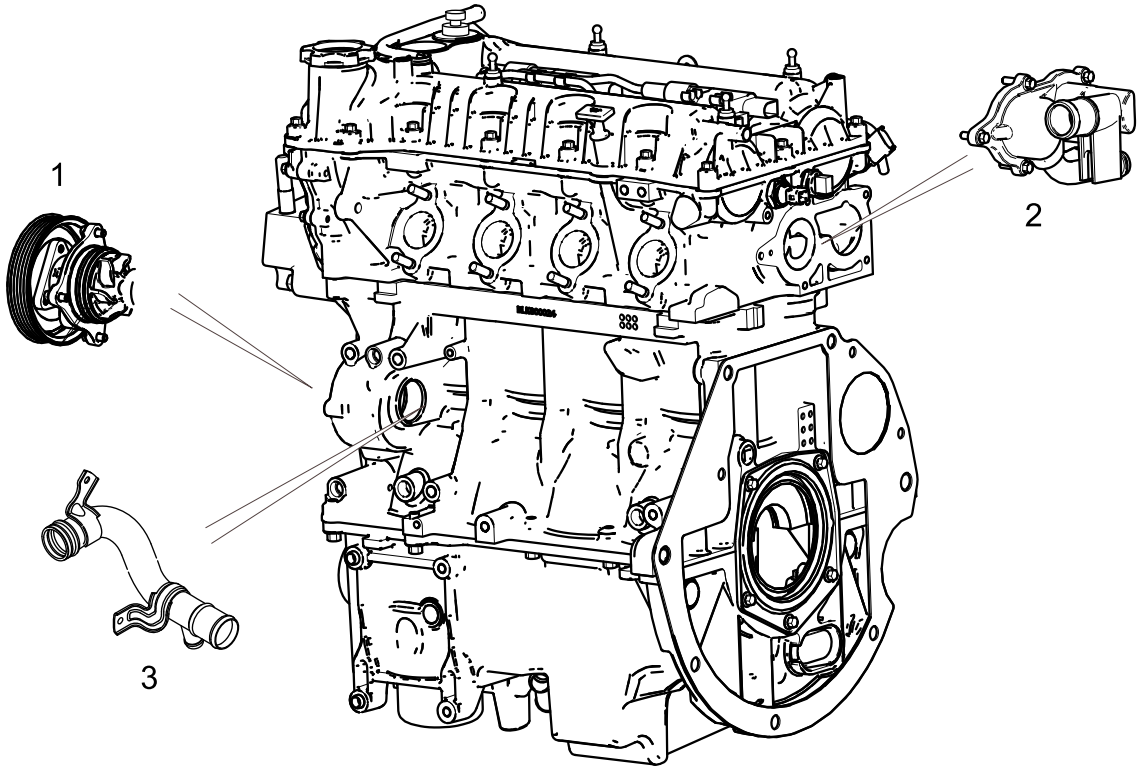
7. Bracket Assembly - PAS Pump
8. Bolt - PAS Pump to Bracket Plate
9. Bolt - PAS Pump Bracket to Block

Engine Sensor



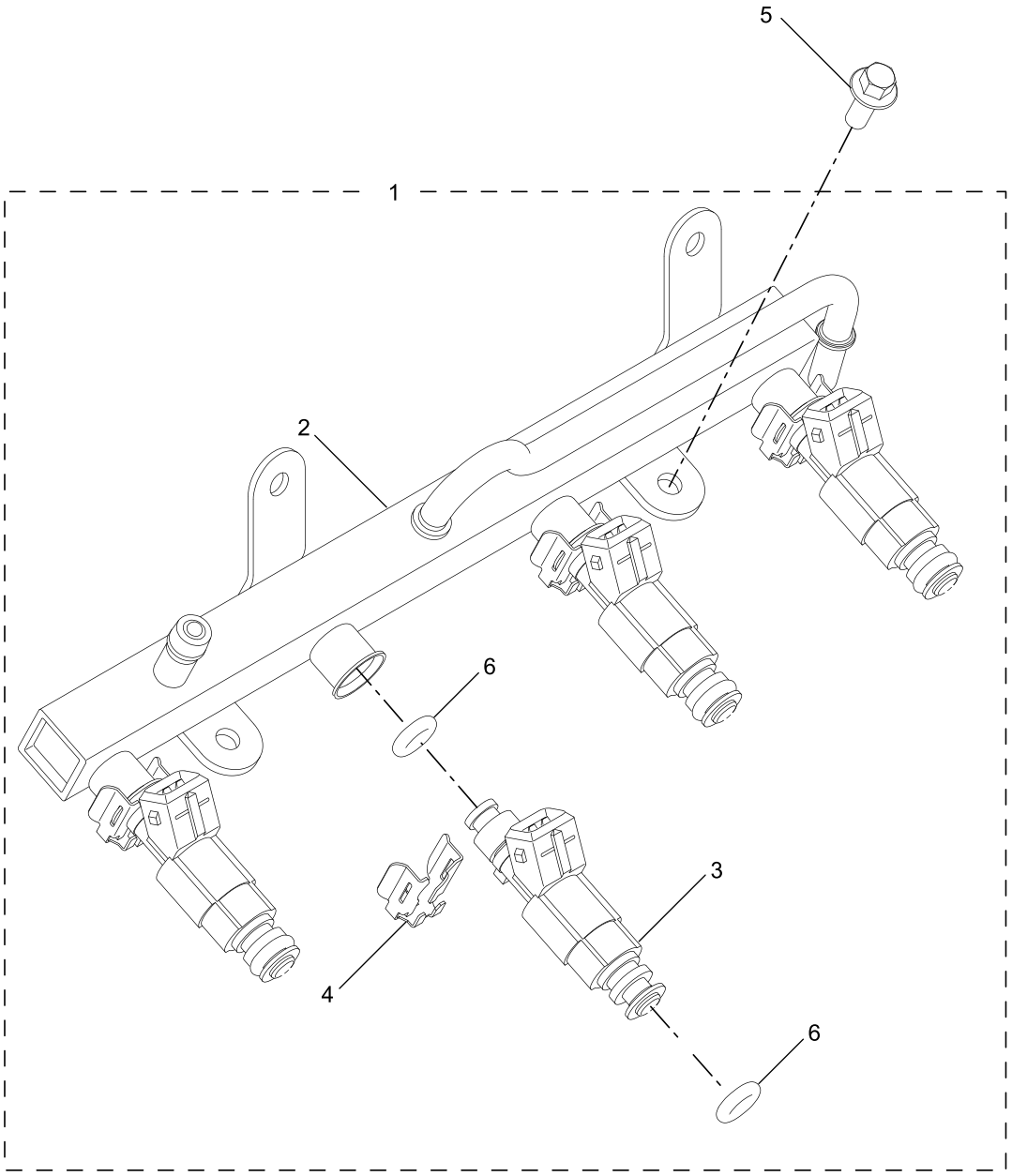
1. Water Temperature Sensor (Oil Temperature Sensor)
2. Shim - Water Temperature Sensor (Shim - Oil Temperature Sensor)
3. TMAP
4. Bolt - TMAP
5. Knock Sensor
6. Bolt - Knock Sensor
7. Oil Pressure Switch
8. Shim - Oil Pressure Switch
9. Cam Phase Senor
10. Bolt - Phase Sensor
11. Front Oxygen Sensor
12. Crankshaft Sensor Assembly
13. O Ring - Crankshaft Sensor
14. Bolt - Crankshaft Sensor
15. Oil Pressure Switch Screen
16. Rear Oxygen Sensor

Water Pump and Thermostat



1. Water Pump
2. Thermostat Assembly
3. Water Pipe

Fuel Rail Assembly



1. Fuel Rail Assembly
2. Fuel Rail
3. Fuel Injector
4. Clip - Fuel Injector
5. Bolt - Oil Rail to Intake Manifold
6. O Ring - Fuel Injector

Description

General

NSE engine is an inline 4-cylinder, 16-valve, timing chain drive, electronically controlled multi-point fuel injection system with a double overhead camshaft structure.

It mainly consists of the cylinder block, cylinder head, crankshaft, connecting rod, camshaft and other components. The cylinder head is made of cast aluminum material, which is connected with the cast iron cylinder block through multiple layers of gasket by ten high strength bolts, and additionally connected directly with cast iron cylinder block by three high strength bolts, providing improved overall strength and a reliable structure.

Cylinder Head Components

The cylinder head adopts the 4-valve per cylinder structure, with spark plugs arranged in the center of the combustion chamber. Due to the use of overhead valve structure, a strong vortex will be formed in the combustion chamber, distributing the air-fuel mixture evenly, which is conducive to the spread of flame to improve the combustion and improve the fuel economy, dynamic performance and emissions performance of the engine.

Mechanical tappets are fit on the top of each valve, and directly driven by the camshaft. Bosses at the bottom of the mechanical tappets are grouped by size, and valve clearance is guaranteed by matching the appropriately grouped mechanical tappets. The valve stem oil seal is pressed and fitted on the oil seal seat of the cylinder head, and at the same time it can serve as the valve spring seat, supporting the valve spring.

The exhaust valve is of carbon deposits removing type, whose processed valve stem on its side can clear the carbon deposits at the end of the valve guide and in the combustion chamber, thereby preventing valve sticking.

It has a multilayer cylinder gasket made of metal, and a pressure ring structure at the cylinder mouth, which strengthens the seal at cylinder mouth; a locally applied rubber coating can ensure the sealing performance.

At the front bearing cap of the camshaft are arranged four oil passages, that is, one oil inlet passage, one oil return passage and two working oil passages. The oil enters into the oil control solenoid valve through the oil passage. The tail end of the intake camshaft is equipped with a camshaft signal wheel, providing signal for the camshaft position sensor. The camshaft has timing pin holes for controlling the timing phase of the camshaft when assembled.

On the drive end of the intake camshaft is fit a phase modulator, which is secured with bolts. The main parts of the phase modulator are made of powder metallurgy. The shell body (stator) driven by timing chain is hydraulically connected with the inner rotor through the five blades fixed to the camshaft end. When the engine is not running, a pin with flexible load locks the two halves of the phase modulator together; when the engine is running, it is released hydraulically to ensure a smooth start.

On the bearing cap of front camshaft is fit an oil control valve, which is sealed with an O-ring and secured with a bolt. The control valve is a four-way proportioning valve, including an oil inlet, an oil return port and two oil passages connected with the working chamber of the phase modulator.

Cylinder Block Components

Cylinder block adopts common cast iron HT250, with improved overall strength, being not easily deformable. Cylinder liner is formed through honing the cylinder bore. To ensure the cylinder cooling effect, Y-shaped waterways are processed between two adjacent cylinders.

Thermal expansion pistons of aluminum alloy are equipped with a semi-floating piston pin, when the engine is cold, the piston pin will be biased toward the thrust side to reduce the "piston impact," and the small end side of the connecting rod adopts interference fit. Each piston is equipped with two gas rings and a oil ring.

The connecting rod of forged steel is constructed with a "H"-type cross section. The big end of the connecting rod moves along the bearing shell on the crankshaft journal. The connecting rod adopts forging + cracking process.

The crankshaft has four counterbalances, supported by five bearing shells. The thrust washer on top of the central main bearing shell controls end float. The radial clearance of bearing shells is optional, and controlled by two bearing shells of different grades. The oil trough provided in the upper half of the main bearing shell supplies oil to the big end bearing shell of the connecting rod through the holes in the crankshaft.

Lower Crankcase Components

The lower crankcase assembly includes a lower crankcase, an oil pump assembly, an oil strainer, and an oil filter.

The aluminum lower crankcase is designed as a shape suitable for accumulating the oil around the oil strainer. After assembly, the oil pump and the oil strainer are assembled to the bottom of the lower crankcase. The oil flows through the oil strainer with screens, pressurized by the oil pump, and then goes through the oil filter.

Clean and impurity-free oil is distributed to the main bearing and cylinder head through the engine block's main oil passages, to lubricate the crankshaft, connecting rod and camshaft and other parts. The lower crankcase and the engine block are secured with bolts, and the mating surface between them is coated with a sealant. Oil drain bolts are located in the left

side of the lower crankcase (in the direction of engine front side).

Engine Accessories

The accessory is a single 5-wedge belt drive system driven by the crankshaft pulley, which consists of a drive water pump, a power assisted steering pump (PAS), an alternator and an air conditioning compressor. The belt is tensioned through the damping tensioner.

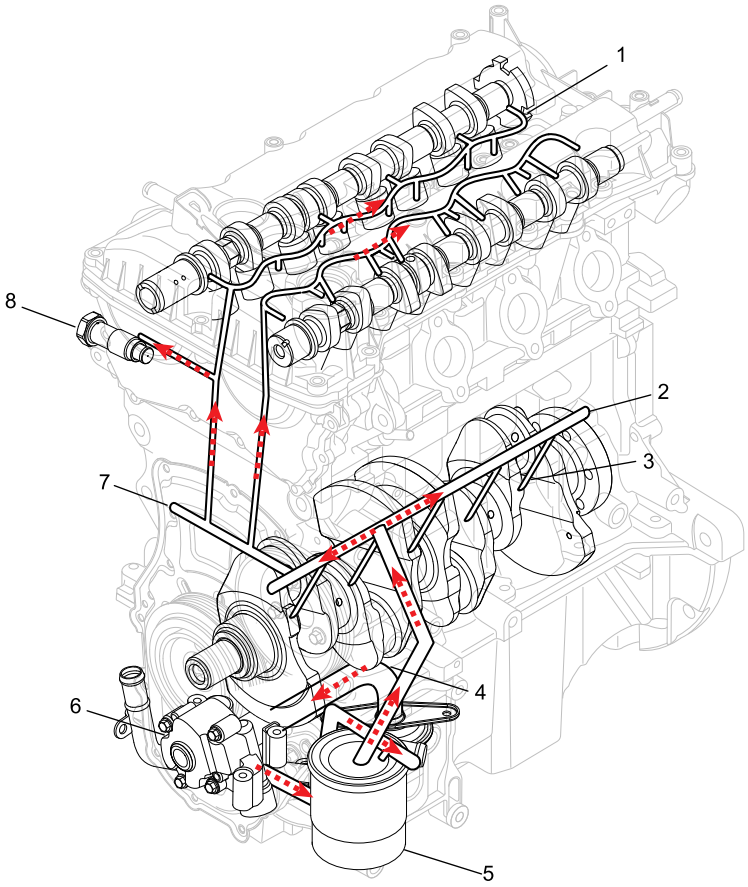
Crankcase Ventilation

Through the vacuum of the intake system, the ventilation system reintroduces the exhaust gas, which has fled into the crankcase, into the intake system, and then into the cylinder to undergo combustion, thus reducing air pollution.

The oil and gas in the crankcase undergo the separation through the oil separator in the camshaft cover, with the oil flowing back into the crankcase.

Operation

Lubricant Passage Ways



1. Cylinder Head Oil Passage
2. Cylinder Block Main Oil Passage
3. Crankshaft Crossover Oil Passage
4. Oil Inlet Tube
5. Oil Filter
6. Oil Pump
7. Main Oil Passage
8. Timing Chain Tensioner

The lubrication system is a forced oil feeding system with full-flow filtration, in which the oil is sucked up by the oil pump from the oil pan, through the oil strainer. The oil strainer has a screen to prevent impurity from entering into the oil pump.

The oil pump with a pressure discharge valve is driven by a crankshaft through the chain. When the oil pressure reaches a certain limit, the pressure discharge valve will open, and the excess oil will flow back into the inlet side of the oil pump, to maintain the oil pressure within a certain operating range and ensure that the engine is running properly. The oil flowing out of the outlet of the oil pump enters into the full-flow oil filter.

The full-flow oil filter is fit directly on the oil pan, with a bypass valve fitted on the oil filter. When the filter element is clogged, the valve is opened, to ensure smooth flow of the oil, but the oil filter needs to be replaced as soon as possible.

Subsequently, the oil enters into the main fluid passages, and then directly lubricates the main bearing shell through the cross passage ways. The cross passage ways on the crankshaft can transport the oil from the main bearing shell to the big end bearing shell of the connecting rod.

On the cylinder head, there are two lateral fluid passages connected with the main fluid passages on the cylinder body. After entering into the lateral fluid passages, the oil flows into two horizontal fluid passages of standard length, to supply the oil to each of the mechanical tappet and the camshaft journal. An oil pressure switch and an oil temperature sensor are provided in the back end of the horizontal fluid passages, monitoring oil pressure and oil temperature, respectively.

The oil splashed by the crankshaft lubricates cylinder walls, and the oil collected on the lower portion of the piston crown lubricates the small end of the connecting rod. The oil passage ways conduct the oil from the small end of the connecting rod into the piston pin.

Service Procedures

Refit and Remove of Power Assembly - MT

Remove

1. Fix the vehicle to the hoist.
2. Disconnect battery earth lead.
3. Remove the battery.

☞**Battery Remove**

4. Remove the bolts securing the battery tray and remove the battery support.

☞**Battery Tray Remove**

5. Remove intake air duct assembly.

☞**Intake Air Duct Assembly Remove**

6. Drain the cooling system.

☞**Cooling System Draining**

7. Empty power steering fluid.
8. Remove expansion tank.

☞**Expansion Tank Remove**

9. Remove the bonnet lock.

☞**Bonnet Lock Remove**

10. Remove the water tank upper beam.

☞**Water Tank Upper Beam Remove**

11. Remove the radiator.

☞**Radiator Remove**

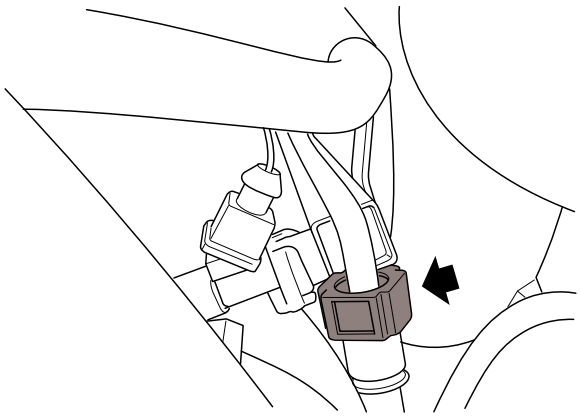
12. Release fuel pressure.

☞**Fuel Pressure Release**

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

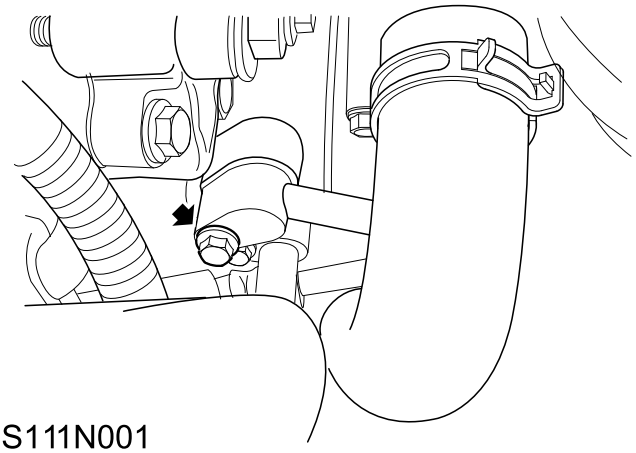
13. Separate the oil supply and return lines of the fuel rail.



14. Remove air cleaner assembly.

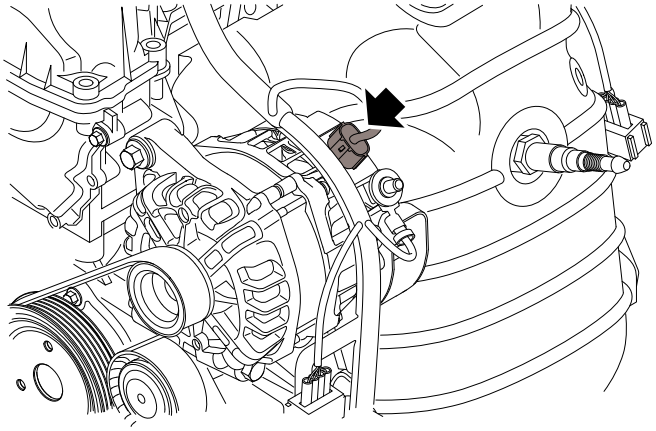
☞**Air Cleaner Assembly Remove**

15. Separate the air-conditioning compressor connector and the pipeline.

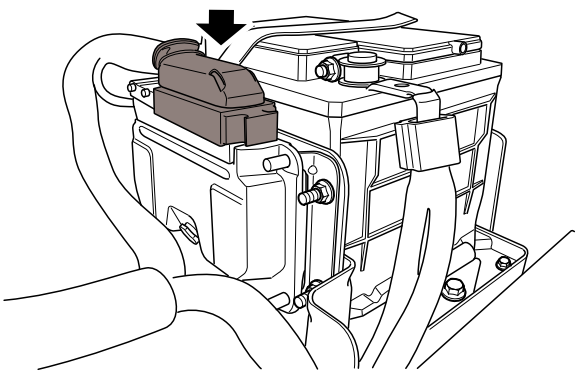


S111N001

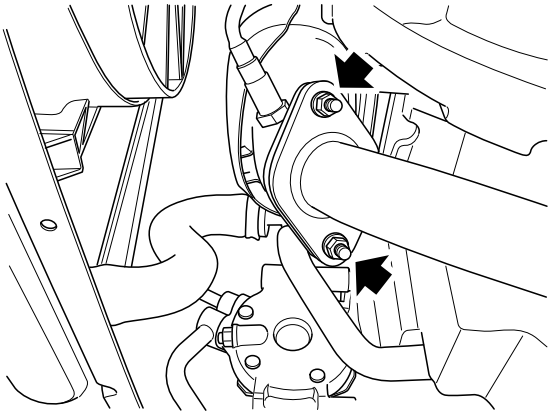
16. Separate the pipeline and the hose from the power assisted steering pump.
17. Disconnect generator harness connector.



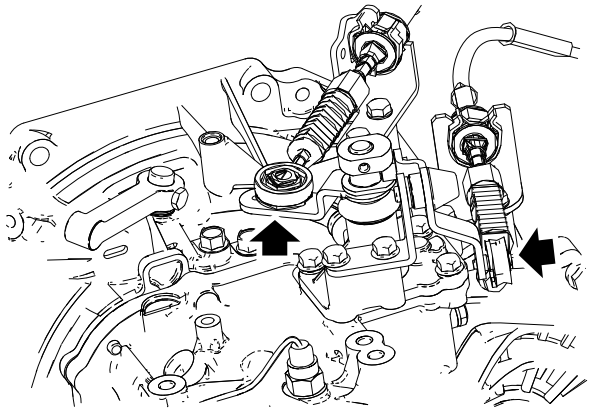
18. Separate the engine**ECM** connection.



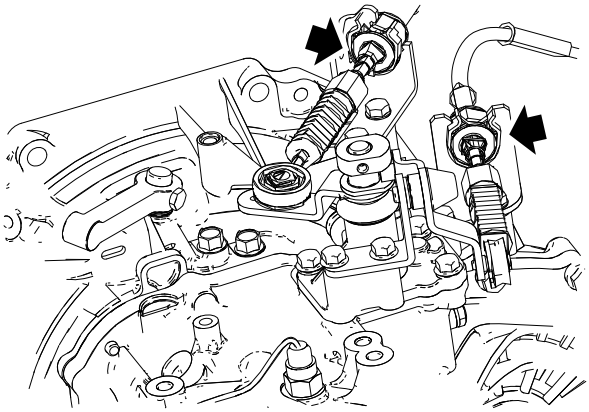
19. Remove the bolts connecting the exhaust manifold and the exhaust front pipe.



20. Disconnect the reverse light switch connector.



21. Pay attention to the refit position and loosen two cable ball joints from the manual transmission gear selection/shift rocker arm.



22. Loosen the clamp fixing the gear selection/shift cable to the bracket.
23. Drain the transmission fluid.

☞**Transmission Fluid Draining**

24. Release two bolts fixing the slave cluster cylinder to the manual transmission, then loosen and temporarily store the slave cluster cylinder aside.

Caution: Don't hang the slave cylinder for a long time.

25. Remove the drive shaft assembly.

☞**Left Drive Shaft Remove**

☞**Right Drive Shaft Remove**

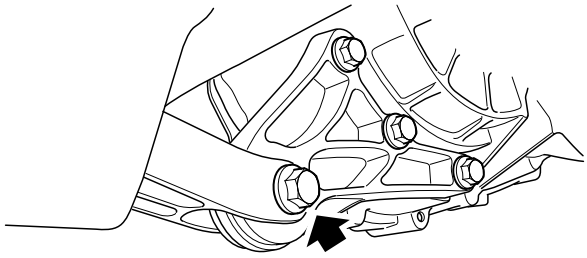
26. Release two bolts fixing the slave cluster cylinder to the manual transmission slave cluster cylinder supporter, then loosen and temporarily put the slave cluster cylinder aside.

Caution: Don't hang the slave cylinder for a long time.

27. Use the lifting tray to support the power assembly

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

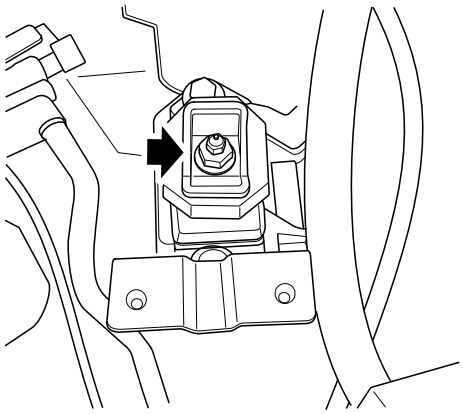
28. Remove the lower tie bar.



29. Remove the power assembly suspension.

☞**Power Assembly Suspension Remove**

30. Remove transmission suspension.



31. Remove the power assembly.

Refit

1. put the powertrain mounting to the engine cabin by using a lifting tray.
2. Put the powertrain mounting to the refit position.
3. Fit the transmission mounting bracket bushing to the transmission mounting bracket bolts and tighten the bolts to **90–110Nm**.
4. Fit the transmission mounting and tighten the nuts

to **90–110Nm**.

5. Fit the powertrain mounting and tighten the bolts to **40–50Nm**.
6. Fit the engine mount lower support and tighten the bolts to **55–65Nm**.
7. Position the slave cluster cylinder and tighten the fastening bolts of the slave cluster cylinder to **40–50Nm**.
8. Position the range selector lever cable to the cable bracket and fix it with a clip.
9. Connect the select shift cable knob to the select shift rocker arm.
10. Inspect the operation of the select shift of the transmission.
11. Connect the reverse lamp switch connector and fix the wiring harness clamp.
12. Fit the drive shaft assembly.

☞**Left Drive Shaft Assembly Refit**

☞**Right Drive Shaft Assembly Refit**

13. Fit the bolts connecting the exhaust manifold and the exhaust front pipe and tighten them to **45–55Nm**.
14. Fit the engine and the connector **ECM**.
15. Connect the engine wiring harness connector.
16. Connect the power assisted steering pump upper lines and hoses.
17. Connect the air conditioning compressor connector and the lines.
18. Fit fuel feed lines and fuel return lines.
19. Fit radiators.

☞**Radiators Refit**

20. Fit expansion water tanks.

☞**Expansion Water Tanks Refit**

21. Fit the bonnet lock body.

☞**Bonnet Lock Body Refit**

22. Fit the member front end panel.

☞**Member Front End Panel Refit**

23. Fit the inlet duct assembly.
24. Air cleaner filter assembly.

☞**Air Cleaner Filter Assembly Refit**

25. Fit the bolts fixing the battery pallet and fit the battery tray.
26. Fit the battery.

☞**Battery Refit**

27. Cooling system filling.

☞**Cooling System Filling**

28. Connect battery earth lead.

Power Assembly Replacer - AMT

Remove

1. Fix the vehicle on the lift.
2. Disconnect battery earth lead.
3. Remove the battery.

☞**Battery Remove**

4. Remove the bolts securing the battery tray and remove the battery support.

☞**Battery Tray Remove**

5. Remove the intake pipe assembly.

☞**Intake Pipe Assembly Remove**

6. Drain the cooling system.

☞**Cooling System Draining**

7. Empty the power steering fluid.
8. Remove expansion tank.

☞**Expansion Tank Remove**

9. Remove the bonnet lock body.

☞**Bonnet Lock Body Remove**

10. Remove the member front end panel.

☞**Member Front End Panel Remove**

11. Remove radiator.

☞**Radiator Remove**

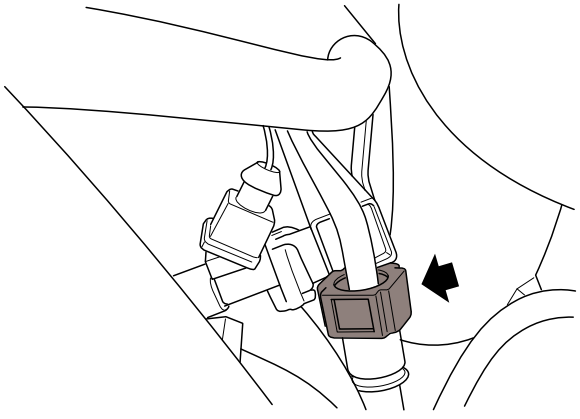
12. Release fuel pressure.

☞**Fuel Pressure Release**

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

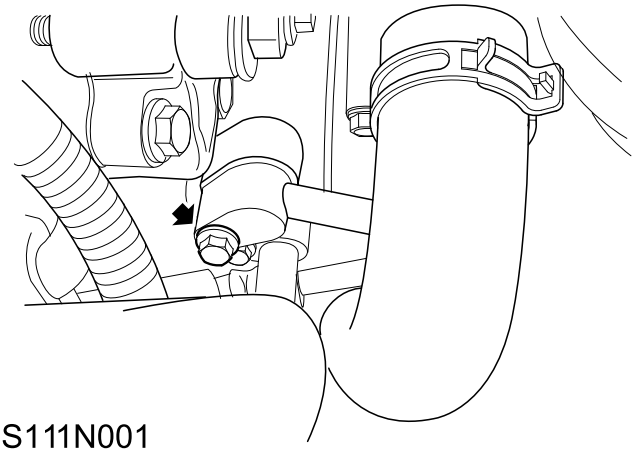
13. Detach feed and return pipes of fuel rail.



14. Remove the air cleaner assembly.

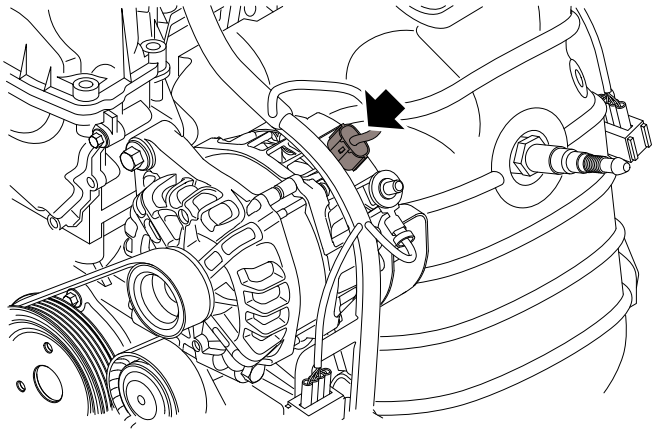
☞**Air Cleaner Assembly Remove**

15. Detach air-conditioning compressor connector and pipes.

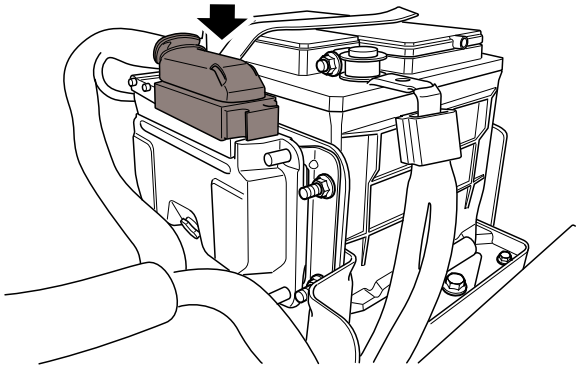


S111N001

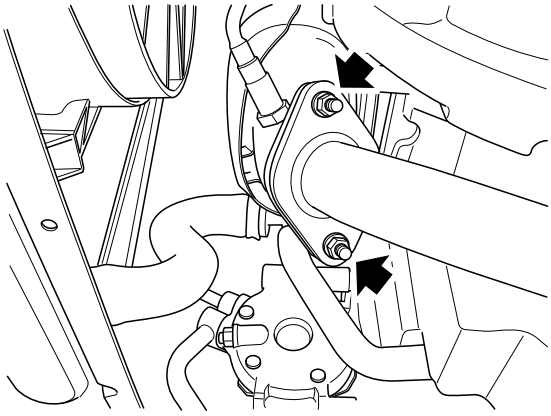
16. Detach pipes and hoses from the power assisted steering pump.
17. Disconnect generator wiring harness connector.



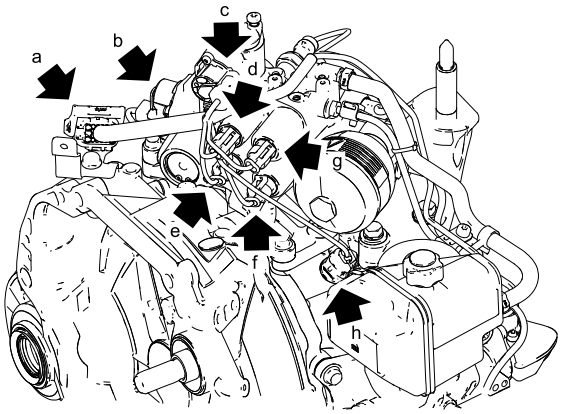
18. Detach generator**ECM** connection.



19. Remove the bolts connecting the exhaust manifold and exhaust front pipe.



20. Disconnect the reverse lamp switch connector.



21. Disconnect the transmission wiring harness and body wiring harness (a).
22. Drain the transmission fluid.

☞**Transmission Fluid Draining**

23. Remove the drive shaft assembly.

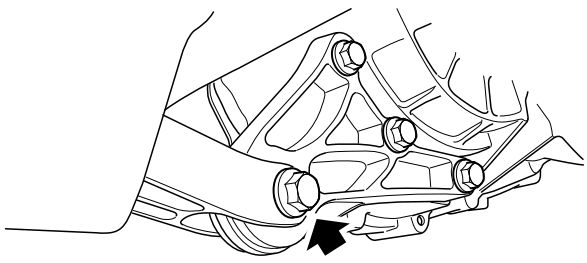
☞**LH Drive Shaft Remove**

☞**RH Drive Shaft Remove**

24. Support the power assembly with a lifting tray.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

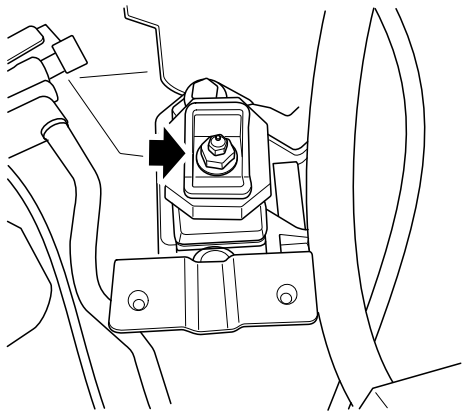
25. Remove engine mount lower support.



26. Remove power assembly Mounting.

☞**Power Assembly Mounting Remove**

27. Remove transmission case mounting.



28. Remove power assembly.

Refit

1. With assistance, use the lifting tray to put the power assembly into the engine compartment.
2. Put the power assembly to the refit location.
3. Fit transmission Mounting and tighten bolts to **55–65Nm**.
4. Fit power assembly Mounting and tighten bolts to **40–50Nm**.
5. Fit engine mount lower support and tighten bolts to **55–65Nm**.
6. Connect the connector between transmission wiring harness and body wiring harness.
7. Connect the reverse lamp switch connector.
8. Fit the drive shaft assembly.

☞**LH Drive Shaft Assembly Refit**

☞**RH Drive Shaft Assembly Refit**

9. Fit bolts connecting exhaust manifold and exhaust front pipe and tighten them to **45–55Nm**.
10. Fit engine**ECM** connector.
11. Connect generator wiring harness connector.
12. Connect the power assisted steering pump upper pipes and hoses.
13. Connect air-conditioning compressor connector and pipes.
14. Fit feed and return pipes of fuel rail.
15. Fit radiator.

☞**Radiator Refit**

16. Fit expansion tank.

☞**Expansion Tank Refit**

17. Fit bonnet lock body.

☞**Bonnet Lock Body Refit**

18. Fit member front end panel.

☞**Member Front End Panel Refit**

19. Fit intake pipe assembly.
20. Air cleaner assembly.

☞**Air Cleaner Assembly Refit**

21. Fit bolts fixing the battery tray, fit the battery bracket.
22. Fit the battery.

☞**Battery Refit**

23. Fill the cooling system.

☞**Filling Cooling System**

24. Connect battery earth lead.

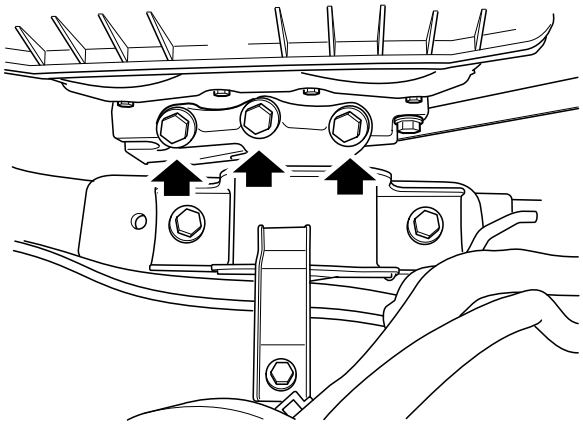
Powertrain mounting

Remove

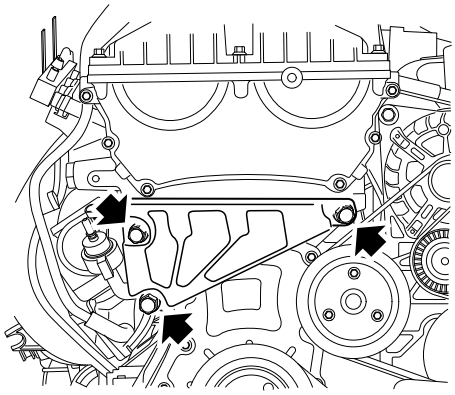
1. Disconnect battery earth lead.
2. Support the engine on a jack.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

3. Remove three bolts that are used to fix the engine mounting on the engine mounting bracket.

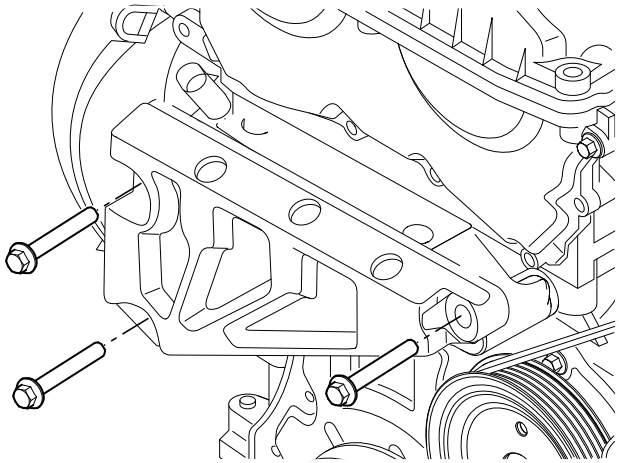


4. Remove three bolts that are used to fix the engine mounting on the engine body.



Refit

1. Clean the fitting surfaces of the engine mounting and the engine body.
2. Fit the engine mounting onto the engine and tighten the bolt to **40–50Nm**.



3. Fit the bolts within the scope from the engine mounting to the engine mounting bracket and tighten the bolts to **90–110Nm**.
4. Connect battery earth lead.

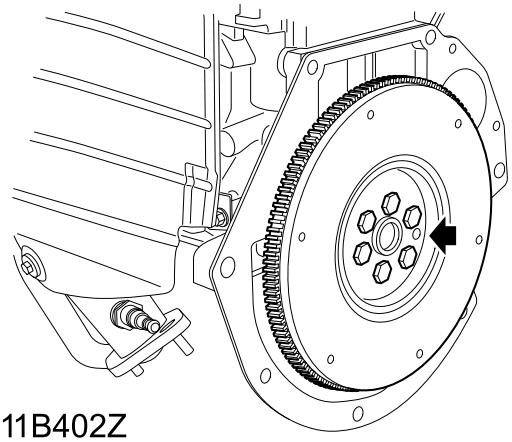
Flywheel

Remove

1. Remove the clutch assembly.

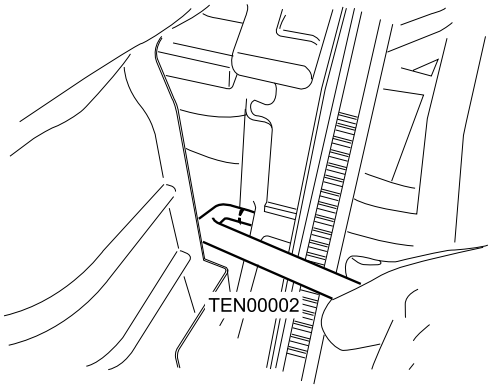
☞**Clutch Assembly Remove**

2. Remove the plug from the timing hole of the cylinder block.
3. Rotate the flywheel, observe the position of the flywheel refit pin hole from the flywheel end, when the pin hole is horizontally aligned to the air intake side, then the flywheel timing pin hole is aligned with the pin hole of the cylinder block.



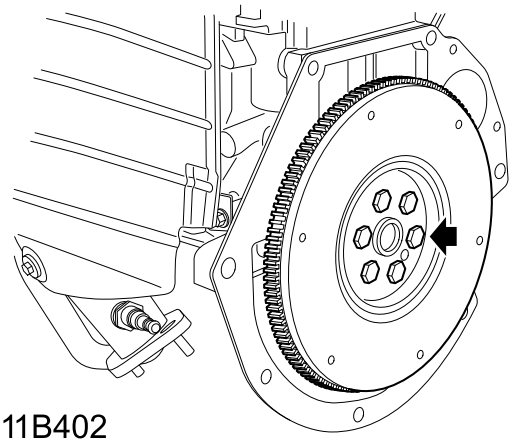
S111B402Z

4. Use a special tool for flywheel timing pin**TEN00002** to insert the flywheel pin hole through the timing hole on the cylinder block, so as to lock the flywheel.



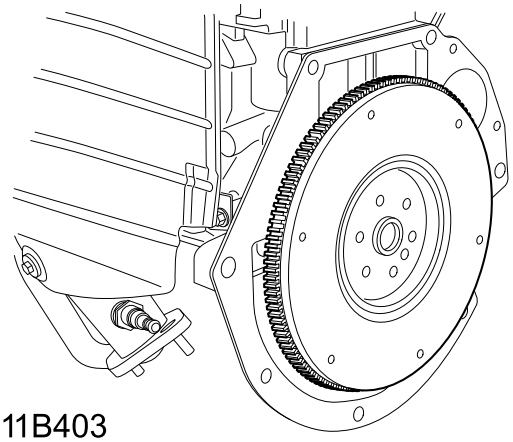
S111B401

5. Remove the six bolts securing the flywheel on the crankshaft and discard them.



S111B402

6. Remove the flywheel from the crankshaft.

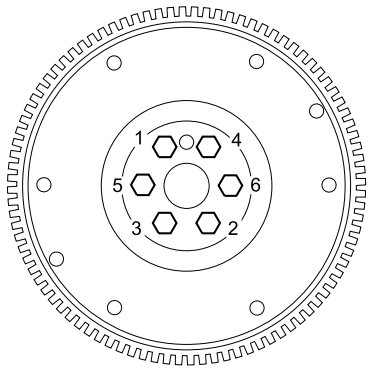


S111B403

7. Remove the special tool for the flywheel timing pin **TEN00002**.

Refit

1. Saw two 45 degree tooth sockets on bolts removed from the flywheel, and clean the crankshaft bolt holes with the removed bolts.
2. Clean the mating face between the flywheel and crankshaft.
3. Fit the flywheel onto the crankshaft.
4. Fit a new sealant coated bolt and tighten it by hand.
5. Rotate the flywheel, observe the position of the flywheel refit pin hole from the flywheel end, when the pin hole is horizontally aligned with the air intake side, insert the special tool for the flywheel timing pin**TEN00002** into the timing hole through the cylinder block to lock the flywheel.
6. On diagonal sequence basis, tighten the bolts to **(32–38)Nm+60°±2°**.



S111B404

7. Remove the special tool for the flywheel timing pin **TEN00002**.
8. Fit the upper plug.
9. Fit the upper clutch assembly.

☞**Clutch Assembly Refit**

Crankshaft Belt Pulley

Remove

1. Disconnect battery earth lead.
2. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

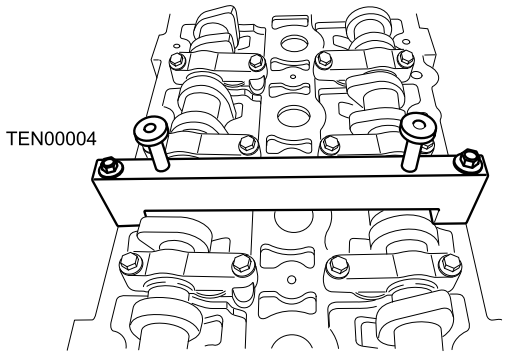
3. Remove the right front wheels.
4. Remove the ignition coil.

☞**Ignition Coil Remove**

5. Remove the camshaft cover.

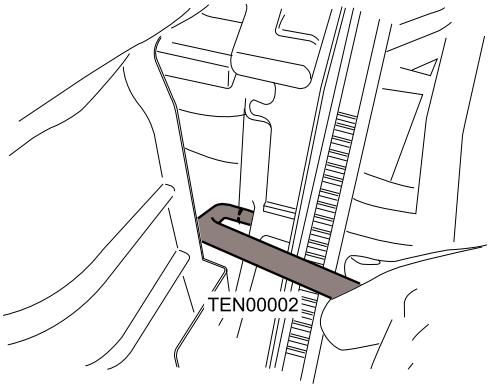
☞**Camshaft Cover Remove**

6. Remove the plug fit for the timing pin hole on the block.
7. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used, and lock the camshaft phase.



S111B408

8. Using the timing pin special tool**TEN00002** to insert the block timing pin hole and the flywheel pin hole so as to lock the flywheel.

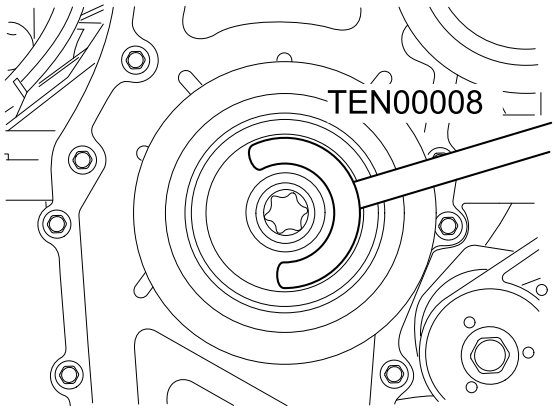


S111B401

9. Remove the auxiliary drive belt.

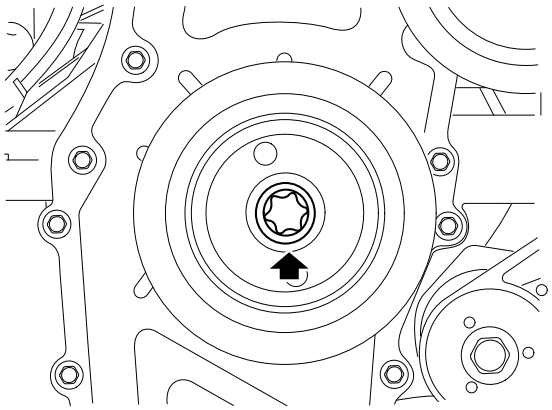
☞**Auxiliary Drive Belt Remove**

10. Using the crankshaft belt pulley holding special tool**TEN00008** to fix the crankshaft belt pulley.



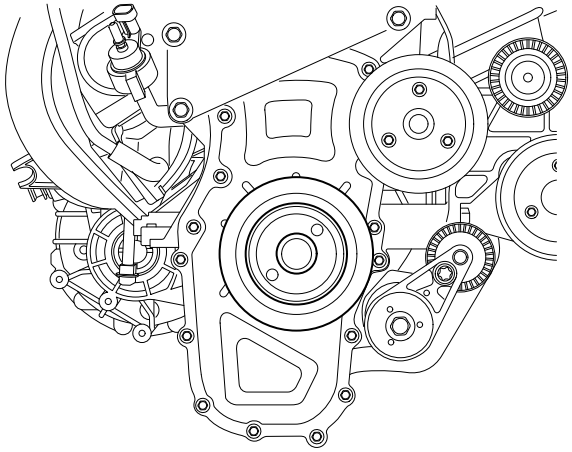
S111A414

11. Remove and remove bolts within the range that is from the belt pulley to the crankshaft, and discard the bolts.



S111A401

12. Remove the crankshaft belt pulley.



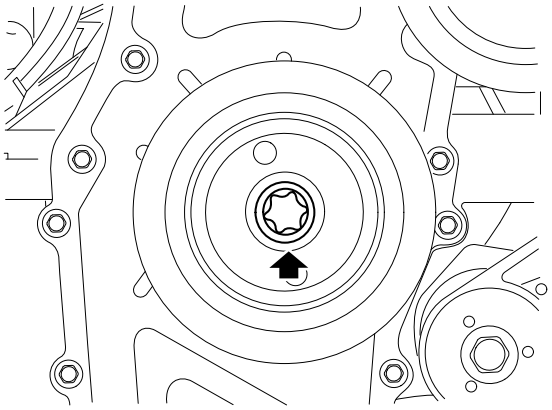
Caution: Avoid damaging the crankshaft front oil seal lip when removing the pulley.

Refit

1. Clean the mating face between the crankshaft belt pulley and the front oil seal of the crankshaft.

Caution: If it is necessary to replace the crankshaft front oil seal, try to keep the centre axis of the pulley align with the centre axis of the crankshaft without deflection to avoid damaging the seal lip during pushing the crankshaft pulley with hand.

2. Fit the crankshaft belt pulley using the crankshaft belt pulley holding special tool**TEN00008** Fit the crankshaft belt pulley, and then tighten the bolts to **(60±2)Nm+120°±2°**.



S111A401

3. Fit the auxiliary drive belt.

☞**Auxiliary Drive Belt Refit**

4. Remove the camshaft phase locking special tool **TEN00004**.
5. Remove the flywheel timing pin special tool **TEN00002**.
6. Fit the plug.
7. Fit the camshaft cover.

☞**Camshaft Cover Refit**

8. Fit the ignition coil.

☞**Ignition Coil Refit**

9. Fit the right front wheel.
10. Lower the vehicle.
11. Connect battery earth lead.

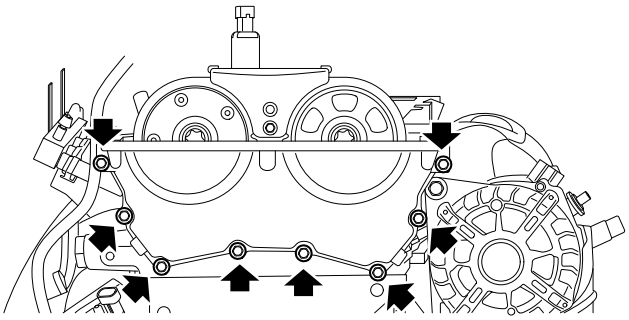
Timing chain upper cover plate

Remove

1. Remove the camshaft cover.

☞**Camshaft Cover Remove**

2. Release the eight bolts securing the timing chain upper cover plate.

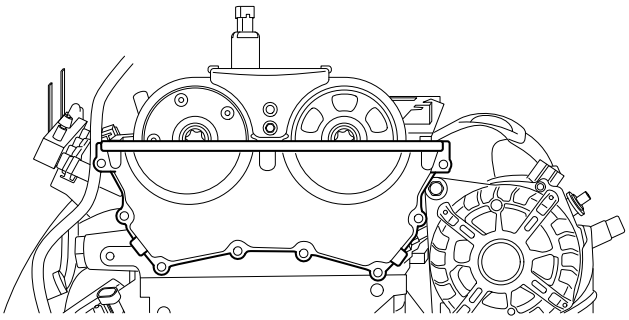


S111J401

3. Remove the eight retaining bolts securing the timing chain upper cover plate.

Caution: When removing the timing chain upper cover plate, ensure that the cover plate does not deform.

4. Remove the timing chain upper cover plate.



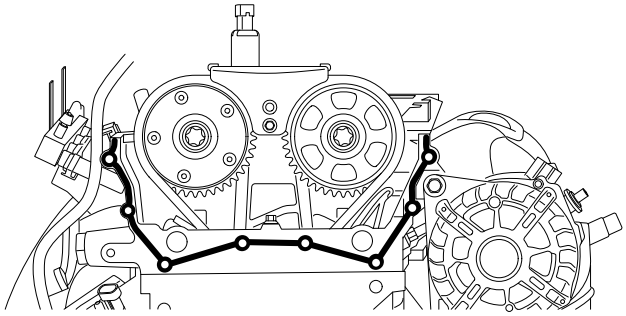
S111J402

Refit

1. Detect the timing chain upper cover plate.

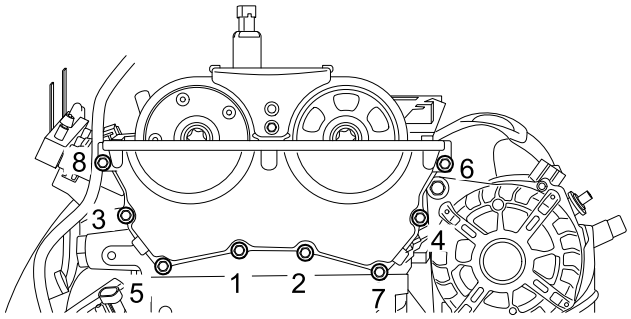
Caution: Ensure that there is no damage on the timing chain upper cover plate, otherwise, it may cause oil leak.

2. Apply sealant on the mating face of the timing chain upper cover plate and the cylinder head along the weatherstrip (Sealant width: 1.5-2.0mm).



S111J403

3. Fit the bolts securing the timing chain upper cover plate and tighten them to **8–12Nm**,and there are eight retaining bolts.



S111J426

4. Fit the camshaft cover.

☞**Camshaft Cover Refit**

Timing chain lower cover plate

Remove

Warning: Always replace both crankshaft front oil seal and timing chain lower cover plate together.

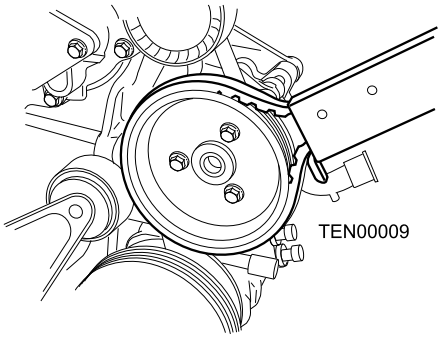
1. Disconnect battery earth lead.
2. Remove the sub drive belt.

☞**Sub Drive Belt Remove**

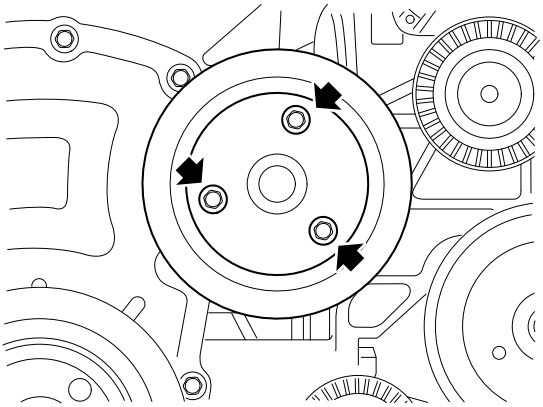
3. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

4. Use special tools designed for pulley's refit and remove**TEN00009** to remove the water pump pulley.

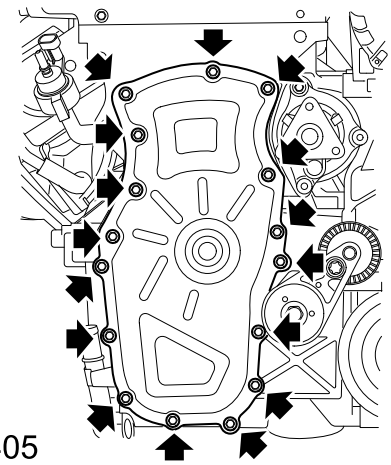


S111J423



S111J404

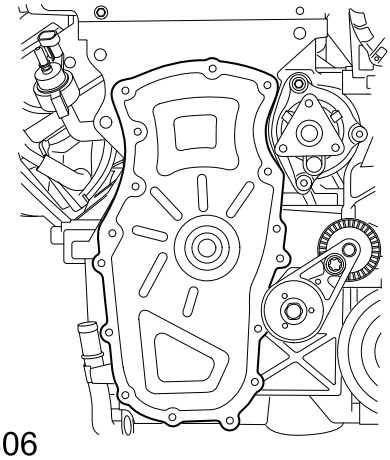
5. Remove the bolts securing the timing chain lower cover plate.



S111J405

6. Remove and discard the crankshaft front oil seal and timing chain lower cover plate.

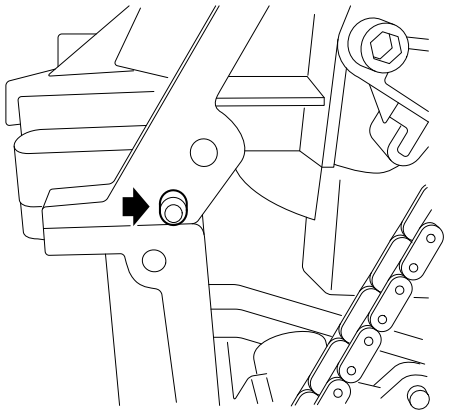
Caution: Be sure to keep the flatness of the timing chain lower cover plate when removing it, otherwise, it will cause oil leak.



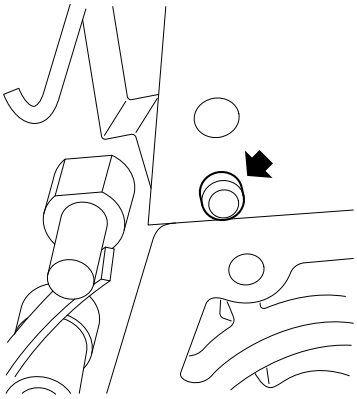
S111J406

Refit

1. Clean the sealant on the contact surface of the cylinder block and timing chain upper cover plate, and make sure no residual sealant is found on cylinder block.
2. Clean the crankshaft pulley journal.
3. Fit the location pin of the timing chain lower cover plate (It is not necessary to fit it again if it was not removed).



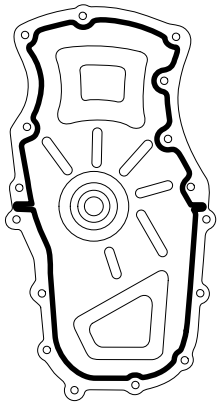
S111J407



S111J408

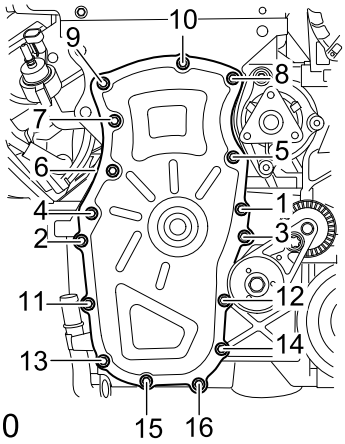
4. gelatinize 2.5mm-width sealant as shown on the

schematics with appropriate tools, ensuring the continuity of the sealant application.



S111J409

5. Fit the timing chain lower cover plate assembly bolts and tighten to **8–12Nm**, in accordance with the sequence 1–16 shown in the following schematics within 3-5 minutes.

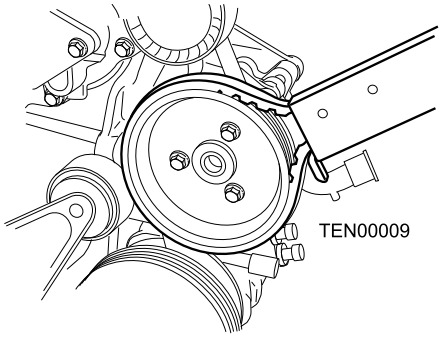


S111J410

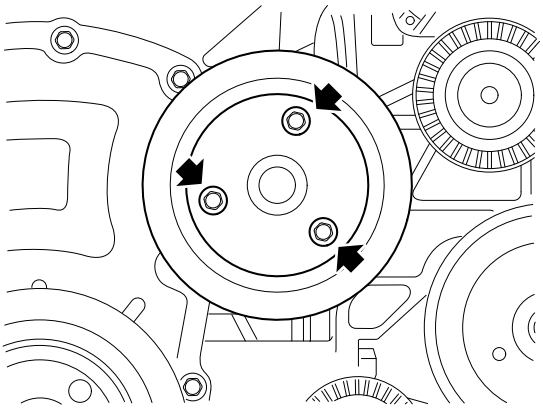
6. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

7. Use special tools designed for pulley's refit and remove**TEN00009** to fit the water pump pulley.



S111J423



S111J404

8. Fit the sub drive belt.

☞**Sub Drive Belt Refit**

9. Connect battery earth lead.

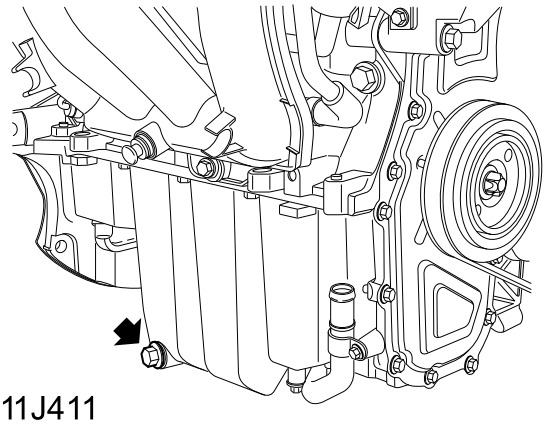
Timing Chain

Remove

1. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove the drain plug to drain the oil.



S111J411

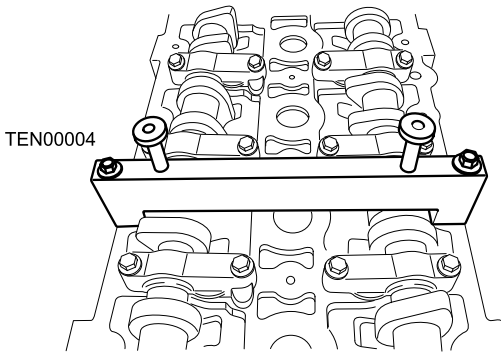
3. Remove the right front wheel.
4. Remove the ignition coil.

☞**Ignition Coil Remove**

5. Remove the camshaft cover.

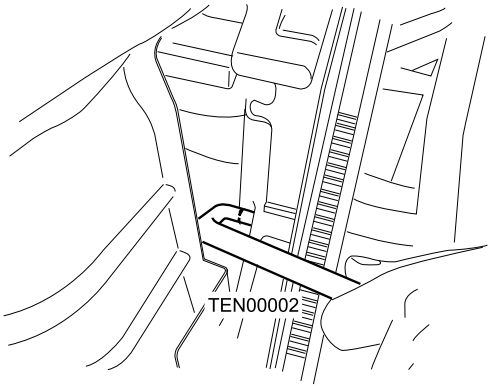
☞**Camshaft Cover Remove**

6. Remove the plug fit for the timing pin hole on the body.
7. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used and lock the camshaft phase.



S111B408

8. Using the timing pin locking special tool**TEN00002** to insert the block timing pin hole and flywheel pin hole to lock the flywheel.



S111B401

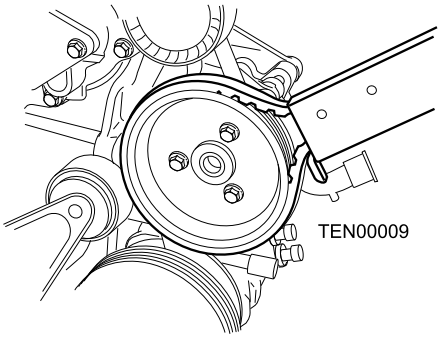
9. Remove the auxiliary drive belt.

☞**Auxiliary Drive Belt Remove**

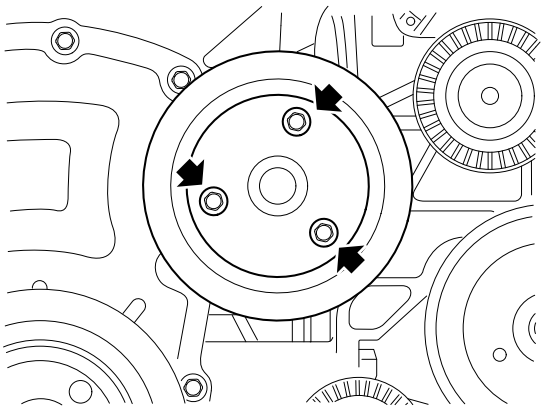
10. Loosen and remove bolts within the range that is from the crankshaft belt pulley to the crankshaft, and discard bolts.
11. Remove the crankshaft belt pulley.

☞**Crankshaft Belt Pulley Remove**

12. Using the belt pulley remove special tools**TEN00009** to remove the water pump pulley.



S111J423



S111J404

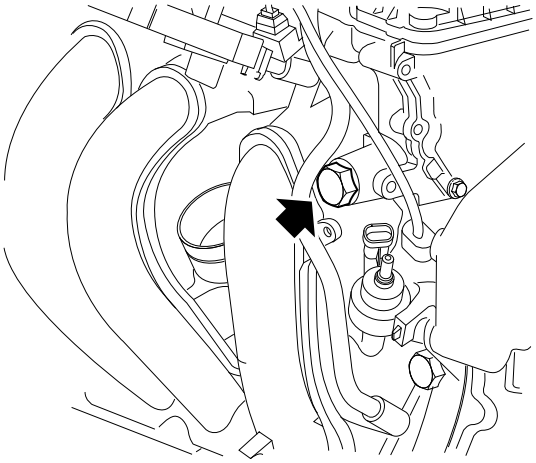
13. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

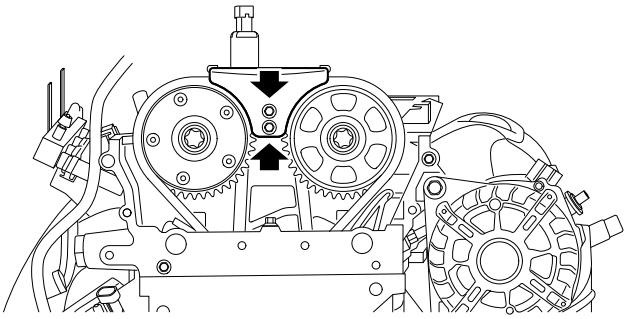
14. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

15. Remove the timing chain tensioner and discard the seal ring.

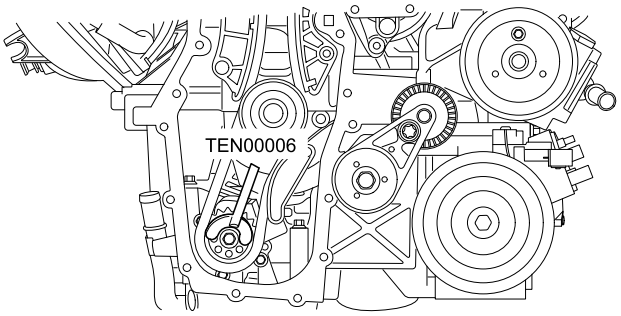


16. Remove the upper guide rail



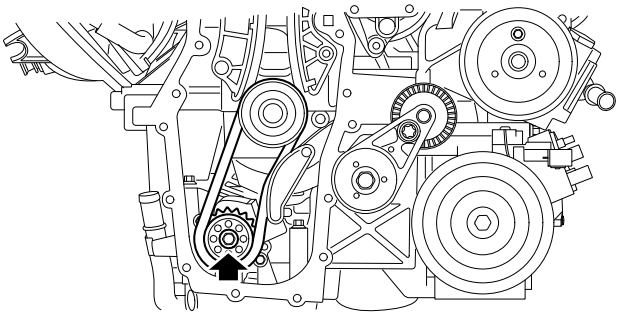
S111J413

17. Using the oil pump sprocket holding special tool**TEN00006** to remove the oil pump sprocket bolts.

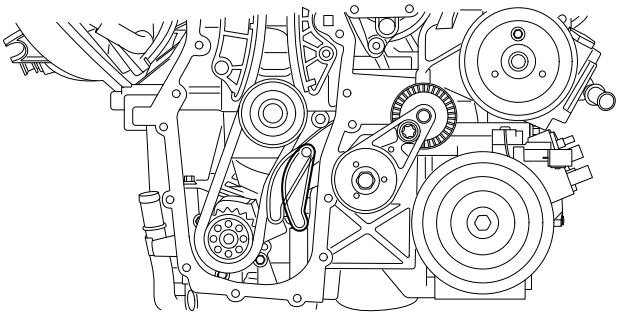


S111J424

18. Open the oil pump chain tensioner rightwards, and remove the oil pump sprocket, oil pump chain and drive oil pump crankshaft sprocket together.

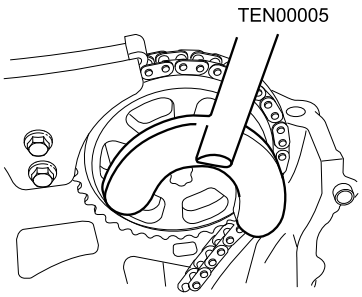


S111J414



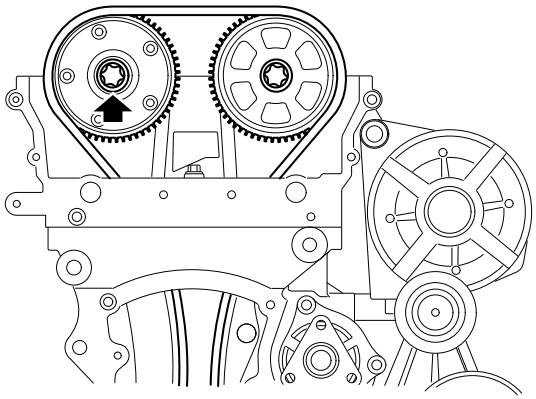
S111J415

19. Remove the oil pump chain tensioner.
20. Remove and discard the intake phase modulator bolts.
21. Using the camshaft sprocket holding special tool**TEN00005** to remove and discard the intake phase modulator and the exhaust camshaft sprocket bolt.



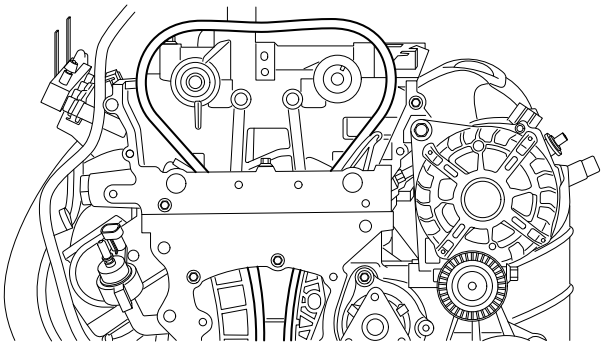
S111J425

22. Remove the intake phase modulator and the exhaust camshaft sprocket.



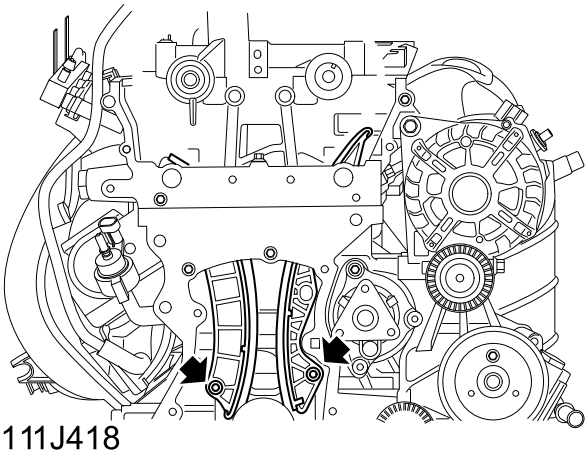
S111J416

23. Remove the crankshaft sprocket and the timing chain.



S111J417

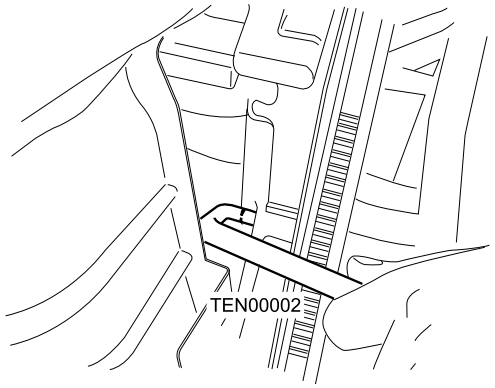
24. Remove the guide rail pivot, and take the tensioner rail and chain guide rail out from the upper end of the chain case.



S111J418

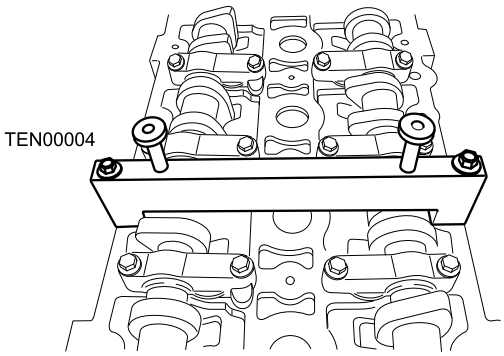
Refit

1. Remove the plug for the refit of the block timing pin hole.
2. Align the range that is from the disk flywheel to the flywheel pin hole with the block pin hole.
3. Use the flywheel locking special tool**TEN00002** to insert the block timing pin hole and flywheel pin hole to lock the flywheel.



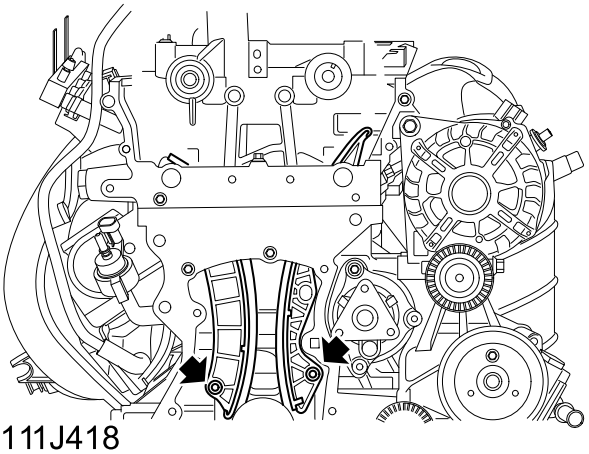
S111B401

4. Using the camshaft locking special tool**TEN00004** lock the camshaft phase.



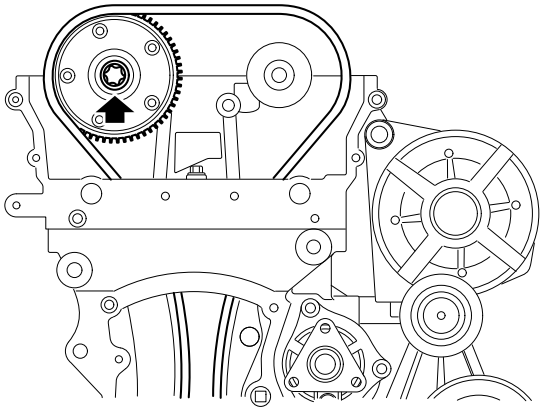
S111B408

5. Inspect each part for damage, oil, rust or dirt before assembling. Do not use any part if it is damaged, and always clean oil contamination.
6. Place the chain guide rail from the upper right side of the guide rail case. Screw in the pivots respectively, and finally tighten them in sequence with the tightening torque of **22–28Nm**.
7. Place the tensioner guide rail from the upper left side of the guide rail case. Screw in the pivots, and finally tighten them in sequence with the tightening torque of **22–28Nm**.



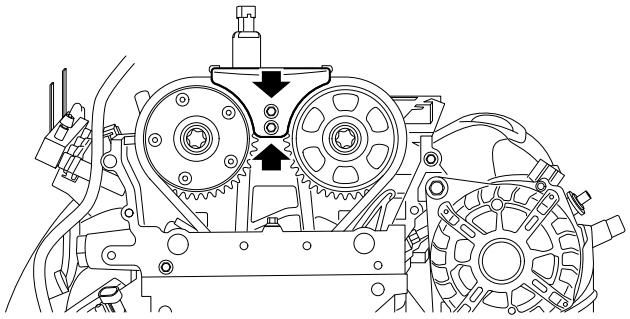
S111J418

8. Set a crankshaft sprocket on the front end of the crankshaft; Place the timing chain from the upper part of the cylinder head guide rail with the lower part of the chain set with a crankshaft sprocket, and hang the chain on the upper guide rail mounting boss. Assemble the intake phase modulator to the intake camshaft, and pre-tighten the bolts.
9. Using a camshaft sprocket fixation special tool**TEN00005** to assemble the camshaft sprocket to the exhaust camshaft. Fit the chain into 2 sprocket wheels after pre-tightening the bolts.



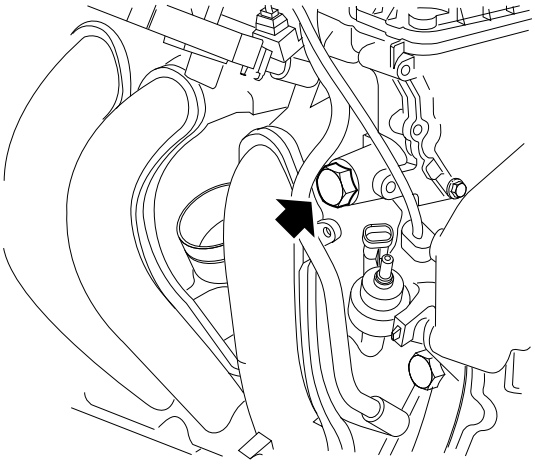
S111J419

10. Fit the upper guide rail on the camshaft front bearing cover, fit it with 2 bolts with the tightening torque of **8–12Nm**.

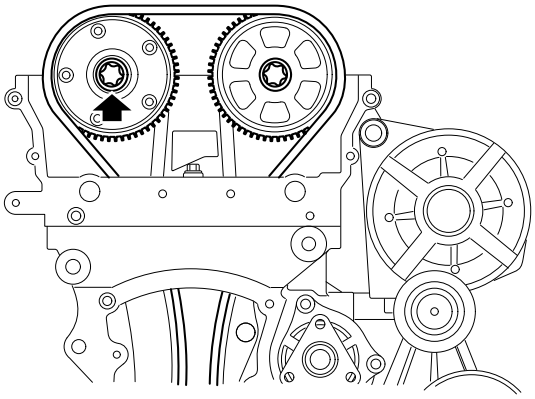


S111J413

11. After replacing new timing hydraulic tensioner washer, screw in the timing hydraulic tensioner onto the cylinder head, and tighten with the tightening torque of **77-83Nm**.

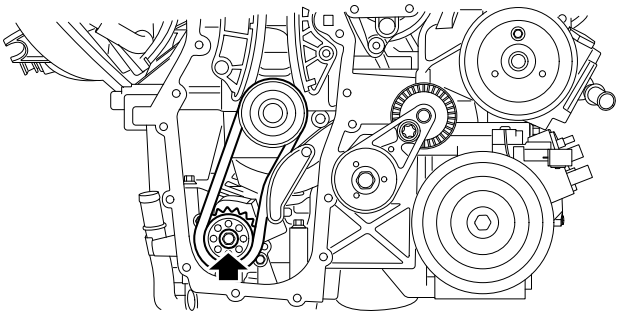


12. Screw down the intake phase modulator and exhaust camshaft sprocket onto the camshaft with the tightening torque of the camshaft sprocket bolts of **(25±3)Nm+45°±2°**, tighten the intake phase modulator bolts to **70–80Nm**.



S111J416

13. Fit the oil pump chain tensioner.



S111J414

14. Set the oil pump chain on the crankshaft sprocket, and then fit the crankshaft sprocket into the front end of the crankshaft.

Caution: At the foot of the crankshaft sprocket-oil pump teeth side is a dent mark that is used to distinguish it with the crankshaft sprocket-timing chain.

15. Set the oil pump sprocket onto the oil pump chain.

Tip: The side with product logo faces outward.

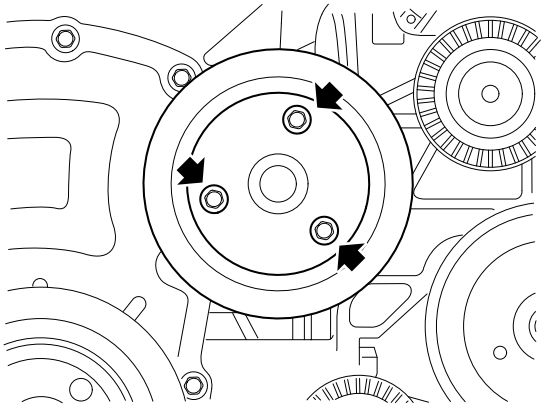
16. Rotate the oil pump sprocket to align the center D-hole with the D-shaft of the oil pump.
17. Pull the lower end of the oil pump chain tensioner rightwards, set the oil pump sprocket onto the oil pump shaft, and push the crankshaft sprocket to the bottom.
18. Release the oil pump chain tensioner.
19. Check whether the oil pump chain is pressed correctly on the tensioner guide plate surface.
20. Use the special tool**TEN00006** to set the oil pump sprocket, screw on the oil pump sprocket bolts, and finally tighten with the tightening torque of **22–28Nm**.
21. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

22. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

23. Fit the water pump pulley.



S111J404

24. Fit the crankshaft belt pulley.

☞**Crankshaft Belt Pulley Refit**

25. Fit the auxiliary drive belt.

☞**Auxiliary Drive Belt Refit**

26. Remove the camshaft phase locking tooling.
27. Remove the flywheel timing pin special tool **TEN00002**.
28. Fit the plug.
29. Fit the camshaft cover.

☞**Camshaft Cover Refit**

30. Fit the ignition coil.

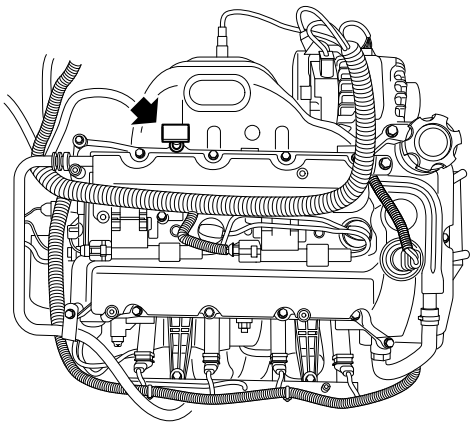
☞**Ignition Coil Refit**

31. Fit the wheels.
32. Lower the vehicle.
33. Check the oil level, and fill some if necessary.

Camshaft cover

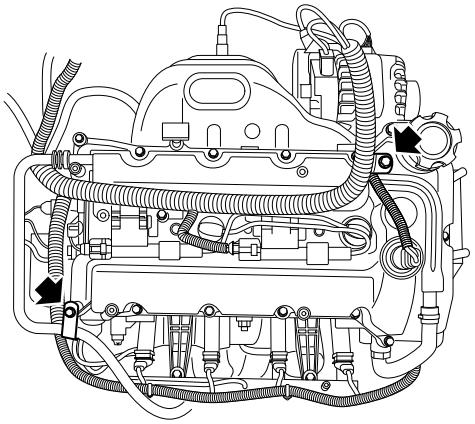
Remove

1. Remove the oil dipstick.



S111C401

2. Release and remove the wire harness bracket and the high voltage coil bolts, then record the position of the bolt and put them away.

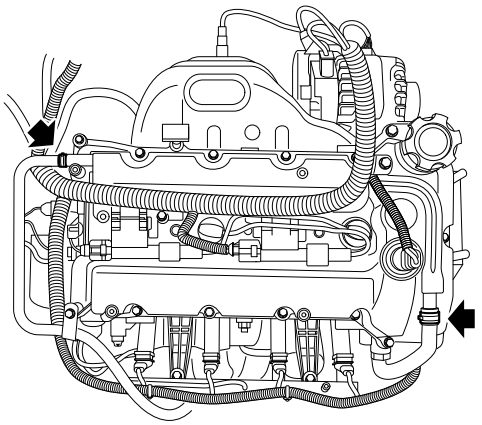


S111C402

3. Remove the ignition coil and the coil bracket.

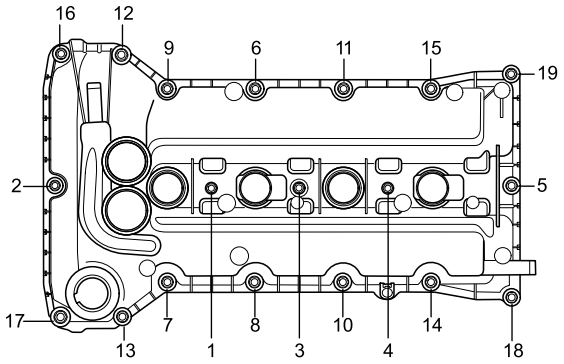
☞**Ignition Coil Remove**

4. Release the full load and partially load breather tube bracket.



S111C403

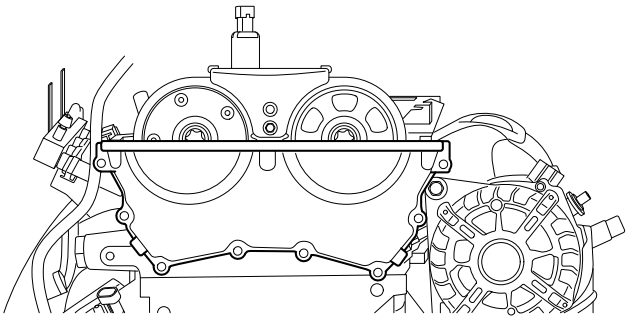
5. Remove the full load and partially load breather tube.
6. Release and remove the 19 bolts securing the camshaft, and record their position.



7. Remove the camshaft cover, carefully protect the one-way valve film and keep it clean.

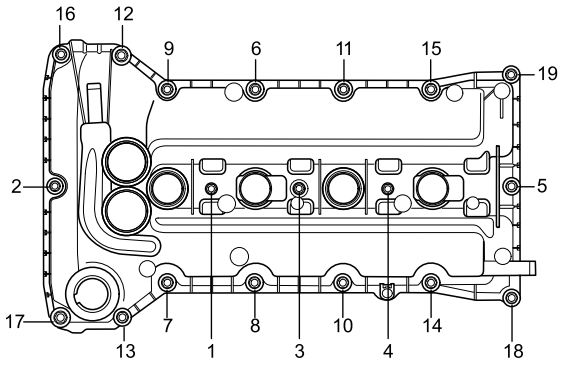
Refit

1. Inspect the top surface of the cylinder head to make sure there is no damage existing, and then clean the top surface of the cylinder head and remove the oil.
2. Gelatinize 4mm-width silica glue on the seam between the timing chain upper cover plate and the cylinder head.



S111J402

3. Put the camshaft cover on the cylinder head.
4. Fit the bolts and tighten them in the sequence shown **8–12Nm**.



5. Fit high voltage coil and bracket, and tighten the retaining bolts to **8–12Nm**.

☞**High Voltage Coil Refit**

6. Fit the oil dipstick.

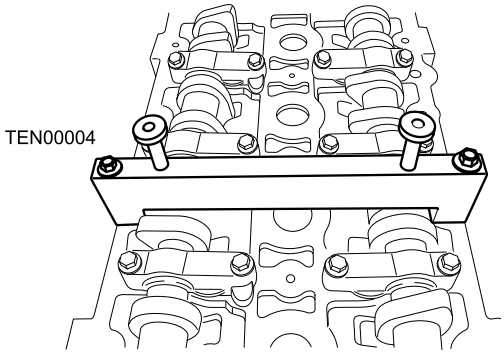
Intake or exhaust camshaft

Remove

1. Disconnect battery earth lead.
2. Remove the camshaft cover.

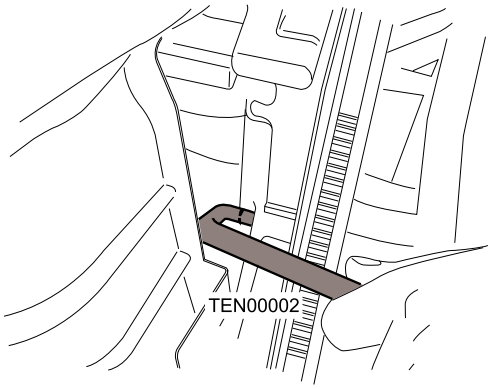
☞**Camshaft Cover Remove**

3. Rotate the crankshaft until the camshaft can be locked by the special tool **TEN00004**. Lock the camshaft phase.



S111B408

4. Special tool for timing pin**TEN00002** into the timing pin hole and flywheel pin hole of the cylinder block to lock the flywheel.



S111B401

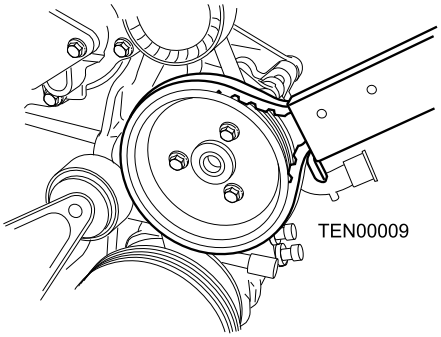
5. Remove the special tool for locking the camshaft **TEN00004**.
6. Remove the sub drive belt.

☞**Sub Drive Belt Remove**

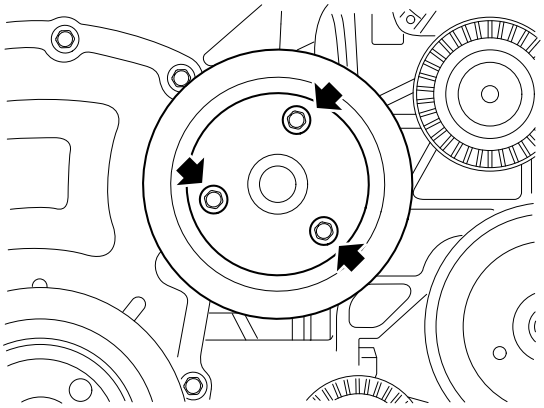
7. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

8. Using special tools designed for pulley's refit and remove **TEN00009**. Remove the water pump pulley.



S111J423



S111J404

9. Remove the timing chain upper cover plate

☞**Timing Chain Upper Cover Plate Remove**

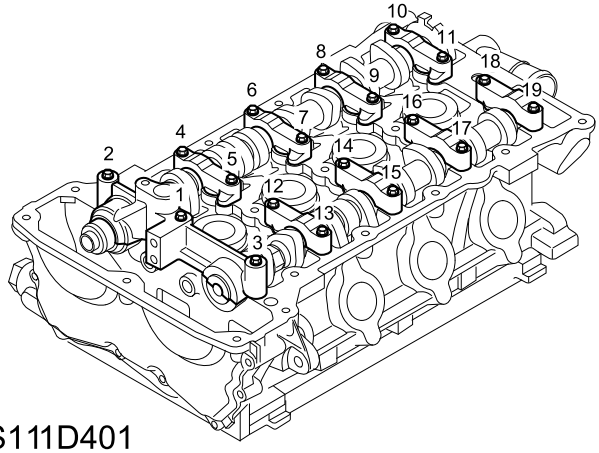
10. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

11. Remove the timing chain.

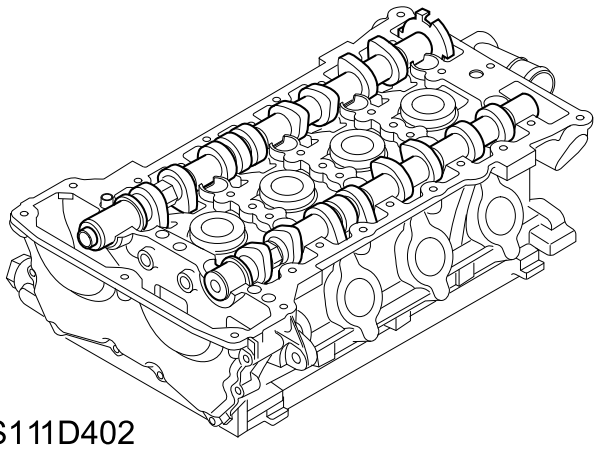
☞**Timing Chain Remove**

12. Release the 19 bolts on the camshaft bearing cap in sequence shown, until the valve spring pressure no longer works on the camshaft.



S111D401

13. Remove the camshaft bearing cover.
14. Take away the two camshafts.



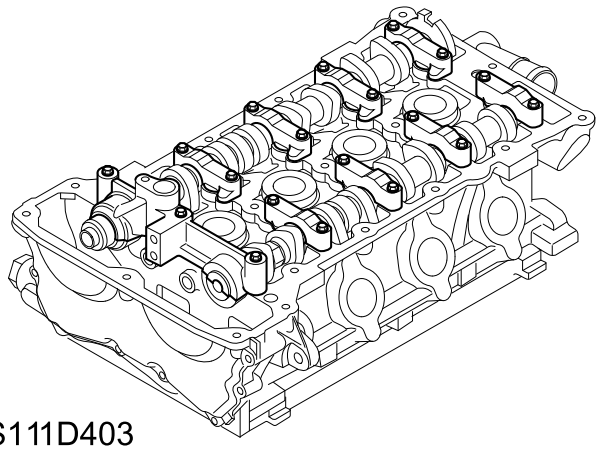
S111D402

Caution: Remove the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

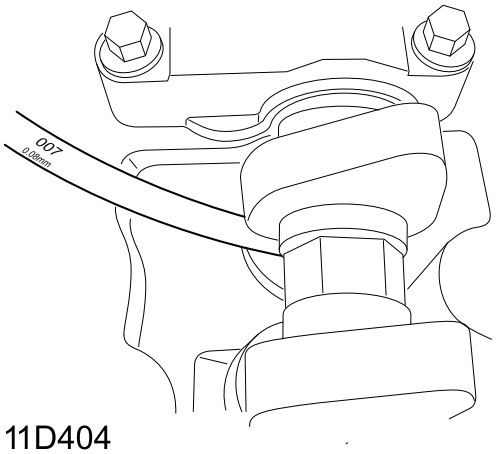
Refit

1. Clean the camshaft.
2. Clean the top surface of the cylinder head, mechanical stems and camshaft bearing cap.
3. Coat the camshaft journal, bearing seat and the top of the stem with oil.
4. Put the camshaft into the bearing seat, fit the camshaft bearing cap and camshaft bolts (do not tighten it), measure the valve gap, the gap on the intake valve side should be 0.11-0.19mm, and on the exhaust valve side should be 0.20-0.28mm, calculate the valve gap and select the appropriate stem.

Caution: Assemble the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

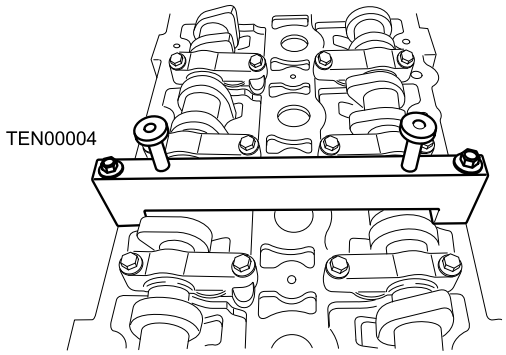


S111D403

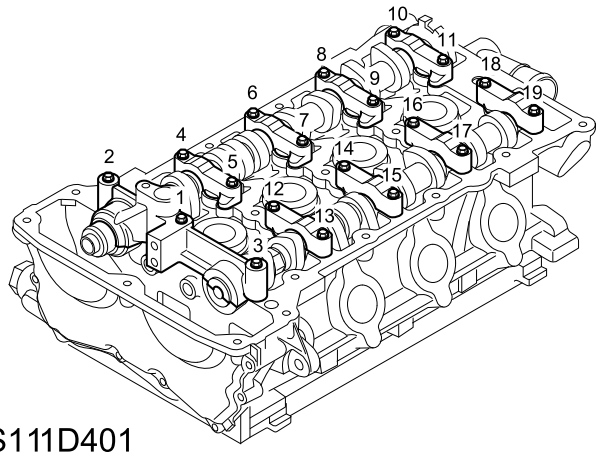


S111D404

5. Replace with appropriate mechanical stems and put the camshaft into the bearing seat, fit the camshaft bearing cap (Do not tighten it), and use special tools for camshaft timing**TEN00004** to fit the intake and exhaust camshaft, and tighten the camshaft bearing cap in the sequence shown in the schematics, and the tighten torque should be **8–12Nm**.



S111B408



S111D401

6. Fit the timing chain.

☞**Timing Chain Refit**

7. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

8. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

9. Fit the water pump pulley.
10. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

11. Fit the upper sub drive belt.

☞**Sub Drive Belt Refit**

12. Remove the special tool for the flywheel timing pin **TEN00002**.
13. Fit the plug.
14. Remove the special tool for timing **TEN00004**.
15. Fit the camshaft cover.

☞**Camshaft Cover Refit**

16. Connect battery earth lead.

Mechanical tappet

Remove

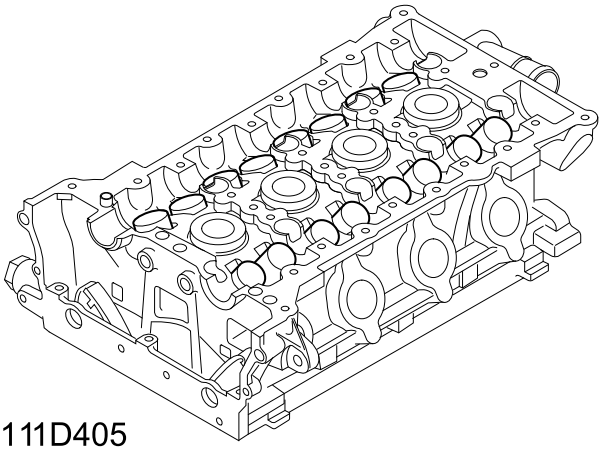
1. Disconnect battery earth lead.
2. Remove the camshaft cover.

☞**Camshaft Cover Remove**

3. Remove the intake or exhaust camshaft.

☞**Intake or Exhaust Camshaft Remove**

4. Carefully put away the valve tappets with a sticky magnet, and put them aside well.



S111D405

Refit

1. Clean the tappet hole.
2. Lubricate the standard valve tappets (H group), fit the standard valve tappets into the tappet holes, fit the camshaft, and assemble the tappet groups based on the valve gap.
3. Assemble the selected tappet groups (For information about how to divide valve tappet groups, refer to the parts manual).
4. Assemble the intake or exhaust camshaft.

☞**Intake or Exhaust Camshaft Refit**

5. Fit the camshaft cover.

☞**Camshaft Cover Refit**

6. Connect the battery ground terminal.

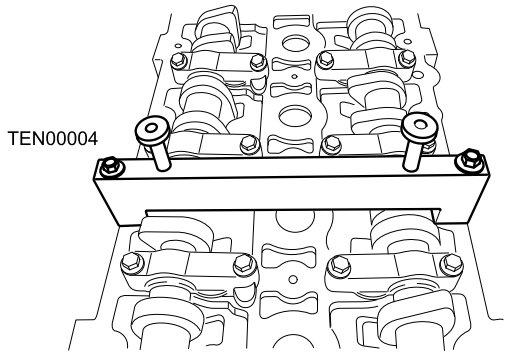
Remove of Valve

Remove

1. Disconnect battery earth lead.
2. Remove the camshaft cover.

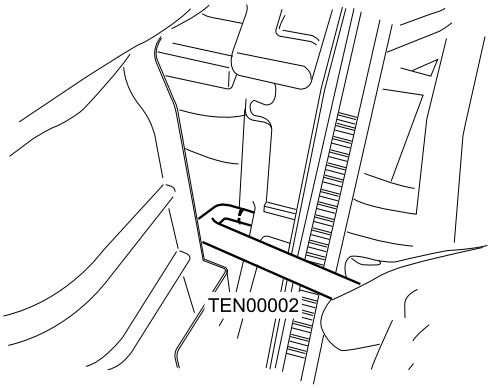
☞**Camshaft Cover Remove**

3. Remove the plug on the upper timing pin hole on the cylinder block.
4. Rotate the crankshaft until the camshaft can be locked by the special tool**TEN00004** Lock the camshaft phase.



S111B408

5. Insert the special tool for flywheel timing pin**TEN00002** into the timing pin hole and flywheel pin hole of the cylinder block to lock the flywheel.



S111B401

6. Remove the special tool for locking the camshaft **TEN00004**.
7. Remove the sub drive belt.

☞**Sub Drive Belt Remove**

8. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

9. Remove the water pump pulley.
10. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

11. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

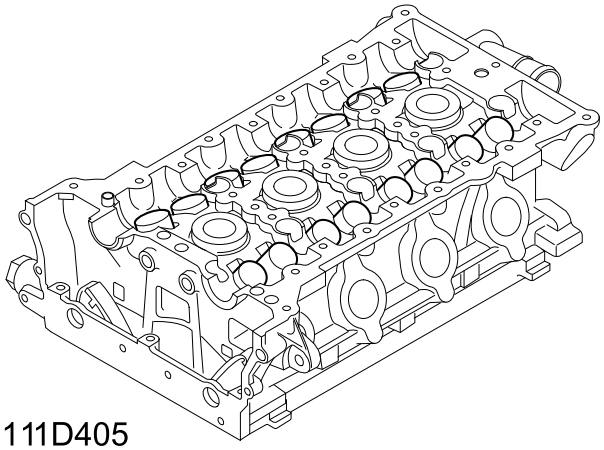
12. Remove the timing chain.

☞**Timing Chain Remove**

13. Remove the intake or exhaust camshaft.

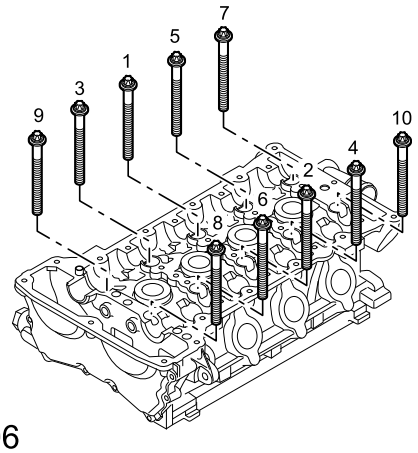
☞**Intake or Exhaust Camshaft Remove**

14. Carefully put away the 16 mechanical lifters with a sticky magnet, and then put them aside.



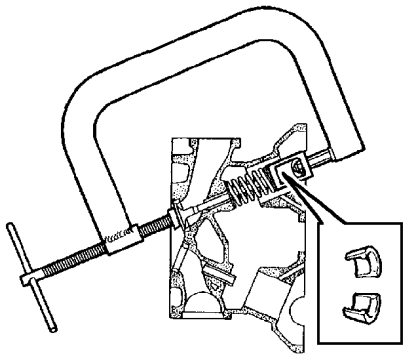
S111D405

15. Remove the cylinder head bolts in the sequence shown in the schematics and remove the cylinder head.



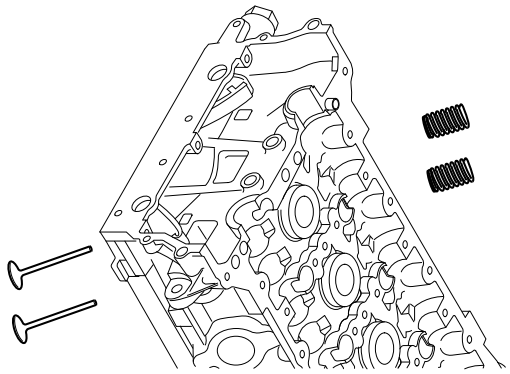
S111D406

16. Use the special tool**T10005** compress the valve spring.



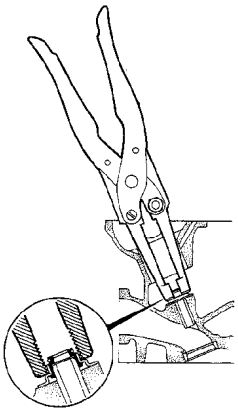
S111D407

17. Take away the valve locks and release the valve spring.
18. Take away the special tool **T10005**.
19. Remove the valve spring, valve spring seat and the valve.



S111D408

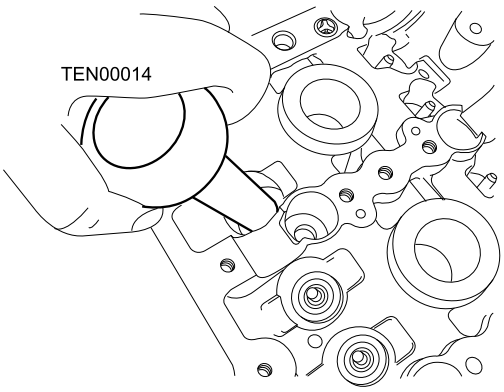
20. Use the special tool **T10006**. Take away the oil seal of the valve.



S111D409

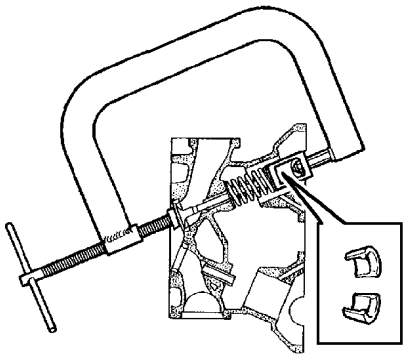
Refit

1. Remove the carbon buildup and other dirts from the valve guide, valve, valve seat and combustion surface.
2. Check the diameter of the current valve stems. Check the gap of the valve guide with a new valve.
3. Check the valve and valve seat condition for reuse purpose.
4. Check the cooperative height.
5. check the valve spring status.
6. Make sure the mechanical stem, valve, valve spring, spring cover and the valve lock are clean.
7. Lubricate the valve and the valve stem oil seal.
8. Use the special tool**TEN00014** to fit the valve stem oil seal on the valve guide.



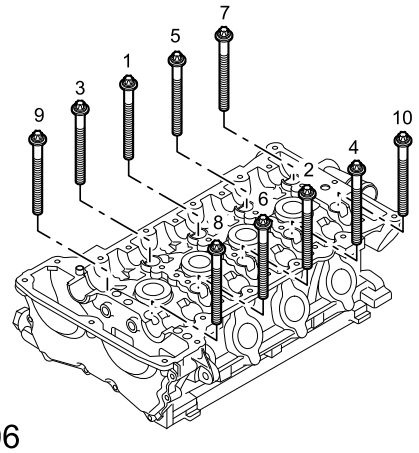
S111D424

9. Fit the valve, spring and spring cover, and**T10005** compress the valve spring with the special tool to fit the valve lock.

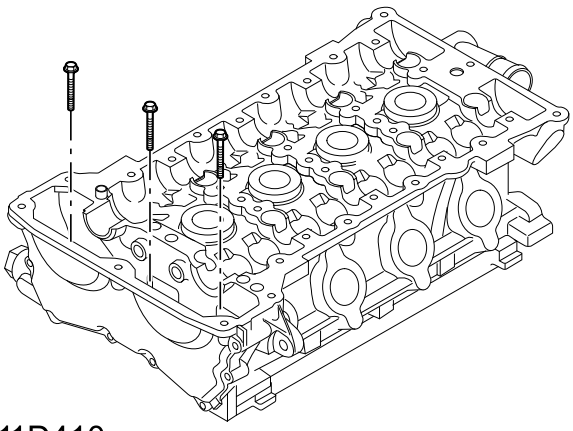


S111D407

10. Release the valve spring and remove the special tool **T10005**.
11. Position the cylinder head on the cylinder block with a cylinder head gasket between them, carefully fit 10 cylinder head bolts and 3 chain case bolts.



S111D406



S111D410

12. Tighten the cylinder head bolts in sequence shown, the tighten torque is **(30±2)Nm+90°+(90°+45°)±2°** tighten the chain case bolts, the tighten torque is **10–12Nm**.
13. Lubricate the valve stems and stem holes, put the stems into the stem holes.
14. Clean the camshaft and the cylinder head upper mating surface.
15. Lubricate the camshaft journal and bearing seat.
16. Assemble the intake or exhaust camshaft.

☞**Intake or Exhaust Camshaft Refit**

17. Fit the timing chain.

☞**Timing Chain Refit**

18. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

19. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

20. Fit the water pump pulley.
21. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

22. Fit the upper sub drive belt.

☞**Sub Drive Belt Refit**

23. Remove the special tool for the flywheel timing pin **TEN00002**.
24. Fit the plug.
25. Remove the special tool for timing **TEN00004**.
26. Fit the camshaft cover.

☞**Camshaft Cover Refit**

27. Connect battery earth lead.

Cylinder Head Assembly

Remove

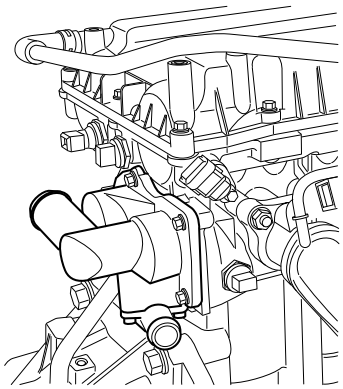
1. Disconnect battery earth lead.
2. Remove the generator.

☞**Generator Remove**

3. Remove the exhaust manifold and discard the exhaust manifold shims.

☞**Exhaust Manifold Remove**

4. Remove the bolts fixing the thermostat assembly to the cylinder head, and remove the thermostat assembly.

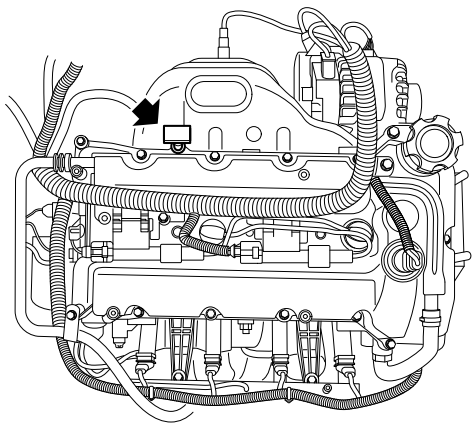


S111D411

5. Clear any dirt in spark plug clearance.
6. Remove the spark plug.

☞**Spark Plug Remove**

7. Remove the oil dipstick.



S111C401

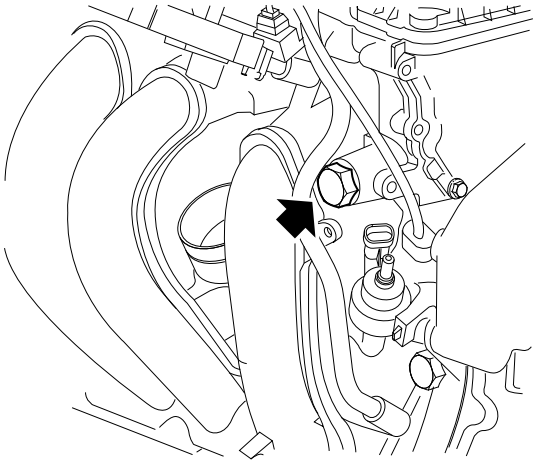
8. Remove the camshaft shield cover.

☞**Camshaft Cover Remove**

9. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

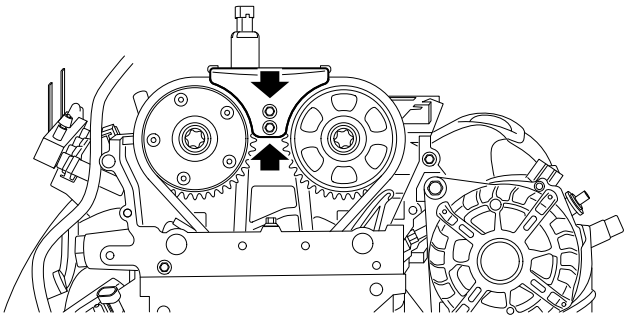
10. Remove the timing chain tensioner.



11. Remove the oil control valve.

☞**Oil Control Valve Remove**

12. Remove the upper guide rail.



S111J413

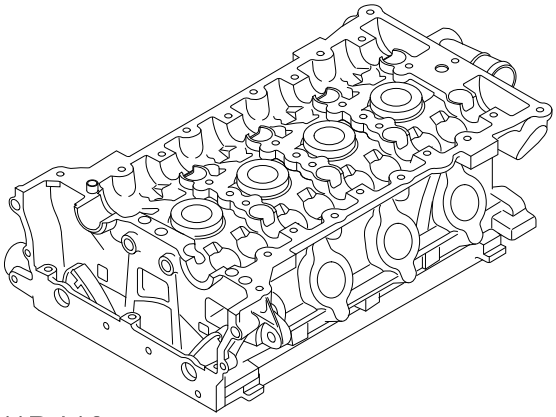
13. Remove the chain, and put it aside.
14. Remove the intake and exhaust camshaft.

☞**Intake and Exhaust Camshaft Remove**

15. Remove the mechanical lifter.

☞**Mechanical Lifter Remove**

16. Remove the cylinder head assembly and discard the cylinder head shim at the same time.



S111D412

17. Remove the intake and exhaust valve.

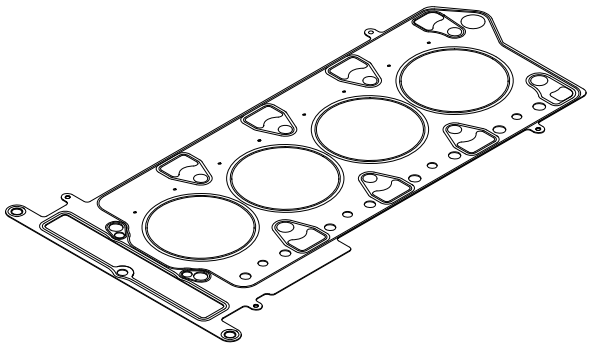
☞**Intake and Exhaust Valve Remove**

Refit

1. Clean the sealing area on the cylinder head and the timing chain upper cover plate. Clean the camshaft cover and mating surface of the intake and exhaust manifold with the foam remover and a plastic scraper.

Caution: Don't use scraper to deal with sealed surface.

2. Blow dry the oil passages and coolant passages.
3. Replace new cylinder gaskets.



S111D413

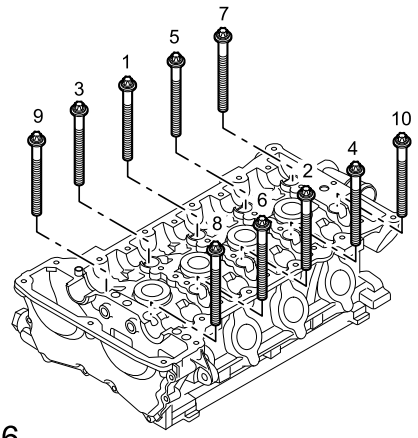
4. Fit intake and exhaust valves.

☞**Intake and Exhaust Valve Refit**

5. Place the cylinder head on the cylinder body, and pre-tighten it with bolts.

Warning: The cylinder head bolts cannot be lubricated by lubricants.

6. Screw down 10 cylinder head bolts with a special socket in the indicated order and the torque is**(30±2)Nm+90°+(90°+45°)±2°** , then screw down 3 bolts near the chain tank, and the torque is **10–12Nm**.



S111D406

7. Fit the mechanical lifter.

☞**Mechanical Lifter Refit**

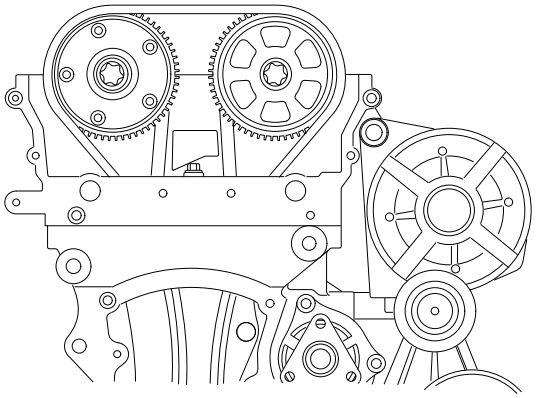
8. Fit the intake and exhaust camshaft.

☞**Intake and Exhaust Camshaft Refit**

9. Press the oil control bushing into the hole of the intake

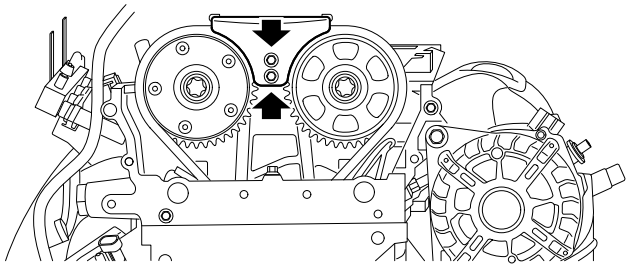
camshaft end.

10. Fit the intake phase modulator and the exhaust camshaft sprocket wheel to the corresponding camshaft, and fit bolts without tightening. Then engage the chain with the sprocket.



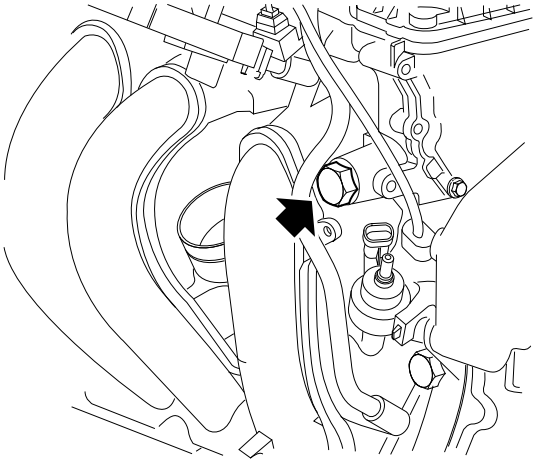
S111D414

11. Screw down the phase modulator and the exhaust sprocket bolts with the torque of the phase modulator bolts of **70–80Nm**, and the torque of the sprocket wheel bolts of **(25±3)Nm+45°±2°**.
12. Fit the sprocket wheel upper guide rail onto the camshaft front bearing cover, and fit 2 bolts and tighten with the torque of **8–12Nm**.



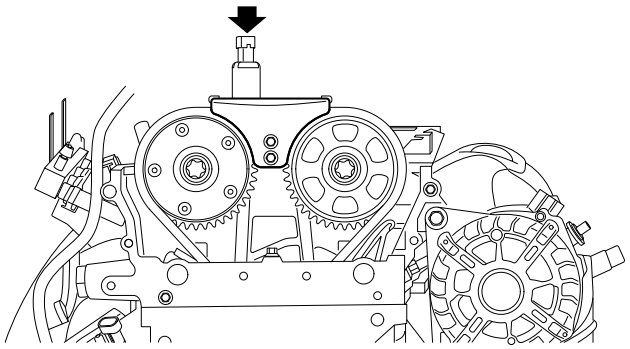
S111J413

13. Fit the timing chain tensioner with the torque of **77-83Nm**.



14. Fit the oil control valve bolts with the torque of **5–7Nm**.

☞**Oil Control Valve Refit**



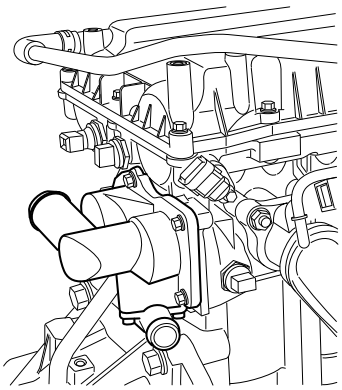
15. Fit the timing chain upper cover plate with the torque of**8–12Nm**.

☞**Timing Chain Upper Cover Plate Refit**

16. Fit the camshaft shield cover assembly with the torque of **8–12Nm**.

☞**Camshaft Cover Refit**

17. Insert the oil dipstick into the oil dipstick hole.
18. Fit the thermostat housing and tighten to **8–12Nm**.



S111D411

19. Fit the intake manifold.

☞**Intake Manifold Refit**

20. Fit the exhaust manifold and new exhaust manifold shims.

☞**Exhaust Manifold Refit**

21. Fit the generator with the torque of: **40–50Nm**.

☞**Generator Refit**

22. Fit the spark plug with the torque of: **20–30Nm**.

☞**Spark Plug Refit**

23. Connect battery earth lead.

Cylinder Head Inspection

Remove

1. Disconnect battery earth lead.
2. Remove the generator.

☞**Generator Remove**

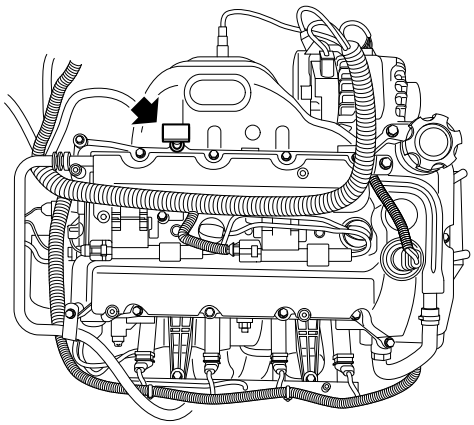
3. Remove the exhaust manifold and dispose of exhaust manifold gasket.

☞**Exhaust Manifold Remove**

4. Remove the bolts fixing thermostat assembly to the cylinder head and remove the thermostat assembly.
5. Remove any dirt at the spark plug clearance.
6. Remove the spark plug.

☞**Spark Plug Remove**

7. Remove the oil level indicator.



S111C401

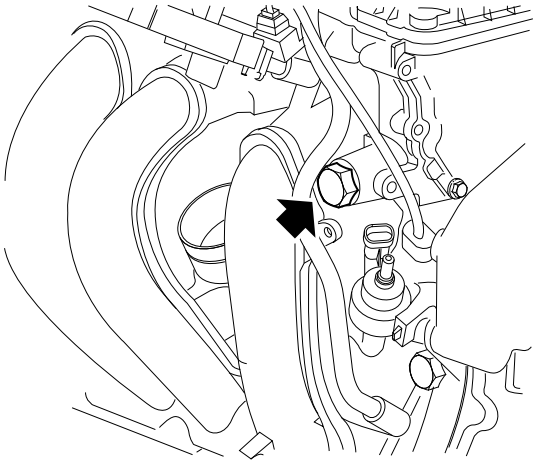
8. Remove the camshaft cover.

☞**Camshaft Cover Remove**

9. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

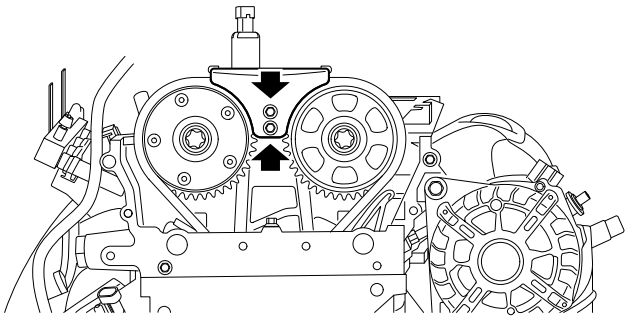
10. Remove the timing chain tensioner.



11. Remove the oil control valve.

☞**Oil Control Valve Remove**

12. Release the bolts fixing the sprocket upper rail, remove the sprocket upper rail.

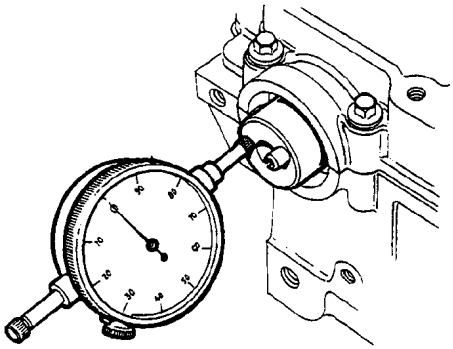


S111J413

13. Remove the chain, and put the chain aside.
14. Remove cylinder head assembly, and dispose of cylinder head gasket.

☞**Cylinder Head Assembly Remove**

15. Check the amount of end float of the camshaft with a dial gauge.

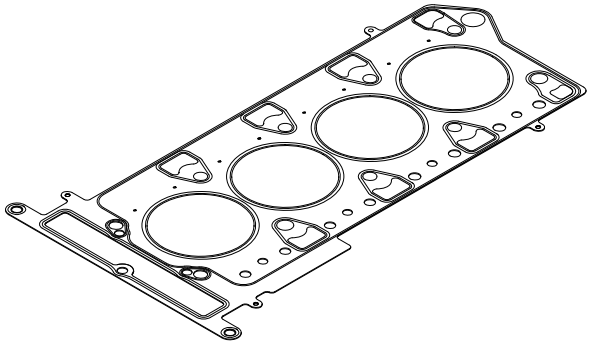


S111D415

16. If the end float amount exceeds tolerance, replace a new camshaft and re-check; if the end float amount still exceeds tolerance, replace the cylinder head assembly.

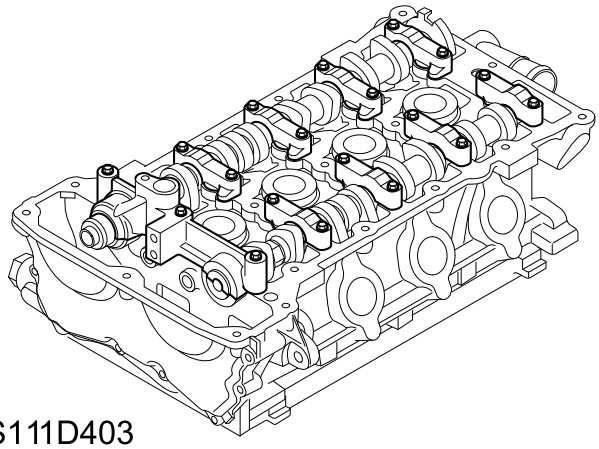
Camshaft axial clearance:	0.06-0.19 mm
Limit of the maintenance value	0.30mm

17. Gradually loosen the cylinder head bolts, remove the cylinder head assembly, put the cylinder head on the wood shelf, protecting fire-face to avoid scratch.
18. Remove and dispose of the cylinder head gasket.



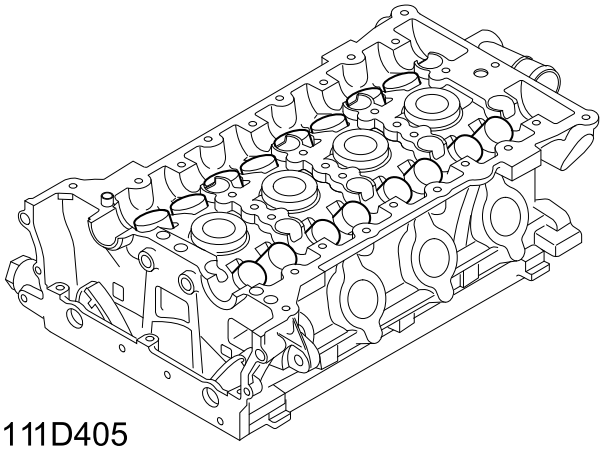
S111D413

19. Loosen the bolts fixing the camshaft bearing cap, identify the location of each camshaft bearing cap and remove the camshaft bearing cap.



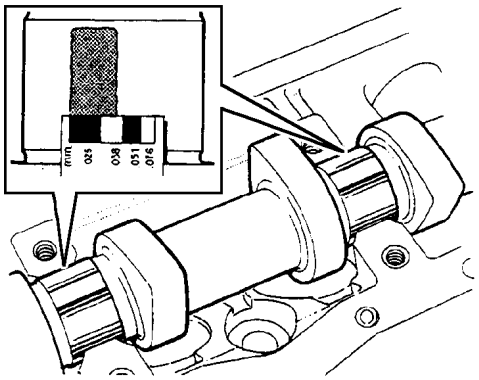
S111D403

20. Identify the location of each camshaft and remove the camshaft.
21. Remove 16 mechanical tappets from the cylinder head, and place them in the appropriate order, to avoid confusion.



S111D405

22. Measure the outer diameter of each mechanical tappet.
23. Clean camshaft, camshaft bearing cap and cylinder head bearing seat.
24. Check the camshaft, if there are scratches, dents or excessive wear, replace it.
25. Fix the camshaft to the cylinder head, place the plastic gauge on each shaft journal, then fit the camshaft bearing cap, do not turn the camshaft.
26. Slowly release the bolts of camshaft bearing cap, remove the camshaft bearing cap.

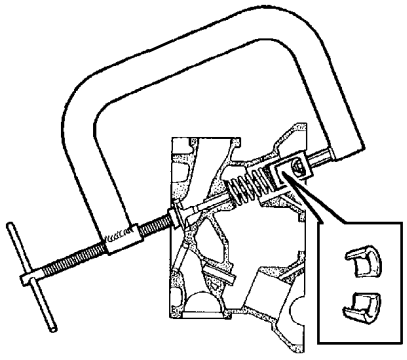


S111D416

27. Measure the widest area of the plastic gauge on each shaft journal, if the clearance exceeds tolerance, replace a new camshaft and re-check; if the clearance still exceeds tolerance, replace a new cylinder head assembly.

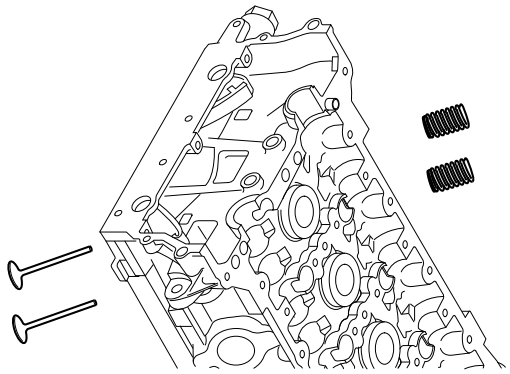
	Bearing Clearance	Maintenance Clearance
Previous one range	0.025-0.066 mm	0.1mm
Last four ranges	0.024-0.066 mm	0.1mm

28. The cylinder head exhaust manifold side is supported by a wooden block, and the intake valve in this location is removed.
29. Use the special tool**T10005** compress the valve spring, remove two lock clamps from the valve, release the valve spring, and remove the tool.



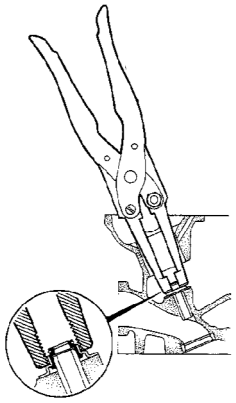
S111D407

30. Remove the remaining valve spring seats, valve springs and valves, and place them by the original refit order.



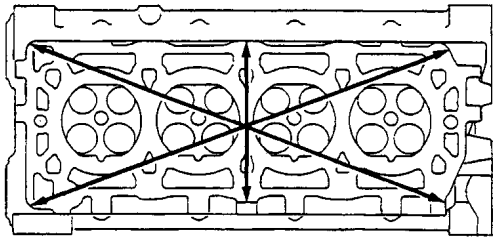
S111D408

31. Use the special tool**T10006** to remove the valve oil seal.



S111D409

32. Clean all mating surfaces of cylinder head.
33. Check cylinder head for any damages, pay special attention to fire-face of the cylinder head.
34. Check whether the cylinder head fire-face has any scratches, alternatively in the method as shown, or from one corner to another corner.

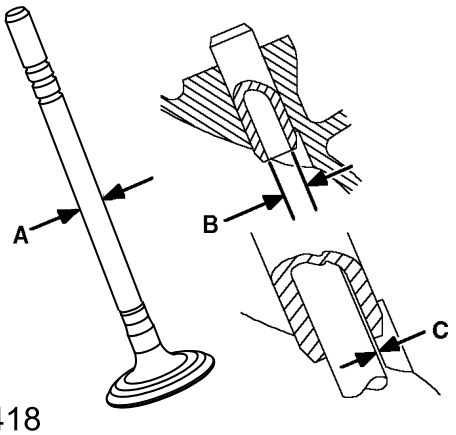


S111D417

35. Check the height of the cylinder head, the cylinder head surface can be trimmed, the maximum refinishing being of 0.20 mm.

The height of the cylinder head	118.95-119.05 mm
New	0.20mm
The limit of the surface refinishing value	

36. Remove the carbon from valve, valve guide, valve seat and the surface of combustion chamber.

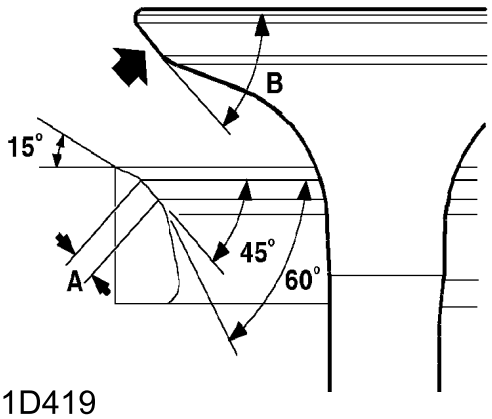


S111D418

37. Check the existing valve stem diameter, use a new valve to one-way valve guide clearance. If necessary, replace new valve; if valve guides need to be replaced, it is necessary to replace the cylinder head assembly.

☞**Parameter**

38. If you want to reuse the cylinder head, check conditions of valve seat and valve.



S111D419

39. The angle of the valve surface and valve seat should be processed to the following standards:

Valve seat:	
Angle	45°
width A:	1.2mm
Intake	1.6mm
Exhaust	
Angle B of the valve surface:	
Intake	45°
Exhaust	45°

40. Push the valve onto the seat with a uniform ground glue.
41. Coat the valve seat with Prussian blue, and fit the the valve and press it in place, which must not turn; remove it and check the uniformity and the centreing of seat, the position of blue seat as shown must be the in the center of valve surface.
42. Coat the valve seat and then re-check.
43. Check the mating height of valve stem.

New intake valve	50.021-50.881 mm
New exhaust valve	49.925-50.785 mm
Limit of the maintenance	0.26mm

44. If it still exceeds the limit, the cylinder head assembly needs to be replaced.

Free length	50mm
Refit length	37.0 mm
Load - valve closed	250±12Nm
Load - the intake valve open	442±18Nm
Load - the exhaust valve open	464±18Nm

45. Check the status of valve spring:

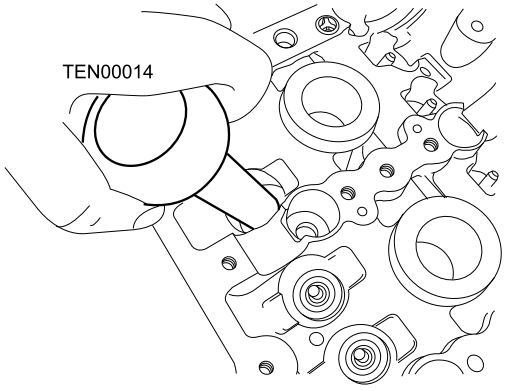
Free length	50mm
Refit length	37.0 mm
Load - valve closed	250±12Nm
Load - the intake valve open	442±18Nm
Load - the exhaust valve open	464±18Nm

Refit

1. Clean the sealing area between the cylinder head and the timing chain upper cover. Use the foam remover and plastic scraper to clean the camshaft cover, the mating surface of intake and exhaust manifold.

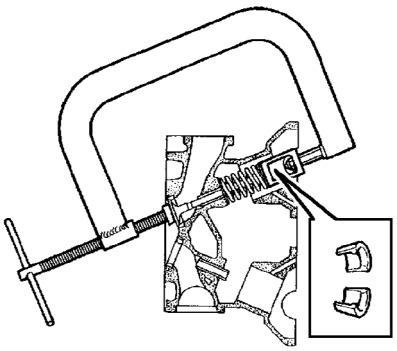
Caution: Don't use scraper to deal with sealed surface.

2. Dry the oil passages and coolant passages with air.
3. Use **TEN00014**, fit a new valve stem oil seal.



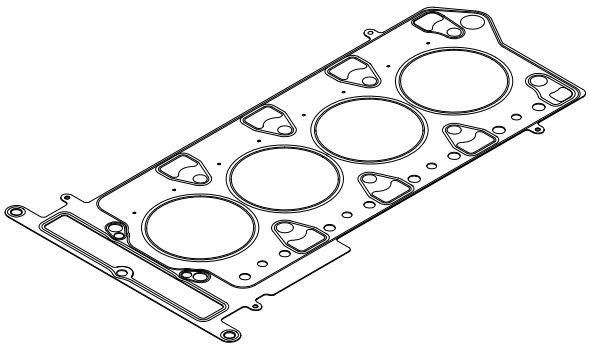
S111D424

4. Lubricate the valve stem and valve assembly, use tools**T10005**to compress the valve spring. Fit the intake valve and exhaust valve, valve spring, valve spring seat and valve locker.



S111D407

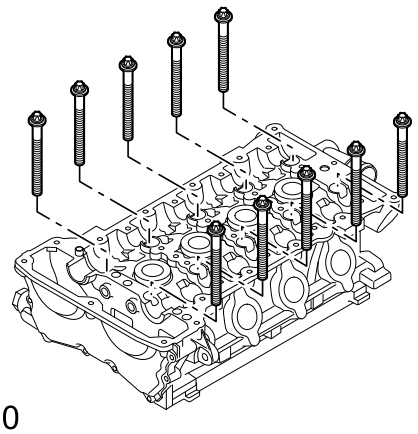
5. Put a new cylinder gasket.



S111D413

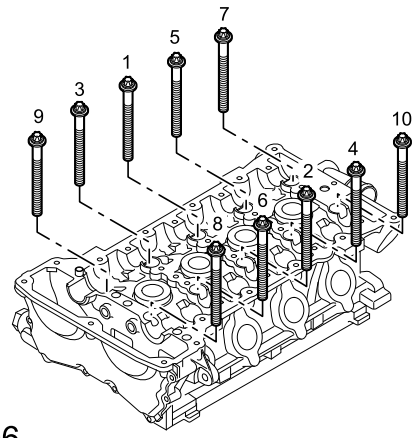
6. Place the cylinder head on the body, then pre-tighten it with bolts.

Warning: The cylinder head bolts cannot be lubricated by lubricants.

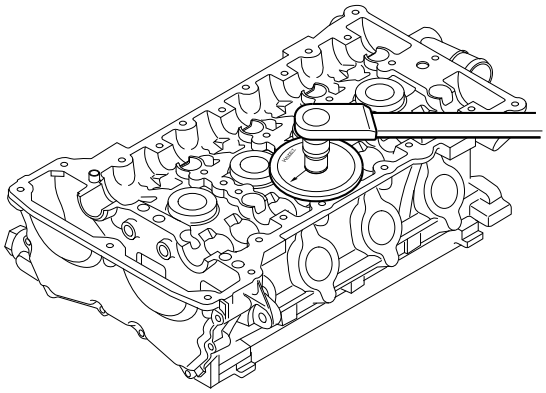


S111D420

7. In the order as shown, tighten 10 cylinder head bolts with a dedicated socket, and the torque is set to **(30±2)Nm+90°+(90°+45°)±2°**, then tighten the three bolts near the chain case, and the torque is set to**10–12Nm**.

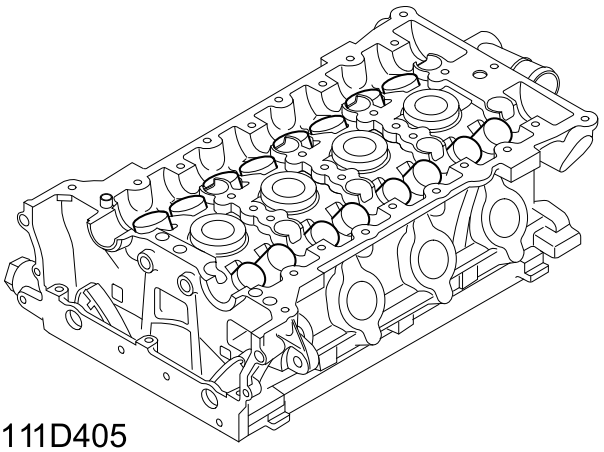


S111D406



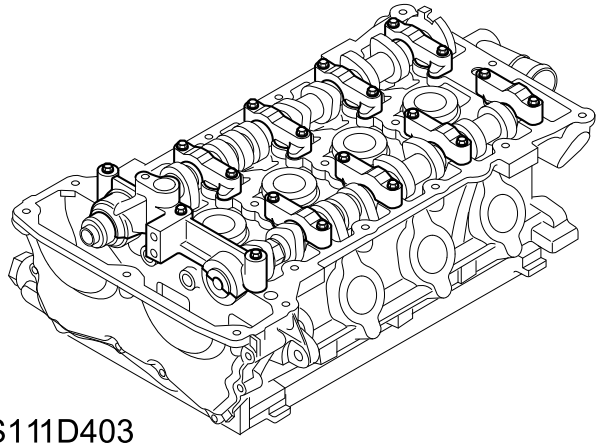
S111D421

8. Lubricate the outside of the mechanical tappet, fit the mechanical tappet to the initial position.



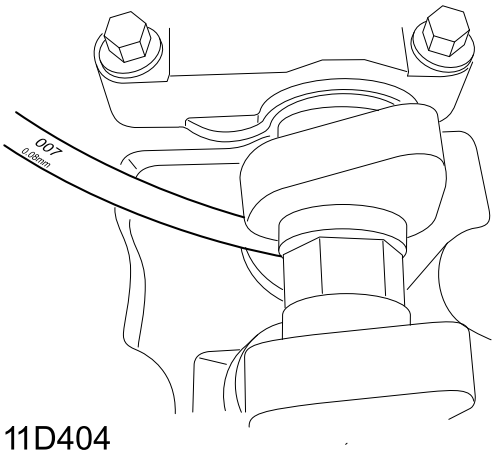
S111D405

9. Lubricate camshaft bearing surface, and place the camshaft onto the cylinder head. Then close the camshaft bearing cover in the proper position, and pre-tighten it with bolts.



S111D403

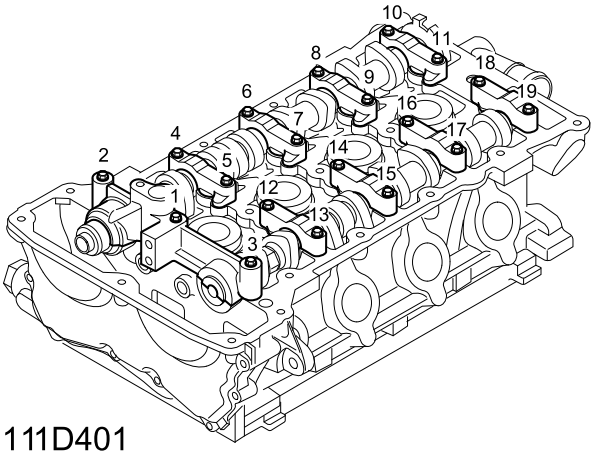
10. Measure each mechanical tappet clearance according to the following method: Turn the camshaft so that the base circle is above the mechanical tappet, measure clearance between the camshaft and the mechanical tappet, record the clearance, repeat the operation for each mechanical tappet. Compute the clearance, select the appropriate mechanical tappet to provide correct clearance. The clearance of the intake side: 0.11-0.19 mm, and the clearance of the exhaust side: 0.20-0.28 mm.



S111D404

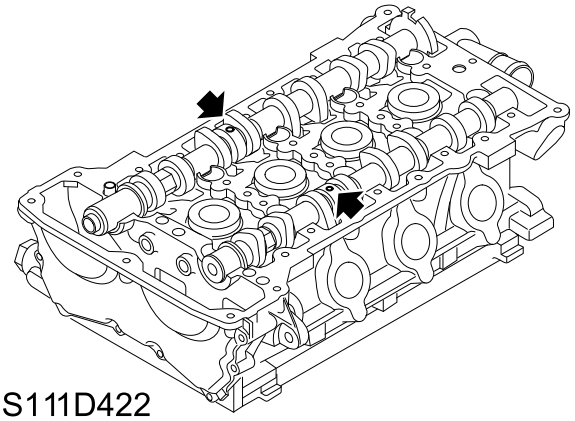
11. Remove the camshaft, and in the corresponding mechanical tappet, fit the mechanical tappet of the correct size; according to the previous method, fit the camshaft, and check the clearance.
12. In the order as shown, tighten the bolts fixing the bearing, and the torque is set to **8–12Nm**, after tightening, rotate the camshaft two circles, and measure the rotational torque.

Caution: rotation is necessary.

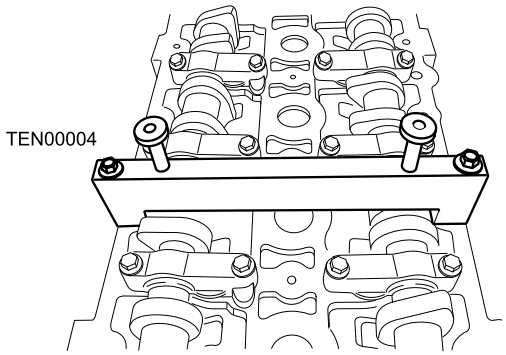


S111D401

13. Add clean oil at the mechanical tappet. Turn the camshaft, so that the timing hole faces upward, and then use camshaft timing special tools **TEN00004**. Fix the camshaft, adjust crankshaft position, making it located before the TDC of cylinder 1 at 90 degrees (Note: The crank angle). Then use the flywheel timing pin special tools**TEN00002** to insert the body timing pin holes and flywheel pin holes, to lock the flywheel.

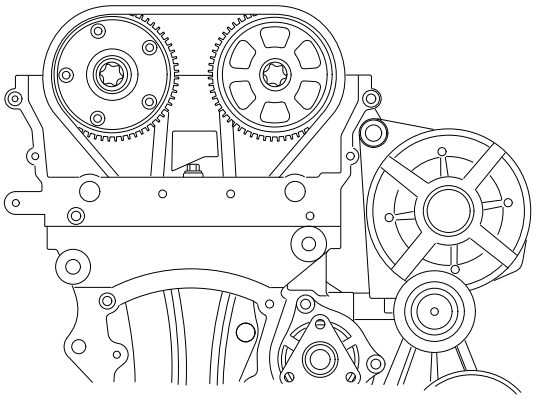


S111D422



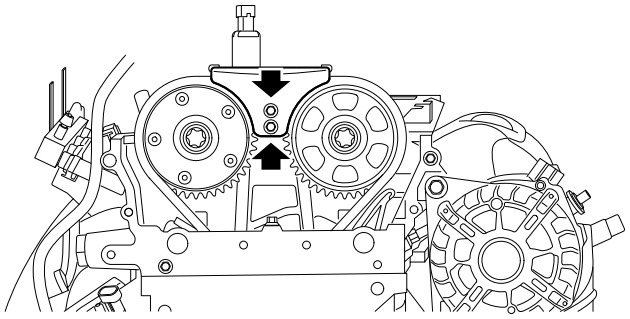
S111B408

14. Press the oil control sleeve into the hole of the camshaft end on the intake side. Fit the intake phase modulator and exhaust camshaft sprocket to the appropriate camshaft, and fit the bolts, but do not tighten. Then engage the chain with sprocket teeth.



S111D414

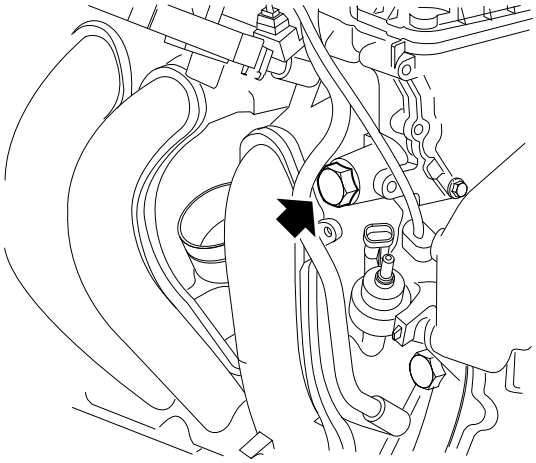
15. Tighten the intake phase modulator and exhaust camshaft sprocket bolts, and the timing chain bolt torque is set to **70–80Nm**, sprocket bolt torque is set to **(25±3)Nm+45°±2°**.
16. Fit the sprocket upper rail on the camshaft front bearing cap, fit and tighten two bolts and the torque is set to **8–12Nm**.



S111J413

17. Fit the timing chain tensioner to the cylinder head and

tighten it, and the torque is set to **77-83Nm**.



18. Fit the oil control valve, and the torque is set to **5–7Nm**.

☞**Oil Control Valve Refit**

19. Fit timing chain upper cover plate, and the torque is set to **8–12Nm**.

☞**Timing Chain Upper Cover Plate Refit**

20. Fit camshaft cover assembly, and the torque is set to **8–12Nm**.

☞**Camshaft Cover Refit**

21. Insert the oil level indicator into the dipstick hole.
22. Fit the thermostat housing and tighten it to **8–12Nm**.
23. Fit the intake manifold.

☞**Intake Manifold Refit**

24. Fit exhaust manifold and a new exhaust manifold gasket.

☞**Exhaust Manifold Refit**

25. Fit the generator, and the torque is set to: **40–50Nm**.

☞**Generator Refit**

26. Fit spark plugs, and the torque is set to **20–30Nm**.

☞**Spark Plug Refit**

27. Connect battery earth lead.

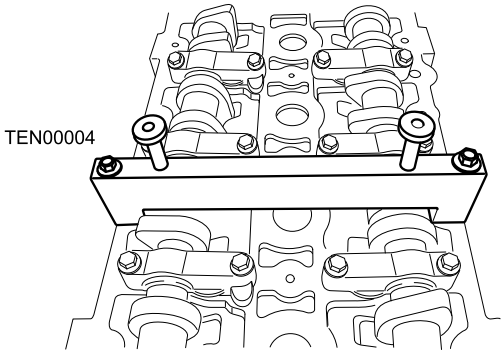
Cylinder Head Gasket

Remove

1. Disconnect battery earth lead.
2. Remove the camshaft cover.

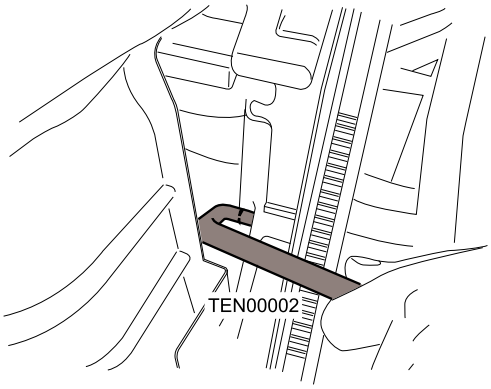
☞**Camshaft Cover Remove**

3. Remove the plug fit in timing pin hole on the body.
4. Rotate the crankshaft, until the camshaft locking special tool**TEN00004** is available to lock the camshaft phase.



S111B408

5. Insert the timing pin special tool**TEN00002** to the body timing pin holes and flywheel pin holes, to lock the flywheel.



S111B401

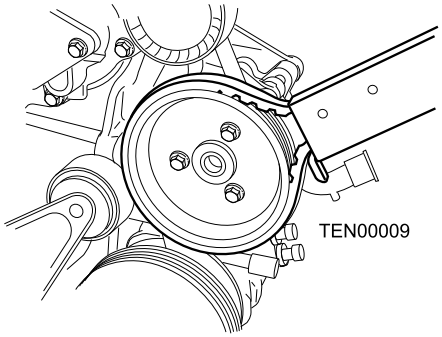
6. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

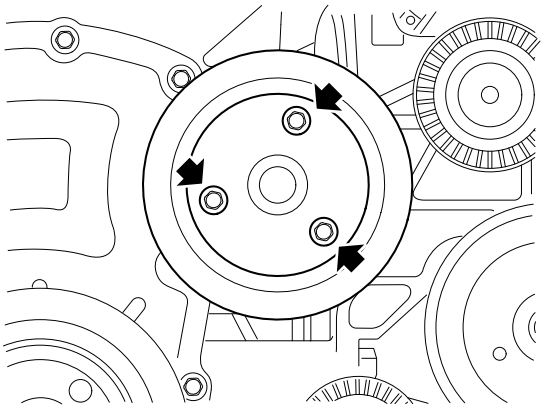
7. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

8. Use pulley removing special tools**TEN00009** to remove water pump pulley.



S111J423



S111J404

9. Remove the timing chain upper cover plate.

Timing Chain Upper Cover Plate Remove

10. Remove the timing chain lower cover plate.

Timing Chain Lower Cover Plate Remove

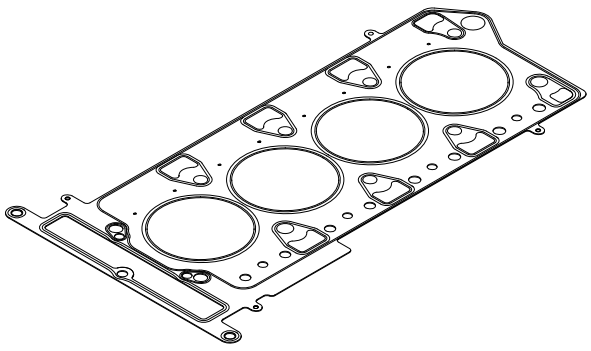
11. Remove the timing chain.

Timing Chain Remove

12. Remove the cylinder head assembly

Cylinder Head Remove

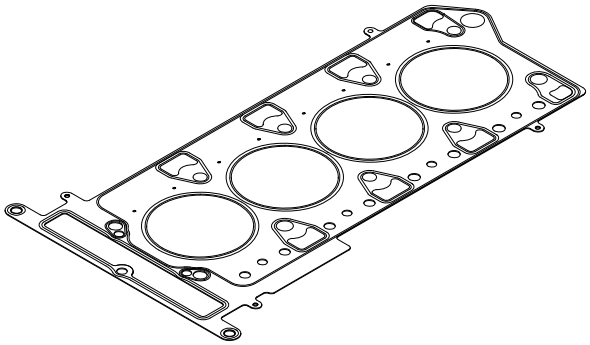
13. Remove the cylinder head gasket from the cylinder block and dispose of it.



S111D413

Refit

1. Clean the mating surface of the cylinder head and cylinder block.
2. Check whether there are any scratches on the cylinder head surface.
3. Check the cylinder head height.
4. Clean the passages of engine oil and coolant.
5. Clean and dry the cylinder head bolts, check whether there are damaged threads.
6. Use the oil to coat the cylinder head bolt threads with a layer of film.
7. Fit new, clean cylinder head gaskets to the cylinder block.



S111D413

8. Fit the cylinder head assembly.

Cylinder Head Assembly Refit

9. Fit the timing chain.

Timing Chain Refit

10. Fit the timing chain upper cover plate.

Timing Chain Upper Cover Plate Refit

11. Fit the timing chain lower cover plate.

Timing Chain Lower Cover Plate Refit

12. Fit the water pump pulley.
13. Fit crankshaft pulley.

Crankshaft Pulley Refit

14. Fit upper accessory drive belt.

Accessory Drive Belt Refit

15. Remove the flywheel timing pin special tool **TEN00002**.
16. Fit the plug.
17. Fit the camshaft cover.

Camshaft Cover Refit

18. Connect battery earth lead.

Lower crankcase

Remove

1. Disconnect battery earth lead.
2. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

3. Drain the engine oil.
4. Remove the oil filter.

☞**Oil Filter Remove**

5. Remove the exhaust front pipe assembly.

☞**Exhaust Front Pipe Assembly Remove**

6. Remove the sub drive belt.

☞**Sub Drive Belt Remove**

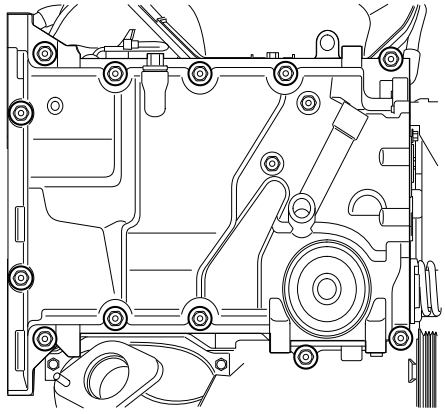
7. Remove the cover plate of the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Remove**

8. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

9. Release the oil pump chain.
10. Remove all the tightening bolts from lower crankcase to cylinder block.



S1111401

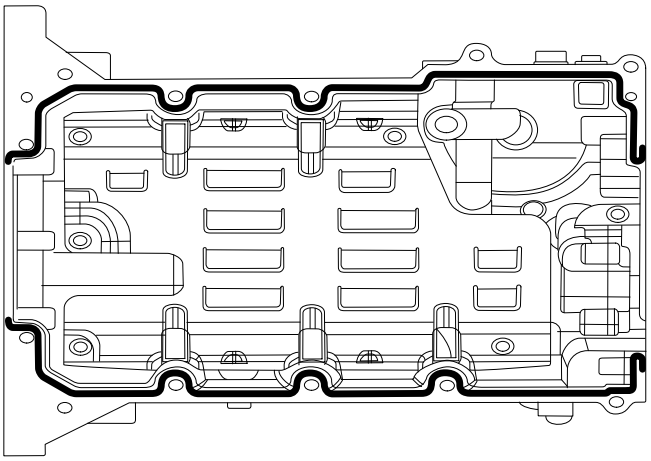
11. Remove the lower crankcase.

Refit

1. Make sure the mating face between the lower crankcase and the cylinder block is clean.
2. Fit the oil pump chain.
3. Fit the crankshaft rear oil seal cover plate.

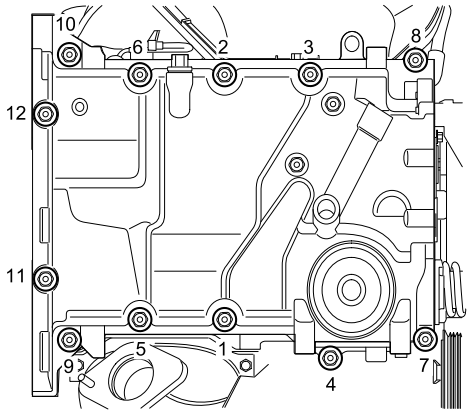
☞**Crankshaft Rear Oil Seal Refit**

4. Please use SAIC MOTOR recommended sealant, when applying sealant on the mating face of the lower crankcase and making assembling operation.



Caution: When fitting the lower crankcase, try to make the lower crankcase close to the flywheel end as near as possible to avoid creating a gap when connecting the lower crankcase and the transmission case.

5. In the sequence shown, tightening the lower crankcase to **22–30Nm**.



S1111402

6. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

7. Fit the sub drive belt.

☞**Sub Drive Belt Refit**

8. Fit the exhaust front pipe assembly.

☞**Exhaust Front Pipe Assembly Refit**

9. Take away the lifting tool and lower the vehicle.
10. Fit a new oil filter.

☞**Oil Filter Refit**

11. Fill the engine with oil.
12. Connect battery earth lead.

Connecting rod bearing inspection

Remove

1. Remove the sub drive belt.

☞**Sub Drive Belt Remove**

2. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

3. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

4. Remove the timing chain.

☞**Timing Chain Remove**

5. Cylinder head assembly.

☞**Cylinder Head Remove**

6. Remove the engine flywheel or the torque converter drive plate.

☞**Hand Flywheel Remove**

7. Remove the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Remove**

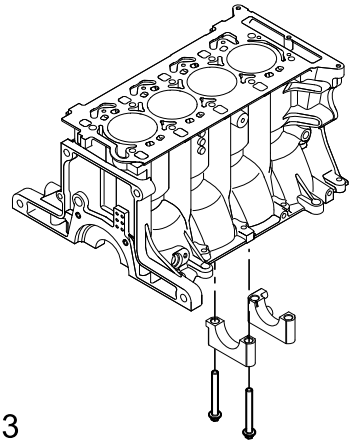
8. Remove the lower crankcase assembly.

☞**Lower Crankcase Remove**

9. Fit and tighten the crankshaft pulley bolts, and then lightly screw down them.
10. Mark the assembling sequence at the large part of the connecting rod.

Caution: Keep bearing caps, bearings and bolts in their fitted order.

11. Remove the crankshaft pulley bolts, rotate the crankshaft, and make the connecting rod bolts on a easily removable position.
12. Remove the connecting rod bolts and remove the connecting rod lower end cover (connecting rod large end cover).

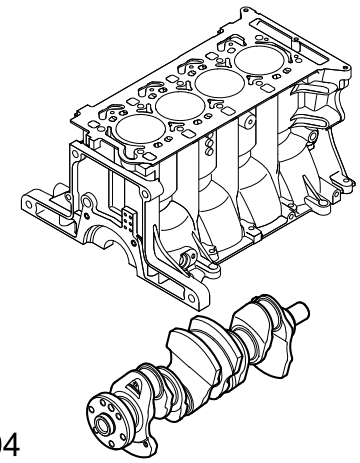


S111A403

13. Remove the connecting rod bearing half on the lower end cover (connecting rod large end cover) of the connecting rod.
14. Push the piston connecting rod out of the cylinder hole slightly by plastic or wood stick from the fire face side, and remove the rest connecting rod bearing halves.

Caution: When fitting the piston, DO NOT scratch the cylinder liner with the connecting rod fracture.

15. Remove the main bearing cap bolts, remove the main bearing cap, and remove the bearing halves from the bearing seat.
16. Remove the crank shaft.



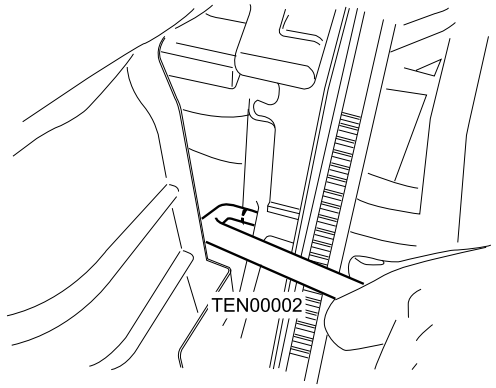
S111A404

17. Remove two thrust washers from the 5th main shaft bearing.
18. Remove the main shaft bearing halves from the cylinder block.

Refit

1. Clean the mating face between the cylinder block and the bearing seat.
2. Clean the pin and the pin hole.
3. Clean the bearing halves and the retaining position of the thrust washer in the cylinder block.
4. Clean the retaining position of the bearing halves on the bearing seat.
5. Clean the retaining position of the bearing halves on the connecting rod and cover.
6. Clean the crankshaft and check for damages.
7. Align the two connecting rod bearing halves with the groove and press it into the connecting rod hole, make the end surface of the bearing halve be flat with the profile of the connecting rod hole.

Caution: The connecting rod bearings are not grouped.



S111B401

Caution: Record the main bearing mark number on the front of the crankshaft.

8. Check the diameter of the main shaft journal of the crankshaft.

☞**Parameter**

9. The main shaft bearing halves is fit in accordance with the selected size and model.

☞**Parameter**

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

10. The rule of selecting main shaft bearing half: upper half is grouped in accordance with the cylinder size (A is blue and B is red).
11. Lower half is grouped in accordance with the cylinder size (1 is blue and 0 is red).
12. Clean the cylinder block and the seal face on the bearing seat with a lint-free cloth and appropriate solvent.

Tip: Please use SAIC MOTOR recommended solvent.

13. Fit the selected crankshaft main shaft bearing half on the cylinder block and bearing seat.
14. Clean and fit the new thrust washer on the 4th part of the main bearing on the cylinder block.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

15. Fit the crankshaft and the main bearing cover. Torque: **(20±2)Nm+90°+45°±2°**.
16. Put the piston connecting rod assembly into the guide sleeve and press it into the cylinder, close the large end cover of the connecting rod. Torque: **(18±2)Nm+90°±2°**.
17. Fit the hand flywheel or the torque converter drive plate.

☞**Flywheel Refit**

18. Fit the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Refit**

19. Fit the cylinder head assembly.

☞**Cylinder Head Assembly Refit**

20. Fit the timing chain.

☞**Timing Chain Refit**

21. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

22. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

23. Fit the water pump pulley.
24. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

25. Fit the upper sub drive belt.

☞**Sub Drive Belt Refit**

26. Remove the special tool for the flywheel timing pin **TEN00002**.
27. Fit the plug.
28. Connect battery earth lead.

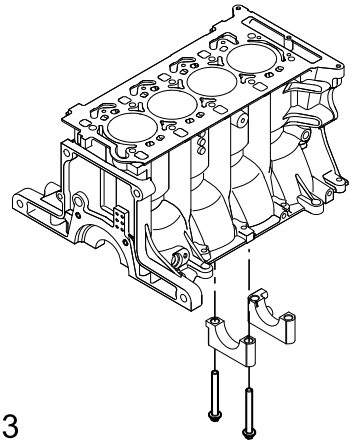
Piston Inspection

Remove

1. Remove the cylinder head assembly.

☞**Cylinder Head Assembly Remove**

2. Loosen the connecting rod bolts.



S111A403

3. Remove the connecting rod cap.
4. Remove the rod bearing shell.
5. Push the piston to the top of the cylinder hole.

Caution: Remove the carbon deposits on the top of the cylinder bore first to avoid scratching the piston rings and the piston.

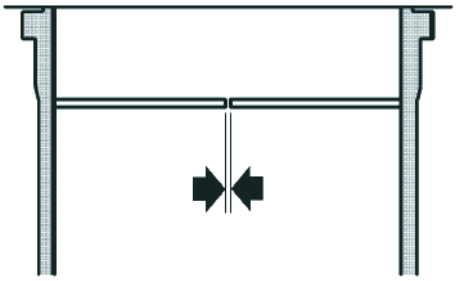
6. Ensuring the connecting rod does not contact the inner wall of the cylinder bore, carefully push the piston assembly out from the cylinder hole.

Caution: Please carefully mark each piston and match liner.

7. Refit the connecting rod big end cap onto the connecting rod, and gently tighten the rod bolts.
8. Remove the old piston rings with an expander (tool), and dispose of the rings.

Refit

1. Clean the ring grooves of the piston and blow oil passages.
2. Position new piston rings 20 mm away from the top of the cylinder bore, and measure the clearance.



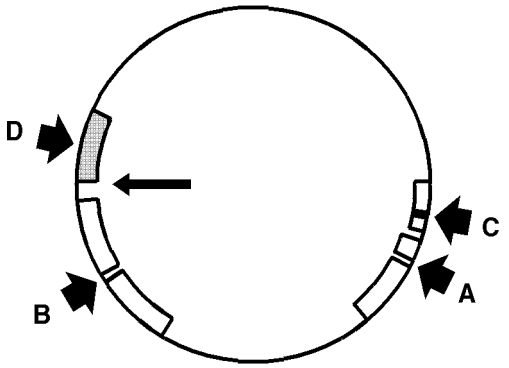
S111A405

3. Check whether the piston has any deformations and cracks.
4. At a vertical angle relative to the piston pin, measure the piston diameter at a measurement point 11 mm upward away from the lower part of the skirt.

☞**Parameter**

Caution: Piston and connecting rods are only supplied as an assembly. Connecting rods refitted must be the same weight group.

5. Fit the oil ring spring.
6. With the "TOP" mark facing toward the top of the piston, use the expander to fit in accordance with the following order: oil ring blade, The second gas ring, the first gas ring.
7. To ensure the piston rings are free to rotate, stagger the gaps A and B of the two air rings at an angle of 120°, and keep them away from the piston thrust side.
8. On both sides of the piston pin, stagger the blade gap C and the spring gap D at an angle of 30°.

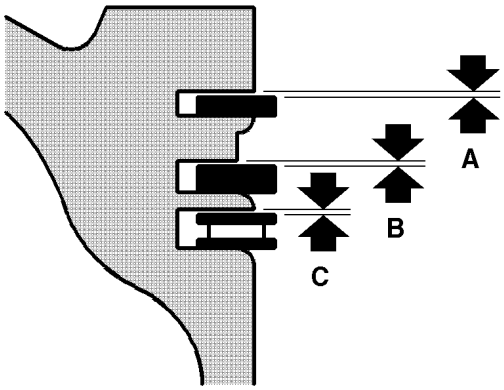


S111A406

9. Check the clearance from the new piston ring to the ring groove.

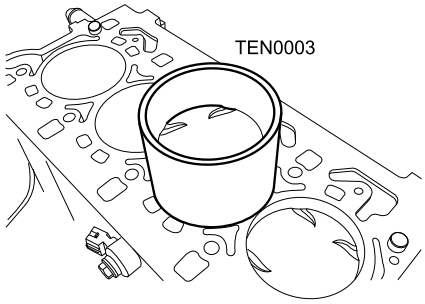
☞**Parameter**

☞Cylinder Head Assembly Refit

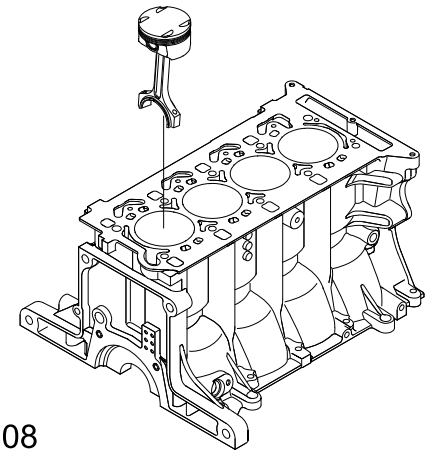


S111A407

10. Put the piston rod assembly into the special tool**TEN00003** from top to bottom, and align the guide tool with the cylinder bore, ensuring the arrow mark "- " on the surface of the piston top faces towards the engine front end.



S111A409



S111A408

11. Forcefully push the piston into the cylinder hole.

Tip: It is recommended to replace the piston connecting rod assembly as a set.

12. Fit the connecting rod cap, tighten the rod bolt following the torque table.
13. Fit the cylinder head assembly.

Crankshaft Inspection

Remove

1. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

2. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

3. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

4. Remove the timing chain.

☞**Timing Chain Remove**

5. Remove the cylinder head assembly.

☞**Cylinder Head Remove**

6. Remove the engine flywheel or torque converter drive plate.

☞**Manual Flywheel Remove**

7. Remove the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Remove**

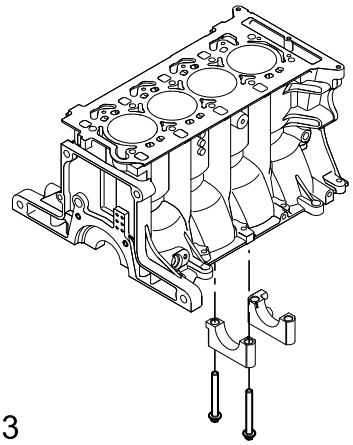
8. Remove the lower crankcase assembly.

☞**Lower Crankcase Remove**

9. Fit the crankshaft pulley bolts, gently tighten the pulley bolts.
10. Mark the order of the cylinders assembled with the connecting rod at the connecting rod big end.

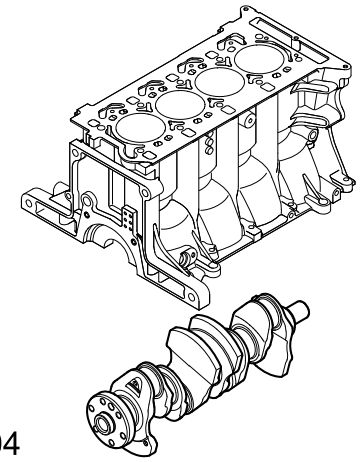
Caution: Keep bearing caps, bearings and bolts in their fitted order.

11. Rotate the crankshaft pulley bolts, turn the crankshaft, correspondingly positioning the bolts of the connecting rod for convenient remove.
12. Remove the connecting rod bolts, remove the lower endcap of the connecting rod (big end cap of the connecting rod); gently push out the piston rod assembly from the cylinder bore.



S111A403

13. Remove the rod bearing shell on the lower endcap of the connecting rod (big end cap of the connecting rod).
14. Remove the main bearing cap bolts, remove the main bearing cap, and remove the main bearing shell from the bearing retainer.
15. Remove the crankshaft.

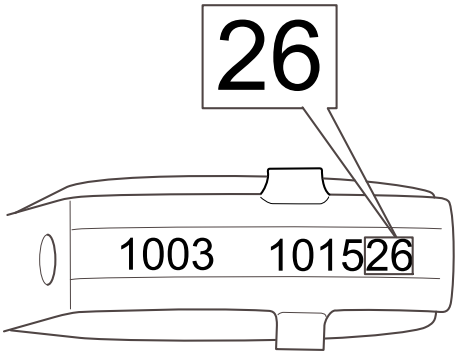


S111A404

16. At the position of the fourth main shaft bearing, remove the two thrust washers.
17. Remove the main bearing shell from the cylinder block.
18. Remove the other half of bearing shell from the connecting rod.

Refit

1. Clean the mating face between the cylinder block and the bearing seat.
2. Clean the pin and the pin hole.
3. Clean the bearing halves and the retaining position of the thrust washer in the cylinder block.
4. Clean the retaining position of the bearing halves on the bearing seat.
5. Clean the retaining position of the bearing halves on the connecting rod and the cover (Refer to the parts manual for the information about how to group the piston connecting rod assembly).



Caution: The weight groupings of the piston connecting rod assemblies on the same engine should be same, fit them correctly. If the piston connecting rod assembly in the same group cannot be selected and fitted when servicing, replace all the piston connecting rod assemblies to ensure the piston connecting rod assembly weight is in the same group.

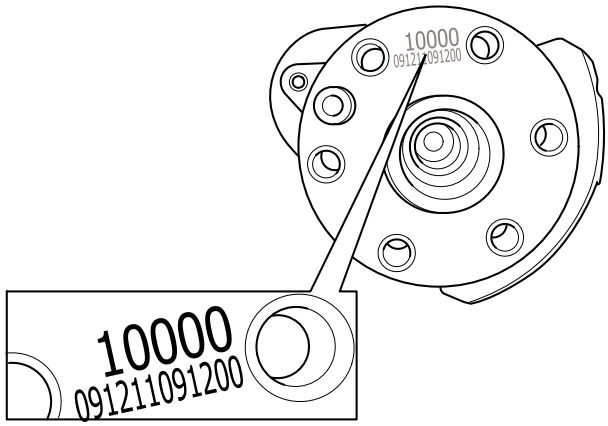
6. Clean the crankshaft and check for damages.
7. Align the two connecting rod bearing halves with the groove and press it into the connecting rod hole, make the end surface of the bearing halve be flat with the profile of the connecting rod hole.

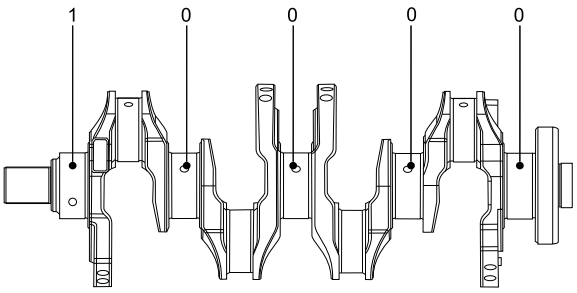
Caution: The connecting rod bearings are not grouped.

Caution: Record the main bearing mark number on the front of the crankshaft.

8. Record the code on the lower main shaft bearing halve from the rear end of the crankshaft, the following is the grouping specification:

JOURNAL DIA.	GRADE
f 50.000-f 49.993	0
f 49.992-f 49.984	1





9. Check the diameter of the main shaft journal of the crankshaft.

☞**Parameter**

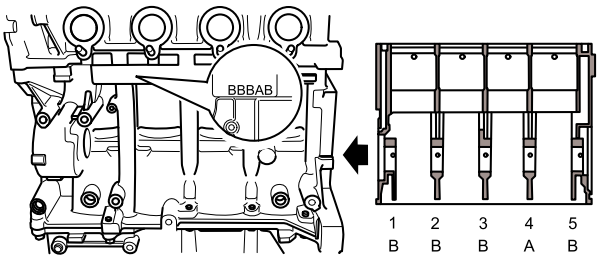
10. The main shaft bearing halves is fit in accordance with the selected size and model.

☞**Parameter**

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

11. The rule of selecting main shaft bearing half: upper half is grouped in accordance with the cylinder size (A is blue and B is red).

GRADE	DIAMETER
A	53.690 f ≤53.700
B	53.680≤f ≤53.690



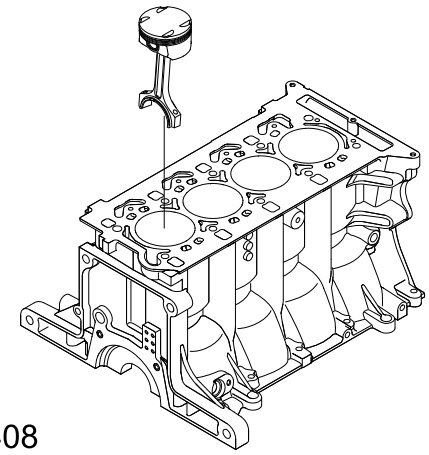
12. Lower half is grouped in accordance with the cylinder size (1 is blue and 0 is red).
13. Clean the cylinder block and the seal face on the bearing seat with a lint-free cloth and appropriate solvent.

Tip: Please use SAIC MOTOR recommended solvent.

14. Fit the selected crankshaft main shaft bearing half on the cylinder block and bearing seat.
15. Clean and fit the new thrust washer on the two sides of the 4th part of the main bearing on the cylinder block.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

16. Fit the crankshaft, lubricate the main shaft journal appropriately, and then fit the main bearing cover. Torque: **(20±2)Nm+90°+45°±2°**.
17. Lubricate the connecting rod bearing halves and the crankshaft connecting rod journal, then put the piston connecting rod assembly into the special tool**TEN00003** and press it into the cylinder, and then close the large end cover of the connecting rod. Torque: **(18±2)Nm+90°±2°**.



S111A408

18. Fit the hand flywheel or the torque converter drive plate.

☞**Flywheel Refit**

19. Fit the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Refit**

20. Fit the cylinder head assembly.

☞**Cylinder Head Assembly Refit**

21. Fit the timing chain.

☞**Timing Chain Refit.**

22. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit.**

23. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

24. Fit the water pump pulley.
25. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

26. Fit the upper sub drive belt.

☞**Sub Drive Belt Refit.**

27. Remove the special tool for the flywheel timing pin **TEN00002**.
28. Fit the plug.
29. Connect battery earth lead.

Crankshaft Rear Oil Seal

Remove

1. Disconnect battery earth lead.
2. Remove the transmission assembly.

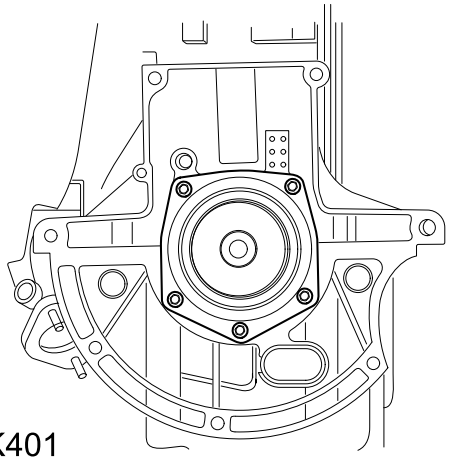
☞**Manual Transmission Remove**

☞**Automated Mechanical Transmission Remove**

3. Remove the hand flywheel or the torque converter drive plate.

☞**Hand Flywheel Remove**

4. Release the five bolts surrounding the oil seal.
5. Remove and discard the oil seal.

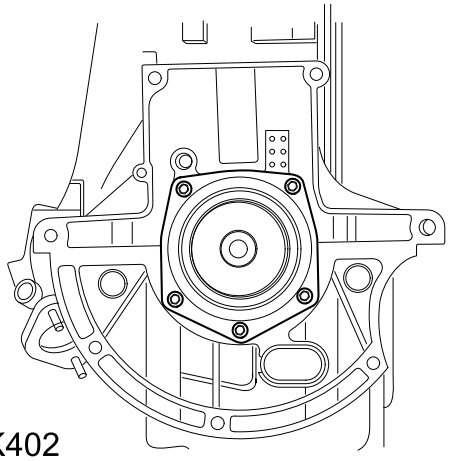


S111K401

Refit

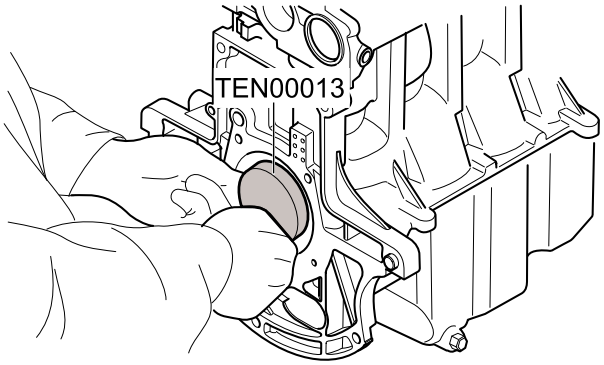
1. Clean the mating face between the crankshaft flange journal and the oil seal, and prevent it from any contamination.
2. Fit a guide sleeve special tool on the crankshaft rear oil seal **TEN00013**. Cover it at the rear end of the crankshaft.
3. Apply clean oil on the edge of the oil seal.

Caution: Take care to avoid damaging the oil seal lip, while fitting it.



S111K402

4. Slowly push the oil seal towards the special tool**TEN00013** to the location pin on the oil seal, and snap it into the pin hole on the cylinder block.



5. Press and hold the oil seal flange, and slowly pull out the special tool.
6. Tighten all of the bolts, and the tighten specification is **8–12Nm**.
7. Fit the hand flywheel.

☞**Flywheel Refit**

8. Fit the transmission assembly.

☞**Manual Transmission Assembly Refit**

☞**Automated Mechanical Transmission Assembly Refit**

9. Connect battery earth lead.

Oil strainer

Remove

1. Disconnect battery earth lead.
2. Empty the engine oil.
3. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

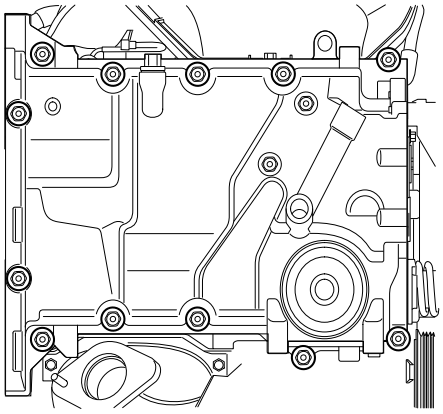
4. Remove the camshaft cover.

☞**Camshaft Cover Remove**

5. Remove the timing chain lower cover plate.

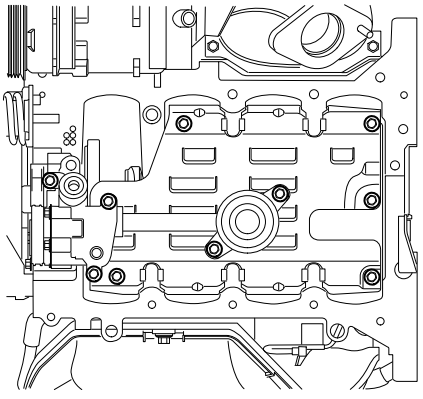
☞**Timing Chain Lower Cover Plate Remove**

6. Remove the oil pump drive chain and drive sprocket.
7. Remove all the bolts securing the lower crankcase to the body, remove the lower crankcase assembly.



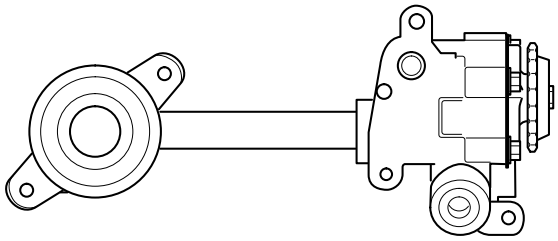
S111I401

8. Remove all the bolts securing the oil baffle to lower crankcase, remove the oil baffle.



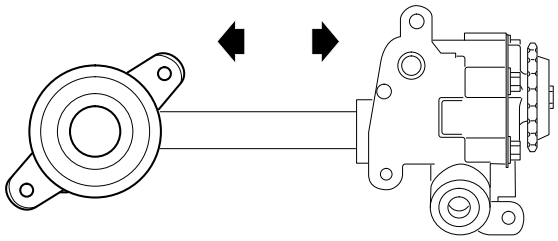
S111H401

9. Remove the retaining bolts of the oil pump and the oil strainer, take the oil pump and the oil strainer out of the lower crankcase.



S111H402

10. Separate the oil pump and the oil strainer in the direction as shown, take out the seal washer of the oil strainer, and dispose of it.



S111H403

Refit

1. Clean the oil strainer and its mating surface.
2. Lubricate the new O-ring with the engine oil, and fit the oil strainer. Insert the oil strainer into a new oil pump in the opposite direction to that shown on the above figure.
3. Fit the mounting bolts of the oil pump and the mounting bolts of the oil strainer, and tighten to **8–12Nm**.
4. Fit the oil baffle, tighten the torque to **8–12Nm**.
5. Fit the lower crankcase.

☞**Lower Crankcase Refit**

6. Fit the oil pump drive chain and drive sprocket.
7. Adjust the timing chain system.

☞**Timing Chain Refit**

8. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

9. Fit the camshaft cover.

☞**Camshaft Cover Refit**

10. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

11. Connect battery earth lead.

Oil Pump

Remove

1. Disconnect battery earth lead.
2. Empty the engine oil.
3. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

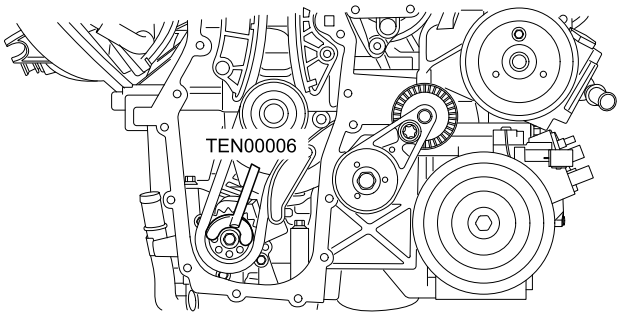
4. Remove the camshaft cover.

☞**Camshaft Cover Remove**

5. Remove the timing chain lower cover plate.

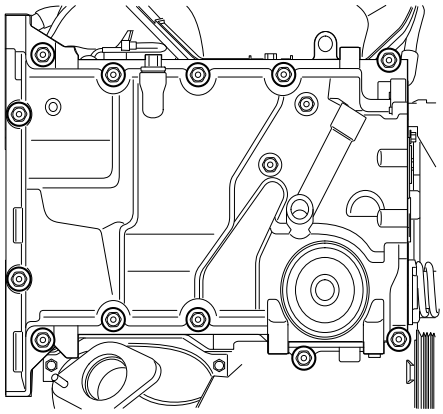
☞**Timing Chain Lower Cover Plate Remove**

6. Use the special tool**TEN00006** to hold the oil pump sprocket and remove the oil pump sprocket.



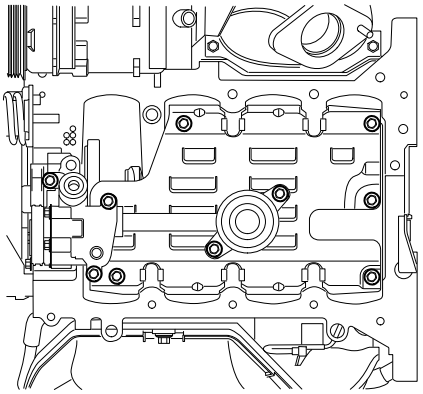
S111J424

7. Remove the oil pump drive chain.
8. Remove all the bolts securing the lower crankcase to the body, remove the lower crankcase assembly.



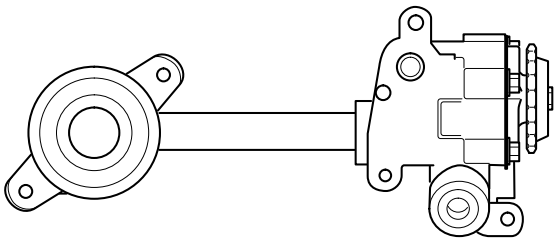
S111I401

9. Remove all the bolts securing the oil baffle to lower crankcase, remove the oil baffle.



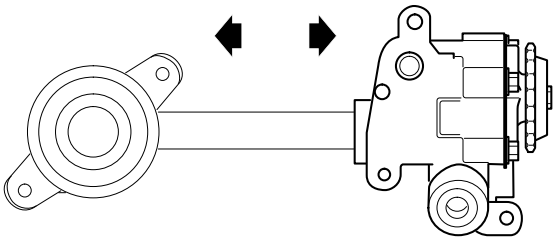
S111H401

10. Remove the retaining bolts of the oil pump and the oil strainer, take the oil pump and the oil strainer out of the lower crankcase.



S111H402

11. Separate the oil pump and the oil strainer in the direction as shown, take out the seal washer of the oil strainer, and dispose of it.



S111H404

Refit

1. Clean the oil strainer and its mating surface.
2. Lubricate the new O-ring with the engine oil, and fit the oil strainer. Insert the oil strainer into a new oil pump in the opposite direction to that shown on the above figure.
3. Fit the mounting bolts of the oil pump and the mounting

bolts of the oil strainer, and tighten to **8–12Nm**.

4. Fit the oil baffle.
5. Fit the lower crankcase.

☞**Lower Crankcase Refit**

6. Fit the oil pump drive chain and drive sprocket.
7. Adjust the timing chain system.

☞**Timing Chain Refit**

8. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

9. Fit the camshaft cover.

☞**Camshaft Cover Refit**

10. Fit the accessory drive belt.

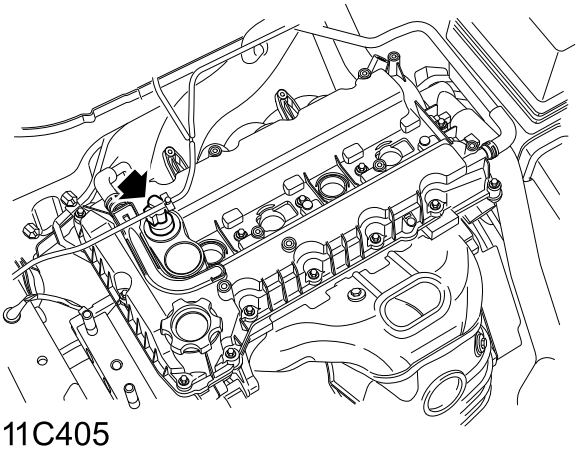
☞**Accessory Drive Belt Refit**

11. Connect battery earth lead.

Oil Control Value

Remove

1. Disconnect the battery ground terminal.
2. Disconnect the connection of the oil control valve connector.

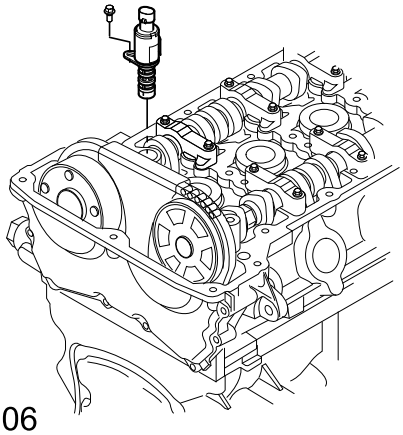


S111C405

3. Remove the camshaft cover.

☞**Camshaft Cover Remove**

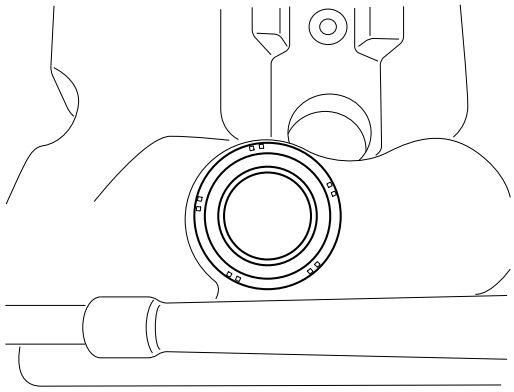
4. Loosen the bolts securing the oil control valve, remove the oil control valve.



S111C406

Refit

1. Fit the new oil control valve to the front bearing cap, and then secure it with bolts, and tighten the torque to **5–7Nm**.
2. Inspect the oil seal of the oil control valve. If there is oil leakage, or the appearances of aging or cracks, you need to replace a new oil seal of oil control valve. Assemble the oil seal of the oil control valve onto the camshaft cover.

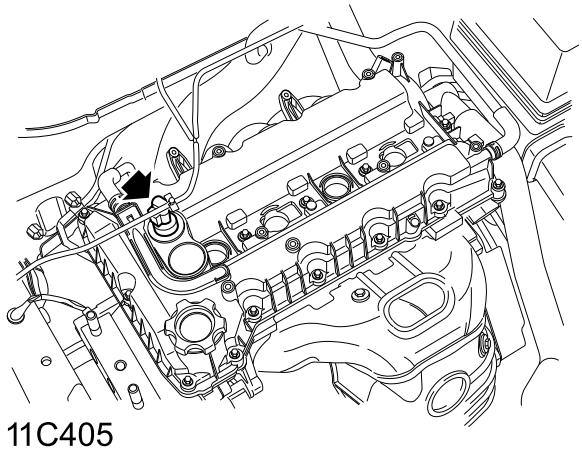


S111C407

3. Fit the camshaft cover.

☞ **Camshaft Cover Refit**

4. Connect the connector of the oil control valve.



S111C405

5. Connect the battery ground terminal.

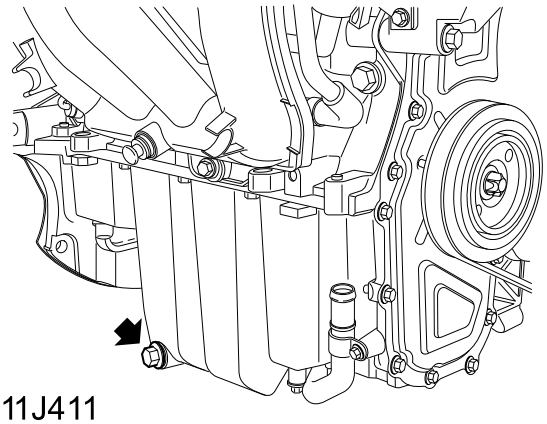
Engine Oil Filter

Remove

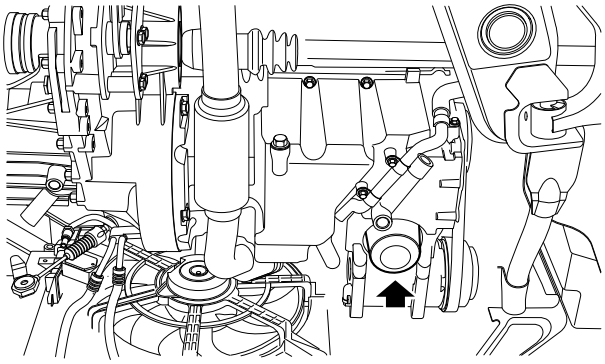
1. Lift the vehicle with a hoist.
2. Place a suitable container under the drain plug of the engine oil pan, remove the plug and dispose of the seal washer. Drain the oil.

Warning: Observe due care when draining engine oil as the oil can be very hot.

Warning: Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.



S111J411

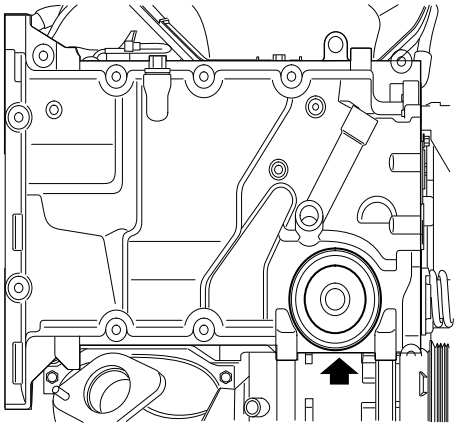


S111H405

3. Clean the area around the filter head, and place a suitable container under the filter to collect the oil that may possibly overflow.
4. Remove the filter counter-clockwise, and dispose of it.

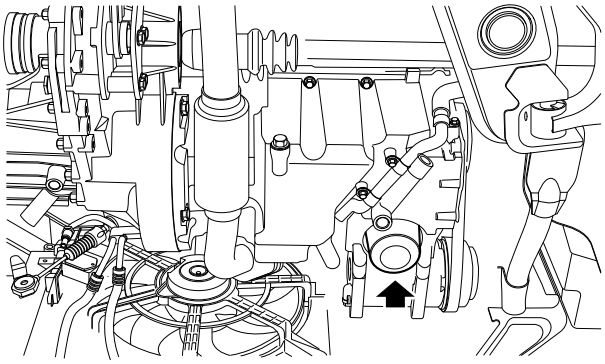
Refit

1. Clean the mating surface of the filter head.



S111H406

2. Lubricate the sealing ring of the filter with clean engine oil.
3. Fit and tighten the new filter to **16–18Nm**.



S111H405

4. Clean the drain plug and fit a new seal washer.
5. Fit the drain plug and tighten it to **35–40Nm**.
6. Remove the engine oil filler cap and add the oil into the engine up to the right level.

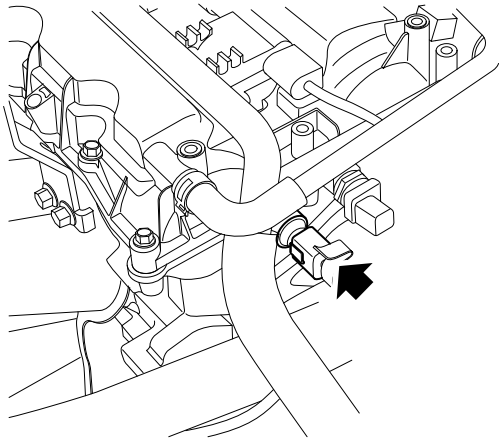
☞**Lubrication Fluid Refill**

7. Fit the oil filler cap.
8. Lower the vehicle.
9. Start and run the engine until the oil pressure warning light goes out.
10. Stop the engine, and then check the engine oil level.
11. Check if there are any signs of leakage.

Oil Pressure Inspection

Inspection

1. Disconnect battery earth lead.
2. Disconnect the oil pressure switch connector.
3. Remove the oil pressure switch.



4. Remove the seal from the oil pressure switch, and fit it on the oil pressure gauge fitting.
5. Fit the oil pressure gauge fitting to the original oil pressure switch and tighten it.
6. Connect the oil pressure gauge**T10001** and**T10002** and tighten the fitting.
7. Check the engine oil, and add if necessary.
8. Start and run the engine until it reaches normal operating temperature.
9. When the engine reached the operating condition of 3500 rev/min, please note the oil pressure gauge readings.

☞**Parameter**

10. Turn off the engine, remove the pressure gauge fitting and remove the gauge.
11. Remove the fitting.
12. Wipe the spilled oil.
13. Fit the oil pressure switch.
14. Connect the oil pressure switch connector.
15. Connect battery earth lead.

Intake Manifold Gasket

Remove

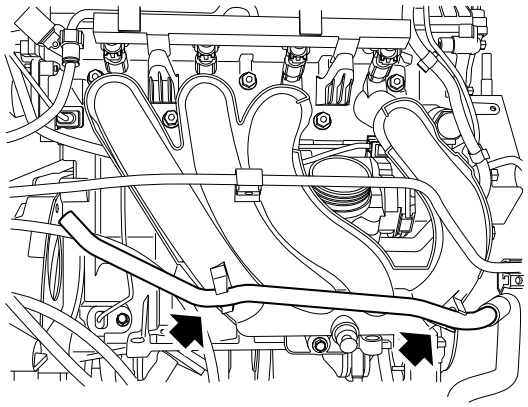
1. Disconnect battery earth lead.
2. Remove the fuel rail.

Fuel Rail Remove

3. Remove the intake pipe assembly.

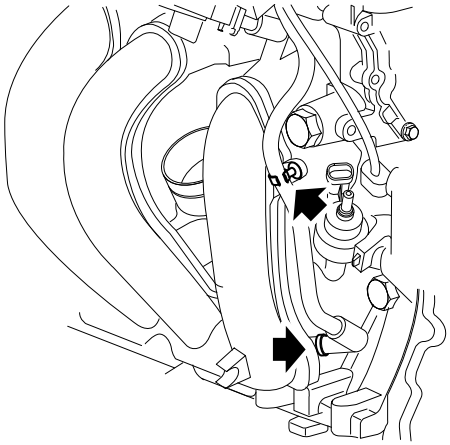
Intake Pipe Assembly Remove

4. Disconnect the heater return pipe from the intake manifold clip.

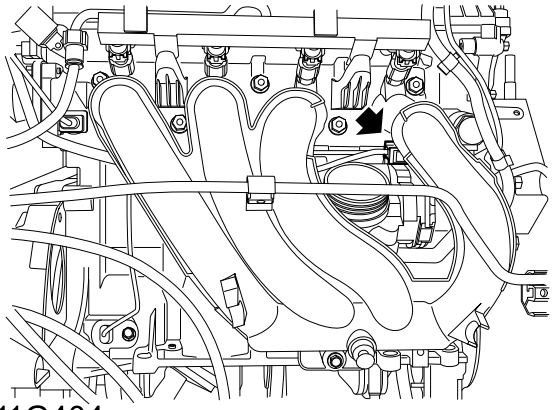


S111G401

5. Release the clamp to disconnect the carbon tank solenoid valve hose from the intake manifold.
6. Pull out the C-clip fit on the intake manifold, release the clamp to disconnect the partial load breather tube clip from the intake manifold.

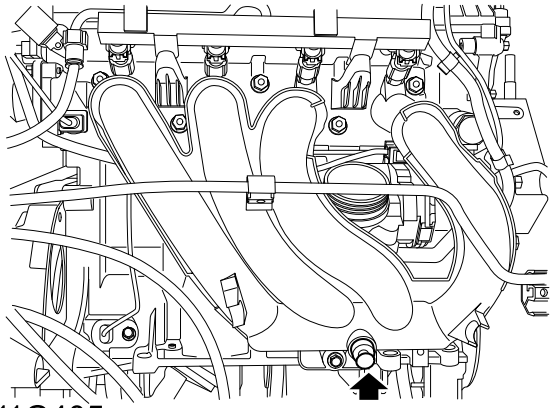


7. Disconnect the electronic throttle sensor connector.



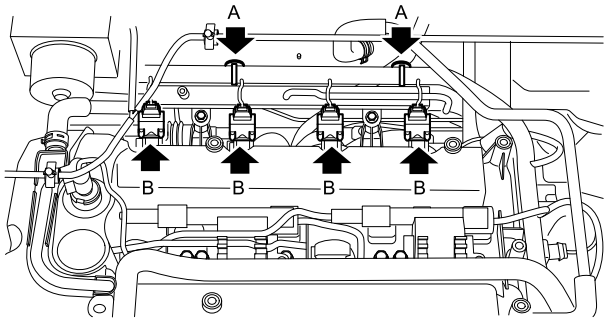
S111G404

8. Press the plastic ring, disconnect the brake booster tube from the intake manifold.



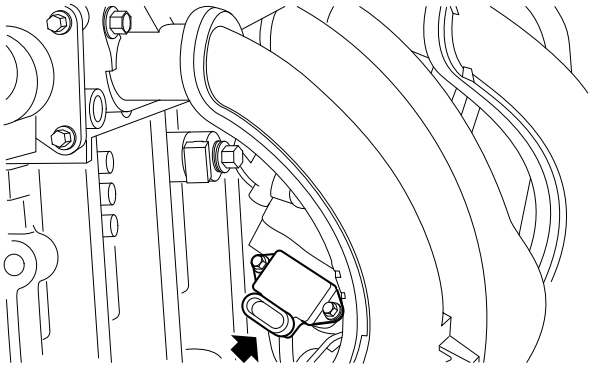
S111G405

9. Pull out wiring harness snap fit A from the fuel rail bracket, disconnect the fuel injector connector B and carbon tank solenoid valve connector.



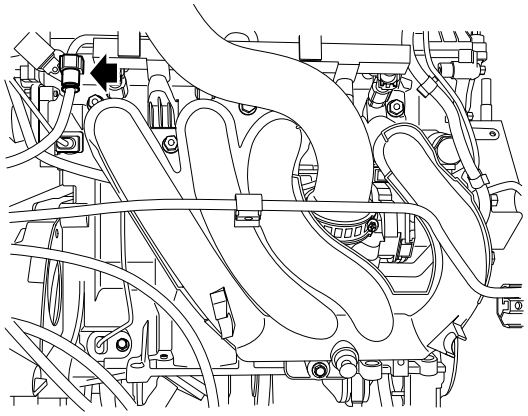
S111G406

10. Disconnect the intake manifold absolute pressure temperature sensors connector.



S111G408

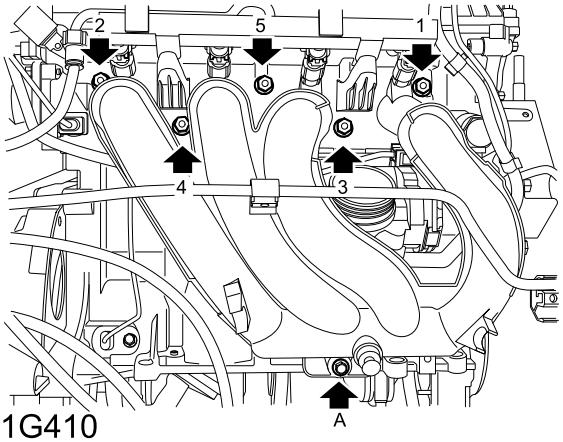
11. Fixed a strong absorbent cloth under the fuel rail.
12. Release the fuel inlet tube from the fuel rail.



S111G409

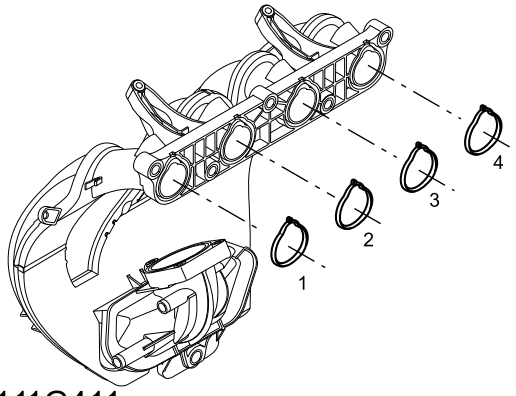
Caution: Always fit plugs to open connections to prevent contamination.

13. First remove bolt A connecting the intake manifold to the body, then remove the 5 nuts fixing the intake manifold to the cylinder head in the order as shown.



S111G410

14. Remove the intake manifold, remove and dispose of 4 seal washers.



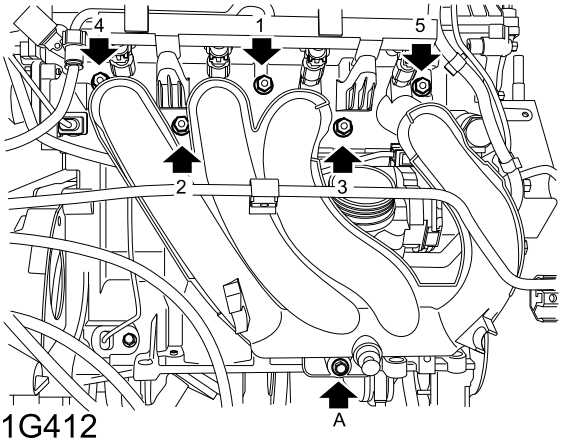
S111G411

Refit

1. Ensure that the mating surface is clean, and the metal inserts have also been fitted to the intake manifold bolts and bolt hole.
2. Fit the new washer onto the intake manifold.

Tip: Be careful of the error proofing design on the washer.

3. Tighten 5 nuts in the order as shown, and then fix mounting bolt A between the body and the intake manifold.



S111G412

4. Remove the plug from the fuel hose and fuel rail.
5. Fix the fuel inlet tube to the fuel rail.
6. Connect**TMAP** the sensor connector.
7. Connect the fuel injector connector, fit the wiring harness snap fit to the fuel rail bracket hole, and connect the carbon tank solenoid valve connector.
8. Insert the brake booster pipe into the intake manifold quick coupler.
9. Connect the electronic throttle sensor connector.
10. Connect the partial load breather tube to the intake manifold, tighten it with a clamp, and insert the C-clip into the intake manifold mounting hole.
11. Connect the carbon tank solenoid valve hose to the intake manifold, tighten it with a clamp.
12. Fix the heater return pipe to the clamp of the intake

manifold.

13. Fit the intake pipe assembly.

☞**Intake Pipe Assembly Refit**

14. Fit the fuel rail.

☞**Fuel Rail Refit**

15. Connect battery earth lead.

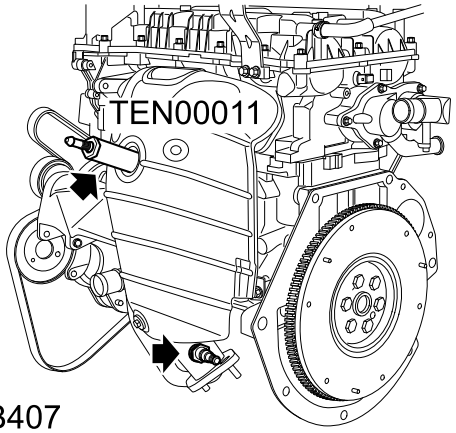
Exhaust manifold Gasket

Remove

1. Disconnect battery earth lead.
2. Remove the generator.

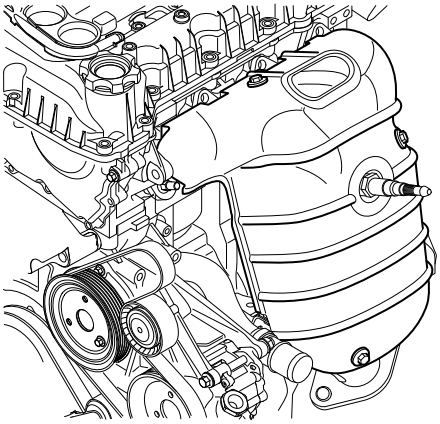
☞**Generator Remove**

3. Remove connection bolts between the exhaust manifold and exhaust front pipe assembly.
4. Disconnect the oxygen sensor connector.

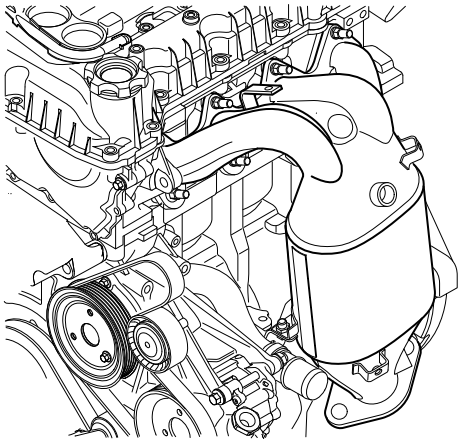


S113B407

5. Remove the exhaust manifold housing.



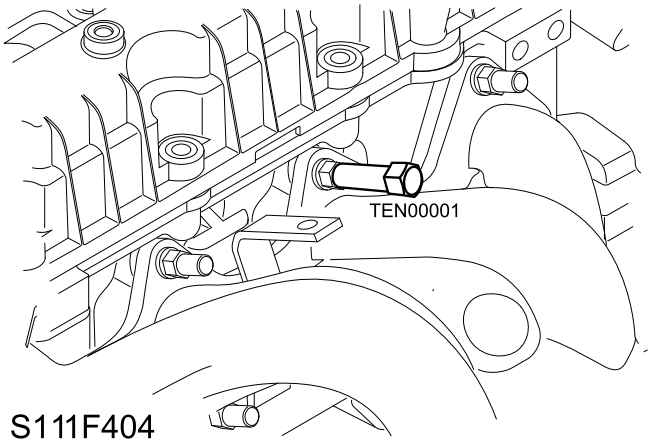
6. Remove the exhaust manifold.



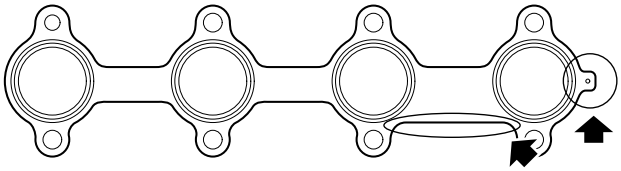
7. Remove the exhaust manifold shim from the mating face between the cylinder head and the exhaust manifold, and discard it.

Refit

1. Clean the mating face between the cylinder head and the exhaust manifold to make sure it is free from foreign objects.
2. Use the stud bolt remove special tool**TEN00001** to fit the bolt.

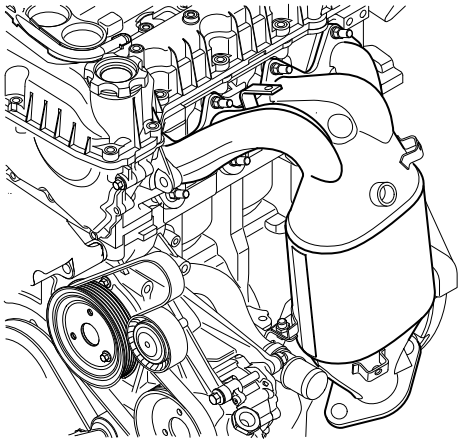


S111F404

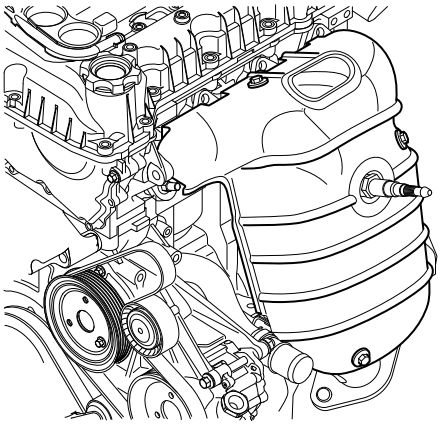


S111F403

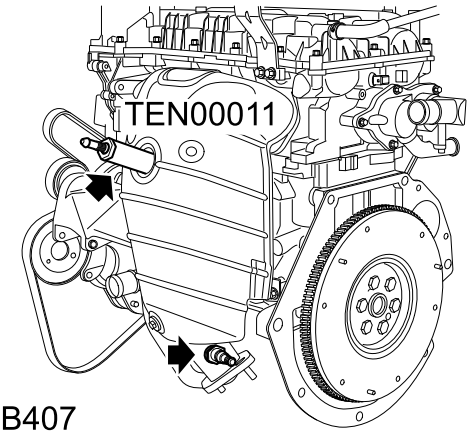
3. Properly fit the exhaust manifold shims to the cylinder head stub bolt in the direction defined by the error proofing design of it.
4. Fit the exhaust manifold.



5. Fit the exhaust manifold housing.

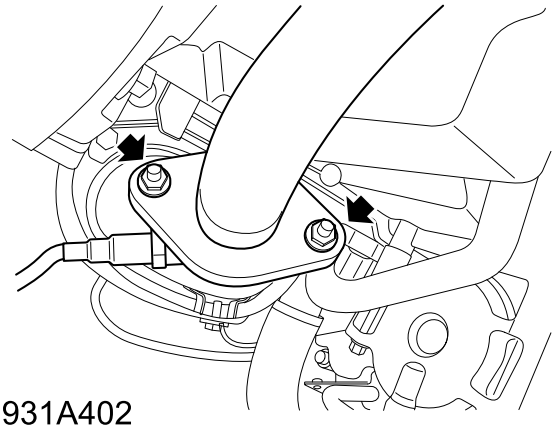


6. Connect the oxygen sensor connector.



S113B407

7. Fit connection bolts between the exhaust manifold and exhaust front pipe assembly.



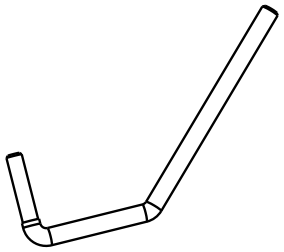
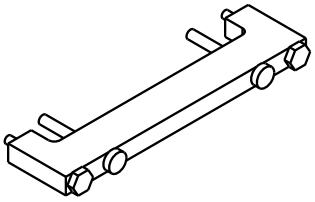
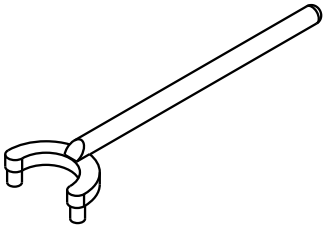
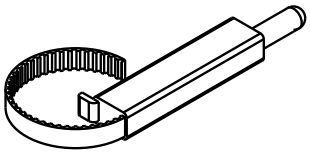
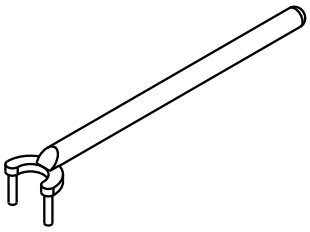
S931A402

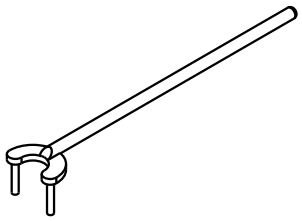
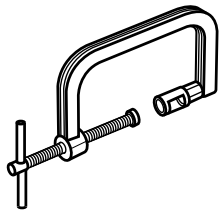
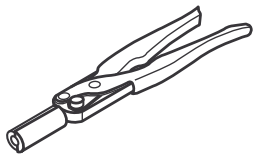
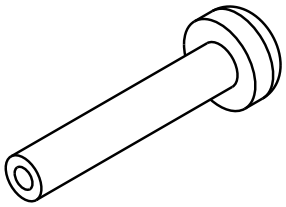
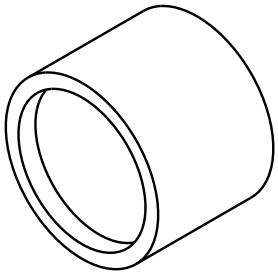
8. Fit the generator.

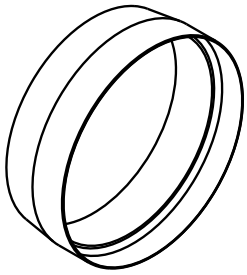
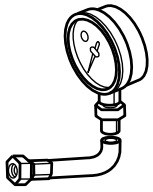
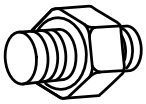
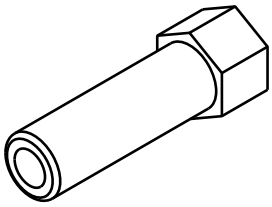
☞**Generator Refit**

9. Connect battery earth lead.

Special Tools

Tool Number	Description	Picture
TEN00002	Holding Pin Flywheel timing	 TEN00002
TEN00004	Camshaft timing locking	 TEN00004
TEN00008	Retainer crankshaft belt wheel	 TEN00008
TEN00009	Retainer belt wheel	 TEN00009
TEN00006	Retainer oil pump gear	 TEN00006

Tool Number	Description	Picture
TEN00005	Retainer camshaft timing gear	 TEN00005
T10005	Valve spring compressor	 T10005
T10006	Remover valve stem seal	 T10006
TEN00014	Replacer valve stem seal	 TEN00014
TEN00003	Piston ring guider	 TEN00003

Tool Number	Description	Picture
TEN00013	Protector Sleeve Crankshaft Rear oil seal	 TEN00013
T10001	Engine oil pressure test equipment	 T10001
T10002	Adaptor Engine Oil Pressure Test	 T10002
TEN00001	Remover and replacer M8 stud	 TEN00001

Engine Mechanical-1.3 BASE

Specifications

Torque

Description	Value
Bolt - transmission mounting to body	55–65Nm
Nut - transmission bracket to transmission mounting	90–110Nm
Bolt - engine mounting to engine	40–50Nm
Bolt - tie bar lower to transmission	55–65Nm
Bolt - slave cylinder bracket to rear housing	40–50Nm
Nut - exhaust manifold to exhaust front pipe	45–55Nm
Bolt - engine mounting to engine mounting bracket	90–110Nm
Bolt - flywheel to crankshaft	(32–38)Nm+60°±2°
Bolt - torsion vibration damper to crankshaft	(60±2)Nm+120°±2°
Bolt - cover upper front to cylinder head	8–12Nm
Bolt - cover lower front to cylinder block and crankcase lower	8–12Nm
Bolt - chain guide rail and chain tensioner rail	22–28Nm
Bolt - chain guide rail upper to cylinder head front cam bearing	8–12Nm
Bolt - timing chain tensioner to cyclinder head	77-83Nm
Bolt - camshaft sprocket to camshaft	(25±3)Nm+45°±2°
Bolt - oil pump procket to oil pump	22–28Nm
Bolt - cam bearing cap to cylinder head	8–12Nm
Bolt - ignition coil	8–12Nm
Bolt - cylinder head to cylinder block	(30±2)Nm+90°+(90°+45°)±2°
Bolt - patch cylinder head to cylinder block	10–12Nm
Bolt - thermostat to cylinder head	8–12Nm
Bolt - alternator to cylinder head	40–50Nm
Spark plugs	20–30Nm
Bolt - cam bearing to cylinder head	8–12Nm
Bolt - cover upper front to cylinder head	8–12Nm
Bolt - crankcase lower to cylinder block	22–30Nm
Bolt - bearing cap to cylinder block	(20±2)Nm+ 90°+45° ±2°
Bolt - connecting rod	(18±2)Nm+90°±2°
Bolt - bearing cap to cylinder block	8–12Nm
Bolt - oil pump to crankcase lower	8–12Nm
Bolt - windage tray to crankcase lower	8–12Nm
Oil filter	16–18Nm
Plug - crankcase lower	35–40Nm

Parameter

1.3 BASE - Overview

Model	1.3L Gasoline Engine, 16V, DOHC
Cylinder Layout	4 Cylinders, In-line, Transversally Mounted, the first cylinder is in the front of the engine
Cylinder Diameter	75 mm
Stroke	76 mm
Displacement	1343 cm3
Ignition Order	1-3-4-2
Compression Ratio	10.5:1
Direction of Rotation	Clockwise, seen from the front end of the engine
Rated Power	68kW@6000 rev/min
Maximum Torque	118Nm@5000 rev/min
Idle Speed	750±50 rev/min
Maximum Engine Speed	7000 rev/min
Weight (excluding oil, PAS, A/C and clutch assembly)	115 kg

1.3 BASE - Crankshaft

Crankshaft	
Crankshaft Axial Clearance	0.205±0.1 mm
Service Limited Value	0.34 mm
Main Bearing Hole Diameter:	
Class A	53.690-53.700 mm
Class B	53.680-53.690 mm
Main Bearing Journal Tolerance:	
Class 0	49.993-50.000 mm
Class 1	49.992-49.984 mm
Crankshaft Connecting Rod Journal Diameter	48.000-47.984 mm
Maximum Out-of-roundness	0.008 mm
Main Bearing:	
Quantity	Five pieces each for lower and upper side
Model	Steel Backing, Alloyed Steel, the oil passage is on the upper half of bearing.
Thrust Washer	Half-flake washers are on the left and right sides of the third main bearing, fitting the thrust surface.
Thrust Washer Thickness	2.810-2.855 mm
Bearing Clearance	0.020-0.054 mm

1.3 BASE - Cylinder Block and Piston

Cylinder Block:			
Material		Cast Iron, HT250	
Cylinder Sleeve Type		Reticulate honing cylinder sleeve from the processing platform	
Cylinder Sleeve Diameter		74.985-75.000 mm	
Cylinder Block Trimmed Size:			
	Cylinder Diameter	Maximum Piston Skirt Diameter	Auxiliary Cylinder Clearance
Normal Size	74.985-75.000	74.941-74.959	0.026-0.059
A(+0.5)	75.485-75.500	75.441-75.459	0.026-0.059
B(+1.0)	75.985-76.000	75.941-75.959	0.026-0.059
C(+1.5)	76.485-76.500	76.441-76.459	0.026-0.059
Connecting Rod:			
Model		Fractured Connecting Rods, material C70S6BY	
Distance between centers		143.7±0.05 mm	
Piston Pin Type		Semi-floating	
Install the connecting rod		Interference	
Length		51.7-52.0 mm	
Connecting Rod Bearing:			
Clearance		0.020-0.071 mm	
Axial Pulsation		0.100-0.246 mm	
Piston:			
Model		Aluminium alloy, surface processed by graphite, offset towards pistion pin in thermal expansion	
Piston Diameter:		74.941-74.959 mm	
Tolerance at the pistion pin opening		0.009-0.020 mm	
Maximum Ovality		0.002 mm	
Piston Ring:			
Model:		two compression rings, one oil ring	
Top Compression Ring		The excircle is symmetrical barrel surface, nitriding treated	
Second Compressin Ring		Nasal shape, surface is phosphate treated	
Oil Ring		The spring is nitriding, and the blade is nitriding and then phosphate treated.	
Tolerance from the piston ring to ring slot:			
Top Compression Ring		0.040-0.080 mm	
Second Compressin Ring		0.030-0.062 mm	
Oil Ring		0.015-0.045 mm	

Piston ring assembling incision clearance (measured at a place that is 20mm away from the cylinder sleeve opening): Top Compression Ring Second Compressin Ring Oil Ring	 0.25-0.40 mm 0.37-0.57 mm 0.15-0.45 mm
Piston Ring Width Top Compression Ring Second Compressin Ring Oil Ring	 0.970-0.990 mm 1.170-1.190 mm 1.880-1.980 mm

1.3 BASE Cylinder Head and Valve

Cylinder Head:	
Material	Aluminium Alloy
Maximum Cylinder Head Bending	0.05 mm
Cylinder Head Height: New mirror side limit	 118.95-119.05 mm 0.20 mm
Camshaft:	
Model	double overhead camshaft directly applied on mechanical tappet
Bearing	five bearings for each camshaft, straight-line arranged
Drive	chain drive at the crankshaft gear
Camshaft Axial Clearance Service Limited Value	0.06-0.19 mm 0.30 mm
Bearing Clearance: Service Limited Value	front end 0.025-0.066 mm, rear end 0.024-0.066 mm 0.15 mm
Mechanical Tappet:	
Model	Mechanical Tappet, driven directly by camshaft
Outer diameter of the mechanical tappet	f 29.964 mm-f 29.980 mm
Valve Timing:	
Intake Valve: open close maximum lift	 3°BTDC 43°ATDC 7.7 mm
Exhaust Valve: open close maximum lift	 38°BBDC 2°ATDC 7.3 mm
Valve: Valve Stem Diameter: Intake Valve Exhaust Valve	 f 5.952-f 5.967 mm f 5.947-f 5.962 mm
the clearance from valve stem to valve guide: Intake Valve Exhaust Valve	 0.033-0.073 mm 0.038-0.078 mm

Valve Stem Mating Height: New Intake Valve New Exhaust Valve Service Limited Value	 50.021-50.881 49.925-50.785 0.26 mm
Valve Head Diameter: Intake Valve Exhaust Valve	 f 29.2-f 29.4 mm f 24.0-f 24.2 mm
Valve Seat Width Intake Valve Exhaust Valve surface angle of the valve seat - intake valve and exhaust valve	 1.0 mm-1.4 mm 1.4 mm-1.8 mm intake 150°, 90°, 60° exhaust 150°, 90°, 60°
valve surface angle - intake valve and exhaust valve	45°
Valve Clearance	Intake Valve: 0.11-0.19 mm
	Exhaust Valve: 0.20-0.28 mm
Valve Spring: Free Length Installating Length Assembling Load Intake Valve Opening Load	 50.0 mm 37.0 mm 250±12.5 Nm 442±18 Nm
Exhaust Valve Opening Load	464±18 Nm

Lubrication

Lubrication: Model	 Cast Aluminium Lower Crankcase
Oil Pump Model: Internal and External Rotors Meshing Clearance End Surface Clearance of Rotor and Pump Cover	Chain Drive Rotor Pump 0.05-0.18 mm 0.035-0.007 mm
Free Length of Limited Valve Spring	54±1 mm
Oil Filter	Rotary Full Flow Oil Filter
3500 rev/min Limited Valve Shutoff Pressure	0.54-0.658 MPa

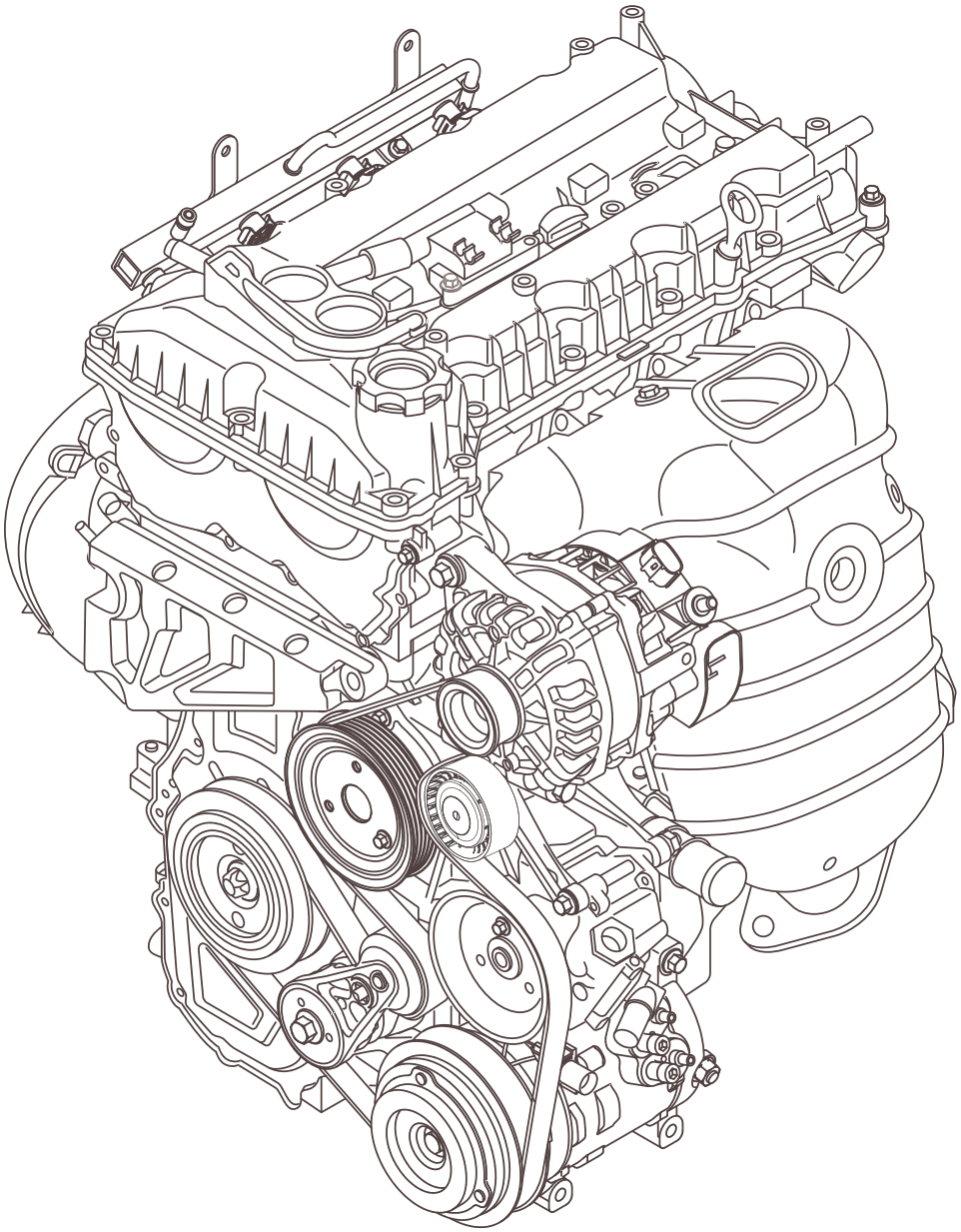
Bolt Usage Frequency

Part Number	Name	Usage Frequency
BLT200010	Bolt - Main Bearing Cap	Once
90004180	Screw - Crankshaft Sensor Signal Plate	Once
BLT200011	Bolt - Connecting Rod	Once
90003592	Bolt - Oil Pump to Oil Pan	Once
90003620	Stud Bolt - Intake Manifold to Cylinder Head	Once
BLT200019	Cylinder Head Bolt	Once
99000007	Bolt - Cylinder Head to Engine Block	Once
BLT200025	Bolt - Camshaft Sprocket	Once
BLT200012	Bolt - Crankshaft Damper	Once
90004291	Bolt - Front Cover to Cylinder Head	Once
90000433	Bolt - Lower Front Cover to Engine Block	Once
BLT200013	Bolt - Auto Transmission Flywheel to Crankshaft	Once
BLT200013	Bolt - Flywheel	Once
BLT200015	Bolt - Tensioner	Once
90000829	Hexagon Flange Bolt - Exhaust Manifold	Once

Description and Operation

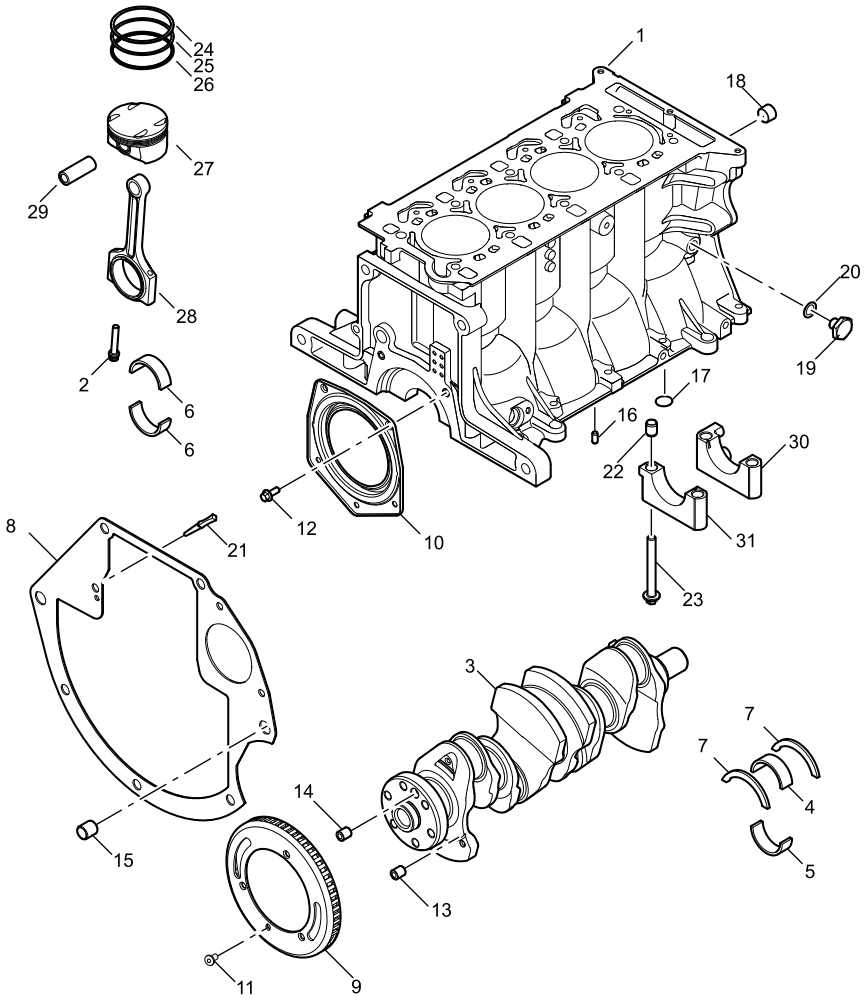
System Component Layout

NSE Engine Component Layout



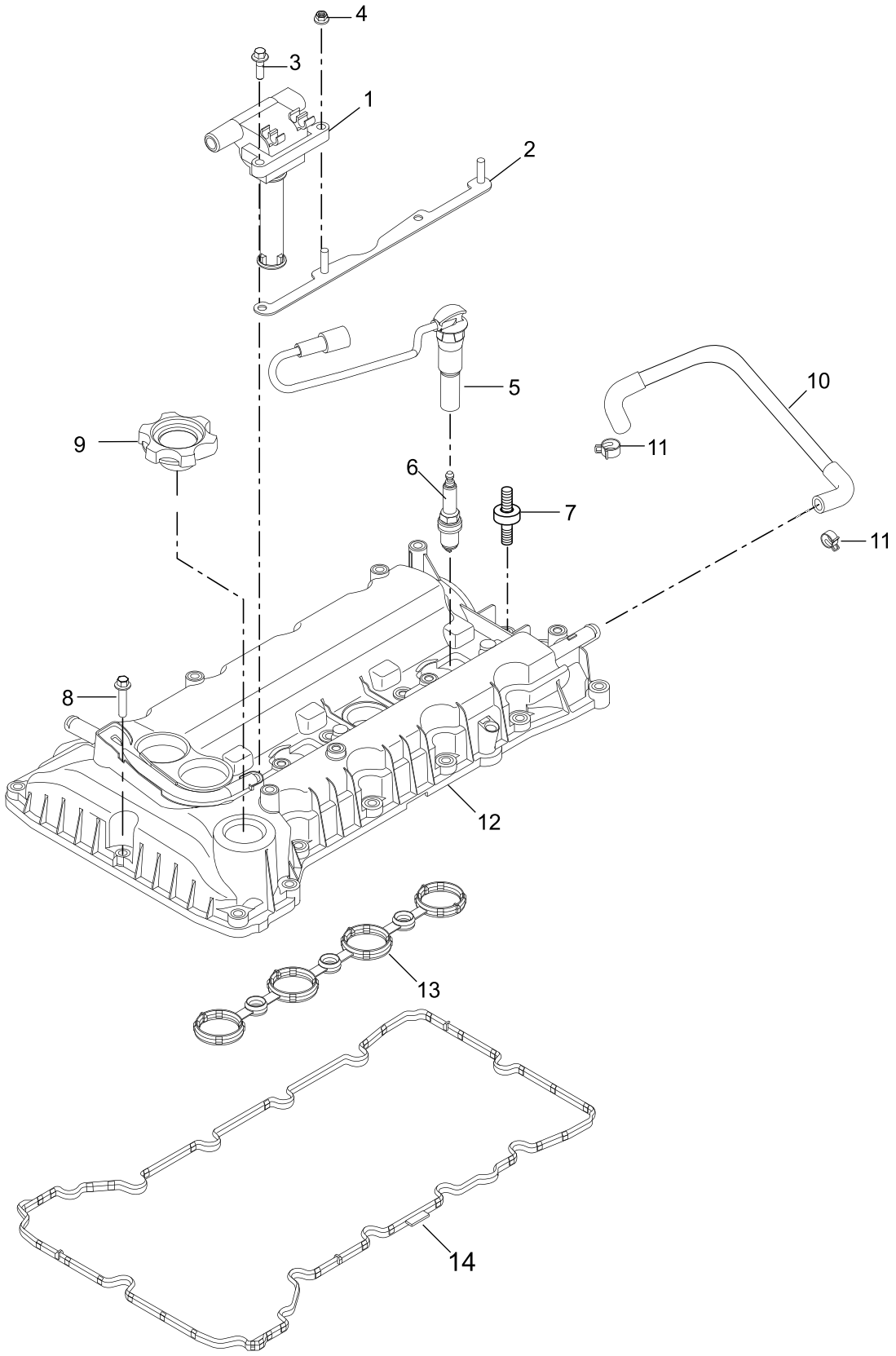
1. 1.3 BASE Engine

Cylinder Block Exploded View



1. Cylinder Block
2. Bolt - Link
3. Crankshaft Assembly
4. Main Bearing (Top)
5. Main Bearing (Bottom)
6. Large Link End Rod Bearing
7. Main Bearing Thrust Plate
8. Block Rear Cover Panel
9. Crankshaft Sensor Encoder Wheel
10. Crankshaft Rear Oil Seal
11. Screw - Crankshaft Sensor Encoder Wheel
12. Bolt - Crankshaft Rear Oil Seal
13. Positioning Pin - Crankshaft Sensor Encoder Wheel
14. Positioning Pin - Between Crankshaft and Flywheel
15. Positioning Pin - Body to Transmission
16. Positioning Pin - Block to Oil Pan
17. O Ring - Lower Crankcase to Block (Fluid Passages)
18. Blockage - Fluid Passages
19. Plug - Oil Pressure Switch
20. Shim - Block Fluid Passage Blockage
21. Blockage - Timing Hole
22. Positioning Pin - Main Bearing Cap
23. Bolt - Main Bearing Cap
24. The First Ring
25. The Second Ring
26. The Third Ring
27. Piston
28. Link
29. Piston Pin
30. Main Bearing Cap
31. Main Bearing Cap

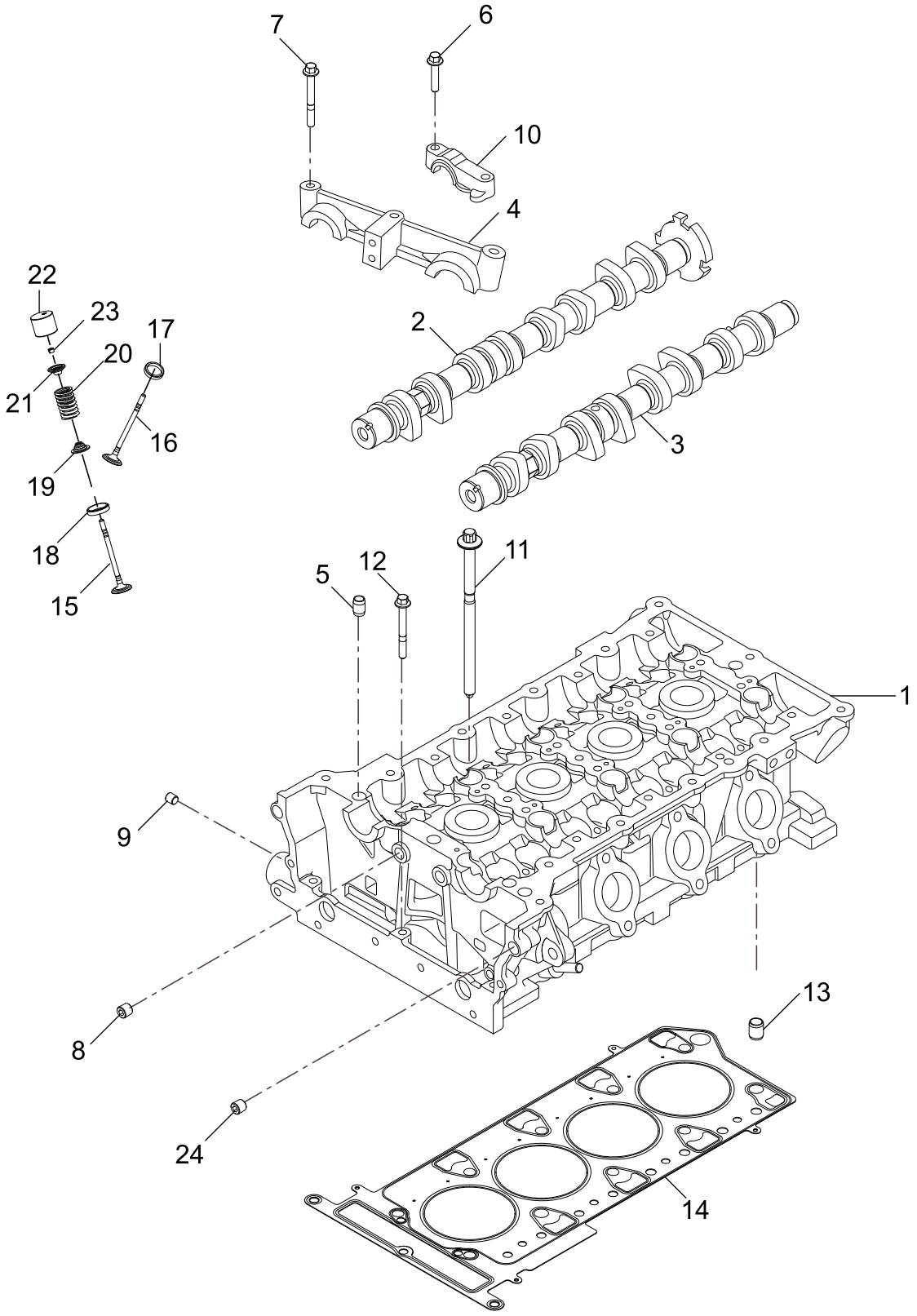
Camshaft Cover Exploded View



1. Ignition Coil
2. Ignition Coil Bracket
3. Bolt - High Pressure Coil
4. Nut - Ignition Coil
5. High Pressure Coil
6. Spark Plug

7. Stud Bolt - Camshaft Cover
8. Bolt - Camshaft Cover
9. Fuel Filler Cap
10. Full Load Breather Tube Assembly
11. Clamp
12. Camshaft Cover
13. Sealing Ring - Camshaft Cover (inner)
14. Sealing Ring - Camshaft Cover (outer)

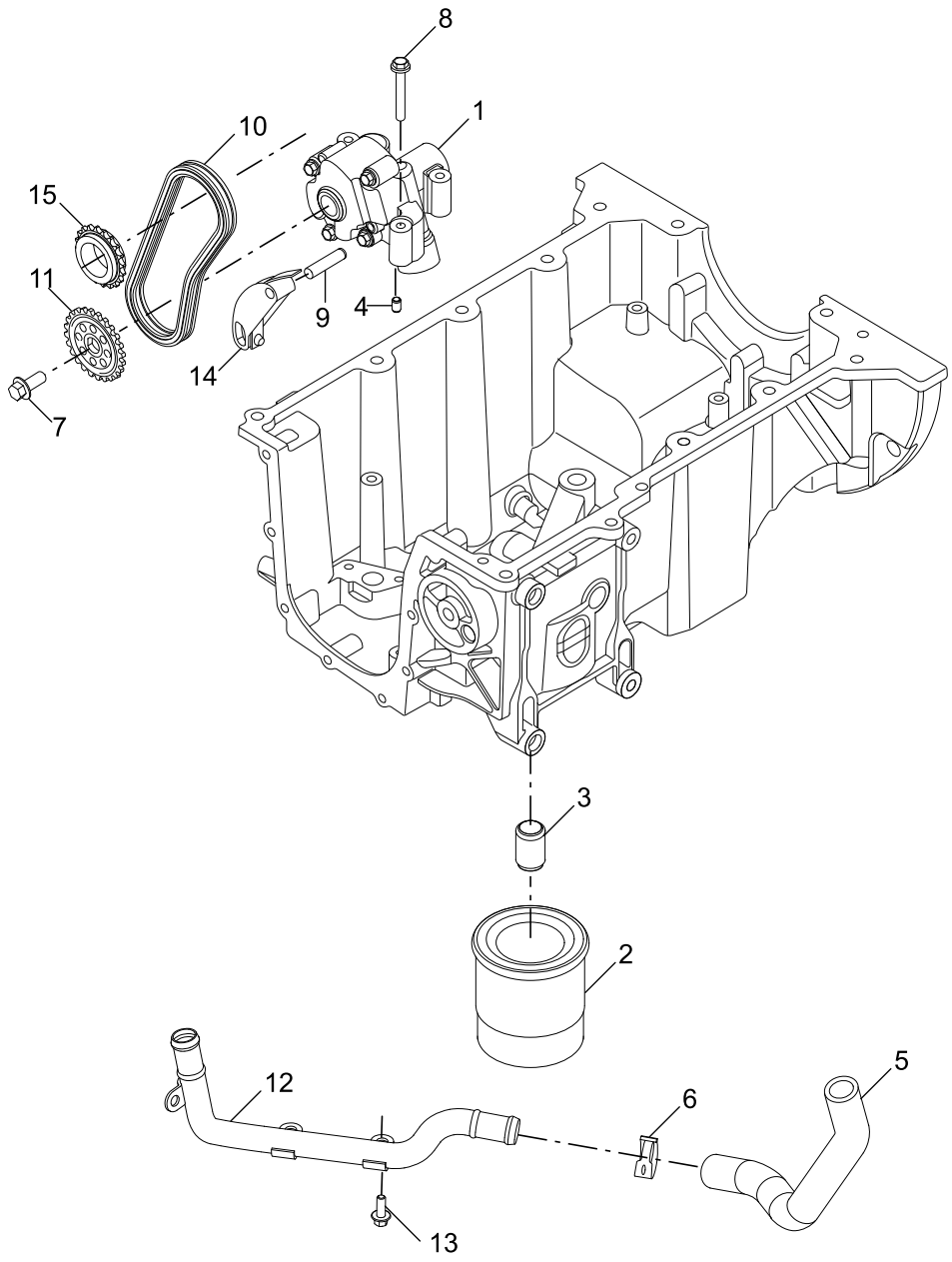
Cylinder Head Exploded View



1. Cylinder Head
2. Intake Camshaft
3. Exhaust Camshaft
4. Camshaft Front Bearing Cap Assembly
5. Locating Pin - Camshaft Front Bearing Cap to Cylinder Head

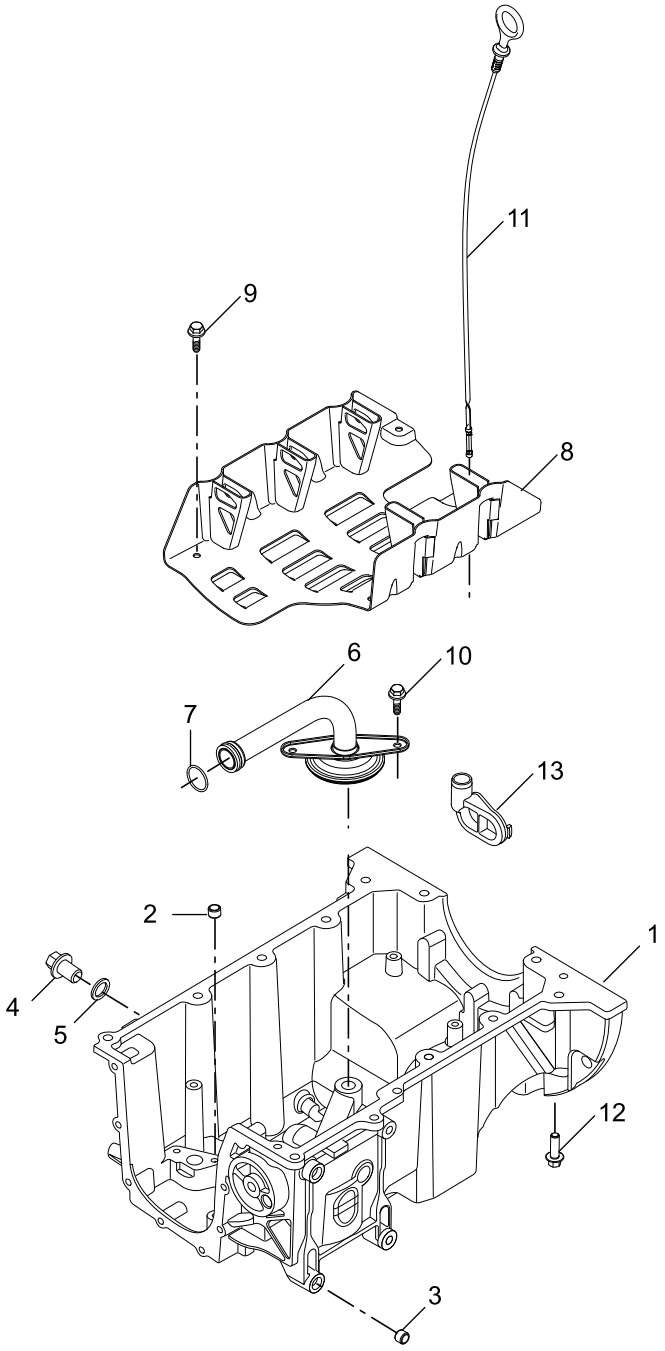
6. Bolt - Camshaft Bearing Cap to Cylinder Head
7. Bolt - Front Camshaft Bearing Cap
8. Oil Passage Plug
9. Oil Passage Plug
10. Camshaft Rear Bearing Cap
11. Cylinder Head Bolt
12. Bolt - Cylinder Head to Engine Block
13. Locating Pin - Cylinder Head to Engine Block
14. Cylinder Head Shim
15. Intake Valve
16. Exhaust Valve
17. Exhaust Valve Seat
18. Intake Valve Seat
19. Valve Stem Seal
20. Valve Spring
21. Valve Spring Seat
22. Tappet
23. Valve Lock Clip
24. Locating Pin - Upper Front Cover to Cylinder Head

Oil Pump and Filter Exploded View



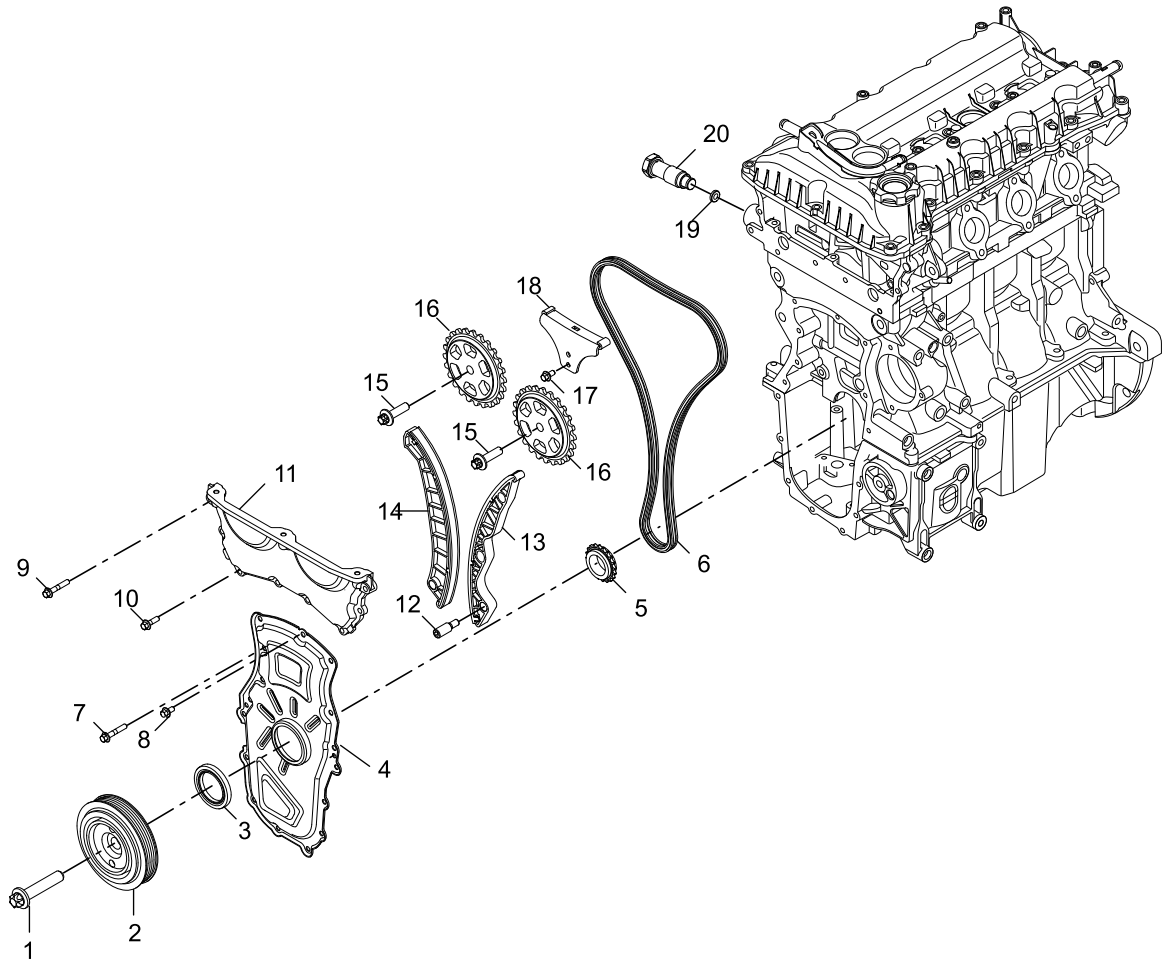
1. Oil Pump
2. Oil Filter
3. Oil Filter Mounting Stud
4. Location Pin - Oil Pump to Lower Crank Case
5. Oil Cooler Hose
6. Clamp - Oil Cooler Hose
7. Bolt - Oil Pump Sprocket
8. Bolt - Oil Pump to Lower Crank Case
9. Pin - Oil Pump Chain Tensioner
10. Oil Pump Chain
11. Oil Pump Sprocket
12. Heater Return Pipe Assembly
13. Bolt - Heater Return Pipe to Lower Crank Case
14. Oil Pump Chain Tensioner
15. Crankshaft Sprocket - Oil Pump Drive

Lower Crankcase Exploded View



1. Lower Crank Case
2. Location Pin - Lower Crank Case
3. Pin Bush - A/C Compressor to Lower Crank Case
4. Drain Plug
5. Washer - Drain Plug
6. Suction Tube Assembly
7. O-ring - Suction Tube to Oil Pump
8. Oil Baffle
9. Bolt - Oil Baffle
10. Bolt - Suction Tube to Lower Crank Case Assembly
11. Oil Dipstick
12. Bolt - Lower Crank Case to Cylinder Block
13. Plug

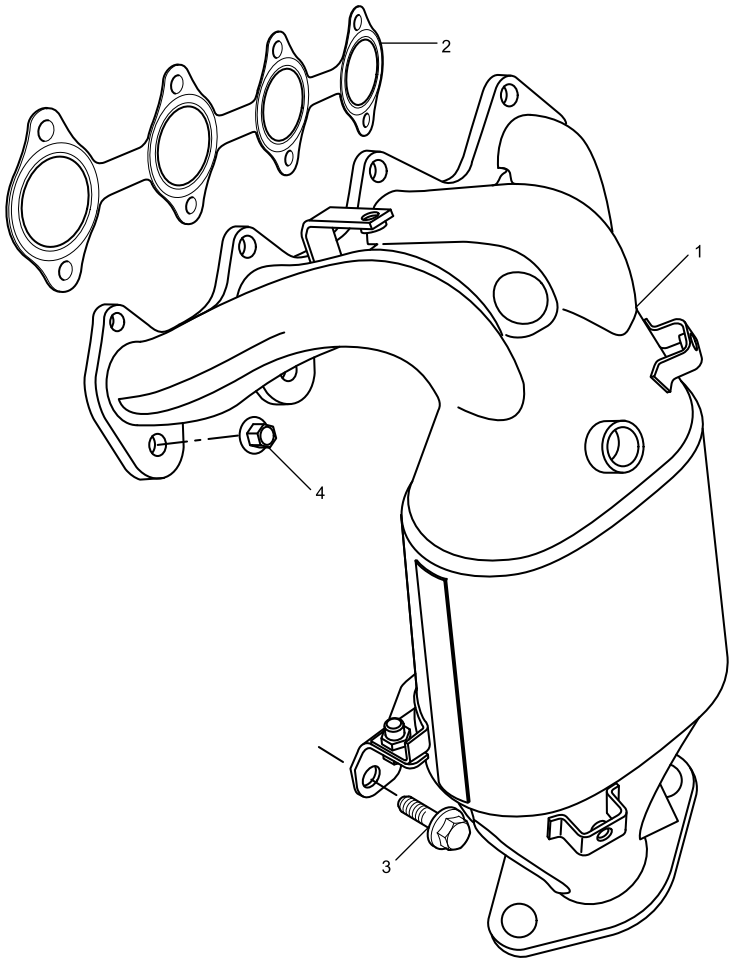
Timing Chain System Exploded View



1. Bolt - Crankshaft Damper
2. Crankshaft Damper
3. Crankshaft Front Oil Seal
4. Lower Front Cover
5. Crankshaft Sprocket - Timing Drive
6. Timing Chain

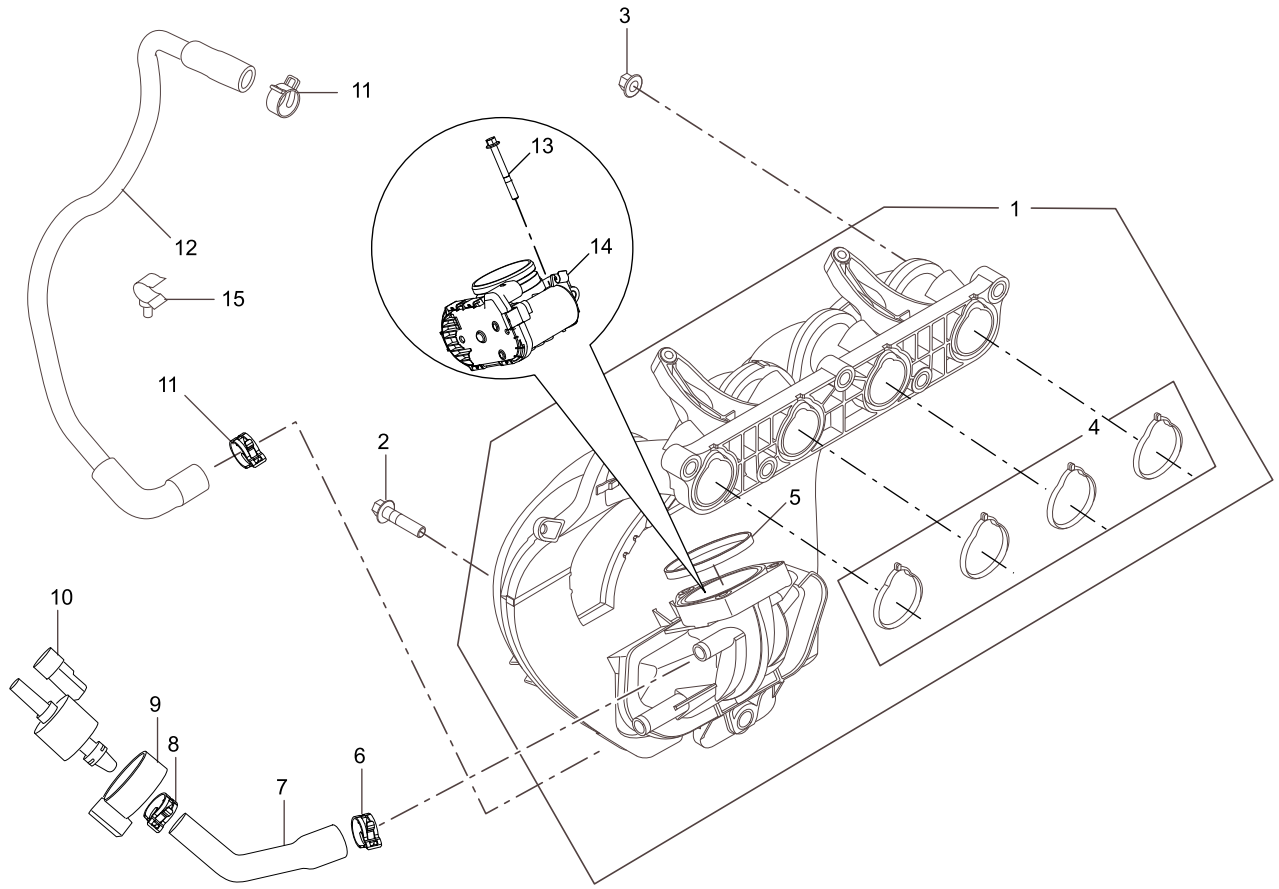
7. Bolt - Lower Front Cover to Engine Block
8. Bolt - Lower Front Cover to Engine Block
9. Bolt - Upper Front Cover to Cylinder Head
10. Bolt - Upper Front Cover to Cylinder Head
11. Upper Front Cover
12. Bolt - Chain Guide Rail to Engine Block
13. Chain Guide Rail
14. Tensioner Rail
15. Bolt - Camshaft Sprocket
16. Camshaft Sprocket
17. Bolt - Sprocket Upper Guide Rail to Cylinder Head Front Bearing Cap
18. Upper Guide Rail
19. Shim - Hydraulic Tensioner
20. Timing Hydraulic Tensioner

Exhaust Manifold Exploded View



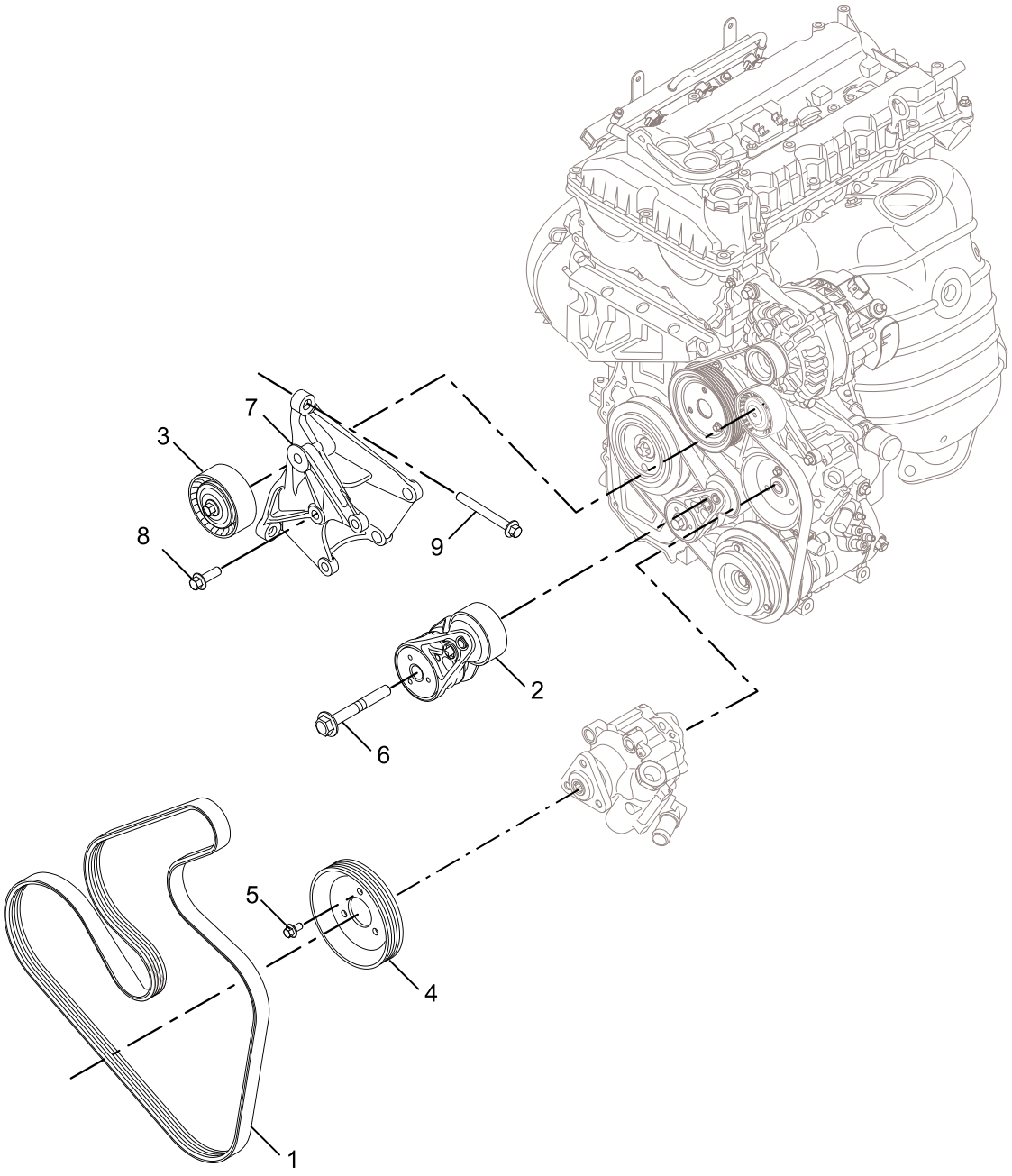
1. Exhaust Manifold
2. Exhaust Manifold Shim
3. Bolt
4. Nut

Intake Manifold Exploded View



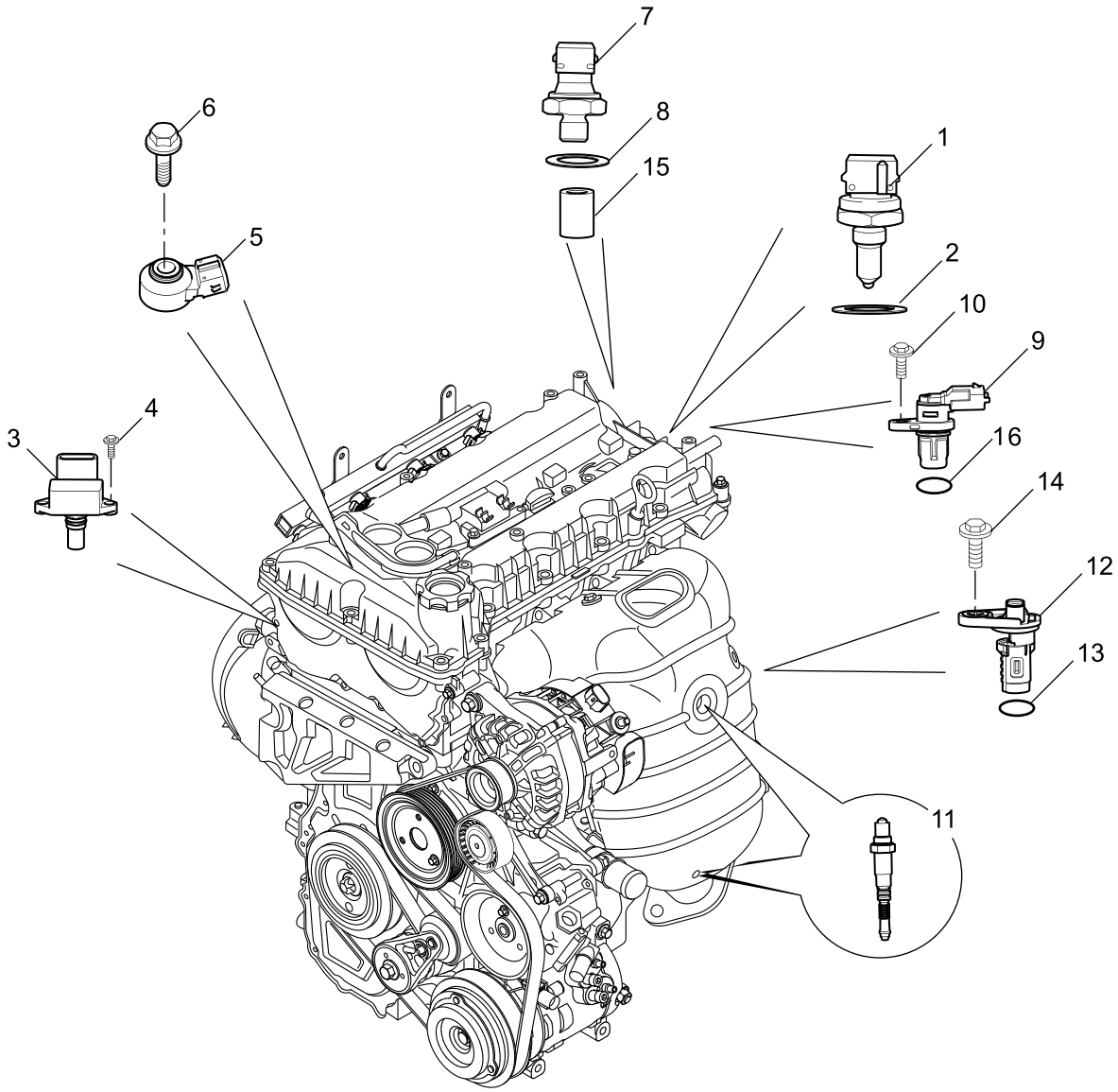
1. Intake Manifold
2. Bolt
3. Nut
4. Intake Manifold Shim - Cylinder Head Side
5. Intake Manifold Shim - Throttle Side
6. Pipe Clip - Canister Solenoid Valve Connecting Pipe
7. Connecting Pipe - Canister Solenoid Valve to Intake Manifold
8. Pipe Clip - Canister Solenoid Valve Connecting Pipe
9. Canister Solenoid Valve Rubber Sleeve
10. Canister Solenoid Valve
11. Clamp
12. Partial Load Breather Tube Assembly
13. Bolt - Throttle Body
14. Throttle Body
15. C-Pipe Clip

Accessory Belt System



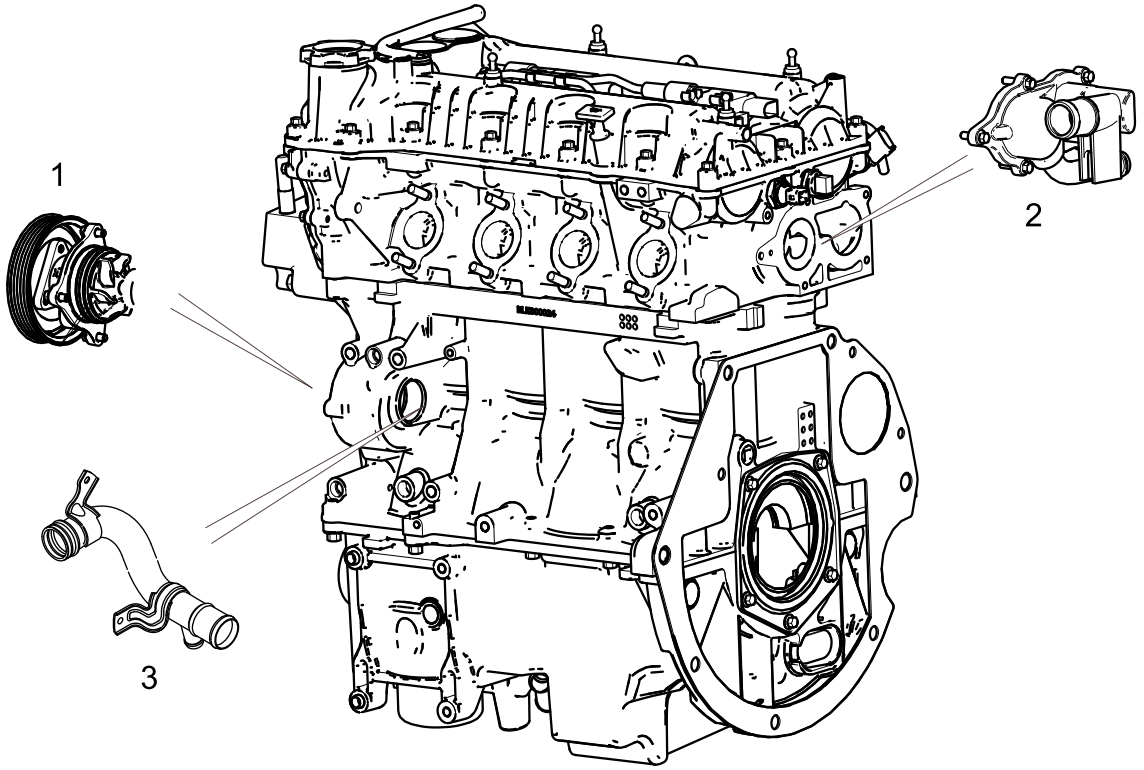
1. Accessory Belt
2. Accessory Belt Tensioner
3. PAS Pump Idler Pulley
4. Pulley - PAS Pump
5. Bolt - PAS Pump Pulley
6. Bolt - Tensioner
7. Support Assembly - PAS Pump
8. Bolt - PAS Pump to Support Plate
9. Bolt - PAS Pump Support to Engine Block

Engine Sensor



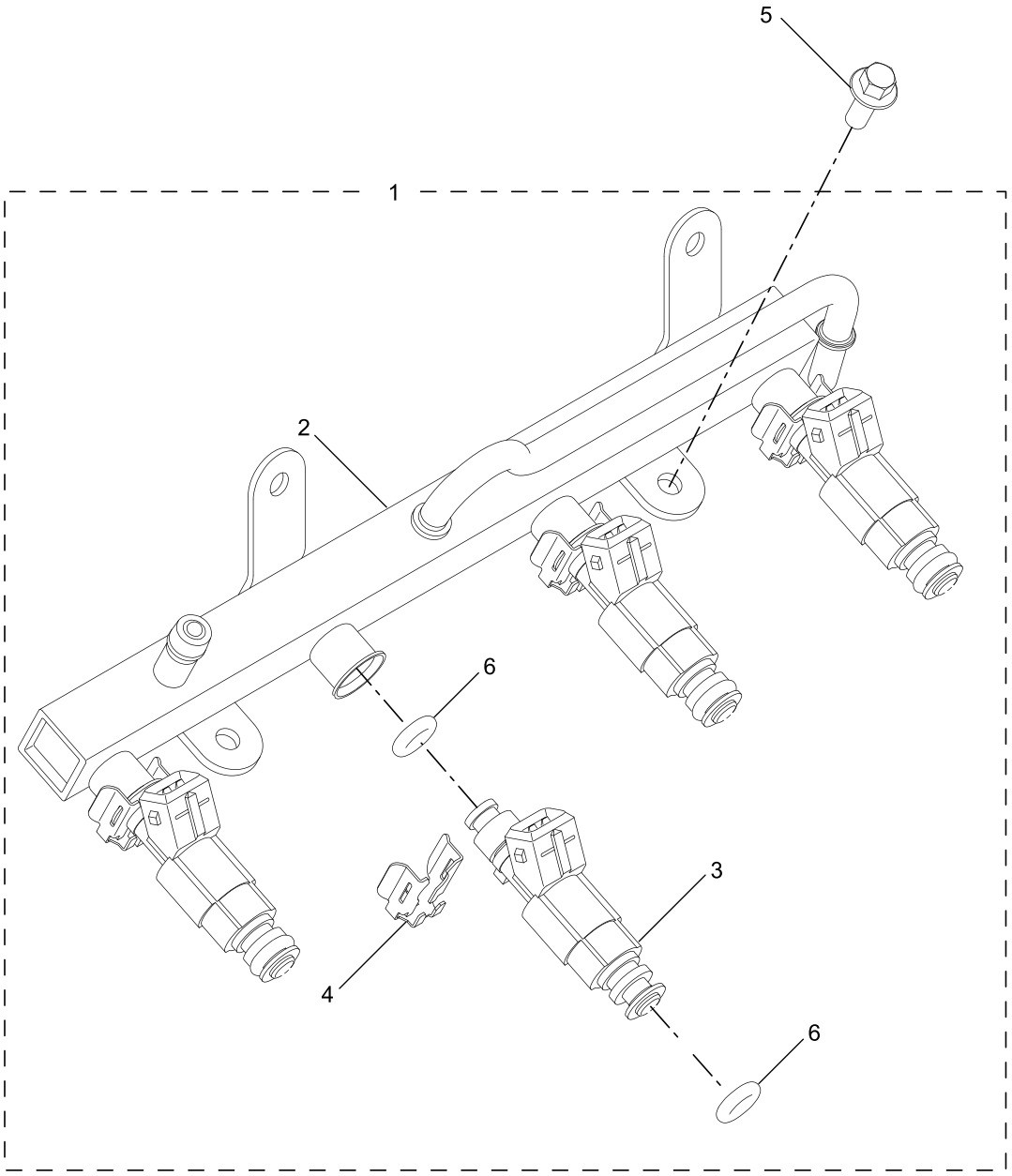
1. Water Temperature Sensor
2. Shim - Water Temperature Sensor
3. TMAP
4. Bolt - TMAP
5. Knock Sensor
6. Bolt - Knock Sensor
7. Oil Pressure Switch
8. Shim - Oil Pressure Switch
9. Cam Phase Sensor
10. Bolt - Phase Sensor
11. Front and Rear Oxygen Sensor
12. Crankshaft Sensor Assembly
13. O-ring - Crankshaft Sensor
14. Bolt - Crankshaft Sensor
15. Oil Pressure Switch Strainer
16. O-ring - Camshaft Phase Sensor

Water Pump and Thermostat



1. Water Pump
2. Thermostat Assembly
3. Water Pipe

Fuel Rail Assembly



1. Fuel Rail Assembly
2. Fuel Rail
3. Fuel Injector
4. Clip - Fuel Injector
5. Bolt - Oil Rail to Intake Manifold
6. O Ring - Fuel Injector

Description

General Description

NSE engine is a timing chain drive and electronic control mutipoint fuel injection system with in-line 4 cylinders, 16 valves and double overhead camshaft structure.

It is mainly composed of cylinder block, cylinder head, crankshaft, connecting rod and camshaft. The cylinder head is made of cast aluminium, connecting with the cast iron cylinder block by the 10 high strength bolts passing through the multi-level cylinder gasket and the other 3 high strength bolts directly connecting with the cylinder block, so it is with high degree of intensity and reliable structure overall.

Cylinder head parts

The structure of the cylinder head is that there are 4 valves per each cylinder and the spark plug arranges in the center of the combustion chamber. Because it is overhead valve structure, strong vortex will form in the combustion chamber to make the mixed gas distribute uniformly and help the flame transmit, so as to improve the combustion condition and the fuel economy, power performance and emission performance of the engine.

The mechanical tappets are installed on the top of each valves, directly driven by the camshaft. The mechanical tappet bottom convex platforms are grouped by the size. The valve clearance is maintained by selecting appropriate grouped mechanical tappets. The valve stem oil seal is pressed and installed on the cylinder head oil seal seat, and it is also used as valve spring seat to support the valve spring.

The exhaust valve is carbon deposit removing type; the lateral processed valve stem can clear away the carbon deposit at the terminal of the valve guide pipe and in the combustion chamber to prevent the valve from being stuck dead.

The cylinder gasket has multi-layer structure and is made of metal, the cylinder port adopts pressing ring struture which intensifies the sealing of the cylinder port. It is made of imported plate to make sure the sealing performance.

Cylinder block parts

The cylinder block is made of common used cast iron material-HT250, so it has a high degree of intensity overall and would not be deformed easily. The cylinder head is formed by the cylinder hole honing. In order to ensure the cooling effect of the cylinder block, Y-shape waterway is processed between the adjacent two cylinders.

The aluminium alloy hot expansion piston is equipped with semifloating piston pin. The piston pin will deviate to the thrust side when the engine is cooling to reduce the piston collision. And interference fit is adopted at the smaller end of the connecting rod. Each piston is equipped with two compressin rings and one oil ring.

The forged steel connectin rod had the structure of H-type cross section. The larger end of the connecting rod moves on the bearing shell of the crankshaft journal. The connecting rod adopts the technology of forging and splitting.

The crankshaft has 4 counterbalances, supported by five bearing. It floats through the thrust washer control terminal at the top of the central main bearing. The radial clearance of the bearing can be selected, controlled by two different grades of bearing. The oil groove provided at the top half part of the main bearing supplies oil to the connecting rod larger end bearing through the oil hole in the crankshaft.

Lower crankcase parts

Lower crankcase assembly includes lower crankshaft, oil pump assembly, oil strainer and oil filter.

The aluminum lower crankcase is designed to be a shape suitable for accumulating the oil around the oil strainer. The oil pump and oil strainer are equipped at the the lower crankcase bottom after assembly. The oil flows through the oil strainer with filter screen, is processed by the oil pump, and then through the oil filter .

The clean oil without impurity is distributed to the main bearing and the cylinder head through the main oil passage of the engine block to lubricate the parts such as the crankshaft, the connecting rod and the camshaft. The mating face of the lower crankcase and the engine block is sealed by gluing and fixed by bolts. The drain bolts locate in the left of the lower crankcase (the direction of engine front end).

The Engine Accessories

The accessory is driven by crankshaft pulley with single five glooves belt: drive water pump, power assisted steering pump (PAS) alternator and air conditioner compressor. The belt is tensioned by the damping vibration attenuation tensioner.

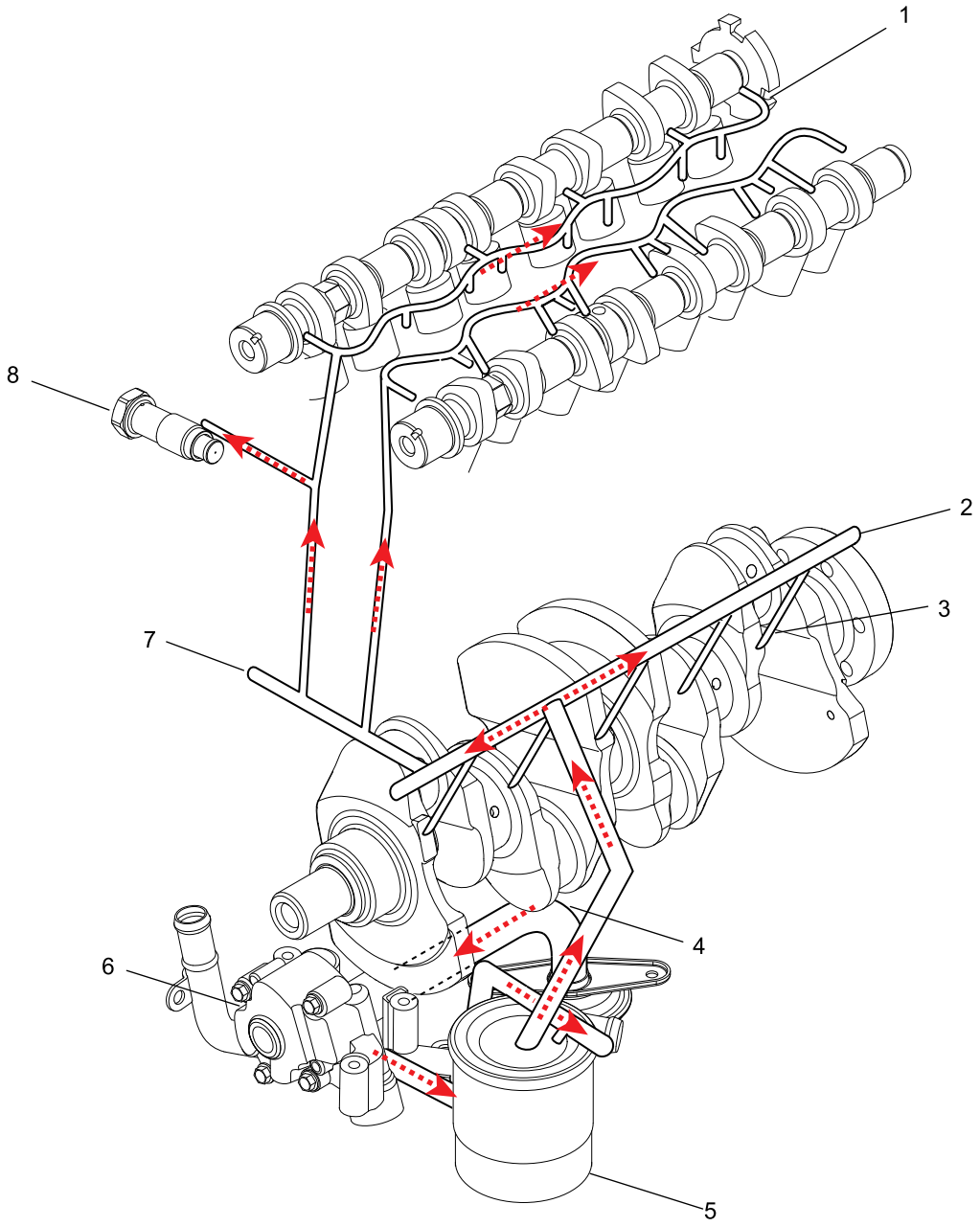
The crankcase venting

By utilizing the vacuum degree of the air intake system, the venting system reintroduces the exhaust gas fleeing in the crankcase into the air intake system and the cylinder for burnning it out to reduce air pollution.

The oil gas in the crankcase is separated by the oil separator in the camshaft cover and the oil flows back into the crankcase.

Operation

Lubricant Line



1. Cylinder Head Oil Passage
2. Cylinder Block Main Oil Passage
3. Crankshaft Crossover Oil Passage
4. Oil Inlet Tube
5. Oil Filter
6. Oil Pump
7. Main Oil Passage
8. Hydraulic Tensioner

The lubrication system is a full flow filtration and compelling oil supply system; the oil is sucked up by the oil pump through the oil strainer from the oil pan. The oil strainer has filter screen to avoid foreign matter into the oil pump.

The oil pump with limited valve is driven by the crankshaft through the chain. When the oil pressure achieves a certain level, the limited valve will open and redundant oil will return to the oil inlet side of the oil pump so as to make the oil pressure keep within a certain working pressure range and keep the engine run normally. The oil flowing out of the oil outlet of the oil pump will enter into the full flow oil filter.

The full flow oil filter is directly mounted on the oil pan. There is bypass valve installed on the oil filter, so when the filter element is blocked, the valve opens to make the oil run smoothly. But you should replace the oil filter as soon as possible.

Afterwards, the oil enters into the main oil passage, and directly lubricate the main bearing through the crossover oil line; the crossover oil line on the crankshaft may delivers the oil from the main bearing to the connecting rod larger end bearing.

The oil splashed from the crankshaft lubricates the cylinder wall, and the oil gathered in the lower side of piston crown lubricates the connecting rod smaller end and enters into the piston pin from the connecting rod smaller end through the oil line.

Service Procedures

Powertrain Assembly Removal and Installation - MT

Remove

1. Fix the vehicle on the raiser.
2. Disconnect battery earth lead.
3. Remove the battery.

☞**Battery Remove**

4. Remove the bolt securing the battery tray and remove the battery support.

☞**Battery Tray Remove**

5. Remove the inlet pipe assembly.

☞**Inlet Pipe Assembly Remove**

6. Drain the cooling system.

☞**Cooling System Drainage**

7. Drain the power steering fluid.
8. Remove the expansion tank.

☞**Expansion Tank Remove**

9. Remove the hood lock.

☞**Hood Lock Remove**

10. Remove the tank upper beam.

☞**Tank Upper Beam Remove**

11. Remove the radiator.

☞**Radiator Remove**

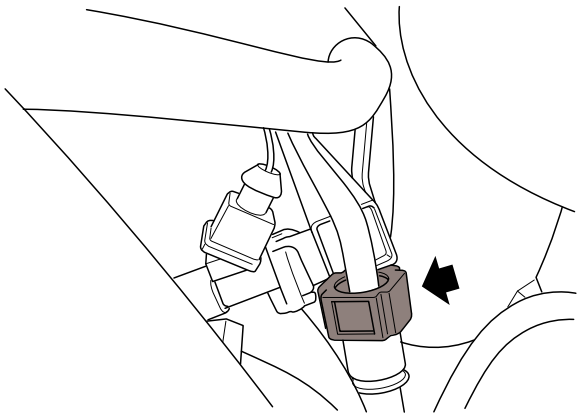
12. Release the fuel pressure.

☞**Fuel Pressure Release**

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

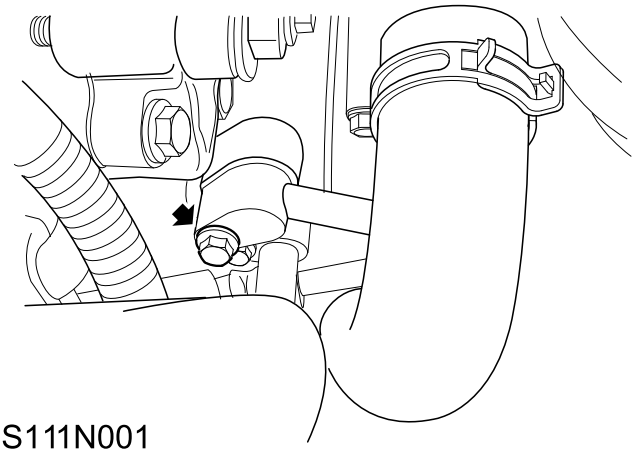
13. Separate the supply and return pipes of the fuel rail.



14. Remove the air cleaner assembly

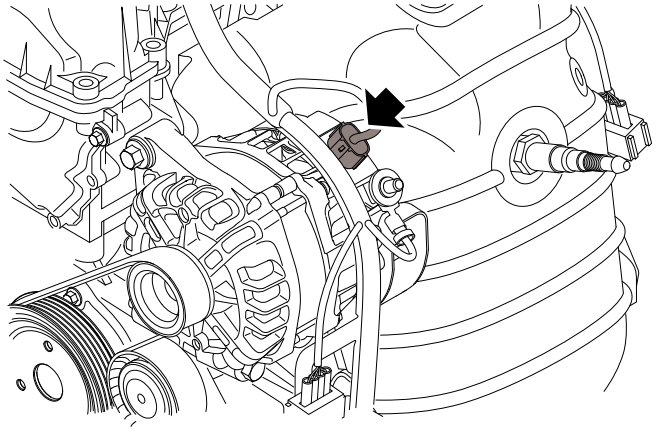
☞**Air Cleaner Assembly Remove**

15. Separate the connector and the line of the A/C compressor.

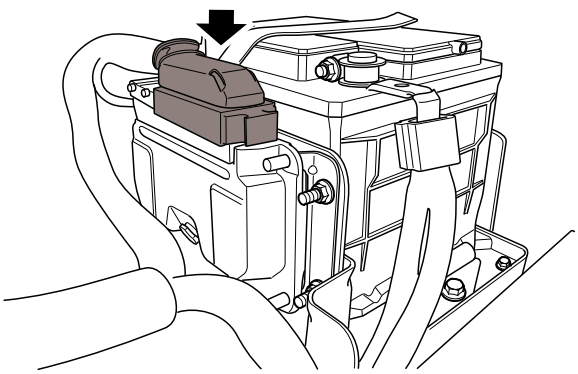


S111N001

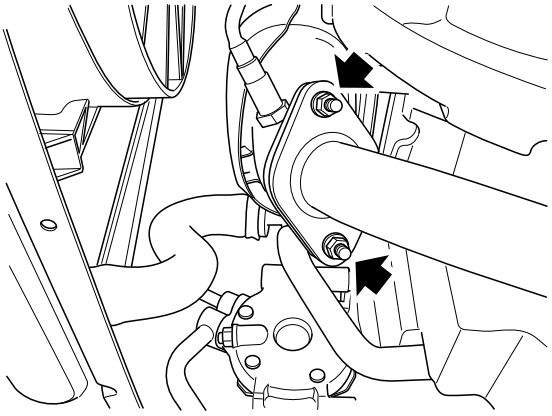
16. Separate the line and hose from the power steering pump.
17. Disconnect the generator harness connector.



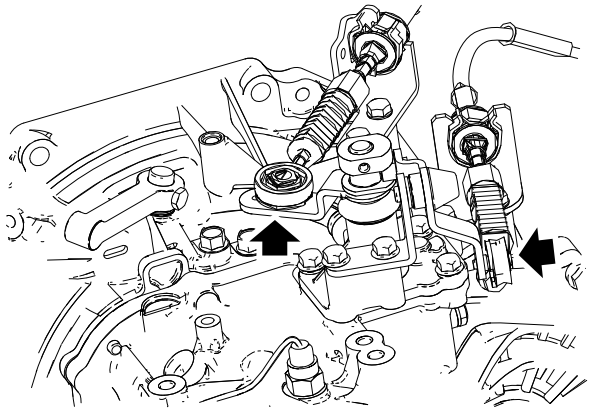
18. Separate the engine**ECM** connection.



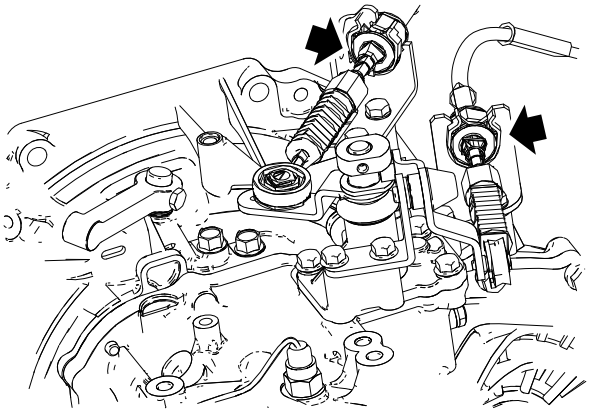
19. Remove the bolt connecting the exhaust manifold to the exhaust front pipe.



20. Disconnect the back-up lamp switch connector.



21. Notice the moutning position and release two cables ball joints from manual transmission select and shift rocker arm.



22. Loose the clip securing the select and shift lever cable to the support.
23. Drain the transmission fluid.

☞**Transmission Fluid Drainage**

24. Loosen two bolts securing slave cylinder to the manual transmission, Loosen and place the slave cylinder in an appropriate place.

Caution: Don't hang the slave cylinder for a long time.

25. Remove the drive shaft assembly.

☞**Left Drive Shaft Remove**

☞**Right Drive Shaft Remove**

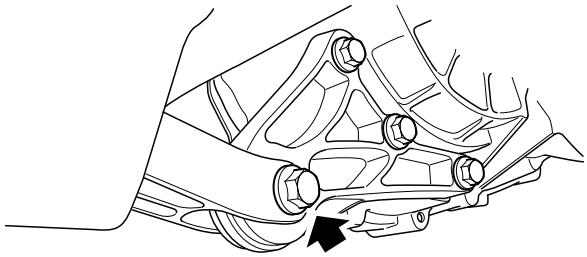
26. Loosen two bolts securing slave cylinder to the manual transmission slave cylinder support, Loosen and place the slave cylinder in an appropriate place.

Caution: Don't hang the slave cylinder for a long time.

27. Support the powertrain assembly with raising tray.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

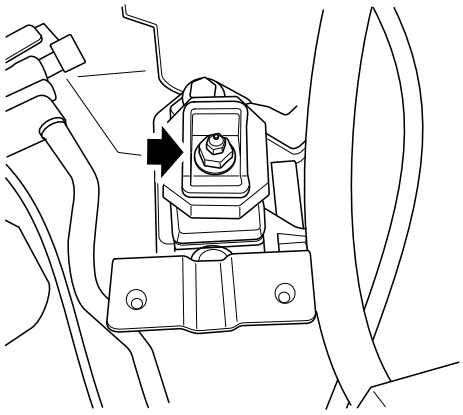
28. Remove lower tie rod.



29. Remove powertrain assembly mounting.

☞**Powertrain Assembly Mounting Remove**

30. Remove transmission mounting.



31. Remove the powertrain assembly.

Refit

1. With assistance, put the powertrain assembly into the engine compartment with the raising tray.
2. Put the powertrain assembly onto the installing position.
3. Install the transmission mounting onto the body and tighten the bolt to **55–65Nm**.
4. Install the transmission mounting and tighten the nut to **90–110Nm**
5. Install the powertrain assembly mounting and tighten

the bolt to **40–50Nm**.

6. Install lower tie rod and tighten the bolt to **55–65Nm**.
7. Locate the slave cylinder and tighten the slave cylinder retaining bolt to **40–50Nm**.
8. Position the select and shift lever cable to the cable support and fix with clip.
9. Connect the select and shift lever cable ball joint to the select and shift rocker arm.
10. Inspect the transmission select and shift operation.
11. Connect backup lamp switch connector and secure the wire clip.
12. Install the drive shaft assembly.

☞**Left Drive Shaft Assembly Refit**

☞**Right Drive Shaft Assembly Refit**

13. Install the bolt connecting the exhaust manifold to the exhaust front pipe and tighten the bolt to **45–55Nm**.
14. Install the engine**ECM** connector.
15. Connect generator harness connector.
16. Connect the pipe and hose of the power steering pump.
17. Connect the connector and the pipe of the A/C compressor.
18. Install the supply and return pipes of the fuel rail.
19. Install the radiator.

☞**Radiator Refit**

20. Install the expansion tank.

☞**Expansion Tank Refit**

21. Install the hood lock.

☞**Hood Lock Refit**

22. Install the tank upper beam.

☞**Tank Upper Beam Refit**

23. Inlet pipe assembly.
24. Air cleaner assembly.

☞**Air Cleaner Assembly Refit**

25. Install the bolt securing the battery tray and install the battery support.
26. Install the battery.

☞**Battery Refit**

27. Cooling system filling.

☞**Cooling System Filling**

28. Connect battery earth lead.

Powertrain Assembly Removal and Installation - AMT

Remove

1. Fix the vehicle on the raiser.
2. Disconnect battery earth lead.
3. Remove the battery.

☞**Battery Remove**

4. Remove the bolt securing the battery tray and remove the battery support.

☞**Battery Tray Remove**

5. Remove the inlet pipe assembly.

☞**Inlet Pipe Assembly Remove**

6. Drain the cooling system.

☞**Cooling System Drainage**

7. Drain the power steering fluid.
8. Remove the expansion tank.

☞**Expansion Tank Remove**

9. Remove the hood lock.

☞**Hood Lock Remove**

10. Remove the tank upper beam.

☞**Tank Upper Beam Remove**

11. Remove the radiator.

☞**Radiator Remove**

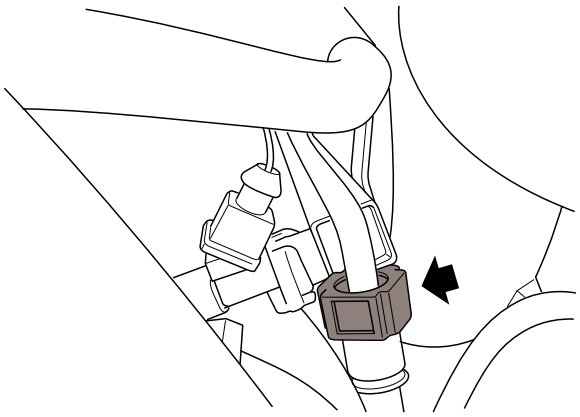
12. Release the fuel pressure.

☞**Fuel Pressure Release**

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

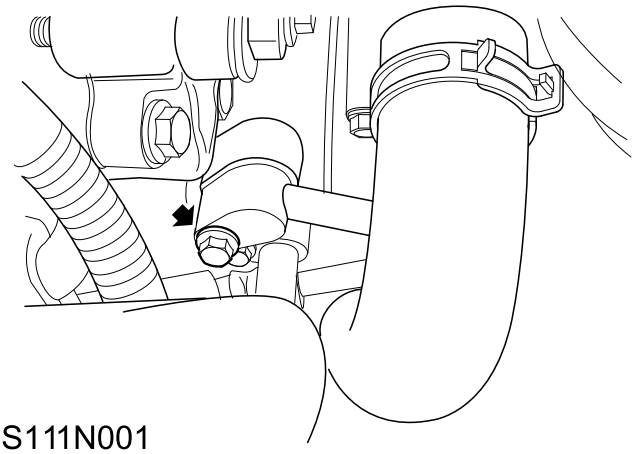
13. Separate the supply and return pipes of the fuel rail.



14. Remove the air cleaner assembly.

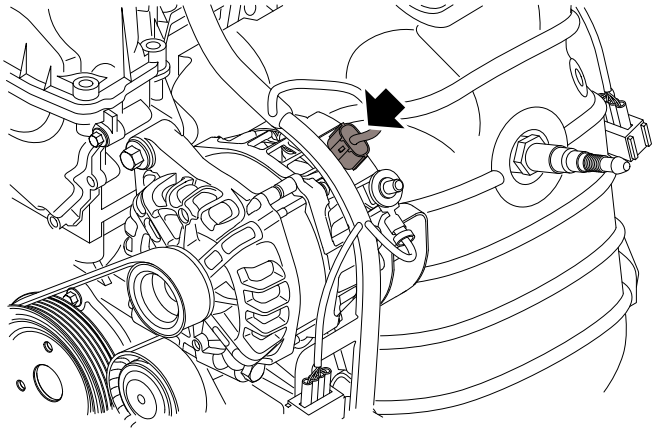
☞**Air Cleaner Assembly Remove**

15. Separate the connector and the line of the A/C compressor.

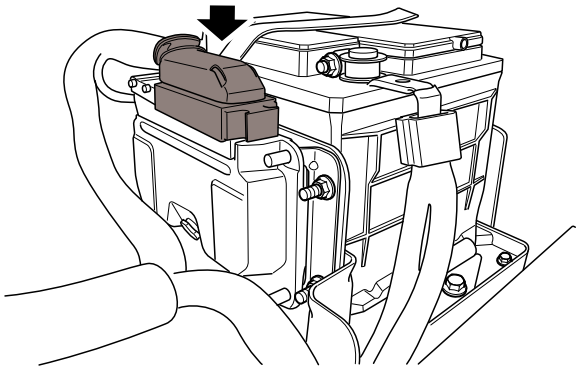


S111N001

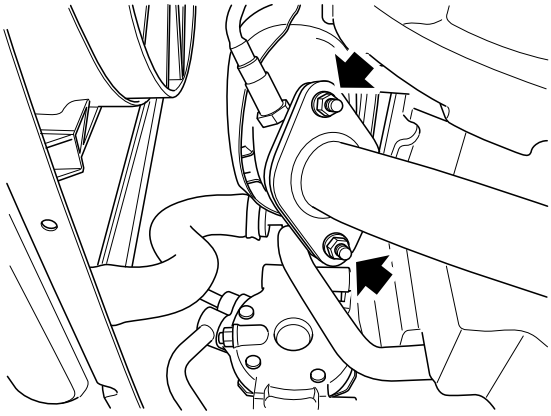
16. Separate the pipe and hose from the power steering pump.
17. Disconnect generator harness connector.



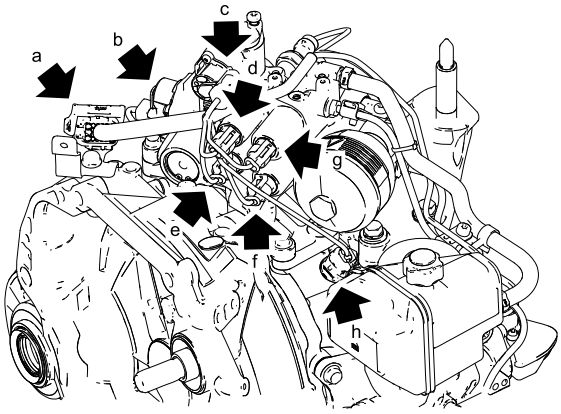
18. Separate the engine**ECM** connection.



19. Remove the bolt connecting the exhaust manifold to exhaust front pipe.



20. Disconnect the back-up lamp switch connector.



21. Disconnect the connection (a) between the transmission harness and body harness.
22. Drain the transmission fluid.

☞**Transmission Fluid Drainage**

23. Remove the drive shaft assembly.

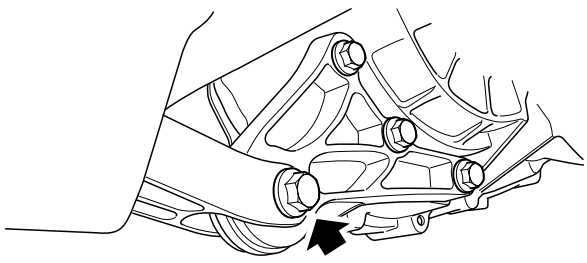
☞**Left Drive Shaft Remove**

☞**Right Drive Shaft Remove**

24. Support the powertrain assembly with the raising tray.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

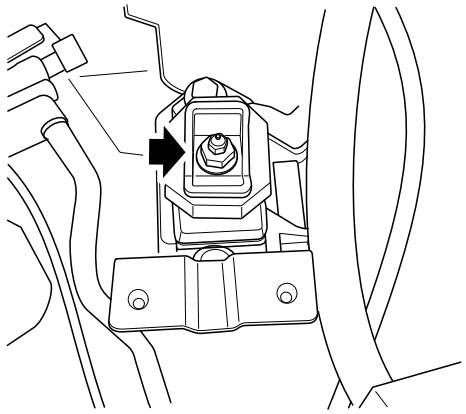
25. Remove lower tie rod.



26. Remove powertrain assembly mounting.

☞Powertrain Assembly Mounting Remove

27. Remove the transmission mounting.



28. Remove the powertrain assembly.

Refit

1. With assistance, put the powertrain assembly into the engine compartment with the raising tray.
2. Put the powertrain assembly onto the Fiting position.
3. Fit the transmission mounting onto the body and tighten the bolt to **55–65Nm**.
4. Fit the transmission mounting and tighten the nut to **90–110Nm**.
5. Fit the powertrain assembly mounting and tighten the bolt to **40–50Nm**.
6. Fit lower tie rod and tighten the bolt to **55–65Nm**.
7. Connect the connector of transmission harness and body harness.
8. Connect the back-up lamp switch connector.
9. Fit the drive shaft assembly.

☞Left Drive Shaft Assembly Refit

☞Right Drive Shaft Assembly Refit

10. Fit the bolt connecting the exhaust manifold to the exhaust front pipe and tighten the bolt to **45–55Nm**.
11. Fit the engine**ECM** connector.
12. Connect generator harness connector.
13. Connect the line and hose of the power steering pump.
14. Connect the connector and the line of the A/C compressor.
15. Fit the supply and return pipes of the fuel rail.
16. Fit the radiator.

☞Radiator Refit

17. Fit the expansion tank.

☞Expansion Tank Refit

18. Fit the hood lock.

☞Hood Lock Refit

19. Fit the tank upper beam.

☞Tank Upper Beam Refit

20. Inlet pipe assembly.
21. Air cleaner assembly.

☞Air Cleaner Assembly Refit

22. Fit the bolts securing the battery tray and Fit the battery support.
23. Fit the battery.

☞Battery Refit

24. Cooling system filling.

☞Cooling System Filling

25. Connect battery earth lead.

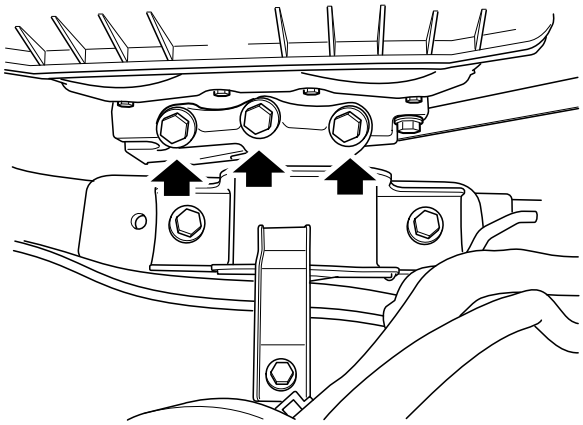
Powertrain Assembly Mounting

Remove

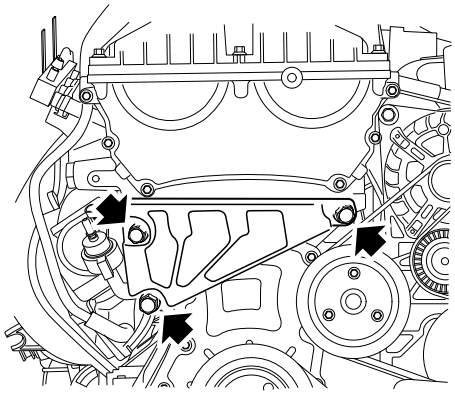
1. Disconnect battery earth lead.
2. Support the engine with the jack.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

3. Remove three bolts retaining the engine mounting to the engine mounting bracket.

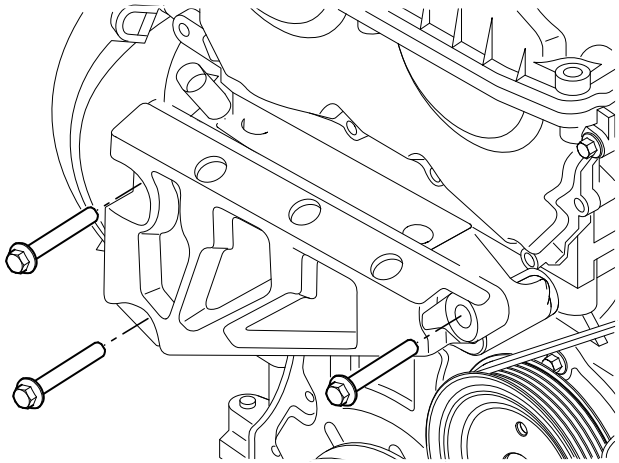


4. Remove three bolts retaining the engine mounting to the engine block.



Refit

1. Clean the engine mounting and the mounting surface of the engine mounting and the engine block.
2. Fit the engine mounting onto the engine and tighten the bolt to **40–50Nm**.



3. Fit the bolt retaining the engine mounting to the engine mounting bracket and tighten to **90–110Nm**.
4. Connect battery earth lead.

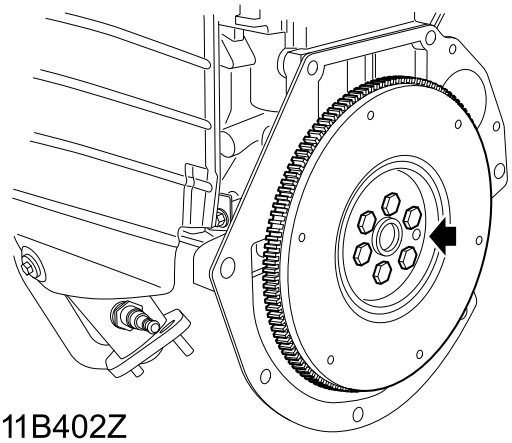
Flywheel

Remove

1. Remove the clutch assembly.

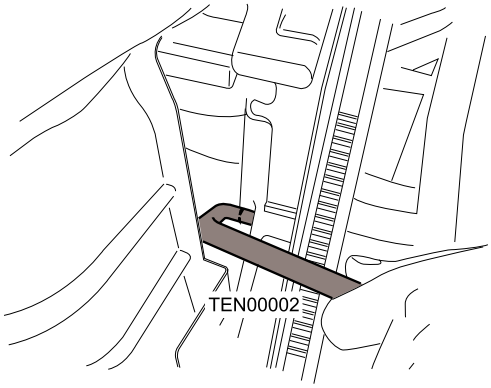
☞**Clutch Assembly Remove**

2. Remove the plug from the engine block timing hole.
3. Rotate the flywheel and observe from the flywheel side, When the flywheel mounting pin hole is horizontally aligned to the intake side, the flywheel timing pin hole is aligned with the engine block pin hole at this time.



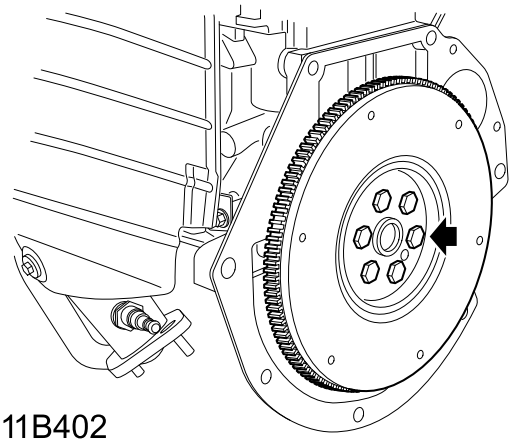
S111B402Z

4. Use the flywheel timing pin special tool **TEN00002**and insert it into the flywheel timing hole from the engine block timing hole to lock up the flywheel.



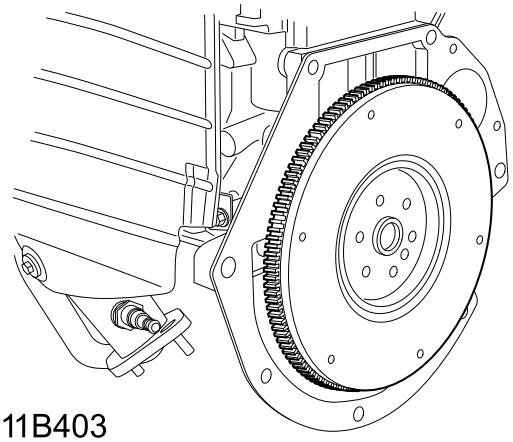
S111B401

5. Unscrew and discard 6 bolts securing the flywheel to the crankshaft.



S111B402

6. Remove the flywheel from the crankshaft.

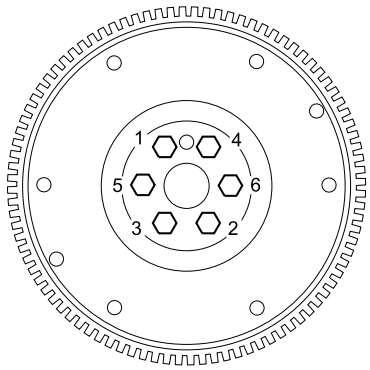


S111B403

7. Remove the flywheel timing pin special tool **TEN00002**

Refit

1. Saw two tooth spaces which is 45 degree to the bolt bar on the bolt once used on the flywheel with saw, and then use the bolt to clean the bolt holes on the crankshaft one by one.
2. Clean the mating surface of the flywheel and the crankshaft.
3. Fit the flywheel onto the crankshaft.
4. Fit a new glued bolt and tighten it.
5. Rotate the flywheel, and observe from the flywheel side, When the flywheel mounting pin hole is horizontally aligned to the intake side, insert the flywheel timing pin special tool**TEN00002** into the engine block timing hole and lock up the flywheel.
6. According to the diagonal order, tighten the bolt to **(32–38)Nm+60°±2°**.



S111B404

7. Remove the flywheel timing pin special tool **TEN00002**.
8. Fit the plug.
9. Fit the clutch assembly.

☞**Clutch Assembly Refit**

Crankshaft Pulley

Remove

1. Disconnect the battery ground terminal.
2. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

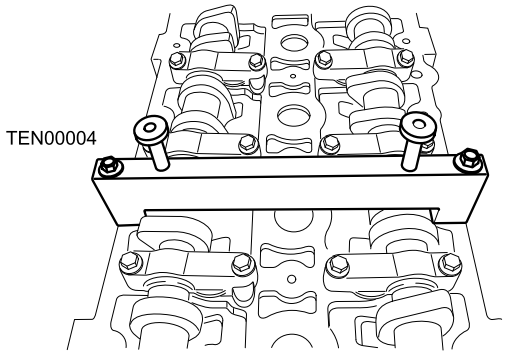
3. Remove the right front wheel.
4. Remove the ignition coil.

☞**Ignition Coil Remove**

5. Remove the camshaft cover.

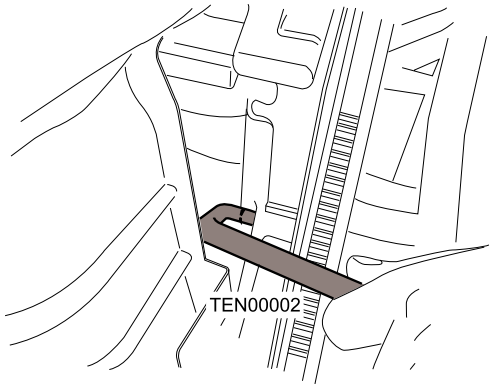
☞**Camshaft Cover Remove**

6. Remove the plug installed on the timing pin hole of the engine block.
7. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used to lock up the camshaft phase.



S111B408

8. Use the timing pin special tool**TEN00002** and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.

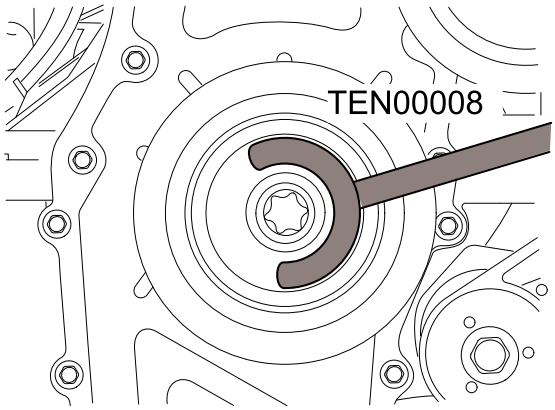


S111B401

9. Remove the accessory drive belt.

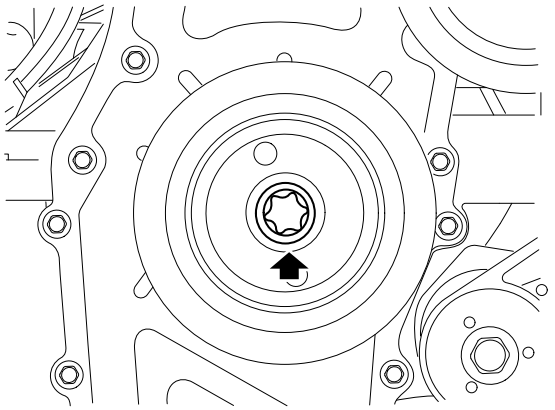
☞**Accessory Drive Belt Remove**

10. Use the crankshaft pulley holding special tool**TEN00008** to hold the crankshaft pulley.



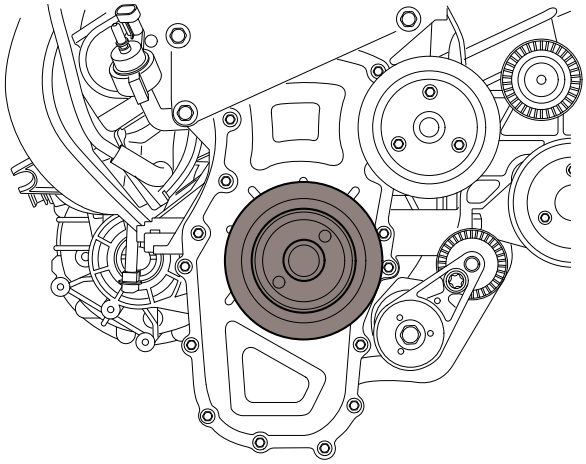
S111A414

11. Unscrew and discard the bolt retaining the crankshaft pulley to the crankshaft.



S111A401

12. Remove the crankshaft pulley.



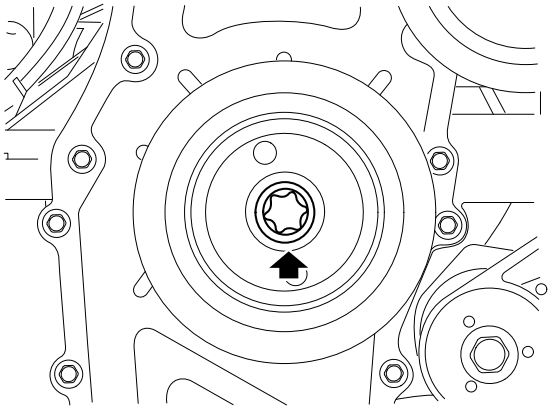
Caution: Avoid damaging the crankshaft front oil seal lip when removing the pulley.

Refit

1. Clean the mating surface of the crankshaft pulley and the crankshaft front oil seal.

Caution: If it is necessary to replace the crankshaft front oil seal, try to keep the centre axis of the pulley align with the centre axis of the crankshaft without deflection to avoid damaging the seal lip during pushing the crankshaft pulley with hand.

2. Fit the crankshaft pulley and then use the crankshaft pulley holding special tool **TEN00008**.Secure the crankshaft pulley and then tighten the bolt to **(60±2)Nm+120°±2°**.



S111A401

3. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

4. Remove the camshaft phase locking special tool **TEN00004**.
5. Remove the flywheel timing pin special tool **TEN00002**.
6. Fit the plug.
7. Fit the camshaft cover.

☞**Camshaft Cover Refit**

8. Fit the ignition coil.

☞**Ignition Coil Refit**

9. Fit the right front wheel.
10. Lower the vehicle.
11. Connect the battery ground terminal.

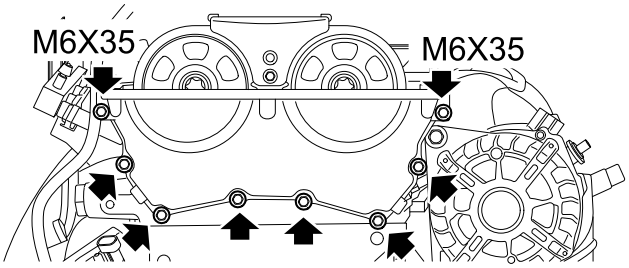
Timing Chain Upper Cover Plate

Remove

1. Remove the camshaft cover.

☞**Camshaft Cover Remove**

2. Loosen eight bolts securing the timing chain upper cover plate; two bolts are M6X35 and the other six are M6X20.

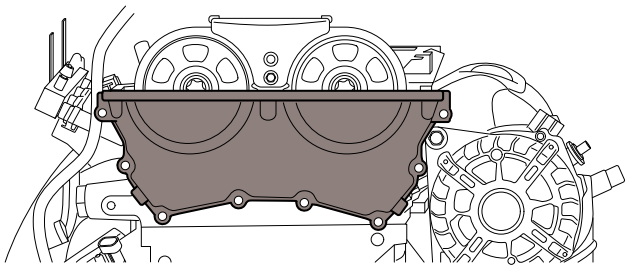


S111J401Z

3. Remove the bolt securing the timing chain upper cover plate, there are 8 retaining bolts.

Caution: When removing the timing chain upper cover plate, ensure that the cover plate does not deform.

4. Remove the timing chain upper cover plate.



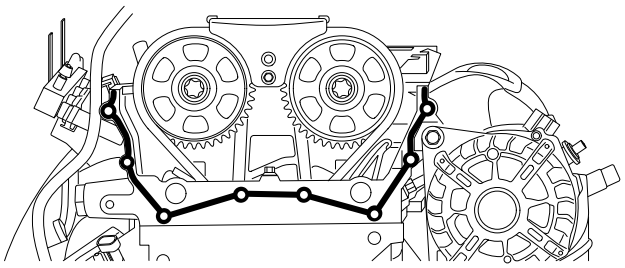
S111J402Z

Refit

1. Inspect the timing chain upper cover plate.

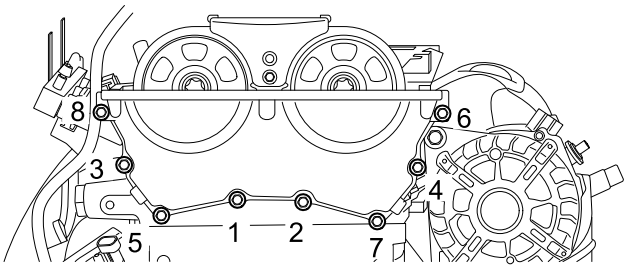
Caution: Ensure that there is no damage on the timing chain upper cover plate, otherwise, it may cause oil leak.

2. Apply the glue on the timing chain upper cover plate and cylinder head along the seal belt (width about 1.5–2.0 mm).



S111J403Z

3. Fit the bolt securing the timing chain upper cover plate and tighten to **8–12Nm**, there are eight retaining bolts.



S111J426Z

4. Fit the camshaft cover.

☞**Camshaft Cover Refit**

Timing Chain Lower Cover Plate

Remove

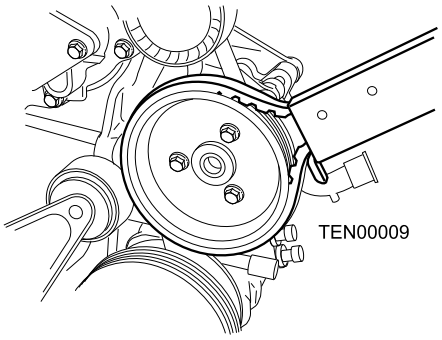
1. Disconnect battery earth lead.
2. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

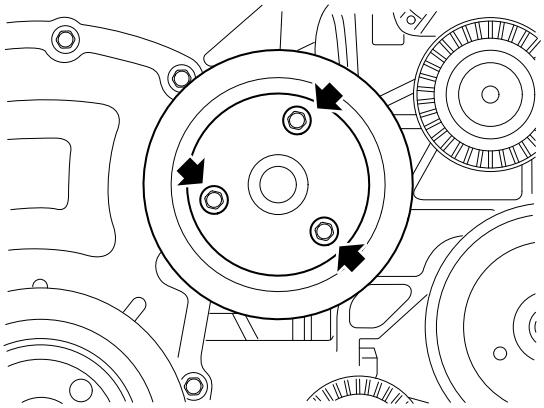
3. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

4. Using the pulley removal and installation special tool **TEN00009**, remove the water pump pulley.

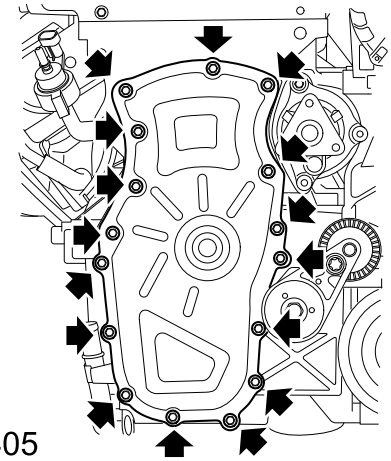


S111J423



S111J404

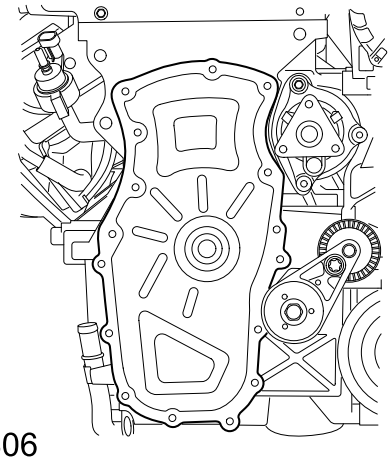
5. Remove the bolt securing timing chain lower cover plate.



S111J405

6. Remove the timing chain lower cover plate, discard crankshaft front oil seal and the timing chain lower cover plate at the same time.

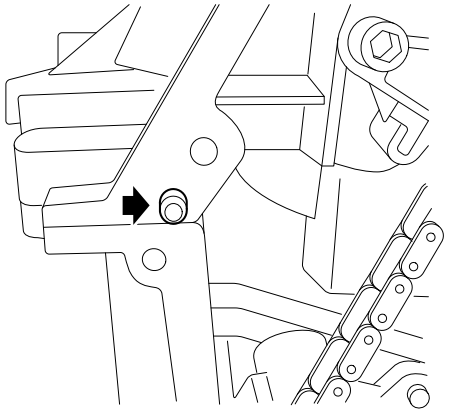
Caution: Be sure to keep the flatness of the timing chain lower cover plate when removing it, otherwise, it will cause oil leak.



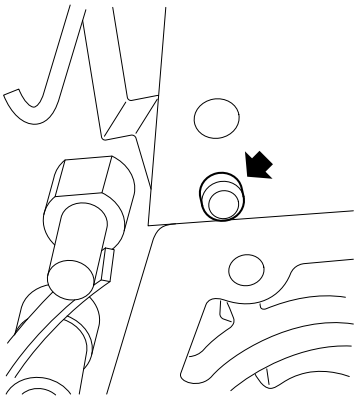
S111J406

Refit

1. Clean the glue on the engine block and the contact surface of the timing chain lower cover plate, ensure that no residual glue remains on the engine block.
2. Clean crankshaft pulley journal.
3. Fit the timing chain lower cover plate locating pin (If it is not removed, do not refit).



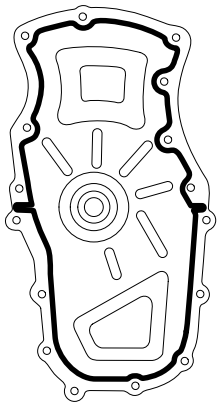
S111J407



S111J408

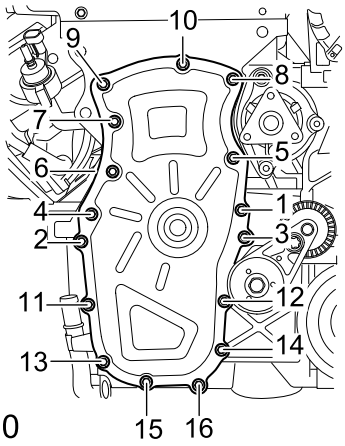
4. Apply glue about 2.5 mm width on the path according to the above chart with appropriate tool, be sure that

the glue is continuous.



S111J409

5. Fit the timing chain lower cover plate assembly bolt and tighten to **8–12Nm**, and tighten according to the order in the chart 1–16 successively and complete Fitation in 3-5 minutes.

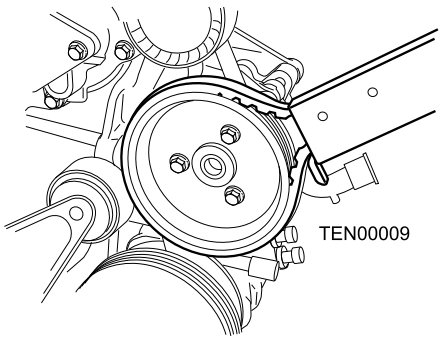


S111J410

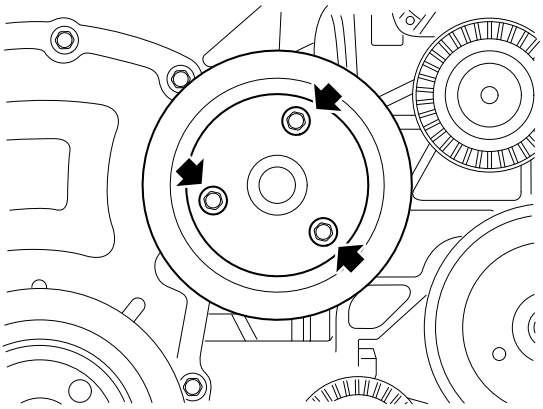
6. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

7. Using the pulley removal and Fitation special tool **TEN00011**, Fit the water pump pulley.



S111J423



S111J404

8. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

9. Connect battery earth lead.

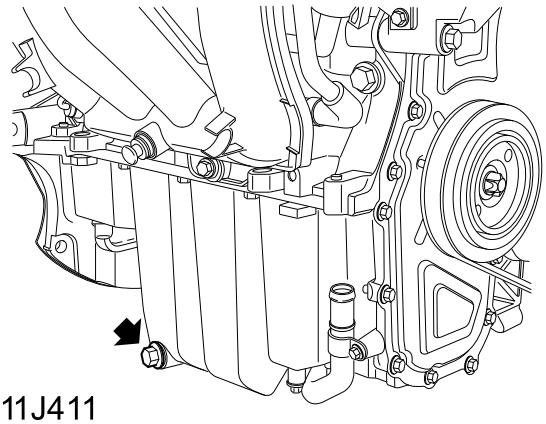
Timing Chain

Remove

1. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Release the drain bolt and drain the oil.



S111J411

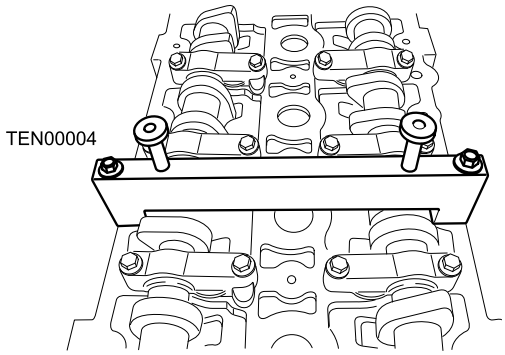
3. Remove the right front wheel.
4. Remove the ignition coil.

☞**Ignition Coil Remove**

5. Remove the camshaft cover.

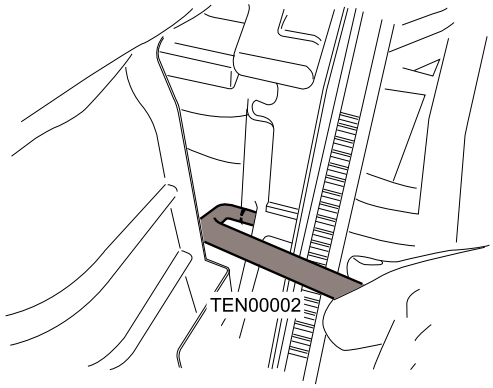
☞**Camshaft Cover Remove**

6. Remove the plug installed on the timing pin hole of the engine block.
7. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used to lock up the camshaft phase.



S111B408

8. Use the timing pin locking special tool**TEN00002** and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.



S111B401

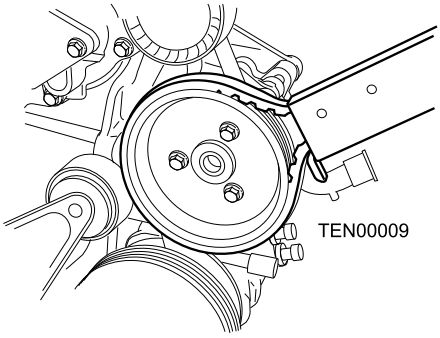
9. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

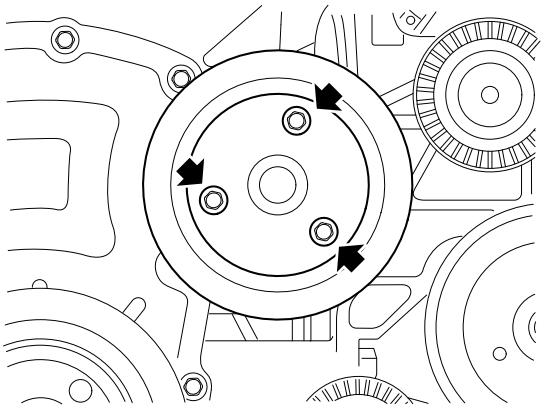
10. Unscrew and discard the bolt retaining the crankshaft pulley to the crankshaft.
11. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

12. Use the pulley removal and installation special tool**TEN00009** to remove the water pump pulley.



S111J423



S111J404

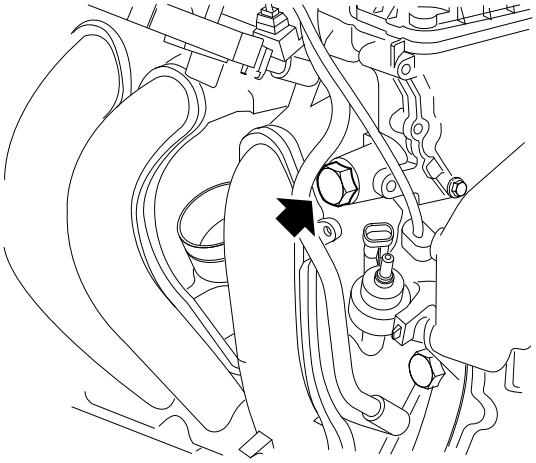
13. Remove timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

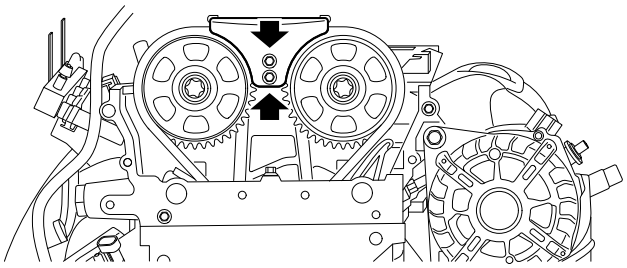
14. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

15. Remove the timing chain tensioner and discard the seal washer.

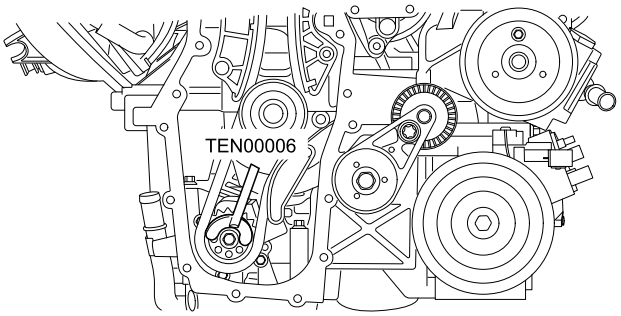


16. Remove the upper guide rail.



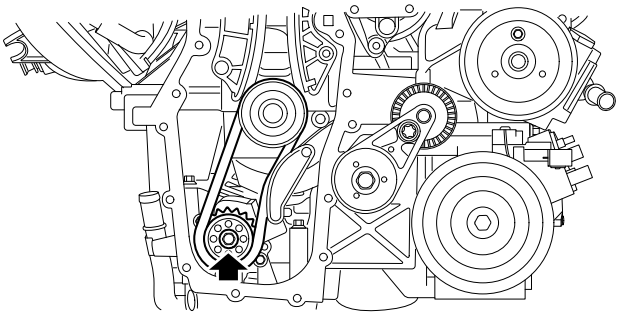
S111J413Z

17. Use the oil pump sprocket holding special tool**TEN00006** and remove the oil pump sprocket bolt.

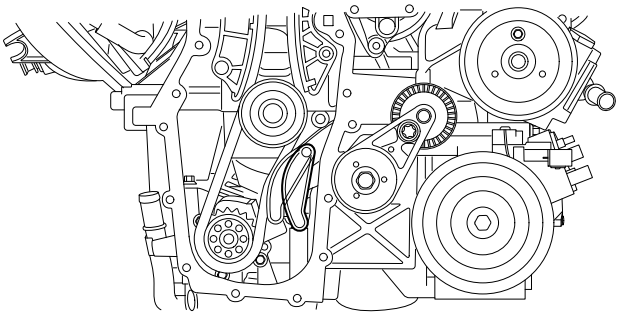


S111J424

18. Open the oil pump chain tensioner to the right, and take down the oil pump sprocket, oil pump chain and the crankshaft sprocket of the drive oil pump at the same time.

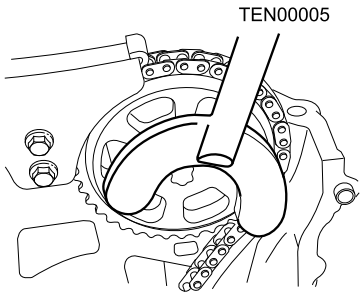


S111J414



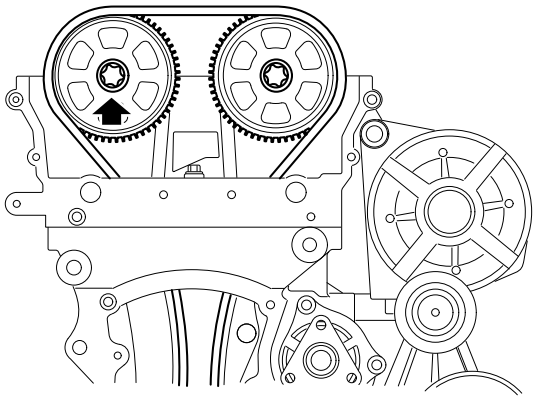
S111J415

19. Remove the oil pump chain tensioner.
20. Use the camshaft sprocket holding special tool **TEN00005**, remove the intake camshaft sprocket and exhaust camshaft sprocket bolts and discard them.



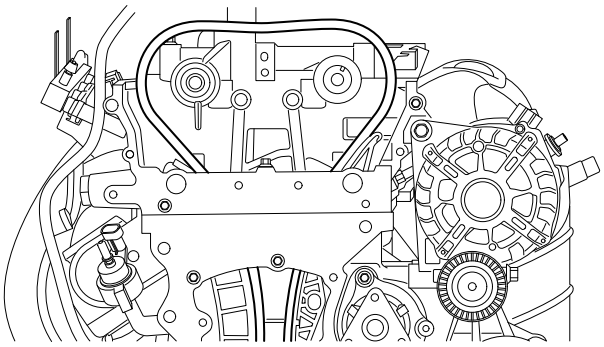
S111J425

21. Remove the intake camshaft sprocket and the exhaust camshaft sprocket.



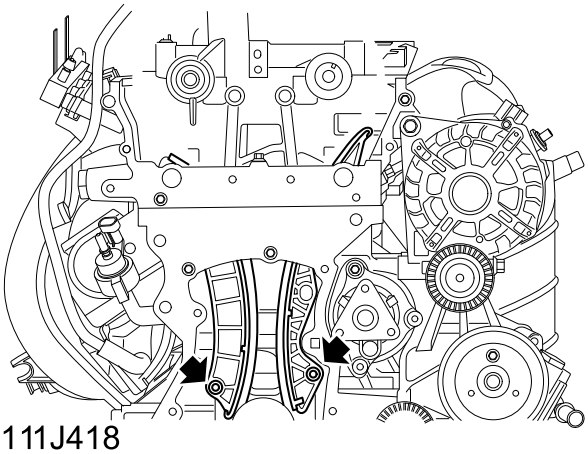
S111J416

22. Remove the timing drive crankshaft sprocket and the timing chain.



S111J417

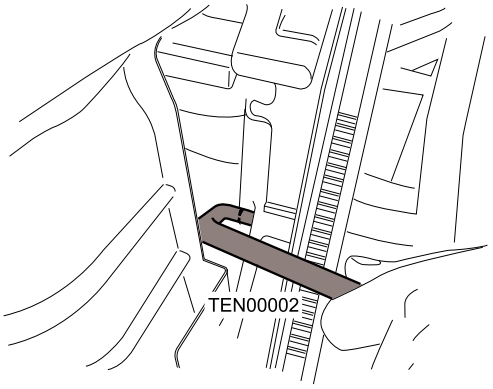
23. Remove the guide rail pivot pin, take out the tensioner guide rail and the chain guide rail from the upper end of the chain case.



S111J418

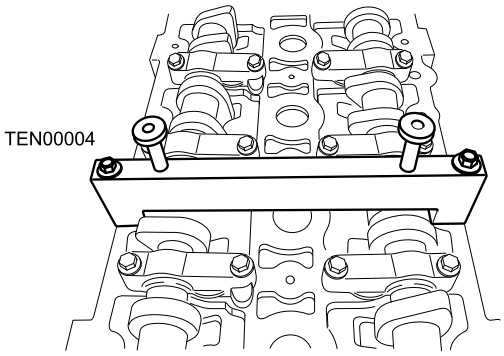
Refit

1. Remove the plug fitted on the timing pin hole of the engine block.
2. Rotate the flywheel until the pin hole is aligned to the engine block pin hole.
3. Use the flywheel locking special tool**TEN00002** and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.



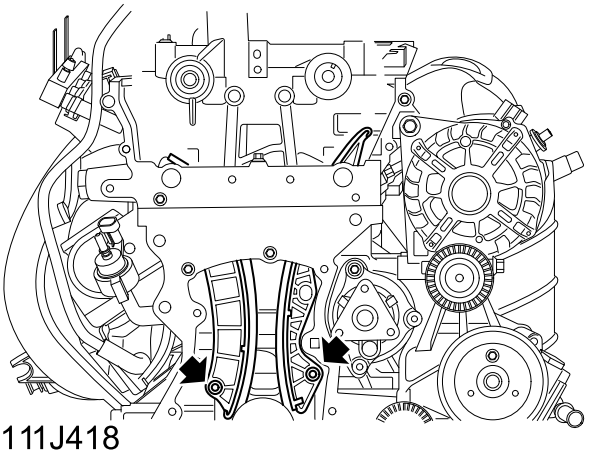
S111B401

4. Use the camshaft locking special tool**TEN00004** to lock up the camshaft phase.



S111B408

5. Inspect all parts for damage, contamination, rust and dirt prior to assembling. If the part is damaged, do not use. If the part is contaminated, always clean it.
6. Put in the chain guide rail from the right side of guide rail compartment, and then tighten pivot pins respectively and tighten torque finally **22–28Nm**.
7. Put in the tensioner guide rail from the left side of guide rail compartment, and then tighten pivot pins respectively and tighten torque finally **22–28Nm**.

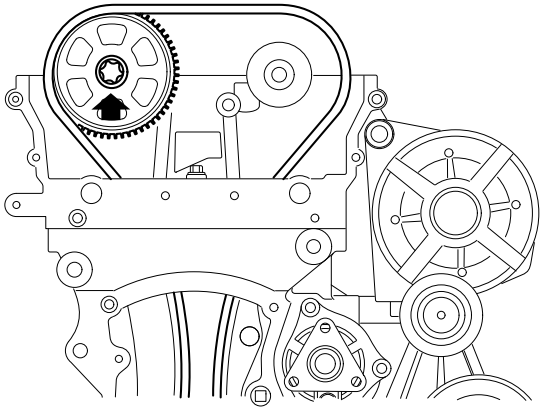


S111J418

8. Position a timing drive crankshaft sprocket into the crankshaft front end; Put in the timing chain from the

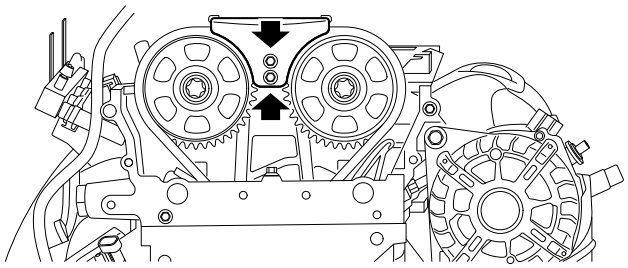
upper end of cylinder head guide rail compartment, and position the lower end of the chain into the crankshaft sprocket, and finally hang the timing drive chain on the fit convex platform of the upper guide rail.

9. Using the camshaft sprocket holding special tool **TEN00005**, fit the intake and exhaust camshaft sprockets onto the intake and exhaust camshafts respectively. After the bolt is pre-loaded, fit chain into the two sprockets.



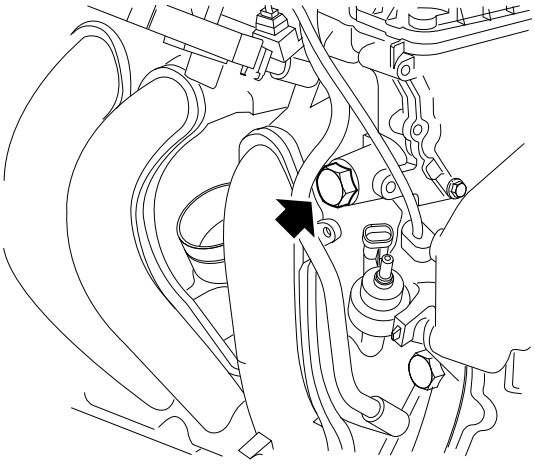
S111J419

10. fit the upper guide rail onto the camshaft front bearing cap, secure it with two bolts and tighten to **8–12Nm**.

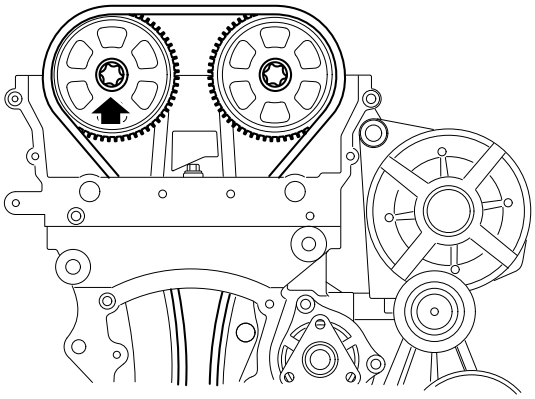


S111J413Z

11. After new timing hydraulic tensioner gasket replacement, screw down and tighten the timing hydraulic tensioner on the cylinder head, and tighten to **77-83Nm**.

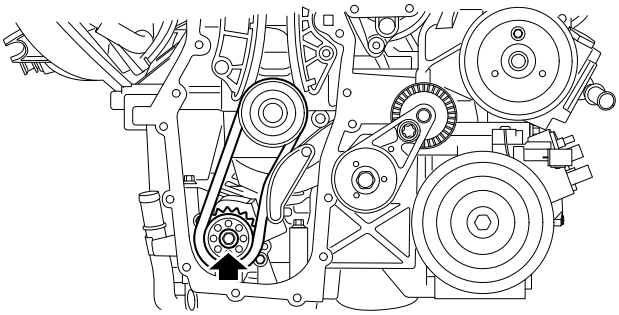


12. Tighten the intake and exhaust camshaft sprockets on the camshaft, and the torque of bolts should be **(25±3)Nm+45°±2°**.



S111J416

13. fit the oil pump chain tensioner.



S111J414

14. Put the oil pump chain onto the oil pump drive crankshaft sprocket, and then fit the oil pump drive crankshaft sprocket on the front end of crankshaft.

Caution: At the foot of the crankshaft sprocket-oil pump teeth side is a dent mark that is used to distinguish it with the crankshaft sprocket-timing chain.

15. Put the oil pump drive sprocket onto the oil pump chain.

Tip: The side with product logo faces outward.

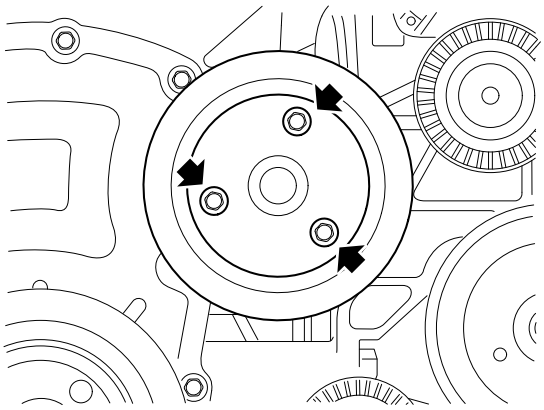
16. Rotate the oil pump sprocket and make the D-type hole in the center aimed at D-type shaft of the oil pump.
17. Pull the lower end of oil pump tensioner to the right, put the oil pump sprocket onto the oil pump shaft and push the crankshaft sprocket to the bottom.
18. Release the oil pump chain tensioner.
19. Inspect the oil pump chain for being pressed on the guide surface of the tensioner properly.
20. Using the special tool**TEN00006**, fit the oil pump sprocket, screw the oil pump sprocket bolt and tighten to **22–28Nm**.
21. fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

22. fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

23. fit the water pump pulley.



S111J404

24. fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

25. fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

26. Remove the camshaft phase lock special tooling.
27. Remove the flywheel timing pin special tool **TEN00002**.
28. fit the plug.
29. fit the camshaft cover.

☞**Camshaft Cover Refit**

30. fit the ignition coil.

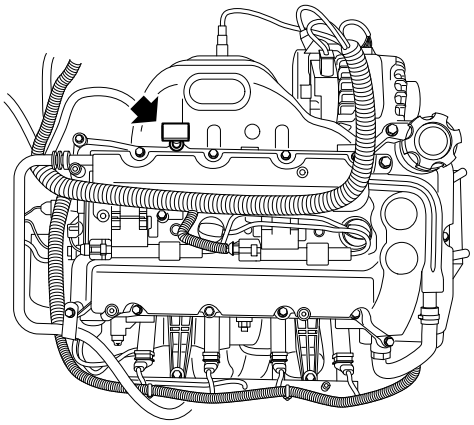
☞**Ignition Coil Refit**

31. fit wheels.
32. Lower the vehicle.
33. Check the oil level, refill as necessary.

Camshaft Cover

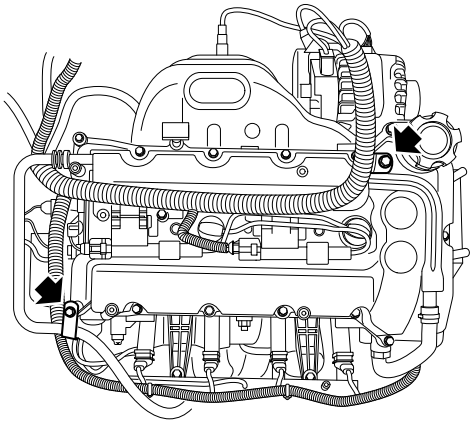
Remove

1. Remove the oil dipstick.



S111C401

2. Loosen and remove the harness support bolts, loosen and remove the high-voltage coil bolts. And record the original position and then place them in suitable place.

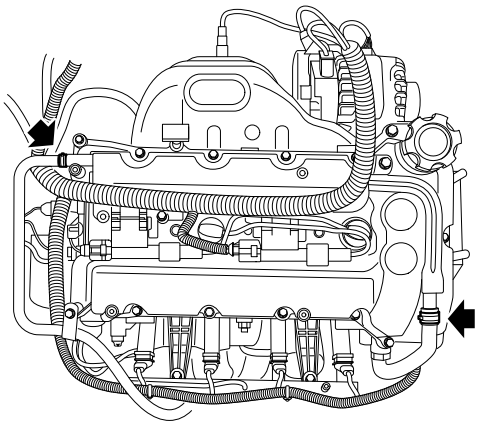


S111C402

3. Remove the high-voltage coil and coil support.

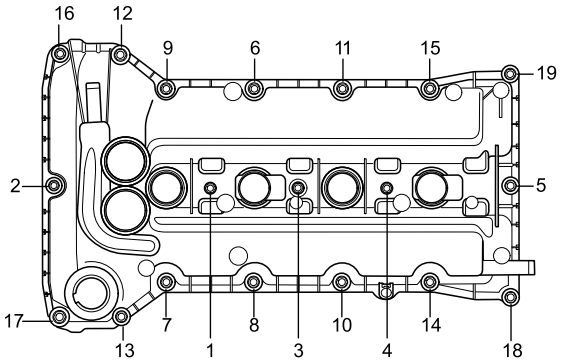
☞**Ignition Coil Remove**

4. Release full load and partial load breather tube clips.



S111C403

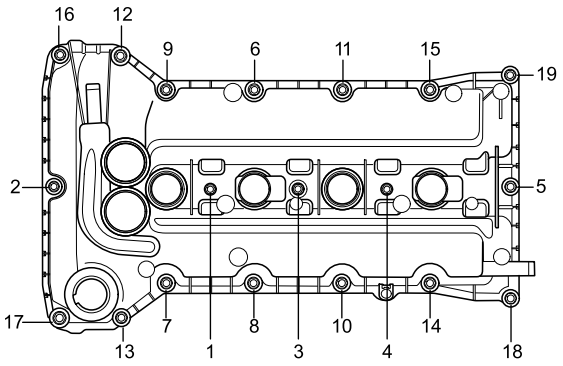
5. Remove full load and partial load breather tubes.
6. Release and remove 19 bolts securing the camshaft cover and record the original position.



7. Remove the camshaft cover. Carefully protect check valve diaphragm and keep it clean.

Refit

1. Check the upper surface of the cylinder head to avoid any damage. Clean the upper surface and remove any oil on it.
2. Gelatinize silicon glue with diameter of 4mm on the seams of the timing upper cover plate and cylinder head.
3. Place the camshaft on the cylinder head.
4. Fit the bolts and tighten them in the order as following **8–12Nm**



5. Fit high-voltage coil and high-voltage coil support, tighten the bolt to **8–12Nm**

☞**Ignition Coil Refit**

6. Fit the oil dipstick.

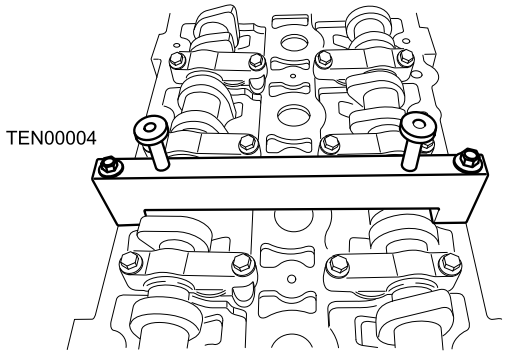
Camshaft - Intake and Exhaust

Remove

1. Disconnect the battery ground terminal.
2. Remove the camshaft cover.

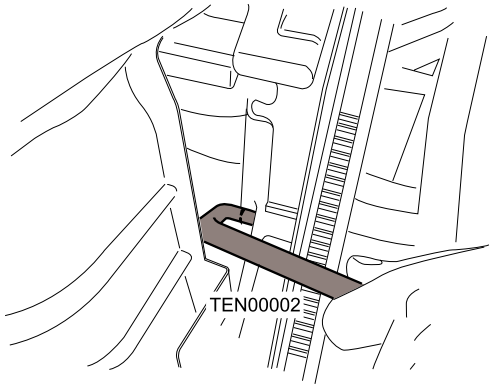
☞**Camshaft Cover Remove**

3. Remove the plug installed on the timing pin hole of the engine block.
4. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used to lock up the camshaft phase.



S111B408

5. Use the timing pin special tool**TEN00002** and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.



S111B401

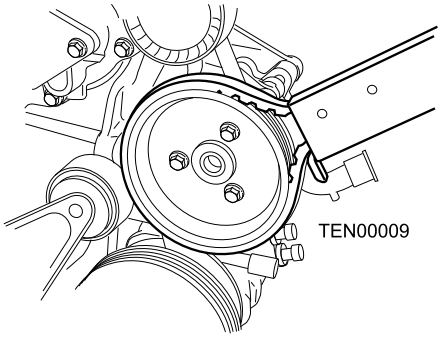
6. Remove the camshaft locking special tool **TEN00004**.
7. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

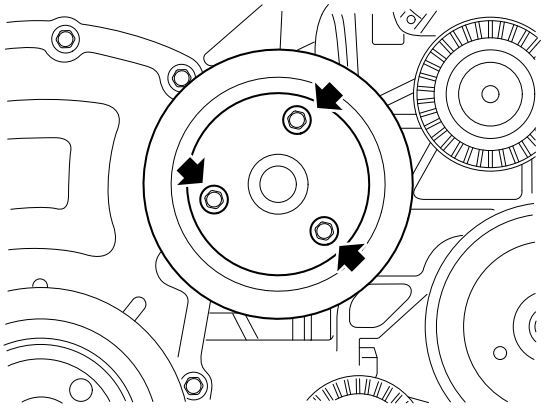
8. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

9. Use the pulley removal and installation special tool**TEN00009** to remove the water pump pulley.



S111J423



S111J404

10. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

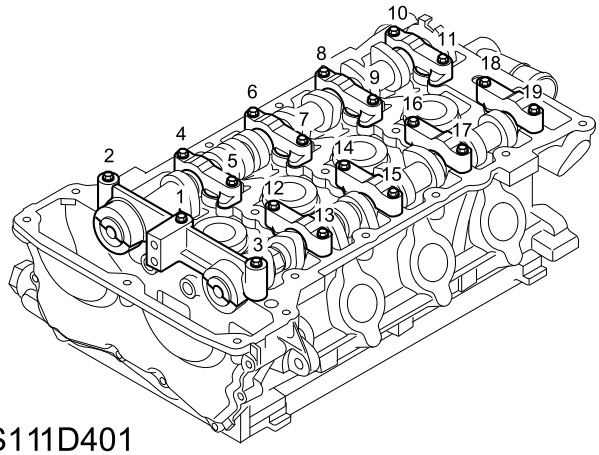
11. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

12. Remove the timing chain.

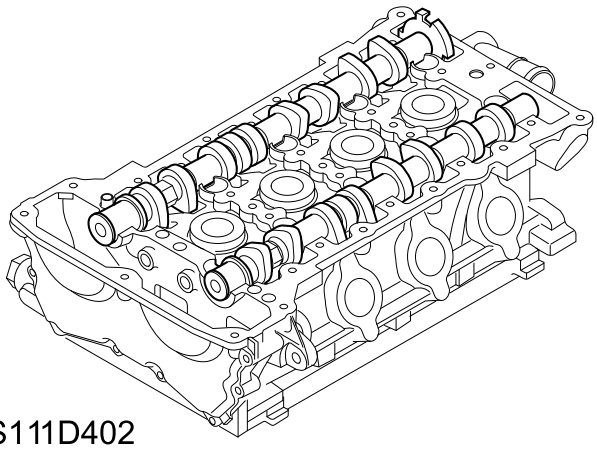
☞**Timing Chain Remove**

13. Unscrew 19 bolts successively on the camshaft bearing cap according to the order as shown until the valve spring pressure is not applied on the camshaft any more.



S111D401

14. Remove the camshaft bearing cap.
15. Take away two camshafts.



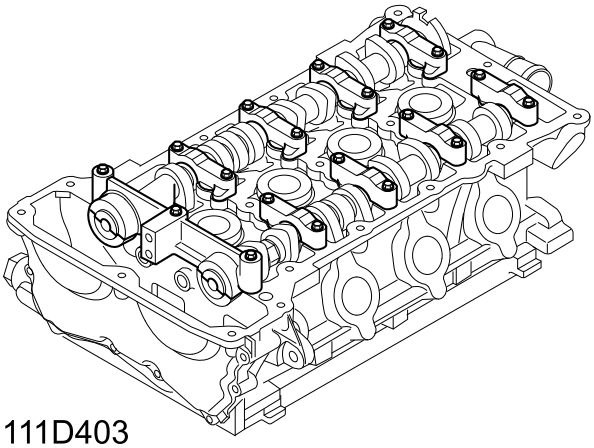
S111D402

Caution: Remove the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

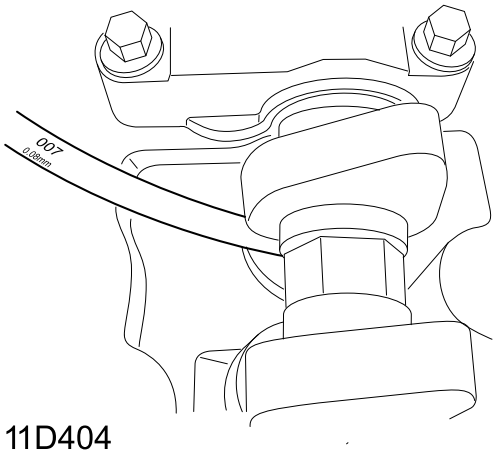
Refit

1. Clean the camshaft.
2. Clean the upper plane of the cylinder head, the top surface of the mechanical tappet and the camshaft bearing cap.
3. Coat the camshaft bearing journal, the bearing seat and the top of the tappet with oil evenly.
4. Place the camshaft into the bearing seat, Fit camshaft bearing cap, screw the camshaft bolt (do not tighten), rotate the camshaft and measure the valve clearance. The clearance at the intake side of the maintenance model is 0.11-0.19 mm; the clearance at the exhaust side is 0.20-0.28 mm. Convert the valve clearance values and calculate appropriate tappet.

Caution: Assemble the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

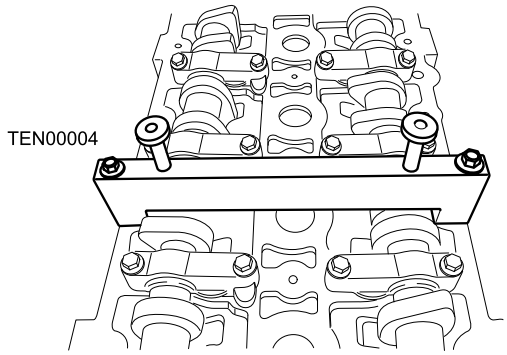


S111D403

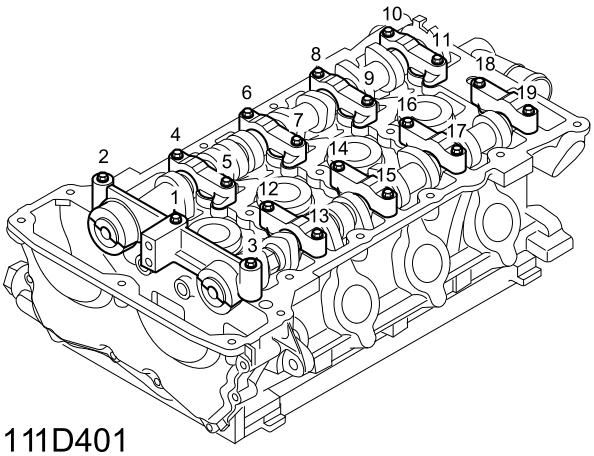


S111D404

5. Replace with appropriate mechanical tappet, place the camshaft into the bearing seat, fit the camshaft bearing cap, screw camshaft bolt (do not tighten), use the camshaft timing special tool**TEN00004** to secure intake and exhaust camshaft and tighten the camshaft bearing cap according to the order as shown, and the tightening torque is **8–12Nm**.



S111B408



S111D401

6. Fit the timing chain.

Timing Chain Refit

7. Fit the timing chain upper cover plate.

Timing Chain Upper Cover Plate Refit

8. Fit the timing chain lower cover plate.

Timing Chain Lower Cover Plate Refit

9. Fit the water pump pulley.
10. Fit the crankshaft pulley.

Crankshaft Pulley Refit

11. Fit the accessory drive belt.

Accessory Drive Belt Refit

12. Remove the flywheel timing pin special tool **TEN00002**.
13. Fit the plug.
14. Remove the timing special tool **TEN00004**.
15. Fit the camshaft cover.

Camshaft Cover Refit

16. Connect the battery ground terminal.

Mechanical Tappet

Remove

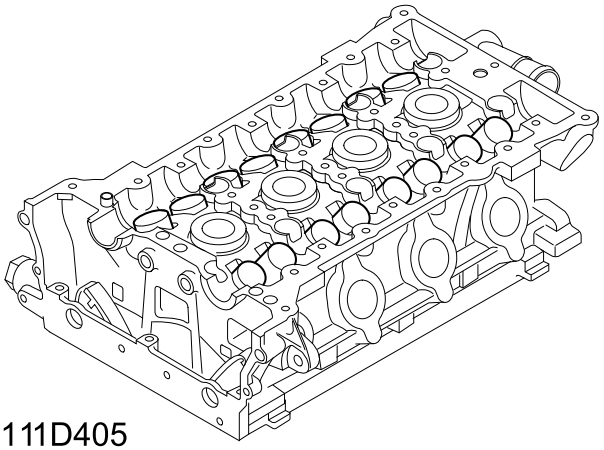
1. Disconnect the battery ground terminal.
2. Remove the camshaft cover.

☞**Camshaft Cover Remove**

3. Remove the camshaft - intake and exhaust.

☞**Camshaft – Intake and Exhaust Remove**

4. Take away the mechanical tappet carefully with an magnet and put the mechanical tappet aside.



S111D405

Refit

1. Clean the tappet hole.
2. Lubricate the standard tappet (Group H), fit the standard tappet into the tappet hole, and fit the camshaft, select and match tappet group according to the valve clearance.
3. Assemble the selected tappet group (see the Parts Manual for the tappet group).
4. Fit the camshaft - intake and exhaust.

☞**Camshaft – Intake and Exhaust Refit**

5. Fit the camshaft cover.

☞**Camshaft Cover Refit**

6. Connect the battery ground terminal.

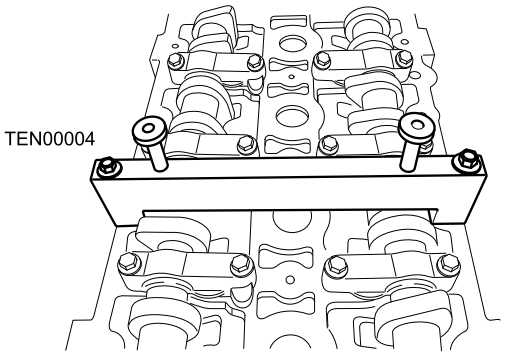
Valve Removal and Installation

Remove

1. Disconnect the battery ground terminal.
2. Remove the camshaft cover.

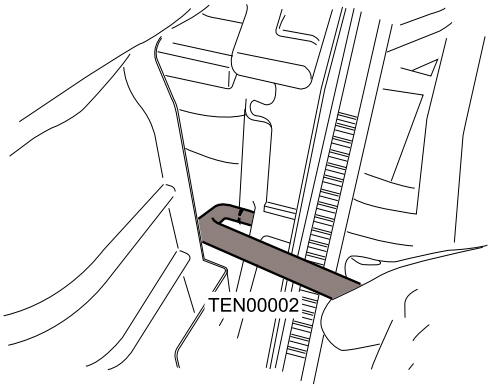
☞**Camshaft Cover Remove**

3. Remove the plug installed on the timing pin hole of the engine block.
4. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used to lock up the camshaft phase.



S111B408

5. Insert the flywheel timing pin special tool**TEN00002** into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.



S111B401

6. Remove the camshaft locking special tool **TEN00004**.
7. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

8. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

9. Remove the water pump pulley.
10. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

11. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

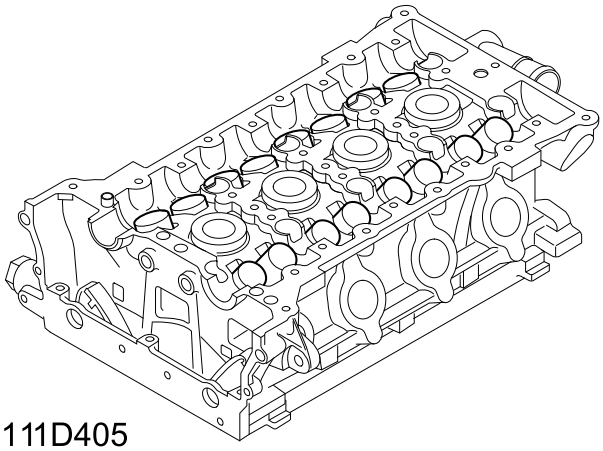
12. Remove the timing chain.

☞**Timing Chain**

13. Remove the camshaft - intake and exhaust.

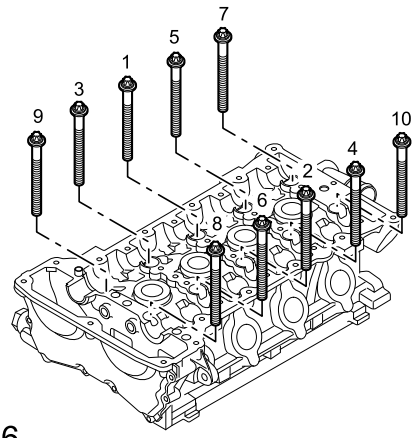
☞**Camshaft – Intake and Exhaust Remove**

14. Take away 16 mechanical tappets carefully with an magnet and put them aside.



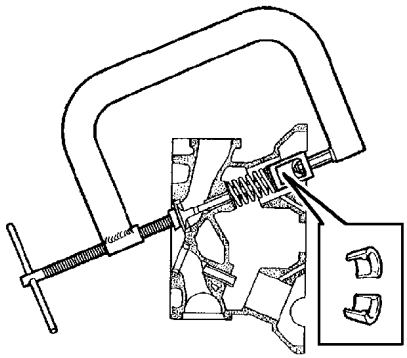
S111D405

15. Remove the cylinder head bolts one after another according to the order as shown and take down the cylinder head.



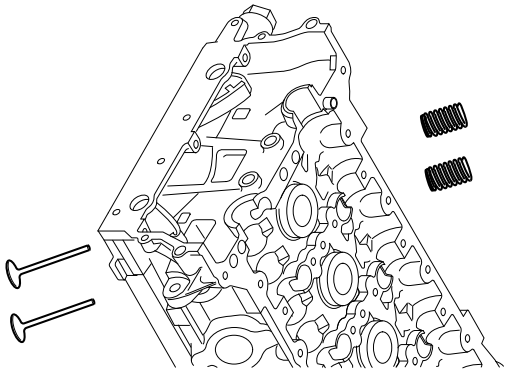
S111D406

16. Use the special tool**T10005** to compress the valve spring.



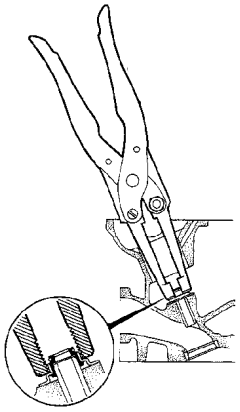
S111D407

17. Take away the valve clip and loosen the valve spring.
18. Take away the special tool **T10005**.
19. Remove the valve spring, the valve spring seat and the valve.



S111D408

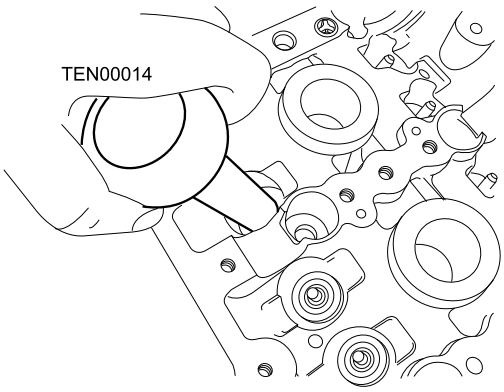
20. Use the special tool**T10006** to take away the valve oil seal.



S111D409

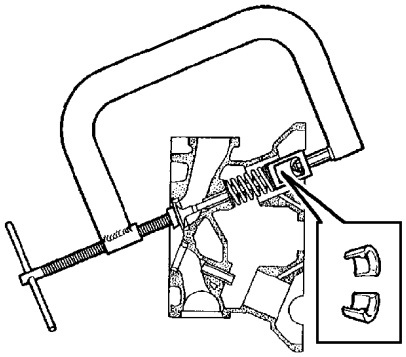
Refit

1. Remove the carbon deposition from the valve guide, valve, valve seat ring and the surface of the combustion chamber.
2. Check the existing valve stem diameter. Check the valve guide with new valve clearance.
3. If it needs to be reused, please check the condition of the valve seat and valve.
4. Check the valve stem mating height.
5. Check the state of the valve spring.
6. Make sure the mechanical tappet, valve, valve spring, spring cup and the lock clip are clean.
7. Lubricate the valve and valve stem oil seal.
8. Use the special tool**TEN00014** to fit the valve stem oil seal on the valve guide.



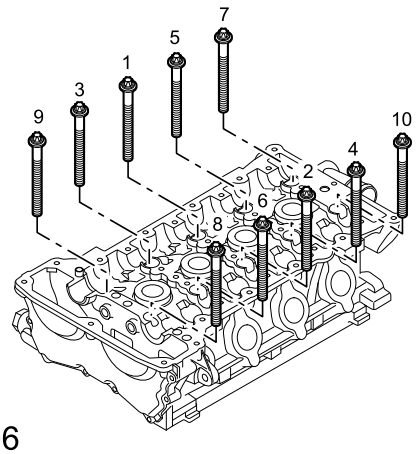
S111D424

9. fit the valve, the spring and the spring cup, and use the special tool**T10005** to compress the valve spring and fit the clip.

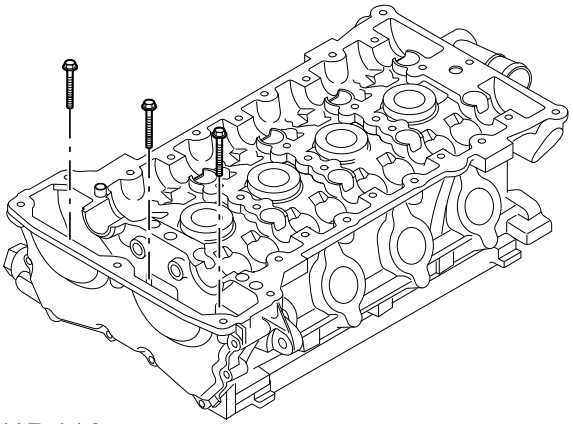


S111D407

10. Loosen the valve spring and take away the tool **T10005**.
11. Place the cylinder head on the cylinder block which is already equipped with the cylinder shim. Carefully put in 10 cylinder head bolts and 3 chain case bolts.



S111D406



S111D410

12. Tighten the cylinder head bolts according to the order as shown, the torque is **(30±2)Nm+90°+(90°+45°)±2°**, tighten the chain case bolts, and the torque is **10–12Nm**.
13. Lubricate the tappet and the tappet hole, and then fit the tappet into the hole.
14. Clean the upper mating surface of the camshaft and the cylinder head.
15. Lubricate the camshaft journal and bearing seat.
16. fit the camshaft - intake and exhaust.

☞**Camshaft – Intake and Exhaust Refit**

17. fit the timing chain.

☞**Timing Chain Refit**

18. fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

19. fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

20. fit the water pump pulley.
21. fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

22. fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

23. Remove the flywheel timing pin special tool **TEN00002**.
24. fit the plug.
25. Remove the timing special tool **TEN00004**.
26. fit the camshaft cover.

☞**Camshaft Cover Refit**

27. Connect battery earth lead.

Cylinder Head Assembly

Remove

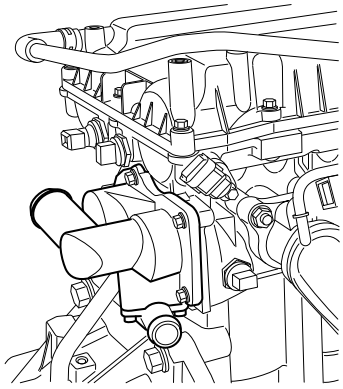
1. Disconnect battery earth lead.
2. Remove the generator.

☞Generator Remove

3. Remove the exhaust manifold and discard the exhaust manifold gasket.

☞Exhaust Manifold Remove

4. Unscrew the bolt securing the thermostat assembly to the cylinder head, and take away the thermostat assembly.

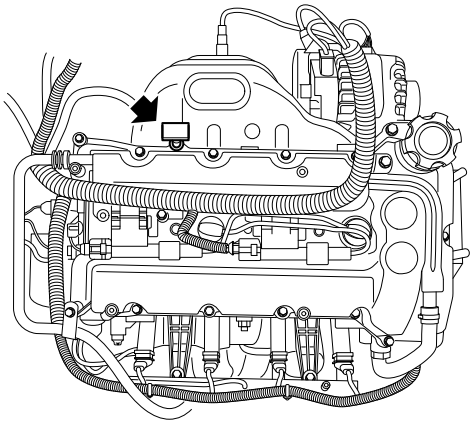


S111D411

5. Remove any dirts in the spark plug gap.
6. Remove the spark plug.

☞Spark Plug Remove

7. Remove the oil dipstick.



S111C401

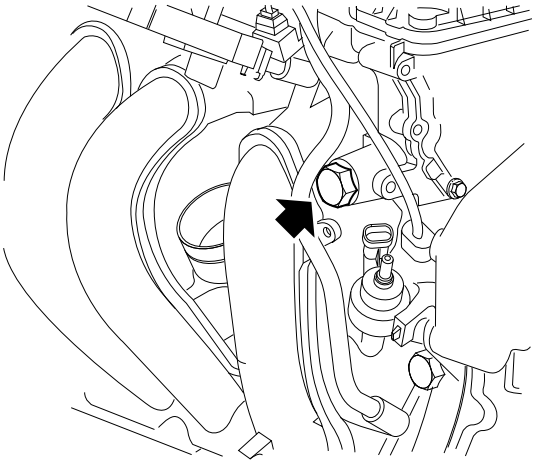
8. Remove the camshaft cover.

☞Camshaft Cover Remove

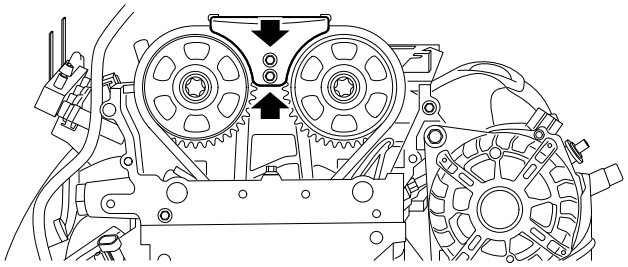
9. Remove the timing chain upper cover plate.

☞Timing Chain Upper Cover Plate Remove

10. Remove the timing chain tensioner.



11. Remove the upper guide rail.

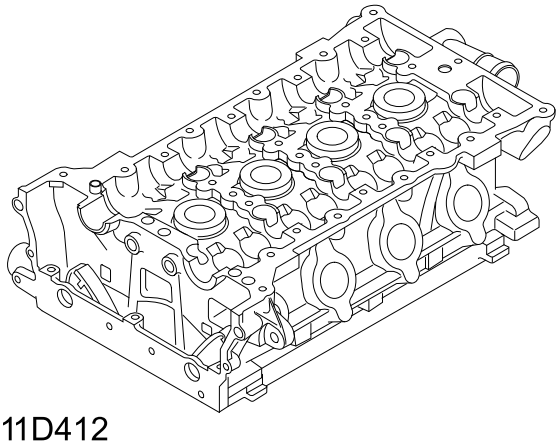


S111J413Z

12. Take out the chain and put it aside.

☞Timing Chain Remove

13. Remove the cylinder head assembly and discard the cylinder head shim at the same time.



S111D412

14. Remove the intake and exhaust camshafts.

☞Camshaft – Intake or Exhaust Remove

15. Remove the tappet.

☞Mechanical Tappet Remove

16. Remove the intake and exhaust valves.

☞Valve Remove

Refit

1. Clean the sealing area between the cylinder head and the timing chain upper cover plate. Use the foam remover and the plastic scraper.

Caution: Don't use scraper to deal with sealed surface.

2. Dry the oil passages and coolant passages with air.
3. Fit the intake and exhaust valves.

☞**Valve Refit**

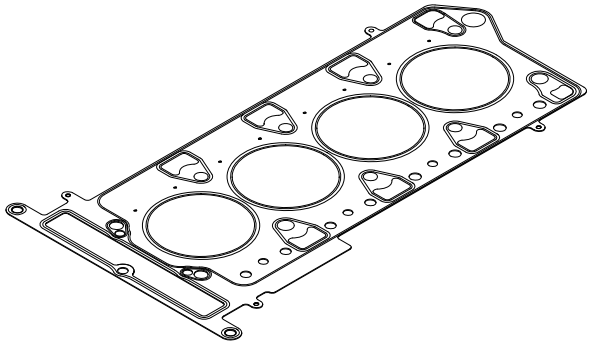
4. Fit the mechanical tappet.

☞**Mechanical Tappet Refit**

5. Fit the intake and exhaust camshafts.

☞**Camshaft - Intake or Exhaust Refit**

6. Replace the new cylinder gasket.

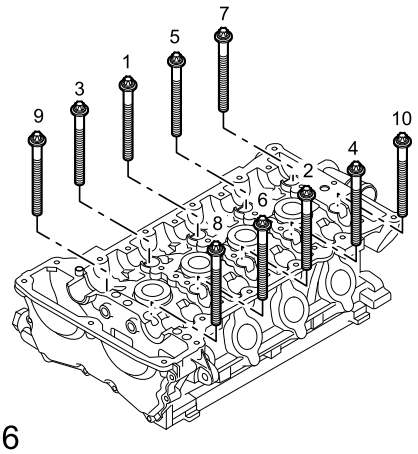


S111D413

7. Put the cylinder head on the engine block, and then tighten with bolt.

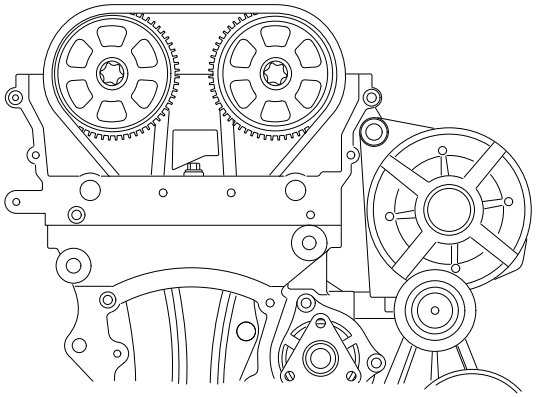
Warning: The cylinder head bolts cannot be lubricated by lubricants.

8. Tighten 10 cylinder head bolts according to the order as shown with special socket (torque: **(30±2)Nm+90°+(90°+45°)±2°**) , then tighten the three bolts near the chain case (torque: **10–12Nm**).



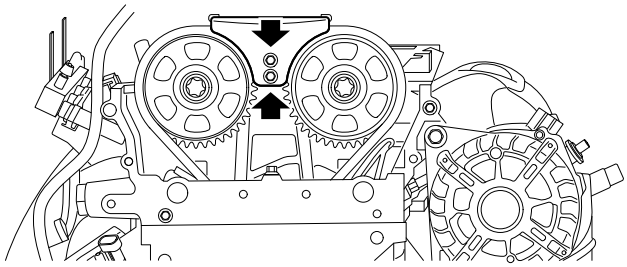
S111D406

9. Fit the intake camshaft sprocket and exhaust camshaft sprocket on the corresponding camshaft, then fit bolts but do not tighten them. Then make the chain mesh with the sprocket teeth.



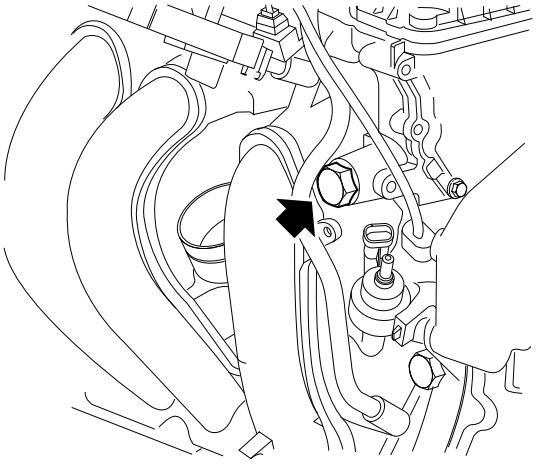
S111D414

10. Tighten the intake and exhaust sprocket bolts (sprocket bolts:**(25±3)Nm+45°±2°**.
11. Fit sprocket upper guide rail on the camshaft front bearing cap, fit and tighten two bolts, the torque is **8–12Nm**.



S111J413Z

12. Fit the timing chain tensioner, and the torque is **77-83Nm**.



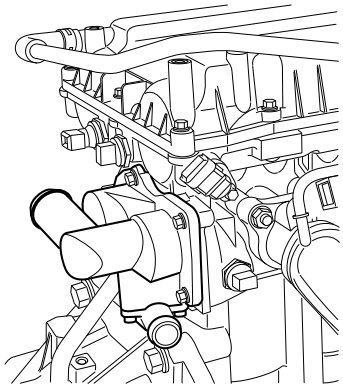
13. Fit the timing chain upper cover plate, and the torque is **8–12Nm**.

☞**Timing Chain Upper Cover Plate Refit**

14. Fit the camshaft cover assembly, and the torque is **8–12Nm**.

☞**Camshaft Cover Refit**

15. Insert the oil dipstick into the dipstick hole.
16. Fit the thermostat housing and tighten it to **8–12Nm**.



S111D411

17. Fit the intake manifold.

☞**Intake Manifold Refit**

18. Fit exhaust manifold and new gasket.

☞**Exhaust Manifold Refit**

19. Fit the generator, and the torque is: **40–50Nm**.

☞**Generator Refit**

20. Fit the spark plug, and the torque is **20–30Nm**.

☞**Spark Plug Refit**

21. Connect battery earth lead.

Cylinder Head Inspection

Remove

1. Disconnect battery earth lead.
2. Remove the generator.

☞**Generator Remove**

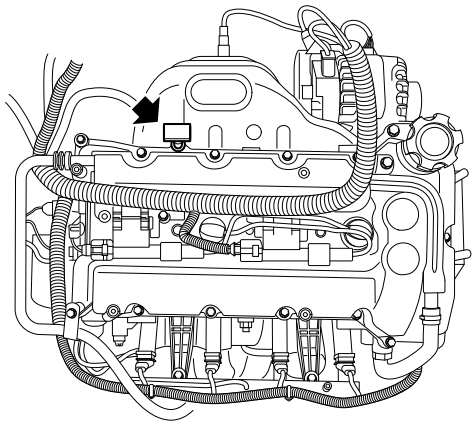
3. Remove the exhaust manifold and discard the exhaust manifold gasket.

☞**Exhaust Manifold Remove**

4. Unscrew the bolt securing the thermostat assembly to the cylinder head, and transfer the thermostat assembly.
5. Remove any dirt in the spark plug gap.
6. Remove the spark plug.

☞**Spark Plug Remove**

7. Remove the oil dipstick.



S111C401

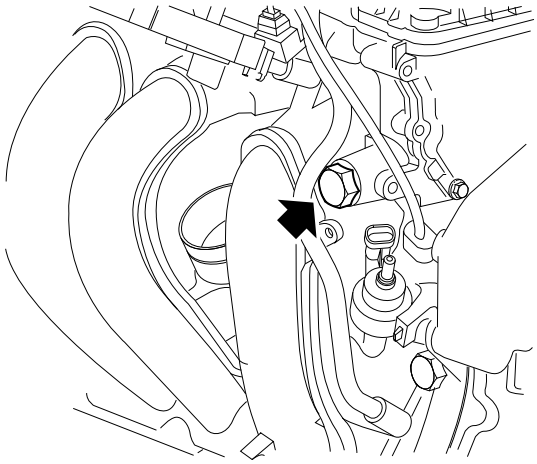
8. Remove the camshaft cover.

☞**Camshaft Cover Remove**

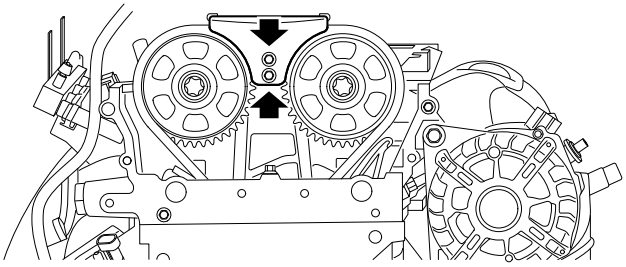
9. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

10. Remove the timing chain tensioner.



11. Unscrew the bolt securing the sprocket upper guide rail and take down sprocket upper guide rail.

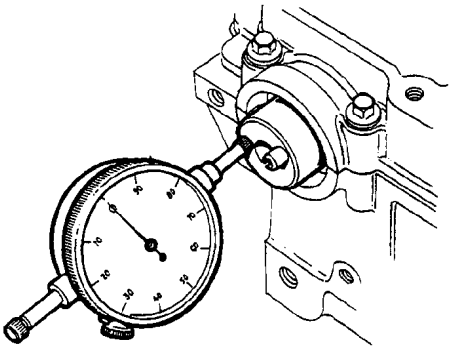


S111J413Z

12. Remove the chain and put it aside.
13. Remove the cylinder head assembly and discard the cylinder head shim at the same time.

☞**Cylinder Head Assembly Remove**

14. Check the camshaft end floating quantity with dial indicator.

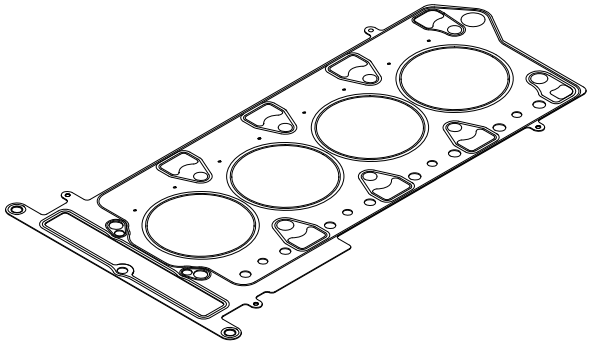


S111D415

15. If the end floating quantity exceeds the tolerance, replace the new camshaft and recheck. If the end floating quantity still exceeds the tolerance, please replace cylinder head assembly.

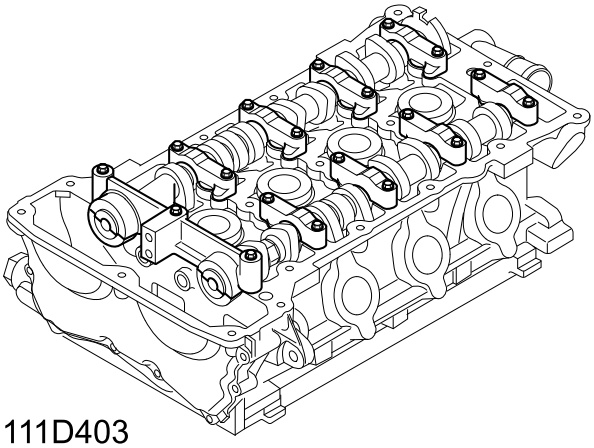
Camshaft Axial Clearance:	0.060.19 mm
Service Limited Value	0.30 mm

16. Loosen the cylinder head bolts one after another, take out the cylinder head assembly and put the cylinder head on the wooden frame. Carefully protect fire face to avoid scratch.
17. Remove the cylinder head gasket and discard it.



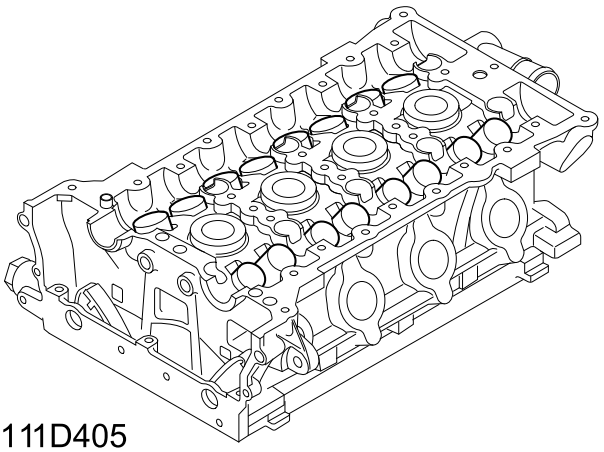
S111D413

18. Loosen the bolt securing camshaft bearing cap, identify the location of every camshaft bearing cap and take them down.



S111D403

19. Identify each camshaft's position and take them out.
20. Remove 16 mechanical tappets from the cylinder head and place them in order to avoid confusion.

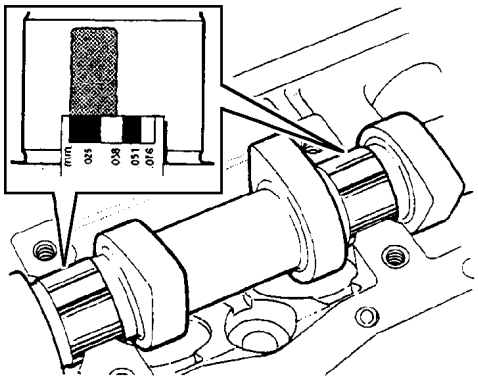


S111D405

21. Measure the outer diameter of each mechanical tappet.
22. Clean the camshaft, camshaft bearing cap and cylinder head bearing seat.
23. Inspect the camshaft and replace it if it has scratch, pit or is overworn.
24. Secure the camshaft on the cylinder head and place plastic gauge on every shaft diameter, then install the

camshaft bearing cap and do not rotate the camshaft.

25. Slowly loosen the camshaft bearing cap bolt and transfer the camshaft bearing cap.



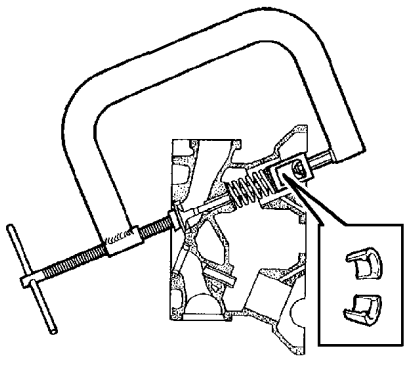
S111D416

26. Measure the widest section of the plastic gauge on every shaft neck. If the clearance exceeds the tolerance, replace with a new camshaft and recheck. If the clearance still exceeds the tolerance, please replace with a new cylinder head assembly.

	Bearing Clearance	Service Clearance
Former one	0.0250.066 mm	0.1 mm
Latter four	0.0240.066 mm	0.1 mm

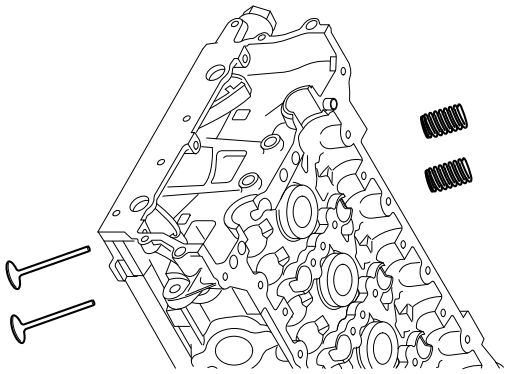
27. Support the exhaust manifold surface of the cylinder head with wood block and at this place remove the intake valve.

28. Using the special tool **T10005**, compress the valve spring, take away 2 clips from the valve, loosen the valve spring and take away the tool.



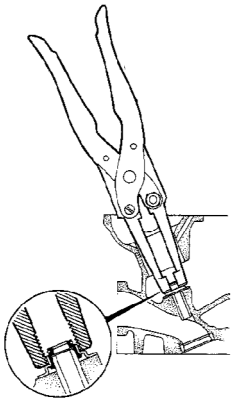
S111D407

29. Take out the remaining valve spring seats, valve spring and valves, and place them well in orignial order.



S111D408

30. Using the special tool **T10006**, take down the valve oil seal.

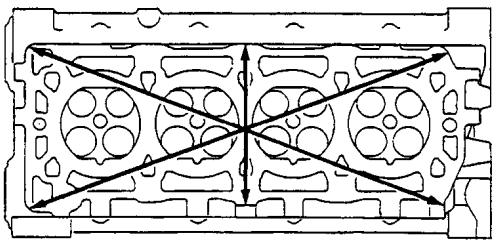


S111D409

31. Clean each mating surface of the cylinder head.

32. Inspect the cylinder head for damange, especially the fire face of the cylinder head.

33. Inspect the cylinder head fire face for any scratch. Check it crosswise according to the method as shown or from one corner to another.

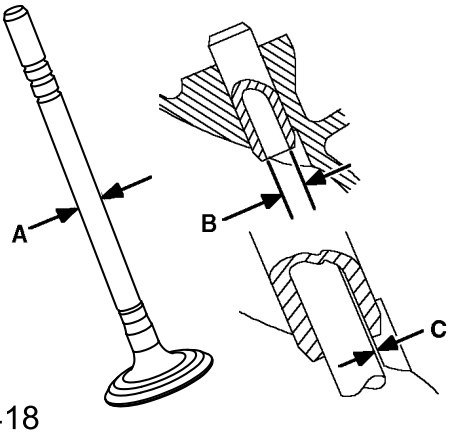


S111D417

34. Check the height of the cylinder head. The cylinder head surface can be repaired, and max repairable length is 0.20 mm.

Cylinder Head Height	
New	118.95119.05 mm
Refinishing Limited Value	0.20 mm

35. Remove the deposited carbon from the valve, valve guide, valve seat, and the surface of the combustion chamber.

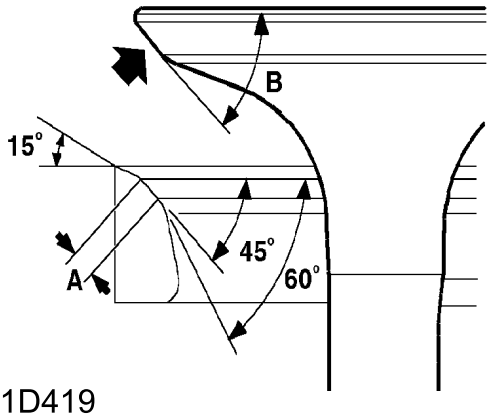


S111D418

36. Check the diameter of the existing valve stem. Inspect the valve guide clearance with new valve. If necessary, replace a new valve. If the valve guide has to be replaced, then replace a cylinder head assembly.

☞**Parameter**

37. If the cylinder head needs to be reused, please check the condition of the valve seat and valve.



S111D419

38. Process the angle of the valve surface and the valve seat to the following standard:

Valve Seat:	
Angle	45°
Width A:	
Intake	1.2 mm
Exhaust	1.6 mm
angle B of the valve surface:	
Intake	45°
Exhaust	45°

39. Push the valve to the valve seat with even grinding glue.
40. Apply prussian blue on the valve seat, put in the valve and compress the valve in place without any rotation. Take away it and check the degree of uniformity and the seat's centering. The seat's position shown by the blue must be in the center of the valve surface.
41. Apply the valve seat and recheck.
42. Inspect the mating height of the valve stem. If it exceeds the limit, the cylinder head assembly needs to be replaced.

☞**Parameter**

43. Inspect the condition of the valve spring. If it exceeds the limit, the valve spring needs to be replaced.

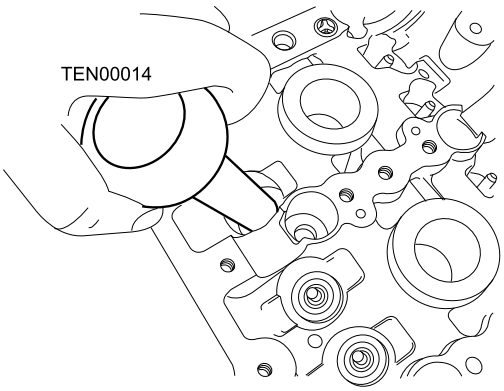
☞**Parameter**

Refit

1. Clean the sealing area between the cylinder head and the timing chain upper cover plate. Clean the contact surface between the camshaft cover, intake and exhaust manifolds with foam remover and plastic scraper.

Caution: Don't use scraper to deal with sealed surface.

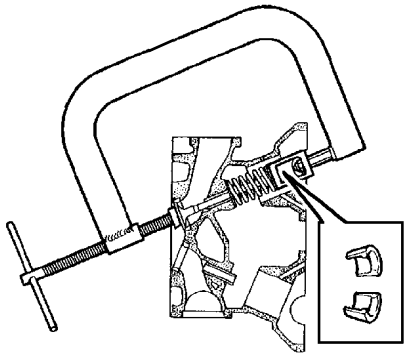
2. Dry the oil passages and coolant passages with air.
3. Using **TEN00014**, fit the new valve stem oil seal.



S111D424

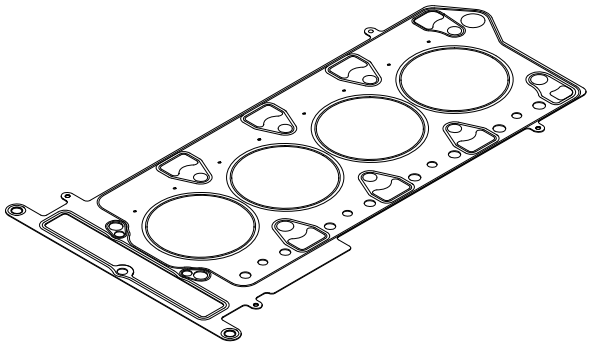
4. Lubricate the valve stem and valve assembly, using the tool**T10005** to compress the valve spring. fit the intake and exhaust valves, the valve spring, the valve

spring seat and valve clip.



S111D407

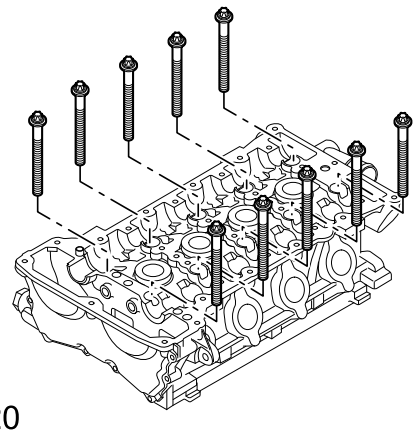
5. fit the new cylinder washer.



S111D413

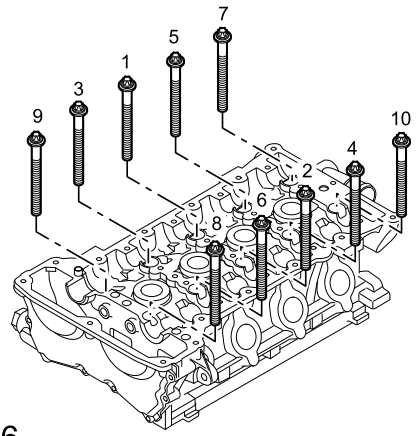
6. Put the cylinder head onto the engine block, and then tighten it with bolt.

Warning: The cylinder head bolts cannot be lubricated by lubricants.

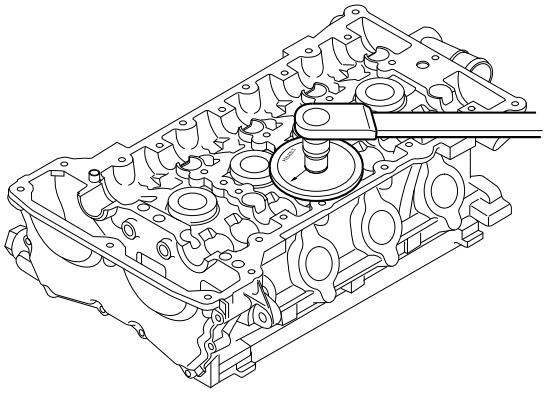


S111D420

7. Tighten 10 cylinder head bolts according to the order as shown with special socket (the torque is: **(30±2)Nm+90°+(90°+45°)±2°**) , then tighten three bolts near the chain case (the torque is: **10–12Nm**.

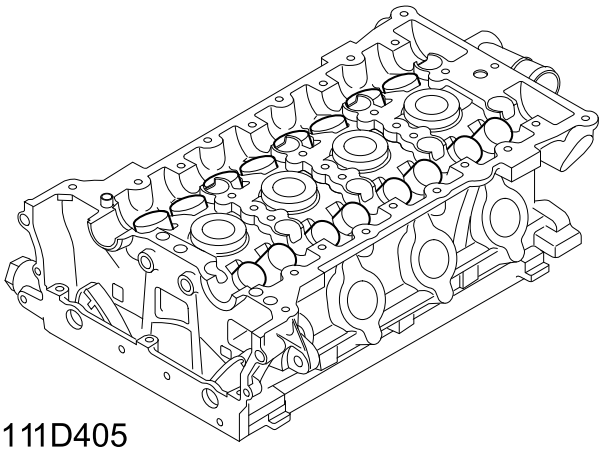


S111D406



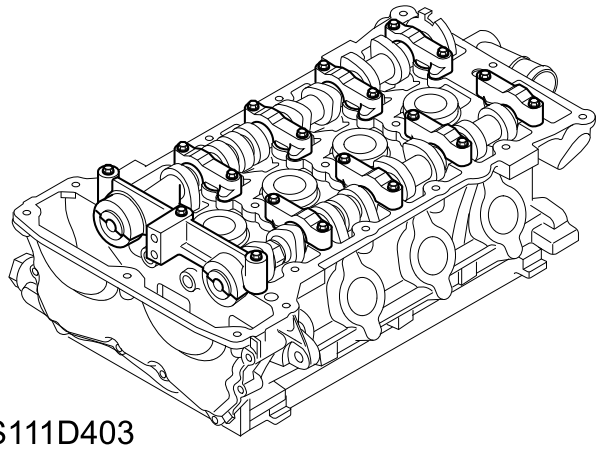
S111D421

8. Lubricate mechanical tappet exterior and intall the mechanical tappet onto the original position.

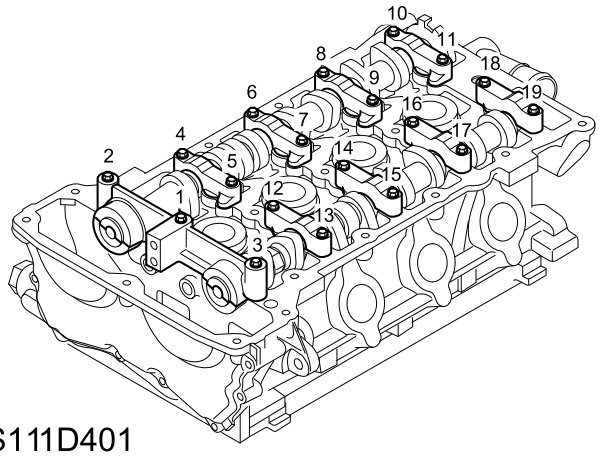


S111D405

9. Lubricate the camshaft bearing surface, and put the camshaft onto the cylinder head. Then shut the camshaft bearing cover according to the right position, and tighten it with bolt.

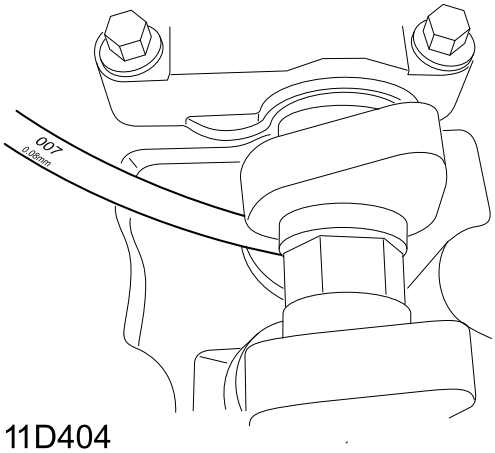


S111D403



S111D401

10. Measure the clearance of each mecahnical tappet. Method: Rotate the camshaft so that its base circle is above the mechanical tappet, and then measure the clearance of camshaft and mechanical tappet, record the clearance. Repeat the operation above for each mechanical tappet. Calculate the clearance, select appropriate mechanical tappets to make the clearance is right. Clearance at the intake side: 0.11-0.19 mm, clearance at the exhaust side: 0.20-0.28 mm.

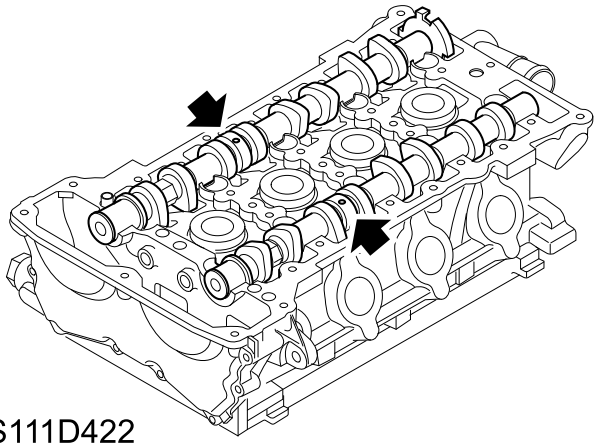


S111D404

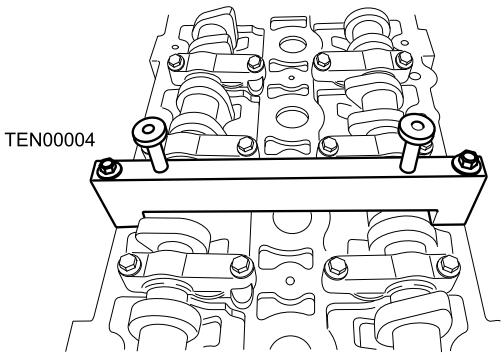
11. Take out the camshaft, fit mechanical tappet with correct size in the corresponding mechanical tappet, fit the camshaft according to the previous method and check the clearance.
12. Tighten the bolt securing the bearing according to the order as shown, the torque is **8–12Nm**, rotate the camshaft twice after tightened, then measure the rotating torque.

Caution: rotation is necessary.

13. Add clean oil at the meachanical tappet. Rotate the camshaft to make its timing hole upwards, then using the camshaft timing special tool**TEN00004** Secure the camshaft, adjust the camshaft position to make it at 90 degrees before the cylinder TDC. Then use the flywheel timing pin special tool **TEN00002**, and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.

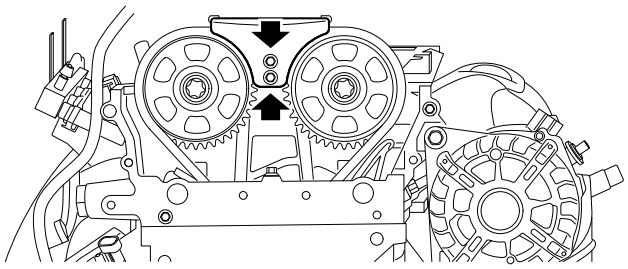


S111D422



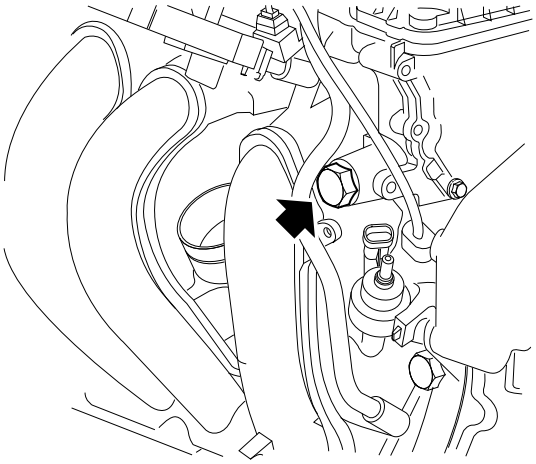
S111B408

14. Tighten the intake camshaft sprocket and exhaust camshaft sprocket bolts (sprocket bolt:**(25±3)Nm+45°±2°**.
15. fit the sprocket upper guide rail on the camshaft front bearing cap, fit two bolts and tighten to **8–12Nm**.



S111J413Z

16. fit the timing chain tensioner on the cylinder head and tighten to **77-83Nm**.



17. fit the timing chain upper cover plate, and tighten to **8–12Nm**.

☞**Timing Chain Upper Cover Plate Refit**

18. fit the camshaft cover assembly, and tighten to **8–12Nm**.

☞**Camshaft Cover Refit**

19. Insert the oil dipstick into the dipstick hole.
20. fit the thermostat housing and tighten to **8–12Nm**.
21. fit the intake manifold.

☞**Intake Manifold Refit**

22. fit the exhaust manifold and the new exhaust manifold gasket.

☞**Exhaust Manifold Refit**

23. fit the generator, and the torque is: **40–50Nm**.

☞**Generator Refit**

24. fit the spark plug, and the torque is **20–30Nm**.

☞**Spark Plug Refit**

25. Connect the battery ground terminal.

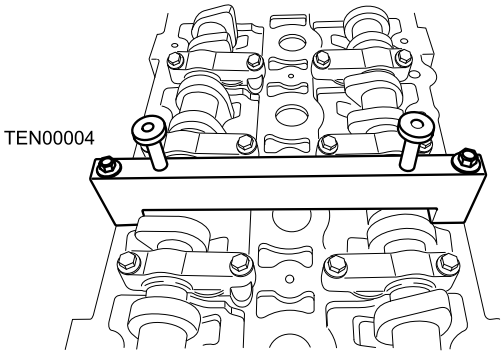
Cylinder Gasket

Remove

1. Disconnect battery earth lead.
2. Remove the camshaft cover.

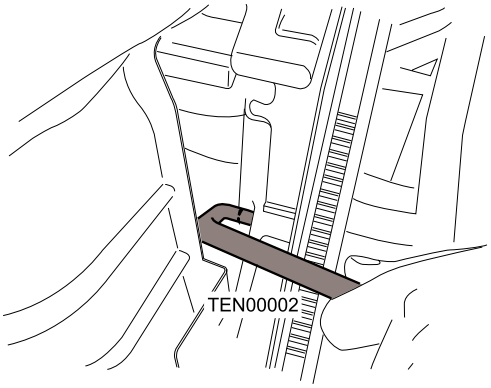
☞**Camshaft Cover Remove**

3. Remove the plug installed on the timing pin hole of the engine block.
4. Rotate the crankshaft until the camshaft locking special tool**TEN00004** can be used to lock up the camshaft phase.



S111B408

5. Use the timing pin special tool**TEN00002** and insert it into the engine block timing pin hole and flywheel pin hole to lock up the flywheel.



S111B401

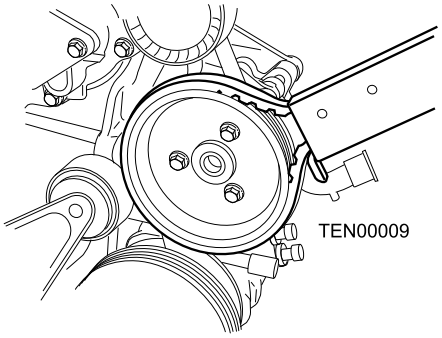
6. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

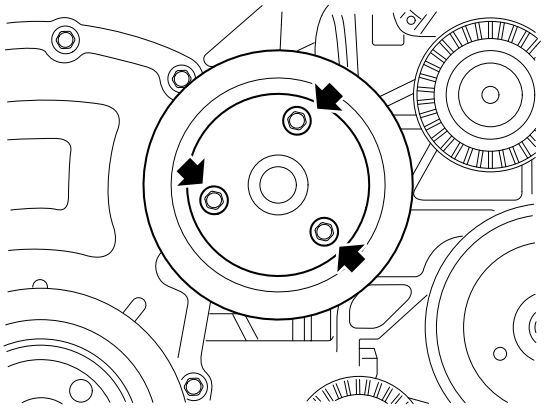
7. Remove the crankshaft pulley.

☞**Crankshaft Pulley Remove**

8. Use the pulley removal and installation special tool**TEN00009** to remove the water pump pulley.



S111J423



S111J404

9. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

10. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

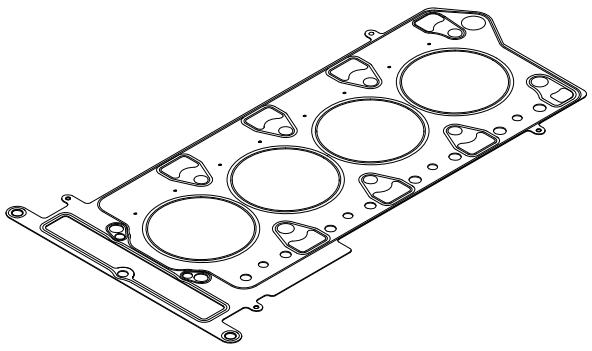
11. Remove the timing chain.

☞**Timing Chain Remove**

12. Remove the cylinder head assembly.

☞**Cylinder Head Remove**

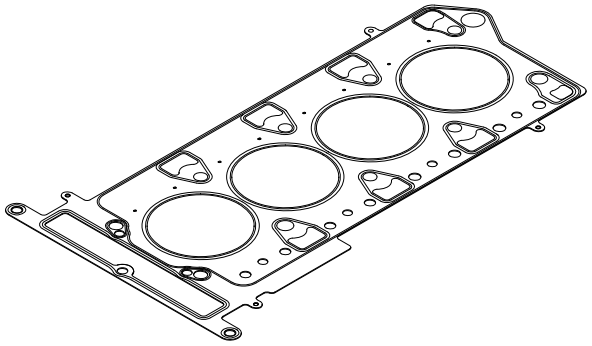
13. remove and discard the cylinder head gasket from the cylinder block.



S111D413

Refit

1. Clean the mating surface of the cylinder head and the cylinder block.
2. Check the cylinder head surface for any scratch.
3. Check the cylinder head height.
4. Clean the passage of the oil and coolant.
5. Clean and dry the cylinder head bolt and check the thread for damage.
6. Apply a layer of film on the thread of the cylinder head bolt with oil.
7. Fit the new and clean cylinder head gasket on the cylinder block.



S111D413

8. Fit the cylinder head assembly.

☞**Cylinder Head Assembly Refit**

9. Fit the timing chain.

☞**Timing Chain Refit**

10. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

11. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

12. Fit the water pump pulley.
13. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

14. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

15. Remove the flywheel timing pin special tool **TEN00002**
16. Fit the plug.
17. Fit the camshaft cover.

☞**Camshaft Cover Refit**

18. Connect battery earth lead.

Lower Crankcase

Remove

1. Disconnect battery earth lead.
2. Lift up the front of the vehicle.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

3. Drain the engine oil.
4. Remove the oil filter.

☞Oil Filter Remove

5. Remove the exhaust front pipe assembly.

☞Exhaust Front Pipe Assembly Remove

6. Remove the accessory drive belt.

☞Accessory Drive Belt Remove

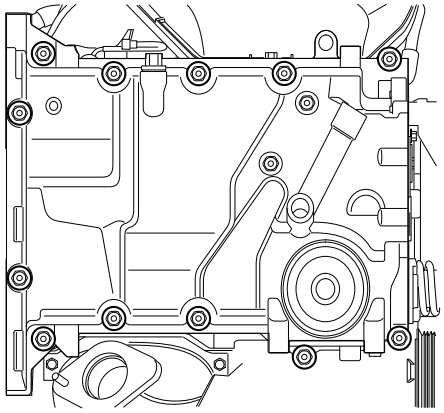
7. Remove the crankshaft rear oil seal cover plate.

☞Crankshaft Rear Oil Seal Remove

8. Remove the timing chain lower cover plate.

☞Timing Chain Lower Cover Plate Remove

9. Loosen the oil pump chain.
10. Unscrew all the lower crankcase to the engine block fastening bolts.



S111I401

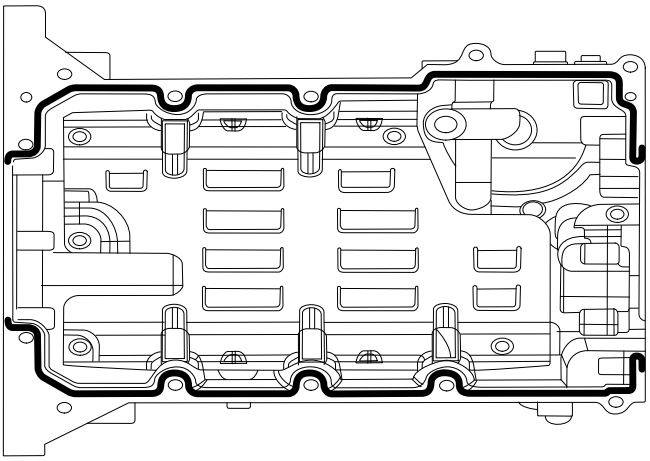
11. Remove the lower crankcase.

Refit

1. Make sure that the mating surface of the lower crankcase and the engine block is clean.
2. Put the oil pump chain on.
3. Fit the crankshaft rear oil seal cover plate.

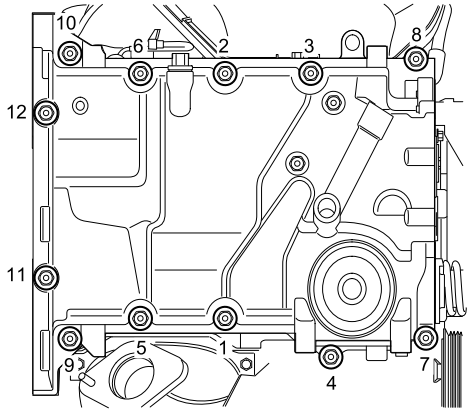
☞Crankshaft Rear Oil Seal Refit

4. Please apply the sealant recommended by SAIC Motor on the mating surface of the lower crankcase and then fit.



Caution: When fitting the lower crankcase, try to make the lower crankcase close to the flywheel end as near as possible to avoid creating a gap when connecting the lower crankcase and the transmission case.

5. Tighten the lower crankcase bolts one after another according to the order as shown to **22–30Nm**.



S111I402

6. Fit the timing chain lower cover plate.

☞Timing Chain Lower Cover Plate Refit

7. Fit the accessory drive belt.

☞Accessory Drive Belt Refit

8. Fit exhaust front pipe assembly.

☞Exhaust Front Pipe Assembly Refit

9. Take away the support and lower the vehicle.
10. Fit the new oil filter.

☞Oil Filter Refit

11. Fill the oil.
12. Connect battery earth lead.

Connecting Rod Bearing Inspection

Remove

1. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

2. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

3. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

4. Remove the timing chain.

☞**Timing Chain Remove**

5. Cylinder Head Assembly.

☞**Cylinder Head Remove**

6. Remove the engine flywheel or torque converter drive plate.

☞**Flywheel Remove**

7. Remove the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Remove**

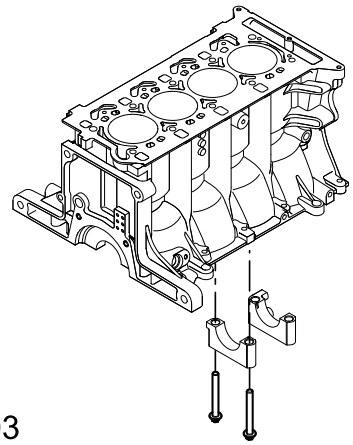
8. Remove the lower crankcase assembly.

☞**Lower Crankcase Remove**

9. Install the crankshaft pulley bolt and tighten slightly the pulley bolts.
10. Mark the order of assembling the connecting rod at the connecting rod larger end.

Caution: Keep bearing caps, bearings and bolts in their fitted order.

11. Rotate crankshaft pulley bolt and the crankshaft to make the connecting rod bolts are in a position convenient to remove.
12. Unscrew the connecting rod bolt and remove the connecting rod lower end cover (connecting rod large end cover).

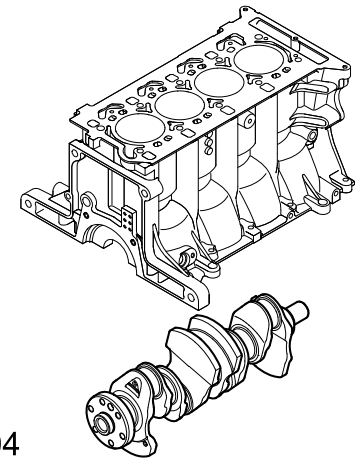


S111A403

13. Remove the connecting rod shell from the connecting rod lower end cover (connecting rod large end cover).
14. Slightly push the piston connecting rod assembly out of the cylinder hole from the fire face with plastic or wooden rod and remove the remaining connecting rod bearing.

Caution: When fitting the piston, DO NOT scratch the cylinder liner with the connecting rod fracture.

15. Unscrew the main bearing cap bolt and remove the main bearing cap. And remove the main bearing from the bearing seat.
16. Remove the crankshaft.



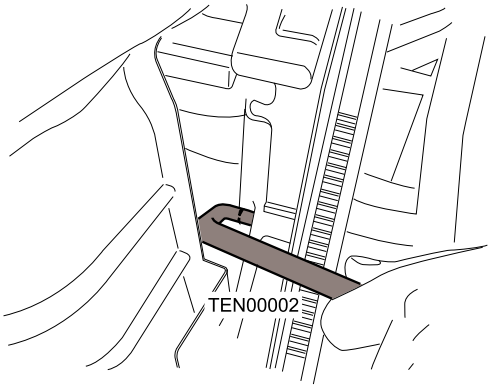
S111A404

17. Remove 2 thrust washers from the fifth main bearing.
18. Remove the main bearing from the cylinder.

Refit

1. Clean the mating surface between the cylinder block and the bearing seat.
2. Clean the pin and the pin hole.
3. Clean the bearing in the cylinder block and the fixed position of the thrust washer.
4. Clean the bearing fixed position on the bearing seat.
5. Clean the bearing fixed position on the connecting rod and the cap.
6. Clean the crankshaft and check for any damage.
7. Make the two connecting rod bearing aimed at the slip groove and compress them into the connecting rod big hole respectively. Ensure that end face of the bearing and expansion face of the big hole are in the same plane as much as possible.

Caution: The connecting rod bearings are not grouped.



S111B401

Caution: Record the main bearing mark number on the front of the crankshaft.

8. Inspect the diameter of the crankshaft main bearing journal.

☞**Parameter**

9. According to the selected size and model, determine the appropriate main bearing to be fited.

☞**Parameter**

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

10. Main bearing selecting and matching rules: upper shells are grouped according to the engine block size (A is blue, B is red).
11. Lower shells are grouped according to the crankshaft size (1 is blue, 0 is red).
12. Clean the sealing surface of the cylinder block and bearing seat with a cloth without burr and suitable solvent.

Tip: Please use SAIC MOTOR recommended solvent.

13. Fit the selected crankshaft main bearing on the cylinder block and the bearing seat.
14. Clean new thrust washers and fit them on both sides of the fourth gear of the engine block main bearing.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

15. Put on the crankshaft, and then Fit main bearing cap. The torque is: **(20±2)Nm+90°+45°±2°**.
16. Put the piston connecting rod assembly in guide sleeve and compress it in the cylinder, and then close the connecting rod larger end cover. The torque is: **(18±2)Nm+90°±2°**.
17. Fit the manual flywheel or torque converter drive plate.

☞**Flywheel Refit**

18. Fit the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Refit**

19. Fit the cylinder head assembly.

☞**Cylinder Head Assembly Refit**

20. Fit the timing chain.

☞**Timing Chain Refit**

21. Fit the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Refit**

22. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

23. Fit the water pump pulley.
24. Fit the crankshaft pulley.

☞**Crankshaft Pulley Refit**

25. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

26. Remove the flywheel timing pin special tool **TEN00002**.
27. Fit the plug.
28. Connect battery earth lead.

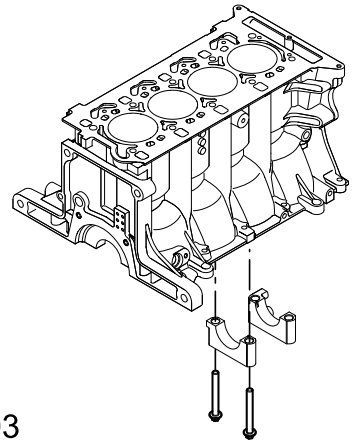
Piston Inpection

Remove

1. Remove the cylinder head assembly.

☞Cylinder Head Assembly Remove

2. Release the connecting rod bolt.



S111A403

3. Remove the connecting rod cap.
4. Remove the connecting rod bearing.
5. Push the piston to the top of the cylinder hole.

Caution: Remove the carbon deposits on the top of the cylinder bore first to avoid scratching the piston rings and the piston.

6. Make sure the connecting rod does not contact the inner wall of the cylinder hole. Push the piston assembly out from the cylinder hole carefully.

Caution: Please carefully mark each piston and match liner.

7. Reinstall the connecting rod larger end cover on the connecting rod, and tighten the connecting rod bolt slightly.
8. Take out the old piston ring with the expander (tool) and discard it.

Refit

1. Clean all ring grooves of the piston and blow the oil passage clean.
2. Locate new piston ring 20 mm away from the top face of the cylinder hole and measure the clearance.

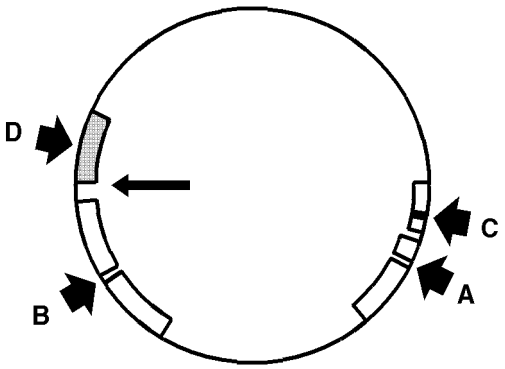
S111A405

3. Check the piston for deformed or cracked.
4. Relative to the vertical angle of the piston, measure the piston diameter at the measuring point that is 11 mm up from the skirt section bottom.

☞Parameter

Caution: Piston and connecting rods are only supplied as an assembly. Connecting rods refitted must be the same weight group.

5. Install the oil ring spring.
6. Make the mark TOP face towards the piston head, and install the following according to the order with expander: oil ring blade, the second compression ring and the top compression ring.
7. Make sure the piston ring can turn freely. Make the notch A and B of the two compression rings stagger with an angle of 120 degree and far away from the thrust side of the piston.
8. On the two sides of the piston pin, make the blade notch C and the spring notch D stagger with an angle of 30 degree.

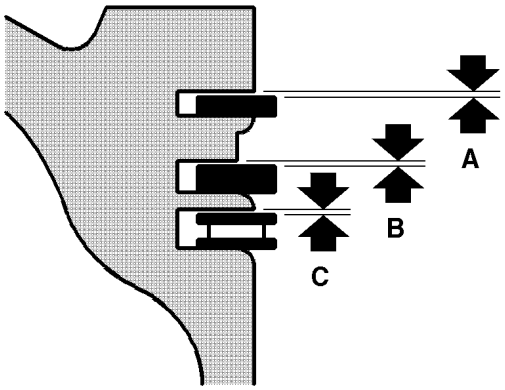


S111A406

9. Check the clearance from the new piston ring to the ring groove.

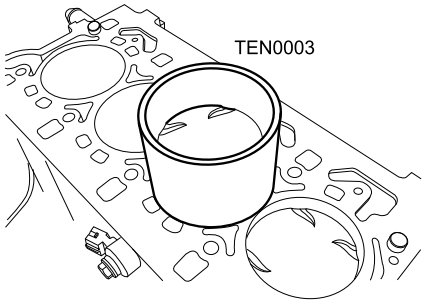
☞Parameter

☞Cylinder Head Assembly Refit

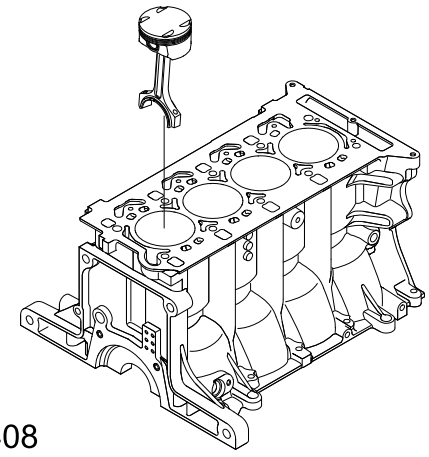


S111A407

10. Install the piston connecting rod assembly from top to bottom into the special tool **TEN00003**and guide the tooling aligned with the cylinder hole, notice that the arrow mark "- " on the top surface of the piston should face the front end of the engine.



S111A409



S111A408

11. Push the piston into the cylinder hole.

Tip: It is recommended to replace the piston connecting rod assembly as a set.

12. Install the connecting rod cap, and tighten the connecting rod bolt according to the torque.
13. Install the cylinder head assembly.

Crankshaft Inspection

Remove

1. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

2. Remove the timing chain upper cover plate.

☞**Timing Chain Upper Cover Plate Remove**

3. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

4. Remove the timing chain.

☞**Timing Chain Remove**

5. Remove the cylinder head assembly.

☞**Cylinder Head Remove**

6. Remove the engine flywheel.

☞**Flywheel Remove**

7. Remove the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Remove**

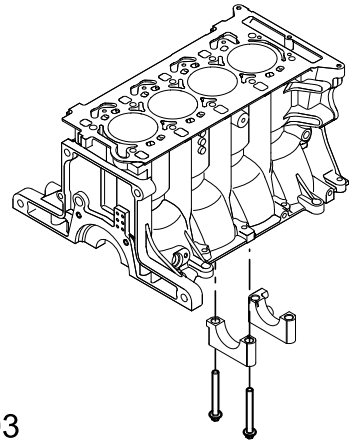
8. Remove the lower crankcase assembly.

☞**Lower Crankcase Remove**

9. Install the crankshaft pulley bolt and tighten slightly the pulley bolts.
10. Mark the order of assembling the connecting rod at the connecting rod larger end.

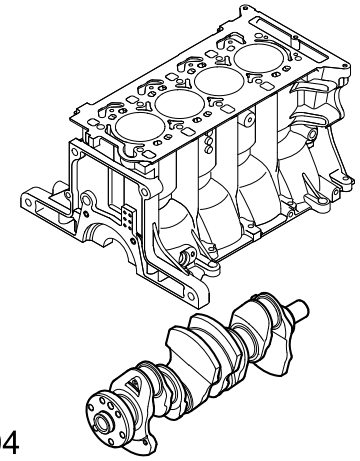
Caution: Keep bearing caps, bearings and bolts in their fitted order.

11. Rotate crankshaft pulley bolt and the crankshaft to make the connecting rod bolts are in a position convenient to remove.
12. Unscrew the connecting rod bolt and remove the connecting rod lower end cover (connecting rod large end cover); Push the piston connecting rod assembly out slightly from the cylinder hole.



S111A403

13. Remove the connecting rod shell from the connecting rod lower end cover (connecting rod large end cover).
14. Unscrew the main bearing cap bolt and remove the main bearing cap. And remove the main bearing from the bearing seat.
15. Remove the crankshaft.

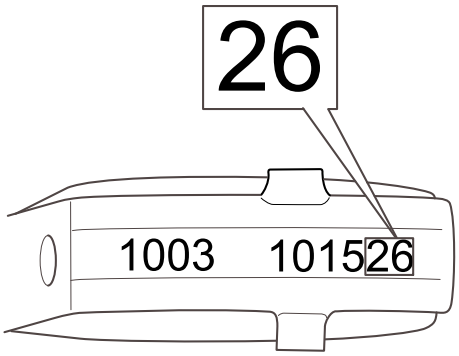


S111A404

16. Remove 2 thrust washers from the fouth main bearing.
17. Remove the main bearing from the cylinder.
18. Remove another half of bearing from the connecting rod.

Refit

1. Clean the mating surface between the cylinder block and the bearing seat.
2. Clean the pin and the pin hole.
3. Clean the bearing in the cylinder block and the fixed position of the thrust washer.
4. Clean the bearing fixed position on the bearing seat.
5. Clean the bearing fixed position on the connecting rod and the cover (please refer to the Parts Manual for piston rod assembly grouping).



Caution: The weight groupings of the piston connecting rod assemblies on the same engine should be same, fit them correctly. If the piston connecting rod assembly in the same group cannot be selected and fitted when servicing, replace all the piston connecting rod assemblies to ensure the piston connecting rod assembly weight is in the same group.

6. Clean the crankshaft and check for any damage.
7. Make the two connecting rod shells aimed at the slip groove and compress them into the connecting rod big hole respectively. Ensure that end face of the bearing

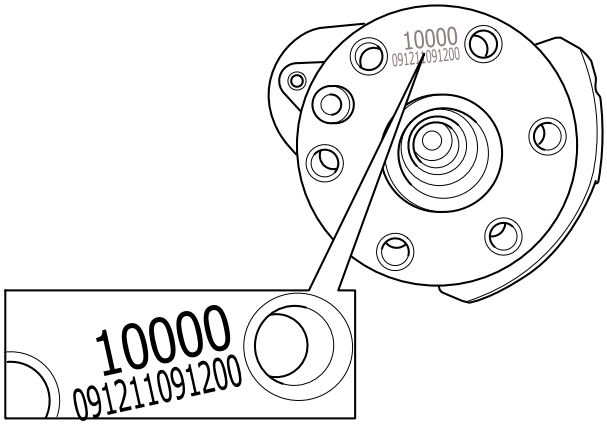
and fractured surface of the big hole are in the same plane as much as possible.

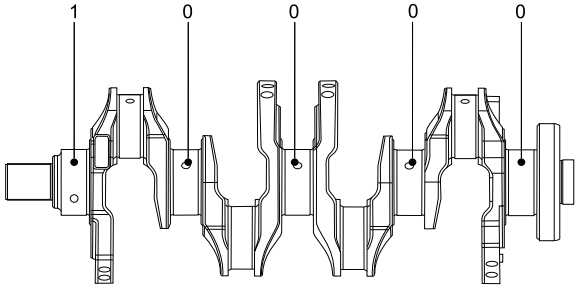
Caution: The connecting rod bearings are not grouped.

Caution: Record the main bearing mark number on the front of the crankshaft.

8. Record the marked number of the main bearing from the crankshaft rear end flange face. For the grouping rules, see the table below:

JOURNAL DIA.	GRADE
f 50.000-f 49.993	0
f 49.992-f 49.984	1





9. Inspect the diameter of the crankshaft main bearing journal.

☞**Parameter**

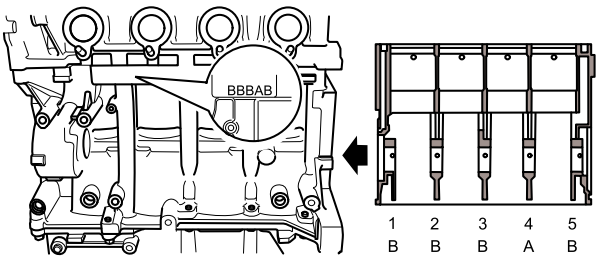
10. According to the selected size and model, determine the appropriate main bearing to be fited.

☞**Parameter**

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

11. Main bearing selecting and matching rules: upper shells are grouped according to the engine block size (A is blue, B is red).

GRADE	DIAMETER
A	53.690f ≤53.700
B	53.680≤f ≤53.690



12. Lower shells are grouped according to the crankshaft size (1 is blue, 0 is red).

13. Clean the sealing surface of the cylinder block and bearing seat with a cloth without burr and suitable solvent.

Tip: Please use SAIC MOTOR recommended solvent.

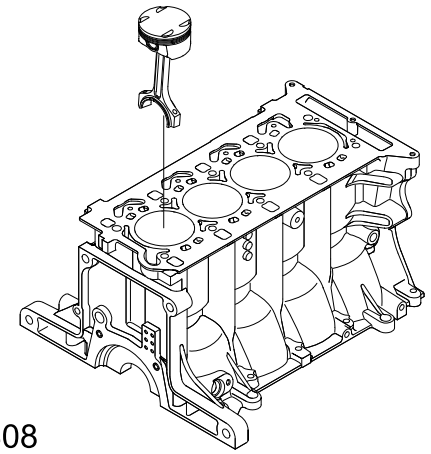
14. Fit the selected crankshaft main bearing on the cylinder block and the bearing seat.

15. Clean new thrust washers and fit them on both sides of the fourth gear of the engine block main bearing.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

16. Put the crankshaft on, apply suitable amount of lubricant on the main bearing journal and then fit the main bearing cover. The torque is: **(20±2)Nm+ 90°+45°±2°**.

17. Apply lubricant first on the connecting rod shell and the crankshaft connecting rod journal and then put the piston connecting rod assembly into the special tool **TEN00003**, and compress it in the cylinder. Then close the connecting rod large end cover. The torque is: **(18±2)Nm+90°±2°**.



S111A408

18. Fit the manual flywheel.

☞**Flywheel Refit**

19. Fit the crankshaft rear oil seal.

☞**Crankshaft Rear Oil Seal Refit**

20. Fit the cylinder head assembly.

☞**Cylinder Head Assembly Refit**

Crankshaft Rear Oil Seal

Remove

1. Disconnect battery earth lead.
2. Remove the transmission assembly.

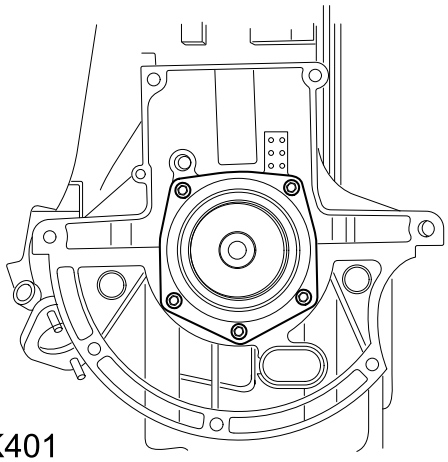
☞**Manual Transmission Remove**

☞**Electric Controlled Mechanical Transmission Remove**

3. Remove the manual flywheel.

☞**Manual Flywheel Remove**

4. Unscrew 5 bolts around the oil seal.
5. Remove and discard the oil seal.

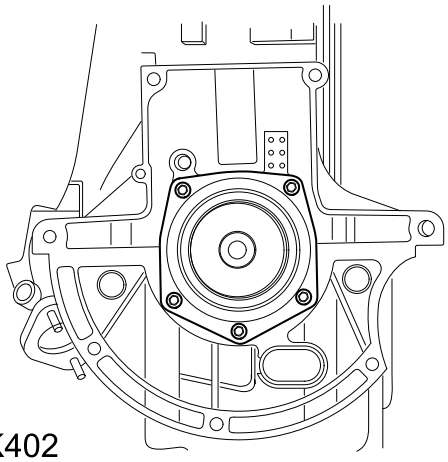


S111K401

Refit

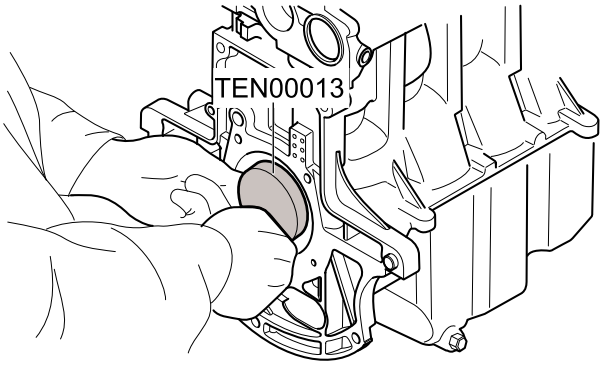
1. Clean the area used in the crankshaft flange surface neck and the oil seal to make sure there is no dirt.
2. Make crankshaft rear oil seal mounting guide sleeve special tool**TEN00013** cover on the rear end of the crankshaft.
3. Apply clean oil on the lip of the oil seal.

Caution: Take care to avoid damaging the oil seal lip, while fitting it.



S111K402

4. Along the special tool **TEN00013**, slowly push the oil seal until the locating pin on the oil seal is in the pin hole of the engine block.



5. Tighten all the bolts, and the tightening torque is **8–12Nm**.
6. Fit the manual flywheel.

☞**Flywheel Refit**

7. Fit the transmission assembly.

☞**Manual Transmission Assembly Refit**

☞**Electric Controlled Mechanical Automatic Transmission Assembly Refit**

8. Connect battery earth lead.

Oil Strainer

Remove

1. Disconnect battery earth lead.
2. Drain the engine oil.
3. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

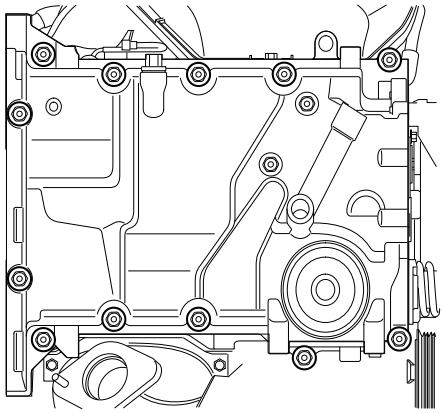
4. Remove the camshaft cover.

☞**Camshaft Cover Remove**

5. Remove the timing chain lower cover plate.

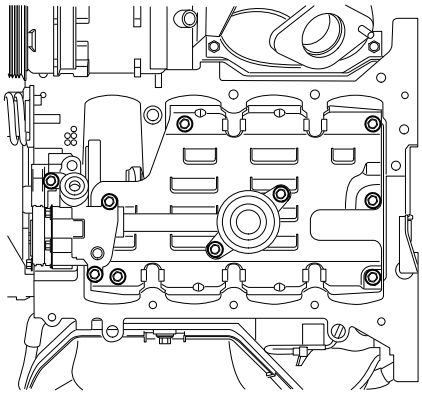
☞**Timing Chain Lower Cover Plate Remove**

6. Remove the oil pump drive chain and drive sprocket.
7. Unsrew all fastening bolts retaining the lower crankcase to the engine block and remove the lower crankcase assembly.



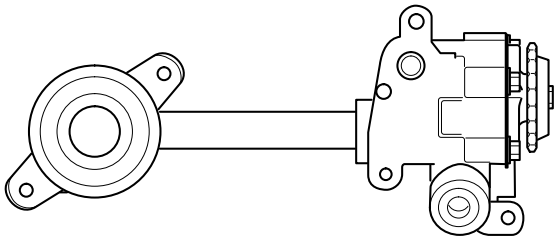
S111I401

8. Unscrew all bolts retaining the oil baffle to the lower crankcase and remove the oil baffle.



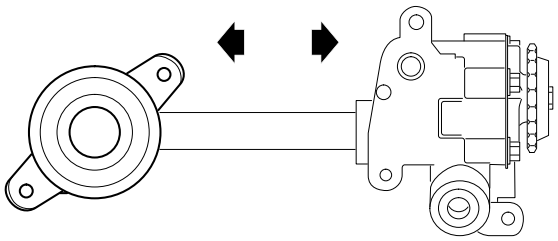
S111H401

9. Remove the oil pump and oil strainer retaining bolts. Then remove the oil pump and oil strainer from the lower crankcase.



S111H402

10. Separate the oil pump and oil strainer according to the direction as shown. Remove the seal ring from the oil strainer and discard it.



S111H403

Refit

1. Clean the oil strainer and the mating surface.
2. Lubricate the new O-ring with engine oil and Fit the oil strainer. Insert the oil strainer into the new oil pump according to the opposite direction as shown above.
3. Use oil pump mounting bolt and oil strainer mounting bolt, and tighten to **8–12Nm**.
4. Fit the oil baffle, and tightening to **8–12Nm**.
5. Fit the lower crankcase.

☞**Lower Crankcase Refit**

6. Fit the oil pump drive chain and the drive sprocket.
7. Adjust the timing chain system.

☞**Timing Chain Refit**

8. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

9. Fit the camshaft cover.

☞**Camshaft Cover Refit**

10. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

11. Connect battery earth lead.

Oil Pump

Remove

1. Disconnect battery earth lead.
2. Drain the engine oil.
3. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

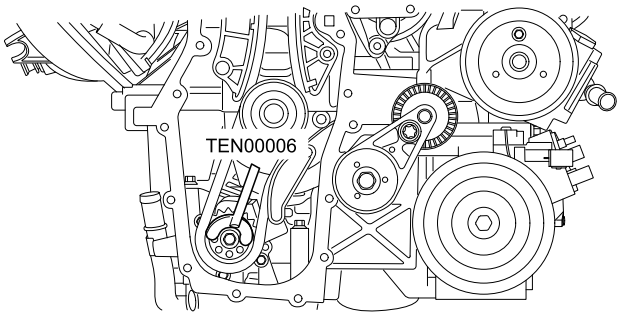
4. Remove the camshaft cover.

☞**Camshaft Cover Remove**

5. Remove the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Remove**

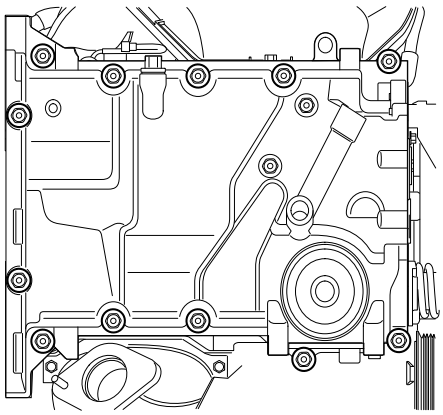
6. Using the special tool **TEN00006**, hold and remove the oil pump sprocket.



S111J424

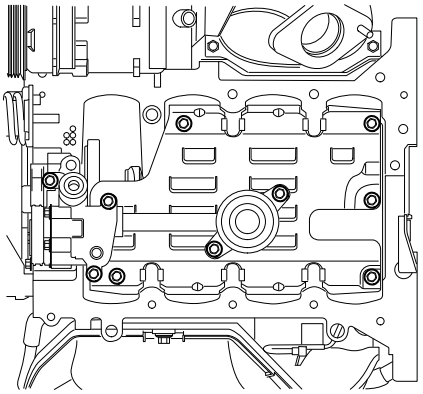
7. Remove the oil pump drive chain.
8. Loosen all fastening bolts retaining the lower crankcase to the engine block and remove the lower crankcase assembly.

☞**Lower Crankcase Remove**



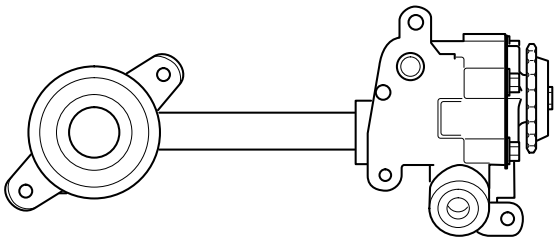
S111I401

9. Loosen all bolts retaining the oil baffle to the lower crankcase and remove the oil baffle.



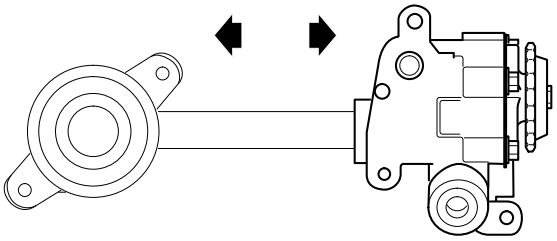
S111H401

10. Remove the oil pump and oil strainer retaining bolts. Then remove the oil pump with oil strainer from the lower crankcase.



S111H402

11. Separate the oil pump and oil strainer according to the direction as shown. Remove the seal ring from the oil strainer and discard it.



S111H404

Refit

1. Clean the oil strainer and the mating surface.
2. Lubricate the new O-ring with engine oil and fit the oil strainer. Insert the oil strainer into the new oil pump according to the opposite direction as shown above.
3. Use oil pump mounting bolt and oil strainer mounting bolt, and tighten to**8–12Nm**.

4. Fit the oil baffle.
5. Fit the lower crankcase.

☞**Lower Crankcase Refit**

6. Fit oil pump drive chain and drive sprocket.
7. Adjust the timing chain system.

☞**Timing Chain Refit**

8. Fit the timing chain lower cover plate.

☞**Timing Chain Lower Cover Plate Refit**

9. Fit the camshaft cover.

☞**Camshaft Cover Refit**

10. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

11. Connect battery earth lead.

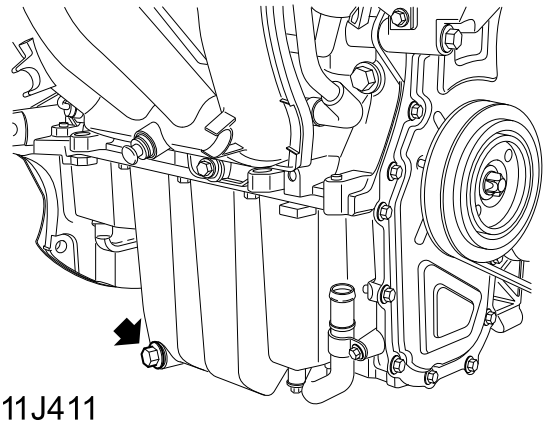
Engine Oil Filter

Remove

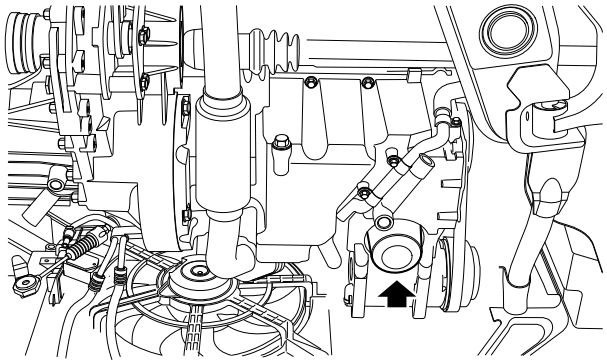
1. Lift up the vehicle on a raiser.
2. Place a suitable container under the drain plug of the engine oil pan, unscrew the plug and discard the sealing washer. Drain the oil.

Warning: Observe due care when draining engine oil as the oil can be very hot.

Warning: Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.



S111J411

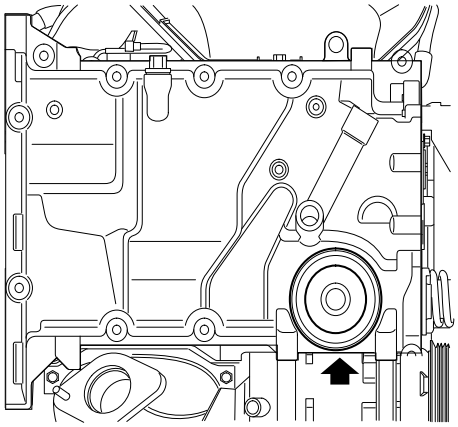


S111H405

3. Clean the area around the filter head, and put a suitable container under the filter to collect the oil which may overflow.
4. Unscrew the filter counterclockwise and discard it.

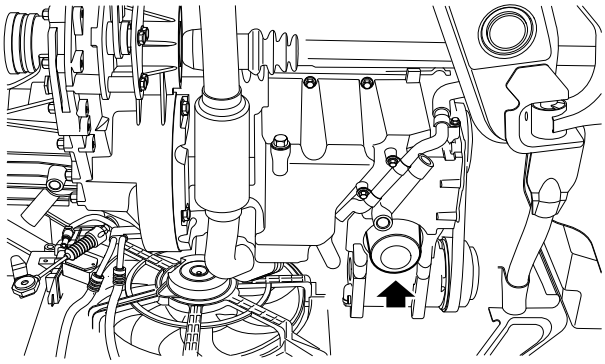
Refit

1. Clean the mating surface of the filter head.



S111H406

2. Lubricate the seal ring of the filter with the clean engine oil.
3. Fit the new filter and tighten to**16–18Nm**.



S111H405

4. Clean the oil drain plug and fit a new sealing washer.
5. Fit the drain plug and tighten to **35–40Nm**.
6. Remove the engine oil fill cap and fill the oil to the proper oil level.

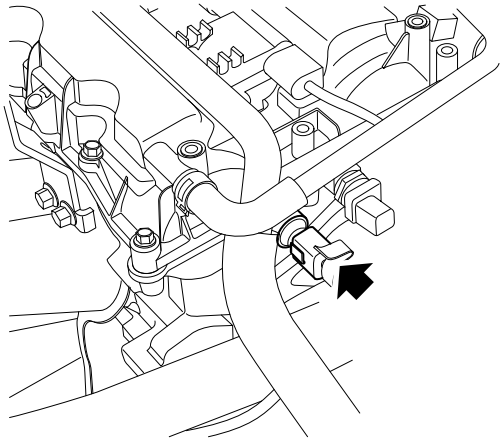
☞**Lubricant Filling**

7. Fit the oil filler cap.
8. Lower the vehicle.
9. Start and run the engine until the oil pressure warning light turns off.
10. Turn off the engine, and then recheck the engine oil level.
11. Check for any signs of leaking.

Oil Pressure Inspection

Inspection

1. Disconnect battery earth lead.
2. Disconnect the connector of the oil pressure switch.
3. Remove the oil pressure switch.



4. Remove the seal ring from the oil pressure switch and fit it on the oil pressure gauge connector.
5. Fit the oil pressure gauge connector on the original oil pressure switch and tighten it.
6. Connect the oil pressure gauge**T10001** with **T10002**and tighten the connector.
7. Inspect the engine oil, fill it if necessary.
8. Start and run the engine until reach the normal operating temperature.
9. When the engine speed is 3500 RPM, please notice the reading on the oil pressure gauge.

☞**Parameter**

10. Turn off the engine, unscrew the gauge connector and transfer.
11. Remove the connector.
12. Wipe out the overflowed oil.
13. Fit the oil pressure switch.
14. Connect the connector of the oil pressure switch.
15. Connect battery earth lead.

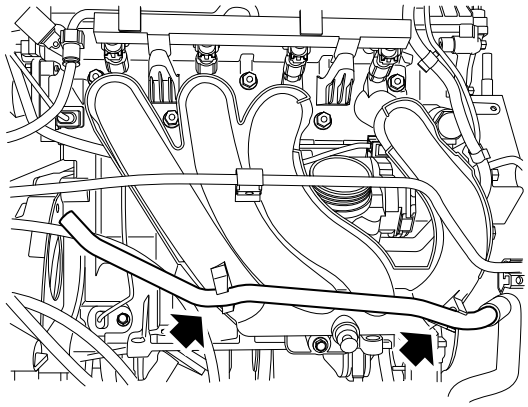
Intake Manifold Gasket

Remove

1. Disconnect battery earth lead.
2. Remove the fuel rail.
3. Remove the inlet pipe assembly.

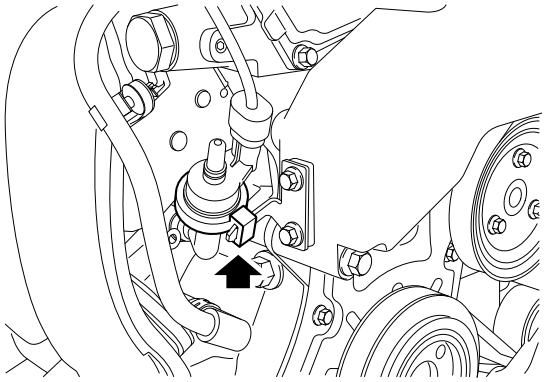
☞ Inlet Pipe Assembly Remove

4. Disconnect the heating return pipe from the intake manifold clamp.



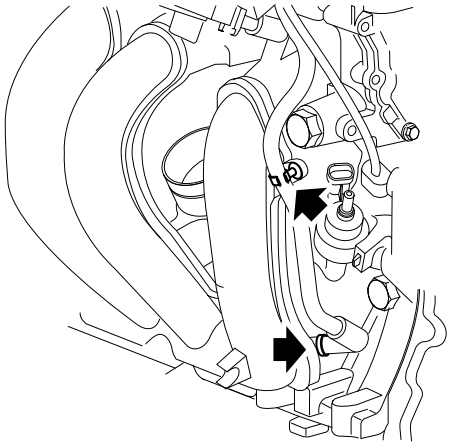
S111G401

5. Release the clamp, and disconnect the canister solenoid valve hose from the intake manifold.

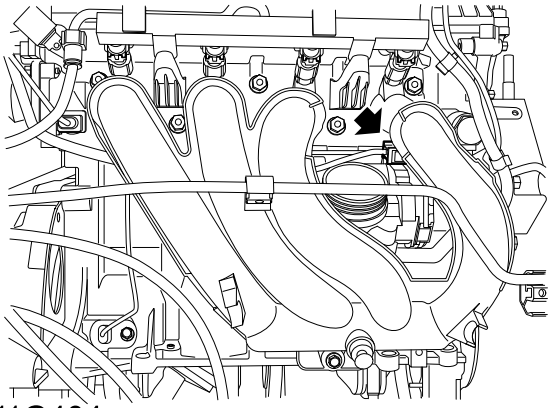


S111G402

6. Pull out the C-clip installed on the intake manifold, release the clamp and disconnect the partial load breather tube clip from the intake manifold.

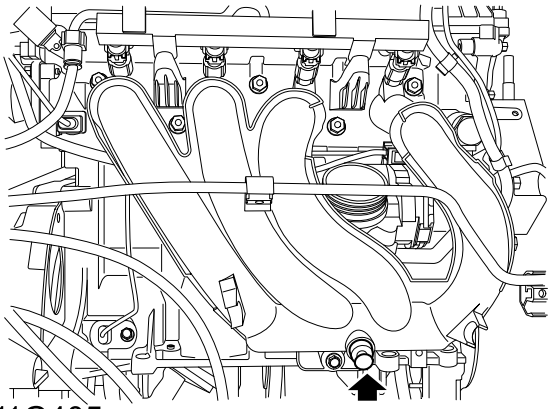


7. Disconnect the connection from the electronic throttle sensor.



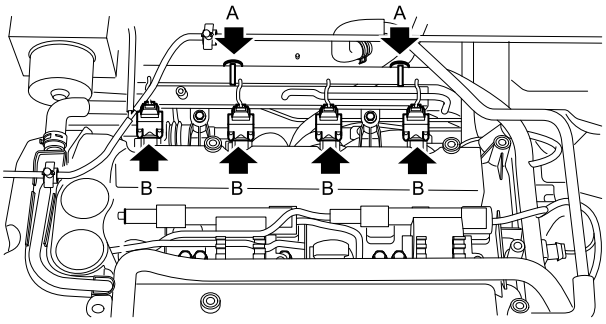
S111G404

8. Press the plastic rim ring and disconnect the brake assist pipe from the intake manifold.

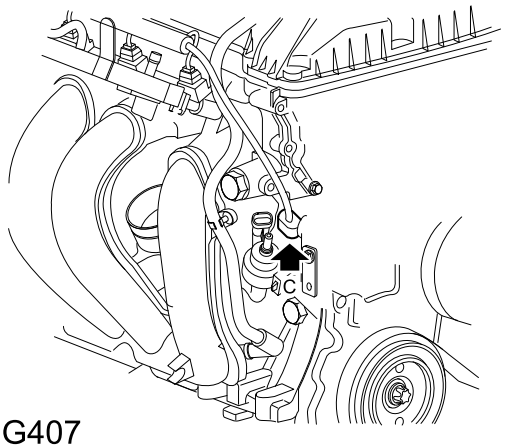


S111G405

9. Pull the wire harness snap A out of the fuel rail bracket, and disconnect the connection of the fuel injector connector B and the canister solenoid valve connector C.

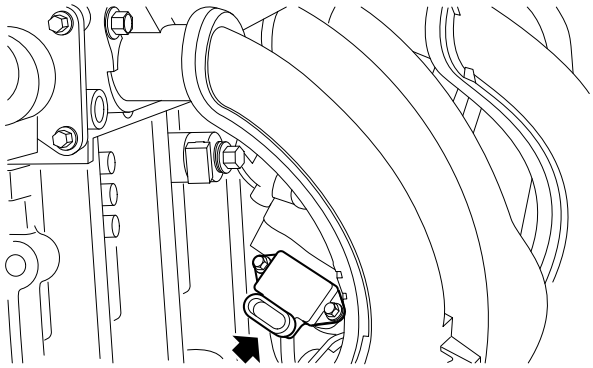


S111G406



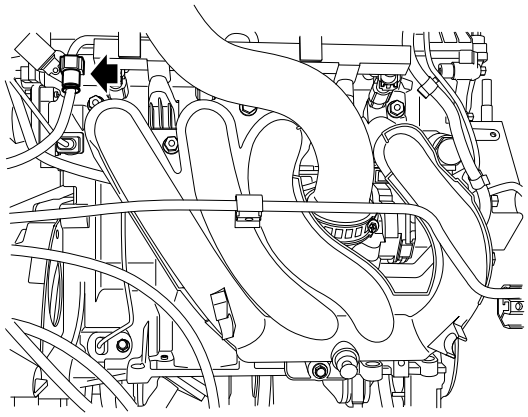
S111G407

10. Disconnect the connector from the intake manifold absolute pressure temperature sensor.



S111G408

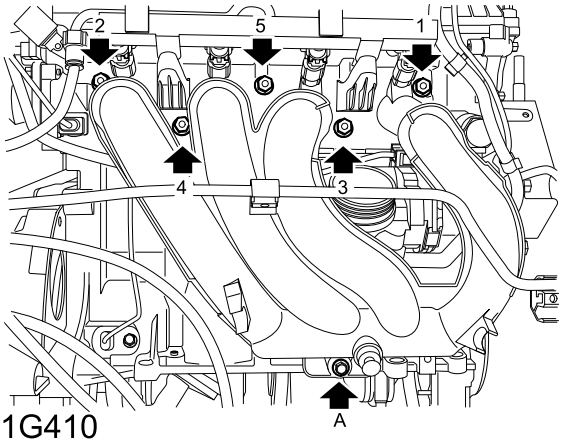
11. Secure a cloth with strong absorption under the fuel rail.
12. Release fuel inlet tube from the fuel rail.



S111G409

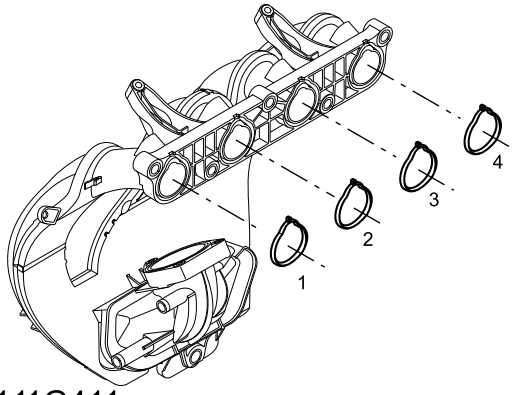
Caution: Always fit plugs to open connections to prevent contamination.

13. First remove bolt A connecting the intake manifold to engine block, then remove the 5 nuts securing the intake manifold to the cylinder head according to the order as shown.



S111G410

14. Take away the intake manifold, remove and discard 4 sealing washers.



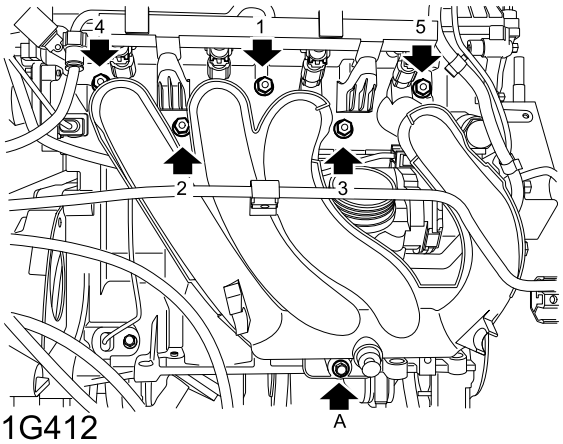
S111G411

Refit

1. Make sure that the mating surface is clean and the metal insert part has also been fixed into the hollow between intake manifold bolts.
2. Fit the new gasket on the intake manifold.

Tip: Be careful of the error proofing design on the washer.

3. Screw 5 bolts according to the order as shown, and secure the mounting bolt A securing the intake manifold and the engine block.



S111G412

4. Take away the plug from the fuel hose and fuel rail.

5. Secure the fuel inlet tube to the fuel rail.
6. Connect**TMAP** the sensor connector.
7. Connect the fuel injector connector, fix the harness snap on the fuel rail bracket hole and connect the canister solenoid valve connector.
8. Insert the brake assist pipe to the quick connector of the intake manifold.
9. Connect the electronic throttle sensor connector.
10. Connect partial load breather tube to the intake manifold, tighten it with the clamp and insert the C-pipe clip into the intake manifold mounting hole.
11. Connect the canister solenoid valve hose to the intake manifold and tighten it with the clamp.
12. Secure the heating return pipe to the intake manifold clamp.
13. Intake inlet pipe assembly.

☞Inlet Pipe Assembly Refit

14. Connect battery earth lead.

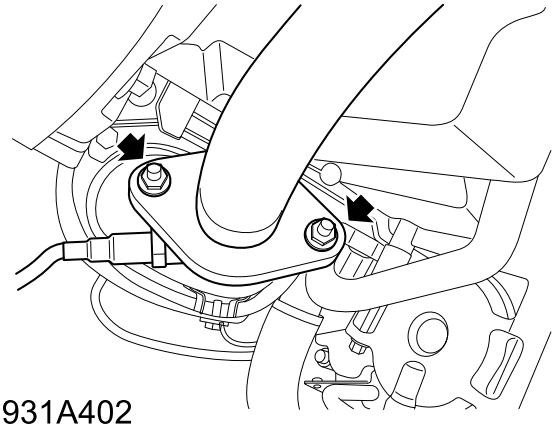
Exhaust Manifold Gasket

Remove

1. Disconnect battery earth lead.
2. Remove the generator.

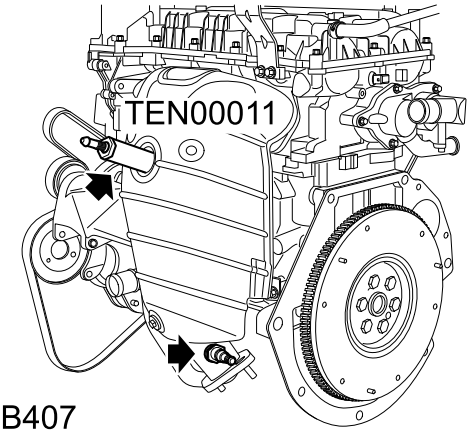
☞Generator Remove

3. Remove the bolt connecting the exhaust manifold to the exhaust front pipe.



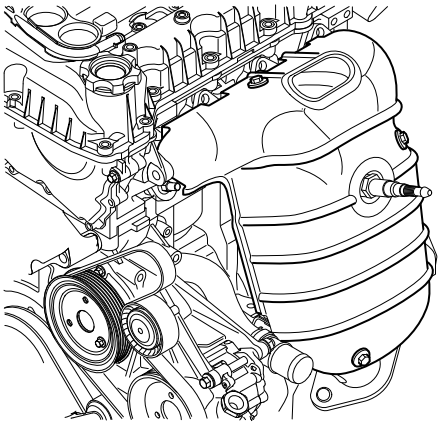
S931A402

4. Connect the oxygen connector.

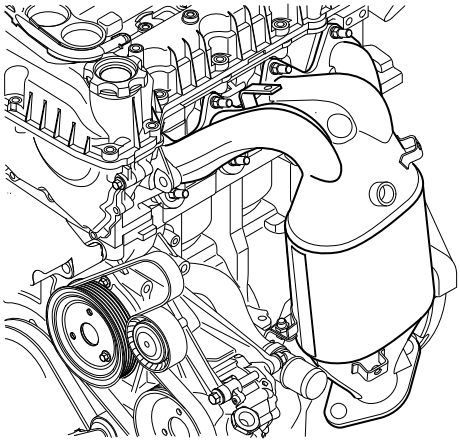


S113B407

5. Remove the exhaust manifold housing.



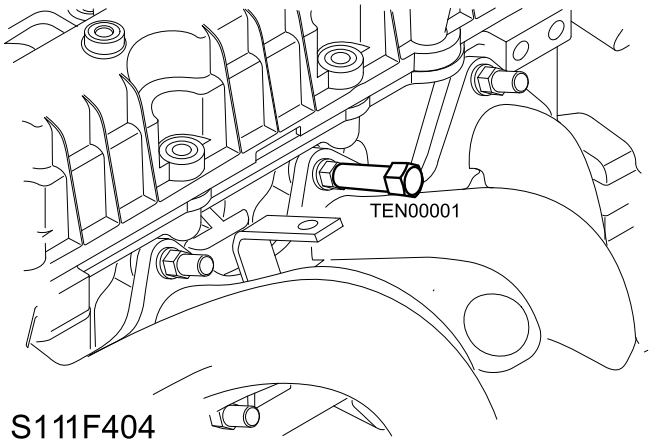
6. Remove the exhaust manifold.



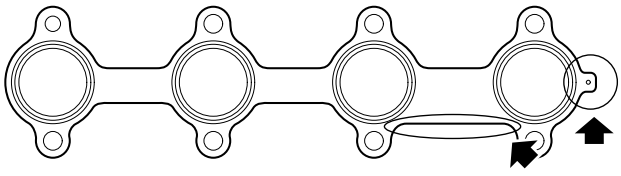
7. Remove and discard the exhaust manifold gasket from the mating surface of the cylinder head and the exhaust manifold.

Refit

1. Clean the mating surface of the cylinder head and the exhaust manifold to make sure it is clean without impurity.
2. Use the stud removal and Fit special tool**TEN00001** to fit the stud.

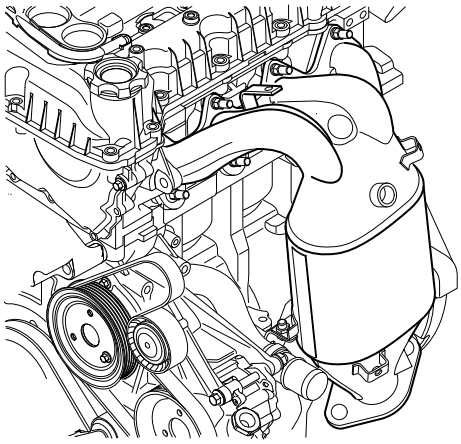


S111F404

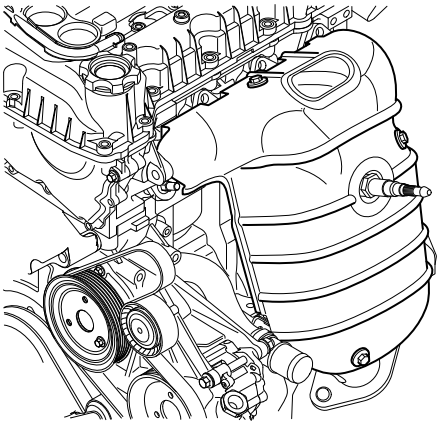


S111F403

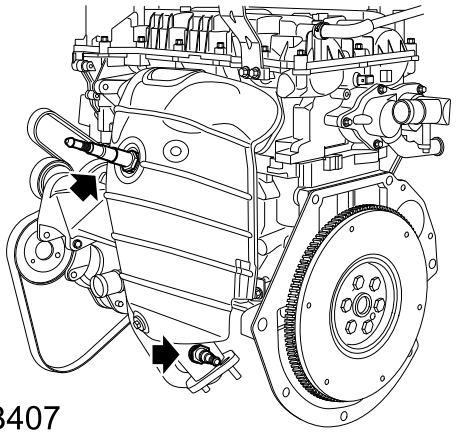
3. Fit the exhaust manifold gasket properly on the stud bolts of the cylinder head according to the direction determined by the design for error prevention.
4. Fit the exhaust manifold.



5. Fit the exhaust manifold housing.

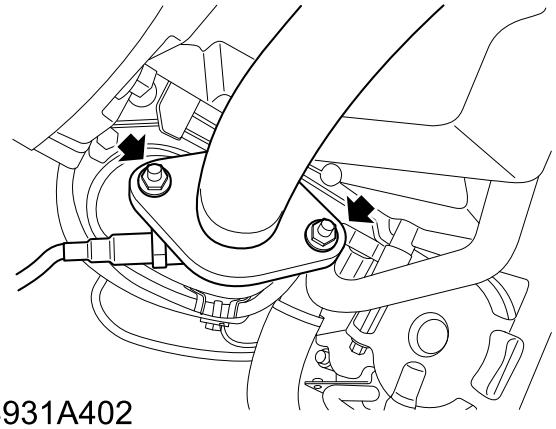


6. Connect the oxygen connector.



S113B407

7. Remove the bolt connecting the exhaust manifold to the exhaust front pipe.



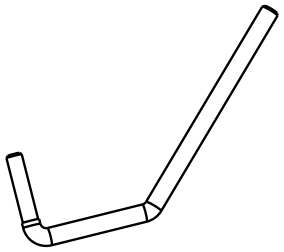
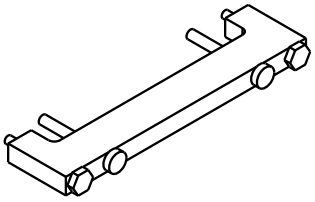
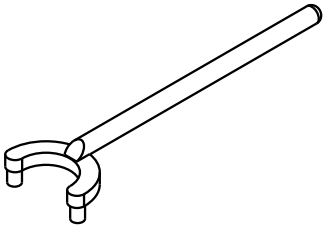
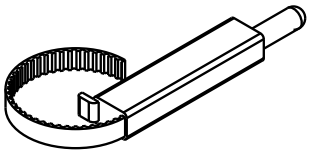
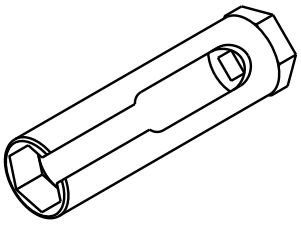
S931A402

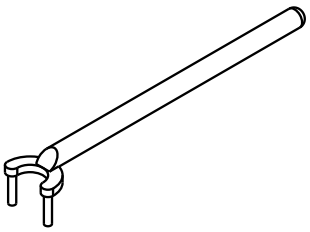
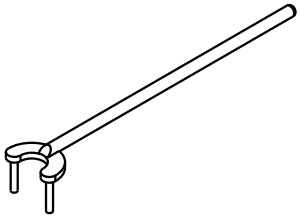
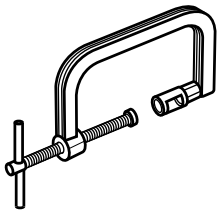
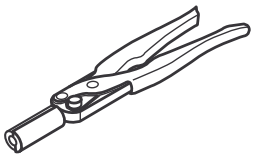
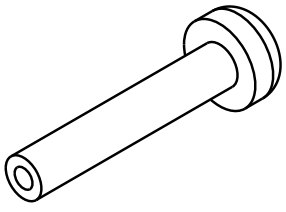
8. Fit the generator.

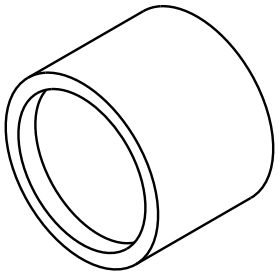
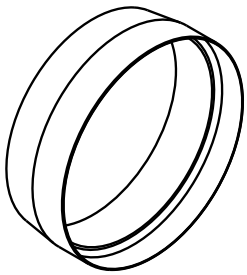
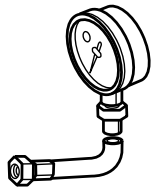
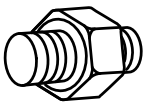
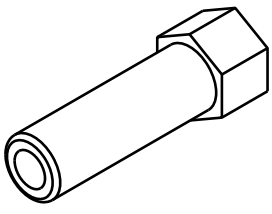
☞**Generator Refit**

9. Connect battery earth lead.

Special Tools

Tool Number	Description	Picture
TEN00002	Holding Pin Flywheel timing	 TEN00002
TEN00004	Camshaft timing locking	 TEN00004
TEN00008	Retainer crankshaft belt wheel	 TEN00008
TEN00009	Retainer belt wheel	 TEN00009
TEN00011	Wrench O2 Sensor	 TEN00011

Tool Number	Description	Picture
TEN00006	Retainer oil pump gear	 TEN00006
TEN00005	Retainer camshaft timing gear	 TEN00005
T10005	Valve spring compressor	 T10005
T10006	Remover valve stem seal	 T10006
TEN00014	Replacer valve stem seal	 TEN00014

Tool Number	Description	Picture
TEN00003	Piston ring guider	 TEN00003
TEN00013	Protector Sleeve Crankshaft Rear oil seal	 TEN00013
T10001	Engine oil pressure test equipment	 T10001
T10002	Adaptor Engine Oil Pressure Test	 T10002
TEN00001	Remover and replacer M8 stud	 TEN00001

Engine Cooling System

Specifications

Torque

Description	Value
Screw - expansion tank assembly	5.5–7.5Nm
Screw - cooling fan assembly to radiator	5.5–7.5Nm
Screw - low speed resistor to cooling fan assembly	5.5–7.5Nm
Bolt - condenser to radiator	5.5–7.5Nm
Bolt - thermostat shell assembly to cylinder head	8–12Nm
Bolt - water pump to cylinder	8–12Nm
Bolt - water pump pulley to hub	9–11Nm

Parameter

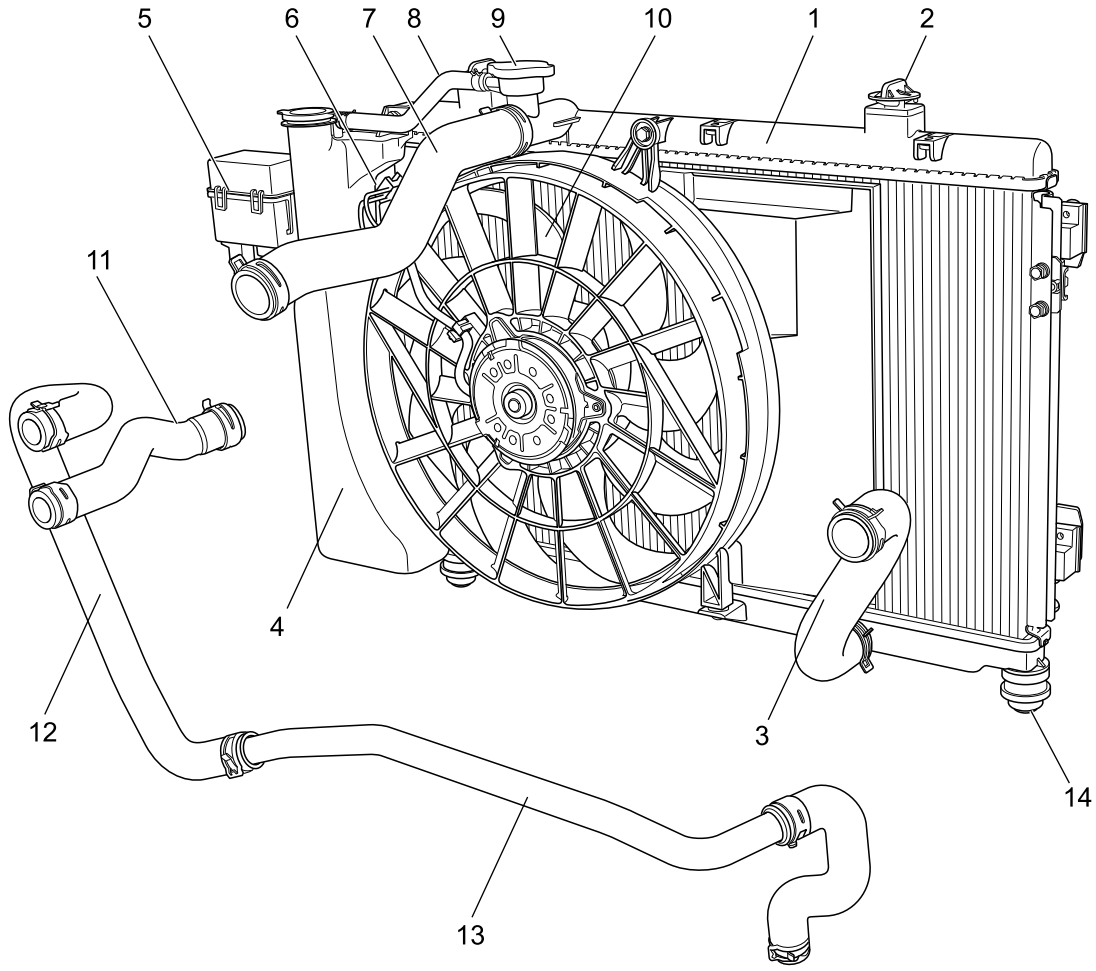
Model	**OAT** Pressure used to control temperature by the mixed liquor consisted of water and organic acid technology
overflow reverse flow type cooling fan: cooling fluid volume: expansion tank loop system	8 blades, temperature control electric shaft type flow 0.9L 4.75L
switching point of cooling fan - for air conditioning system high speed • turn on • turn off	 17.7MPa 13.7MPa
switching point of the cooling fan - being used for cooling down when the engine runs normally turn on • low speed • high speed turn off • low speed • high speed	 100 ℃ 112 ℃ 94 ℃ 106 ℃
switching point of the cooling fan - being used for cooling down after the engine shuts down turn on • low speed • high speed turn off: • low speed • high speed duration	 110 ℃ 104 ℃ 106 ℃ 100 ℃ 30s at most
radiator	longitudinal-flow
coolant pump	mechanical, radial flow impeller
actuating ratio of the coolant pump	1 : 1
Double thermostat	wax element
first class thermostat: • initial startup • complete opening • shut down second class thermostat: • initial startup • complete opening • shut down	 80±2 ℃ 94 ℃ ≤80±2 ℃ 88±2 ℃ 102 ℃ ≤88±2 ℃
pressure dischage valve of the water tank pressure cap	

• high pressure starting • low pressure starting	93-123KPa 0-9.8KPa

Description and Operation

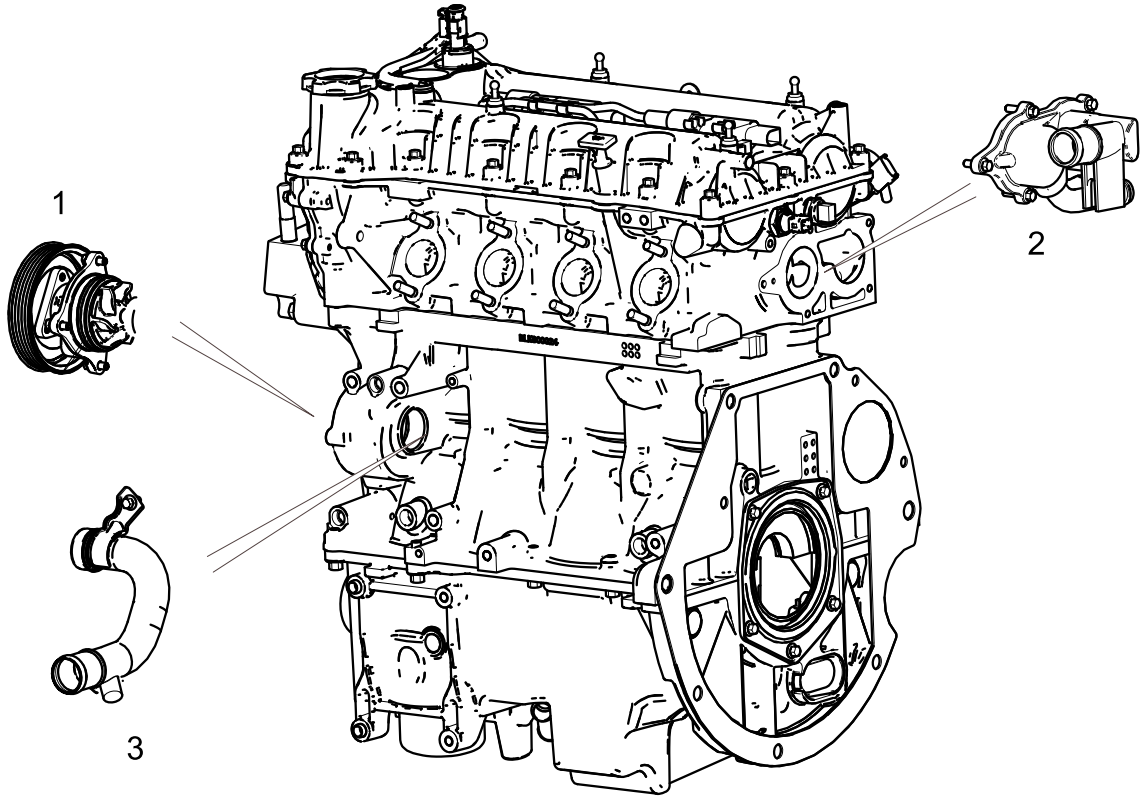
System Layout

Cooling module and pipeline



1. Radiator
2. Upper Fixed Block on Cooling Module
3. Radiator Water Outlet Pipe
4. Expansion Tank
5. Cooling Fan Motor Relay Box
6. Cooling Fan Low Speed Resistor
7. Radiator Water Inlet Pipe
8. Radiator Overflow Pipe
9. Radiator Pressure Seal Cover
10. Cooling Fan Assembly
11. Heater Core Body Water Inlet Pipe
12. Heater Core Body Water Outlet Pipe
13. Oil Cooler Water Inlet Pipe
14. Radiator Bumper Pad

Water pump and thermostat



1. Water Pump
2. Thermostat Assembly
3. Water Pipe

Description

Overview

The cooling system recycles engine coolant in the loop of engine and heater core, and the coolant is a mixture of 50% water and 50% of fluid based on organic acid technology (**OAT**), so that the engine can be kept at optimum operating temperature in different environments and engine working conditions.

Caution: Engine coolant will damage paint finished surfaces. If spilled, immediately rinse area with plenty of water.

Coolant should be changed regularly to maintain its optimum efficiency and corrosion resistance.

Cooling system components

Coolant pump

Coolant cycles by the rotor pump fit in the upper rear part of the engine crankcase drive end. It is sealed by an O ring to the engine block, and driven by the camshaft timing belt.

Coolant hose

Rubber coolant hoses transfer the cooling fluid between components. Spring clamp fixes the hose to each component. Heater core completes the liquid inlet by the liquid inlet pipe connecting the engine liquid outlet bent pipe to the heater core inlet hard pipe through the front panels, and then through the heater core liquid outlet pipe to oil cooler inlet pipe, through the oil cooler, then flows back into the engine block.

Radiator Pressure Seal Cover

Radiator Pressure Seal Cover is fit in the top of the radiator, and there are pressure limiting valve and vacuum valve on the pressure seal cover. When the system pressure reaches 93-123 KPa, the pressure limiting valve opens to release system pressure; when the system pressure reaches 0-9.8 KPa, the vacuum valve opens, the external adds fluids to the system. This enables the cooling system to operate within a certain pressure.

Expansion tank

Coolant expansion tank is fit on the right side of the cooling fan of the cooling model, an overflow / return pipe is connected from the bottom of expansion tank to the pressure cap on the top of the radiator. When the coolant expands on preheating, the redundant coolant in the cooling system through the overflow / return pipe flows back to expansion tank, when coolant in the cooling system is not insufficient, the coolant in the expansion tank flow back to the cooling system through the overflow / return pipe.

Thermostat

The thermostat is a wax element type with a pressure relief feature. It is located in a sealed housing connected to the radiator bottom hose, front coolant pipe and rear coolant pipe. The housing is secured to a lug on the cooling fan cowl. This positioning allows a more stable control of the coolant temperature and easier filling with a reduced chance of air locks forming.

When the engine is cold and the coolant temperature is low, the wax element of the thermostat is solid, the thermostat is closed and the coolant is prevented from circulating through the radiator. Coolant is however able to circulate through the bypass and heater matrix circuits.

As the coolant temperature increases, the wax element starts to melt and the thermostat gradually opens, bleeding low temperature coolant from the radiator bottom hose into the cylinder block and allowing hot coolant to flow to the radiator via the top hose, balancing the flow of hot and cold coolant to maintain the optimum engine temperature. When the thermostat opens fully, the full flow of coolant passes through the radiator.

In the event of a failed thermostat, the complete housing must be replaced.

Radiator and cooling fan

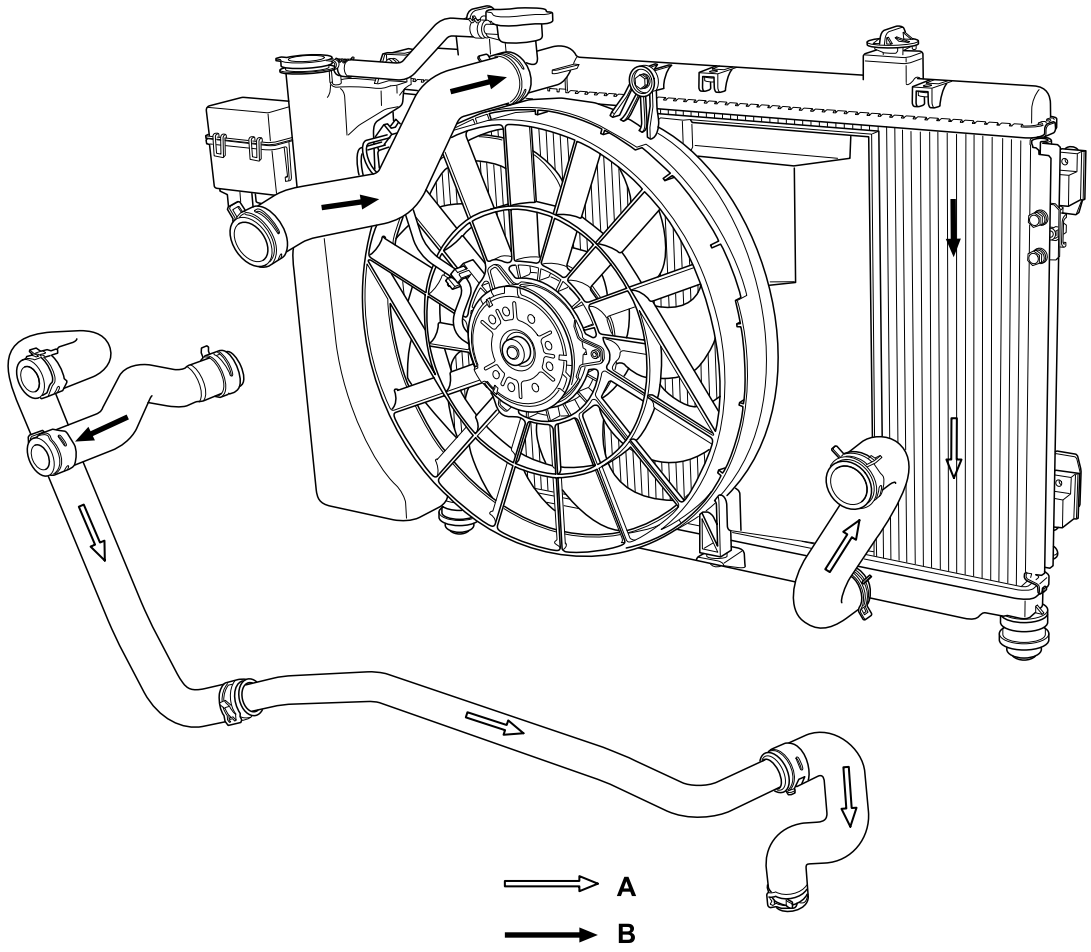
The radiator is an aluminum vertical flow radiator which has two ends with plastic water tank (for automatic transmission cars, automatic transmission oil cooler is in the water room under the radiator. The cooling hose connected with the transmission is connected to the bushing of the transmission oil cooler using nuts). Radiator supports cooling fan assembly, air-conditioning (**A/C**) condenser.

The top of the radiator is located in rubber bushes in the bonnet locking platform. The lower section of the radiator is located in rubber bushes supported by brackets fitted to the front longitudinals. Seal sponge is fit on both sides of the radiator in order to guide the airflow through the radiator. Condenser is fit in the front of the radiator, and is fixed by bolts to the radiator.

Cooling fan and motor assembly are fit on the fan cover of the rear of the radiator . Cooling fan extracts air to pass the radiator. In addition, the left side of the fan cover is designed with additional ventilation holes, which can coordinate the cooling fan to let more airflow pass through the radiator when the car is traveling at high speed. Following the low speed resistor, the cooling fan is fit on the left side of the radiator.

Operation

Coolant flow



A = Cold; B = Hot

The cooling system transmits heat from the engine module to the coolant by making use of the conduction principle. When the engine is at a lower temperature, the coolant pump makes the coolant ciculate among the engine block, cylinder head and the passenger cabin heater core. The thermostat is kept close in case of the coolant flowing through the radiator, while a small amount of coolant is allowed to pass through it from the by-pass so as to prevent the overlarge accumulated pressure. When the engine reaches the normal operation temperature, by turning on the thermostat, the cold coolant will enter into the cylinder block from the hose at the bottom of the radiator and the hot coolant will flow into the radiator from the top hose, balancing the hot and cold coolant to make the engine being at an optimum temperature. When the thermostat is turned on fully, all coolant will flow through the radiator. The redundant coolant generated by thermal expansion returns to the expansion water tank through the overflow pipe on the top of the radiator. Gas within the coolant will be eliminated by the expansion water tank at the same time. The pressure sealing cover of the thermostat with a pressure limiting valve and a vacuum valve isolates the cooling system from the ambient air, so the pressure of the cooling system will rise correspondingly with the expansion of the coolant due to the increase of the temperature. The rise of the pressure increases the boiling point of the coolant, which can make the engine operate in a higher and more effective working temperature without any coolant boiling risk. As there is a limit imposed for the pressurization of the cooling system, a pressure dischage valve is fit on the expansion water tank cover. In this way, when the maximum working pressure is reached, excessive pressure can be released from the cooling system.

Cooling fan control strategy

The cooling fan will run at a high speed or a low speed and realize controlling through **ECM** and relay unit.**ECM**

Using information provided by **ECT** sensor, **BCM** and air conditioning pressure switch to control the fan speed so as to limit the temperature of the engine coolant.

During the normal operation process,the fan will run under the following coolant temperatures:

Cooling fan states	Low speed	High speed
on	100 ℃	112 ℃
off	94 ℃	106 ℃

When the air conditioning system is running, the fan will run under the following pressure states:

Cooling fan states	High speed
on	17.7 MPa
off	13.7 MPa

Fan controlling strategy includes engine idle speed adjustment, which can compensate the additional load after turning on the fan. After removing the ignition key:

Cooling fan states	Low speed	High speed
on	104 ℃	110 ℃
off	100 ℃	106 ℃

The cooling fan will run for 30 seconds to make the engine cool down addtionally under a hotter environment. Under **ECT** a failure condition, the fan will run at a low speed.

Cooling fan relay unit

The fan controlling relay unit is connected by two leads to **ECM** with another lead providing the earth connection of the internal relay winding. The cooling fan is provided with power supply from No.13 fuse inside the engine cabin fuse box and 12V power. The fan motor is driven by the No.13 fusing element output inside the engine cabin fuse box. When the fan runs at a low speed, it is supplied with switching on power from relay R6, while it is supplied with switching on power from relay R7 when the fan runs at a high speed.

Under the following conditions, the cooling fan relay might fail:

- Open high speed relay coil
- Shorted high speed relay coil
- High high speed relay contact resistance
- Open high speed relay contact
- Open low speed relay coil
- Shorted low speed relay coil
- High low speed relay contact resistance
- Open external leads
- External leads are shorted when they are connected to 12V power supply
- Shorted external lead grounding
- High external lead resistance

Warning: Keep clear of the cooling fan. The fan may start automatically without warning, even after the engine is turned off.

Service Procedures

Coolant- drain and filling

Drain

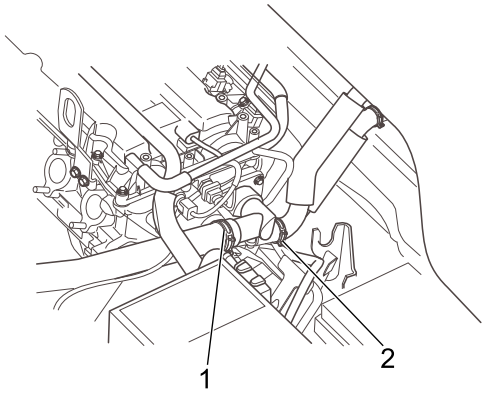
1. Remove the lower bottom air deflector.

☞ **Ref** the bottom air deflector refit.

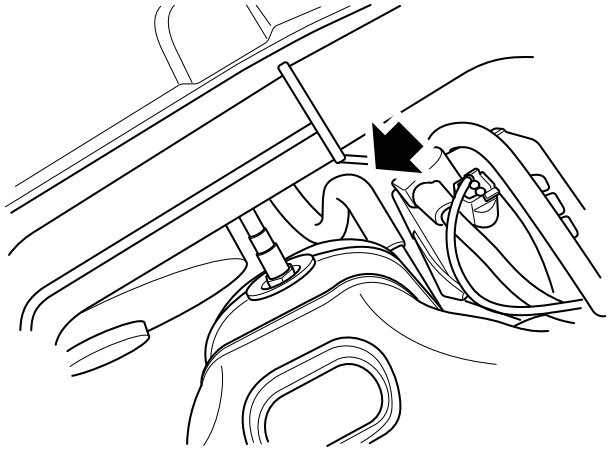
2. Remove the lower pressure seal cover.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

3. Secure an appropriate container so as to collect the coolant.
4. Release the clips and disconnec the return hose of the heater core from the back of the cylinder block.



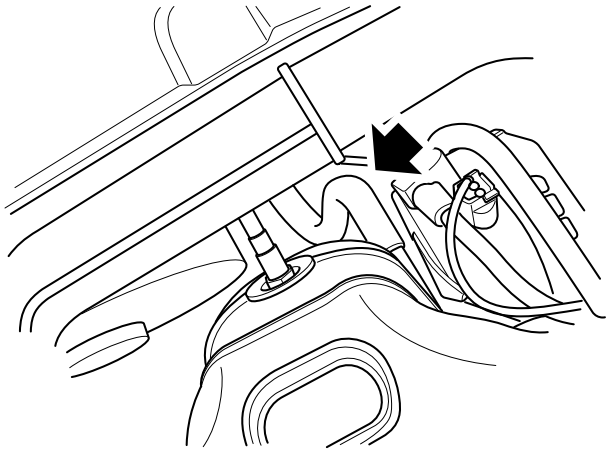
5. Release clips and disconnect the connection of the bottom hose from the radiator.



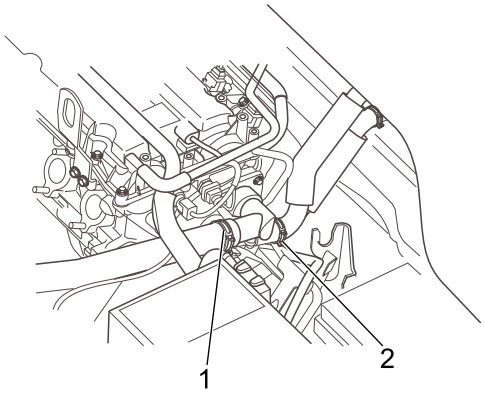
6. Drain the cooling system.

Filling

1. Connect the bottom hose to the radiator and secure with clips.



2. Connect the heater core return hose to the cylinder block and secure with clips.



3. Prepare coolant of the specified concentration.

☞ **Solution**

4. Remove the water tank pressure cover and fill until the coolant reaches the top of the water tank and hold still.
5. Open the expansion tank cover and continue to fill until the coolant reaches a level between MIN and MAX.
6. Ensure that the air conditioning has been turned off.
7. Start the engine and let it run at a speed of 1500–2500 revolutions per minute. According to the specific requirements, fill up the water tank and fit the water tank pressure cover.
8. Continue to let the engine run at a speed of 1500–2500 revolutions per minute until the cooling fan begins to run, then let the engine run at the idle speed until the cooling fan stops operation.
9. Shut down the engine and let it cool down for 30 minutes.
10. Inspect if there is leakage existing in the cooling system.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

11. Fit the pressure seal cover.

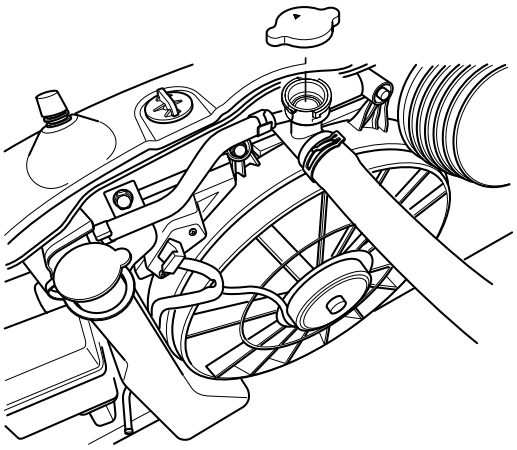
12. Fit the upper bottom air deflector.

☞**Refit of the bottom air deflector**

System pressure test

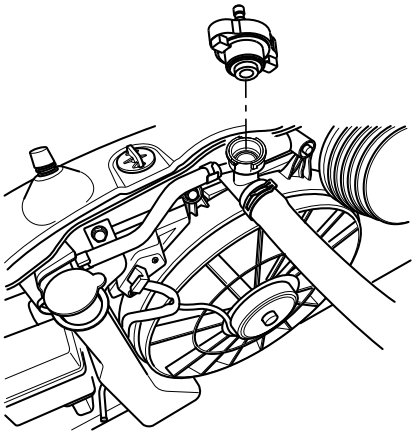
Inspection

1. Inspect if there is a sign of cracking and twist on the hose and the attachment strength of the pipeline connection.
2. Remove the radiator pressure seal cover.

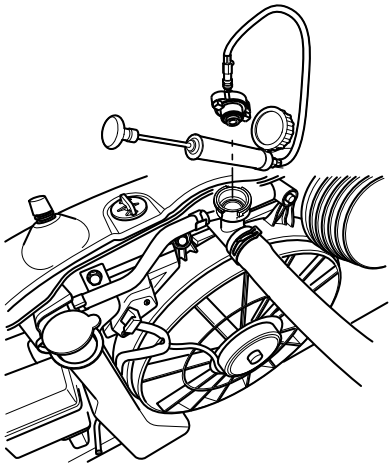


Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

3. Fit**TEN00021** connector to the radiator.



4. Connect the quick connector of the pressure hose to the connector.

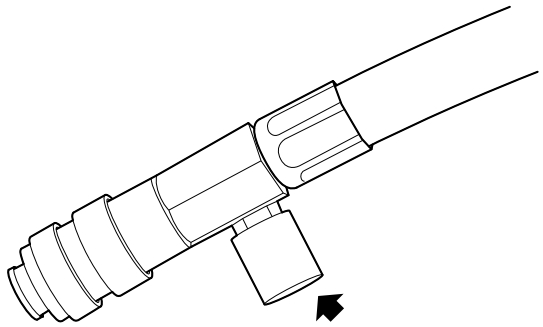


5. Pressurize the system slowly to the pressure of

93-123KPa, and inspect if there is leakage.

Warning: Do not exceed the setting pressure value, or the cooling system will be damaged.

6. Check if there is a sign of coolant leakage in the engine and the cooling system through visual inspection.
7. Through**TEN00021** reducing valve to release pressure.



S143048

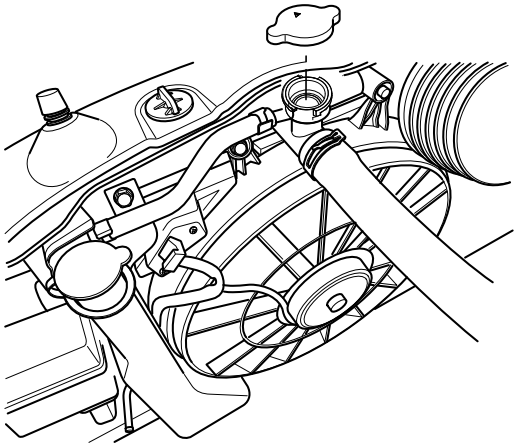
8. Remove the hose from the connector.
9. Remove the connector from the radiator and fit the upper pressure seal cover.

Pressure seal cover - pressure test

Inspection

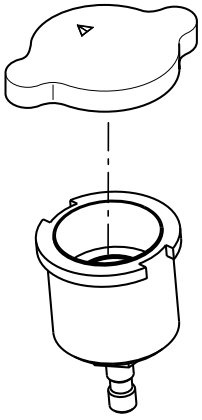
High pressure starting: 93-123 KPalow pressure starting: 0-9.8KPa

1. Visualize if there is a sign of coolant leakage in the engine and the cooling system.
2. Inspect if there is a sign of cracking and twist on the hose and the attachment strength of the pipeline connection.
3. Remove the radiator pressure seal cover.

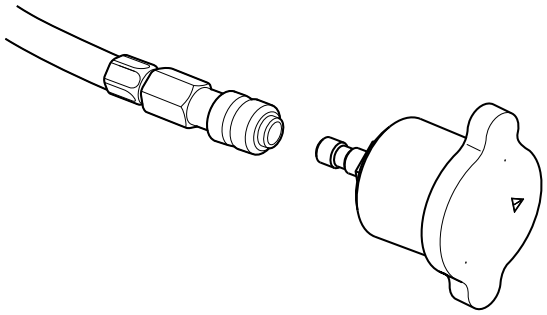


Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

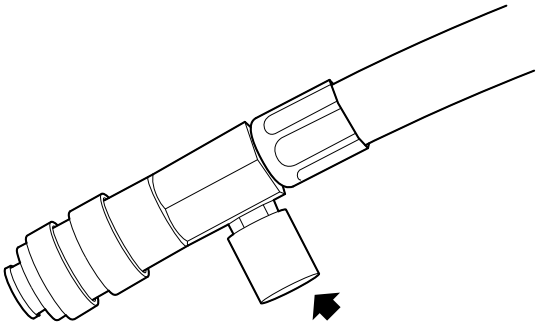
4. Fit the connector of **TEN00020** to the radiator pressure seal cover.



5. Connect the quick connector of the hose to the **TEN00020**.



6. Pressurize the radiator pressure seal cover slowly to the specified pressure and inspect the pressure range. If the range can be maintained between 93-123 KPa, the radiator pressure seal cover can be regarded as running normally.
7. Release the pressure through the reducing valve on **TEN00020**.



S143048

8. Disconnect the quick connector from the pressure hose, use**TEN00020** to remove the pressure hose .

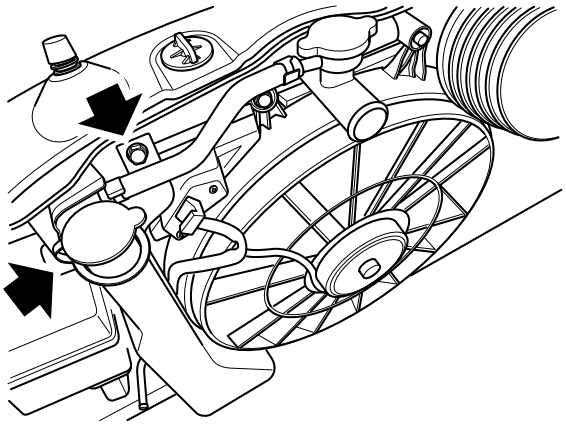
.

9. Remove the radiator pressure seal cover from the connector and fit it to the radiator.

Coolant expansion tank

Remove

1. Release the fixture clamp between the air bleed hose of the radiator and the coupling end of the radiator with clamp pincers.
2. Disconnect the air bleed hose and the radiator.
3. Remove the two bolts used to tighten coolant expansion tanks.



4. Remove coolant expansion tanks from the vehicle.

Refit

1. Fit the coolant expansion water tank to the vehicle.
2. Fit the two screws used to secure the coolant expansion tank to**5.5–7.5Nm**.
3. Connect the air bleed hose to the radiator.
4. Secure the radiator air bleed hose with a clip clamp.

Cooling fan

Remove

Warning: Disconnect the battery to prevent operation of the cooling fan, which could cause personal injury.

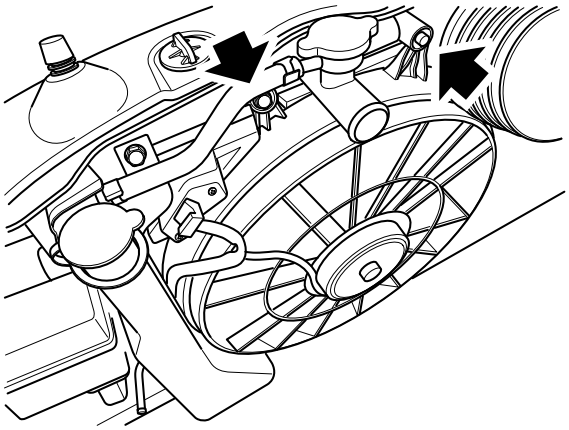
1. Disconnect battery earth lead.
2. Remove the coolant expansion water tank.

☞**the Coolant Expansion Water Tank Remove**

3. Disconnect the cooling fan electrical connector.
4. Remove the cooling fan low speed resistance.

☞**the Cooling Fan Low Speed Resistance Remove**

5. Remove the cooling fan clamping screw.



6. Take the cooling fan from the underpart of the vehicle and fit it.

Refit

1. Fit the cooling fan to the vehicle.
2. Fit the screws used to securing the cooling fan to **5.5–7.5Nm**.
3. Fit the cooling fan low speed resistance.

☞**the Cooling Fan Low Speed Resistance Refit**

4. Connect the cooling fan electrical connector.
5. Fit the coolant expansion water tank.

☞**the Coolant Expansion Water Tank Refit**

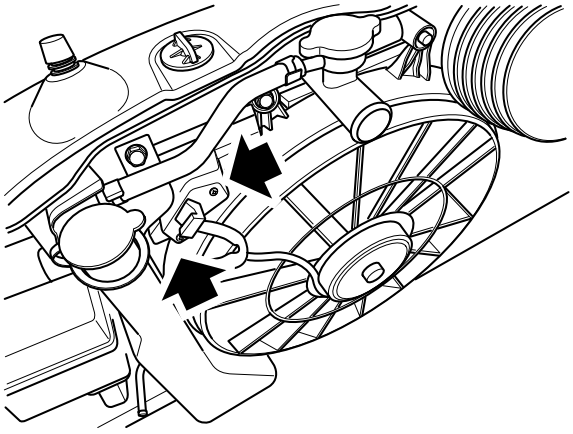
6. Connect battery earth lead

Cooling fan low speed resistance

Remove

Warning: Keep clear of the cooling fan. The fan may start automatically without warning, even after the engine is turned off.

1. Disconnect the battery earth lead.
2. Snip two connections of the speed resistance and try to make the connection staying on the speed resistance become short.
3. Remove the fastening screws of the cooling fan low speed resistance.



4. Remove the cooling fan low speed resistance.

Refit

1. Fit the cooling fan low speed resistance.
2. Fit the fastening screw of the cooling fan low speed resistance to **5.5–7.5Nm**.
3. Connect two cables between the low speed resistance and the fan.
4. Connect battery earth lead.

Radiator

Remove

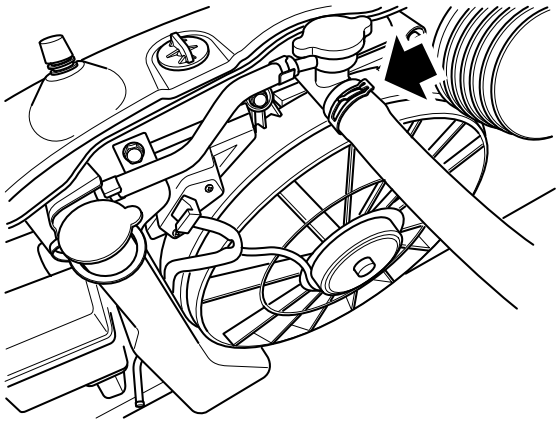
1. Disconnect battery earth lead.
2. Discharge the coolant.

☞**the Coolant Discharge**

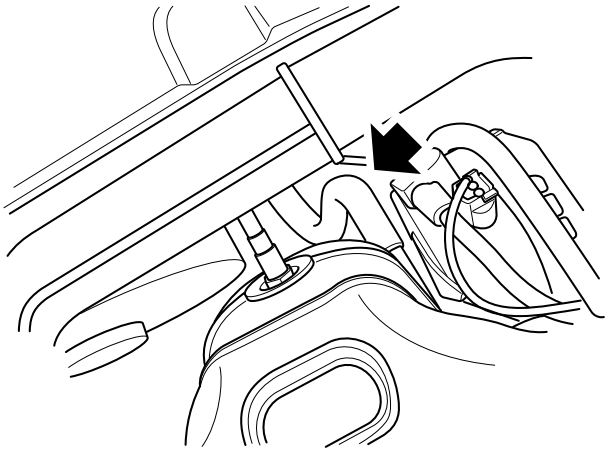
3. Remove air cleaner air inlet pipes

☞**Air Cleaner Air Inlet Pipes Remove**

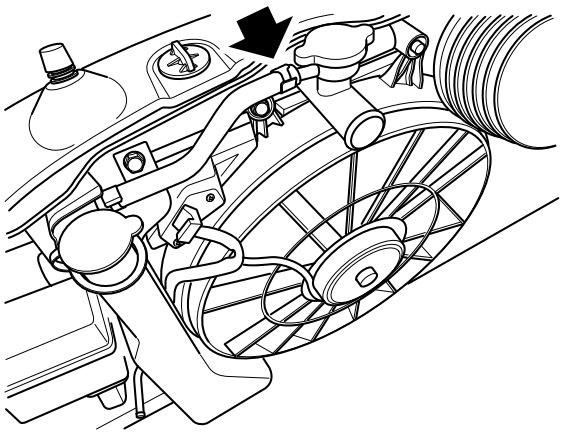
4. Release the clamp of the radiator inlet hose with a clamp pincers and disconnect the radiator inlet hose from the radiator.



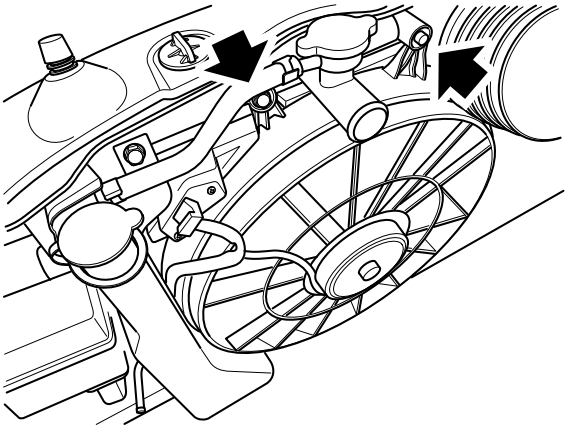
5. Remove the clamp of the radiator inlet hose with a clamp pincers and disconnect the radiator outlet hose from the radiator.



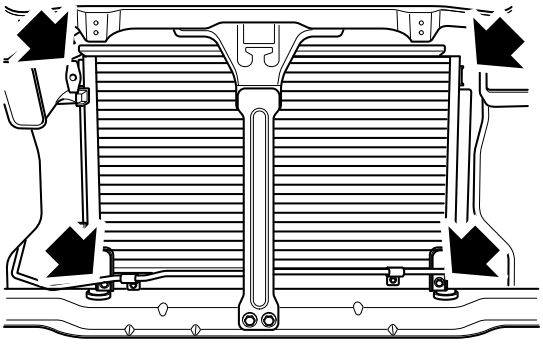
6. Disconnect the cooling fan electrical connector from the main wiring harness.
7. Release the overflow pipe clamp with a clamp pincers and disconnect the overflow pipe.



8. Remove the tightening screws of the radiator cooling fan assembly.



9. Remove the cooling fan along with the expansion tank from above.
10. Lift the radiator upwards from the base and move it towards the engine.
11. Remove the condenser tightening screws.



12. Take the radiator from above.

Refit

1. Put the radiator into the engine cabin.
2. Fix the condenser to the radiator with bolts and tighten the bolts to **5.5–7.5Nm**.

3. Fit the radiator to the lower cross member base of the radiator.
4. Fit the cooling fan and expansion tank to the radiator.
5. Fit fastening bolts of the cooling fan and tighten the bolts to **5.5–7.5Nm**.
6. Connect the electrical connector of the cooling fan to the main wiring harness.
7. Fit the radiator overflow pipe to the radiator and fix it with a clamp.
8. Fit the outlet hose of the radiator to the radiator and fix it with a clamp.
9. Fit the inlet hose of the radiator to the radiator and fix it with a clamp.
10. Fit air cleaner air inlet pipe

☞**Air Cleaner Air Inlet Pipes Refit**

11. Refill the coolant.

☞**the Coolant Refilling**

12. Connect battery earth lead.

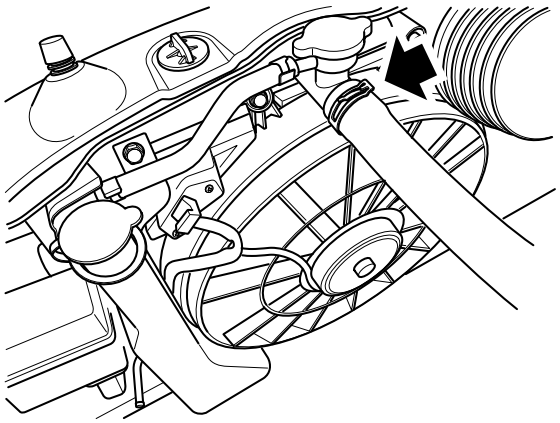
Radiator inlet hose

Remove

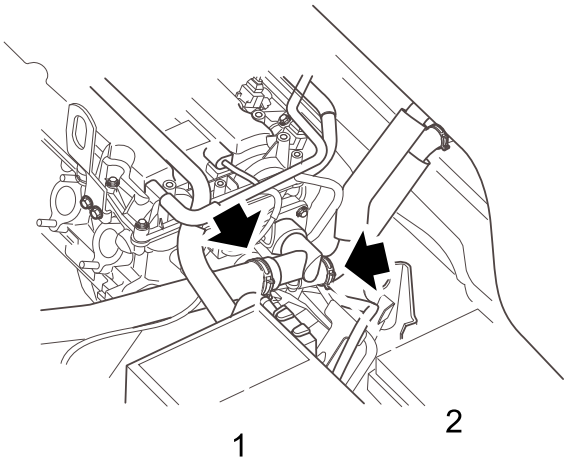
1. Discharge the coolant.

☞**Discharge of the coolant**

2. Release the clamp of the radiator inlet hose with a clamp pincers and disconnect the radiator inlet hose from the radiator.



3. Release the clip (1) of the radiator inlet hose with a clamp pincers and disconnect the radiator inlet hose from the engine.



4. Remove the radiator inlet hose from the vehicle.

Refit

1. Fit the radiator inlet hose to the vehicle.
2. Fit the radiator outlet hose to the radiator and fix it with a clamp.
3. Fit the radiator outlet hose to the engine and fix it with a clamp.
4. Refill the coolant.

☞**Refilling of the coolant**

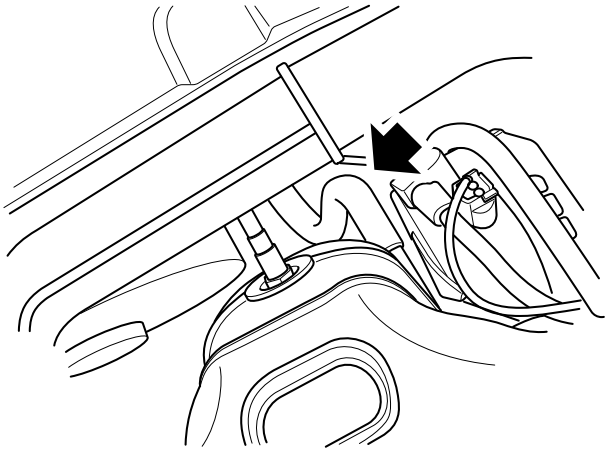
Radiator outlet hose

Remove

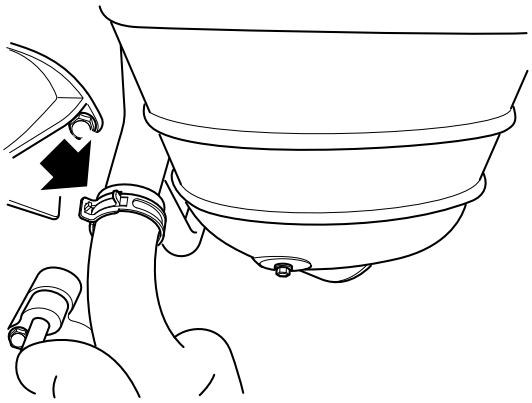
1. Discharge the coolant.

☞Discharge of the coolant

2. Remove the clamp of the radiator outlet hose with a clamp pincers and disconnect the radiator outlet hose from the radiator.



3. Remove the clamp of the radiator outlet hose with a clamp pincers and disconnect the radiator outlet hose from the water pump pipe.



4. Remove the radiator inlet hose from the vehicle.

Refit

1. Fit the radiator inlet hose to the vehicle.
2. Fit the radiator outlet hose to the radiator and fix it with a clamp.
3. Fit the radiator outlet hose to the water pump pipe and fix it with a clamp.
4. Refill the coolant.

☞Refilling of the coolant

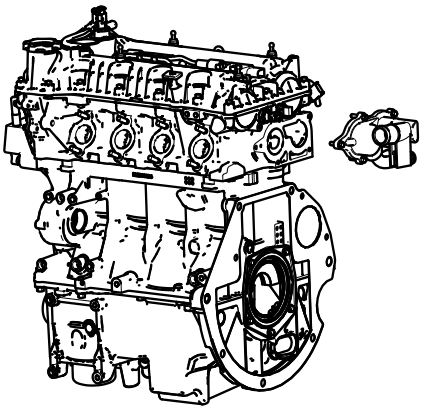
Thermostat

Remove

1. Drain the engine coolant.

Warning: Exhaust components get extremely hot during operation. Ensure exhaust components are sufficiently cooled before handling.

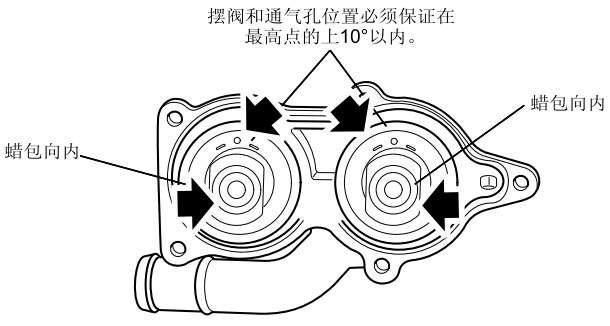
2. Loosen the clamp, and remove the heater hose inlet.
3. Loosen the clamp, and remove the tank hose inlet.
4. Unscrew the 5 bolts assembling the thermostat housing assembly one by one.
5. Remove the damaged thermostat and dispose of it.



6. Remove the seal washer, and dispose of it.

Refit

1. Fit the new seal washer.
2. Fit the thermostat into the thermostat housing, the main thermostat sealing wax with the swing valve facing outwards and the sub-thermostat sealing wax without the swing valve facing inwards, and rotate both of the thermostats respectively to locate the swing valve and the breather hole at the highest point ± 10°as shown in the illustration.



3. Place the thermostat housing assembly on the appropriate location of the cylinder head, fit the bolts, and pretighten them.

4. Tighten the bolts in order, and the tightened torque is **8–12Nm**.
5. Fit the tank water pipe inlet and secure it with clamp.
6. Fit the heater water pipe inlet and secure it with clamp.

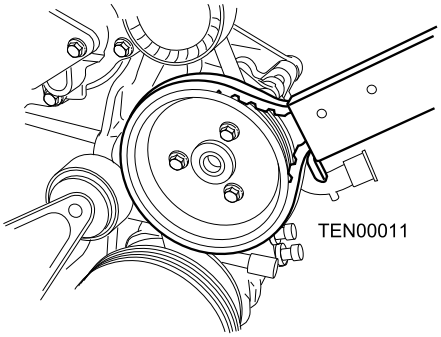
Water Pump

Remove

1. Pre-loosen the 3 bolts connecting the water pump pulley to the pulley hub, just loosen them, and DO NOT remove.
2. Remove the accessory drive belt.

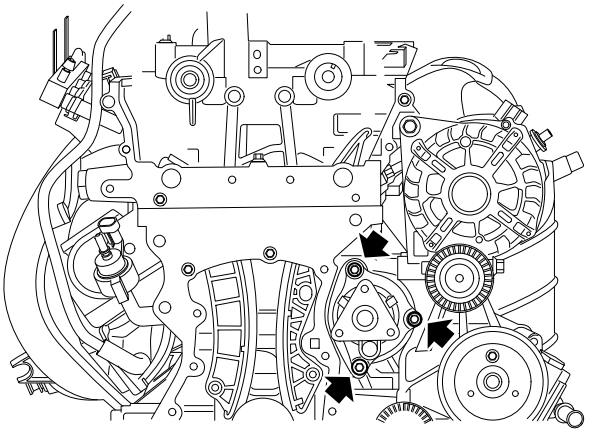
☞**Accessory Drive Belt**

3. Remove the 3 bolts connecting the water pump pulley to the pulley hub, and remove the pump pulley.



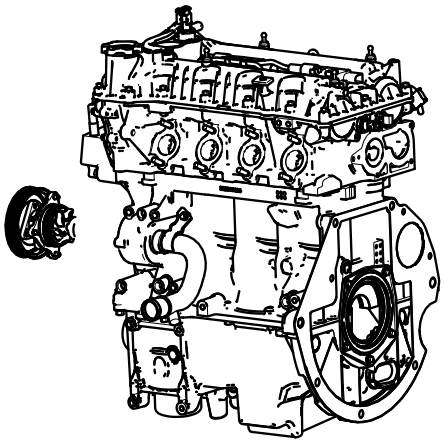
S111J423

4. Remove the 3 bolts connecting the water pump housing to the cylinder block.



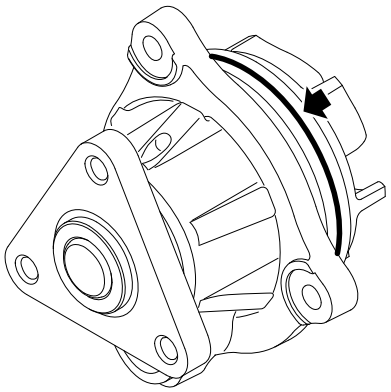
Caution: When removing the water pump, be careful not to pry in radial direction, if it is difficult to pull out, hold the water pump cover and turn in axial direction until the water pump is taken out from the cylinder block.

5. Remove the water pump from the engine.



Refit

1. Since the water pump assembly is a unit, it cannot be disassembled any more. After the water pump assembly is removed, inspect the cause of the water pump failure according to the failure condition. If just the damage of the seal ring causes the leakage, then change a new seal ring. If there is a damage in other parts, it is necessary to change the water pump assembly.



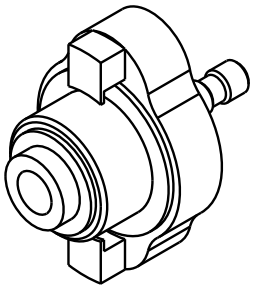
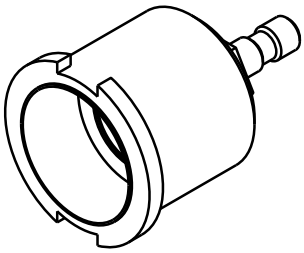
2. Fit the water pump (DO NOT lubricate with oil lubricant, and apply refrigerant to lubricate is recommended); rotate the pump in the axial direction and firmly press it until it snags with the pump mounting surface of the cylinder block. Notice that location pin is not designed in the water pump to allow it to rotate in the circumferential direction, so take care to align the water pump mounting hole with the appropriate bolt hole in the cylinder block when fitting.
3. Fit the 3 service bolts connecting the water pump and the cylinder block, and the torque is **8–12Nm**.
4. Fit the water pump pulley.
5. Fit the 3 service bolts connecting the water pump pulley and the pulley hub, and just pretighten them.
6. Fit the accessory drive belt.

☞Accessory drive belt **Refit**

7. Tighten the 3 service bolts connecting the water pump pulley and the pulley hub, and the torque is **9–11Nm**.

Warning: Exhaust components get extremely hot during operation. Ensure exhaust components are sufficiently cooled before handling.

Special Tools

Tool Number	Description	Picture
TEN00021	Pressure test connector - cooling system	 TEN00021
TEN00020	Pressure test connector - cooling system cap	 TEN00020

Engine Fuel & Management-1.5 VCT

Specifications

Torque

Description	Value
Spark plugs	20–30Nm
Bolt - ignition coil	8–12Nm
Nut - ECM to ECM bracket	8–10Nm
Oil temperature sensor	14–18Nm
Bolt - crank sensor	8–12Nm
Bolt - camshaft.sensor	8–12Nm
Bolt - VCT unit	70–80Nm
Oil pressure sensor	14–18Nm
Bolt - knock sensor	15–25Nm
Bolt - rail fuel to inlet manifold	8–12Nm
Oxygen sensor	50–60Nm
Bolt - utterly temperature sensor to inlet manifold	4–5Nm
Bolt - fuel filter to filter support bracket	7–10Nm
Fuel tank unit locking ring	75–85Nm
Bolt - fuel tank strap	22–28Nm
Bolt - fuel filler to body	7–10Nm
Bolt - fuel filler neck to body	7–10Nm
Bolt - inertia switch	3–5Nm

Parameter

Engine Management System–1.5VCT

manufacturer/model	Bosch UAES/ME 7.8.8
discharge standard	EU4
spark plug:	
Torch	0.8 – 0.9mm
clearance	
Ignition coil:	
Manufacturer	BERU
Model	2×two-spark ignition coil, top stuffing type, common use for cylinder 1 and cylinder 4, common use for cylinder 2 and cylinder 3
primary resistance (typical)	0.67 ± 0.07 Ω @ 20 ℃
secondary resistance (typical)	10.2 ± 2 k Ω @ 20 ℃
fuel injection:	
model	There is no return oil system or multiple fuel injection.
ECM	Bosch contactless electronic type full control chart type engine management system
nozzle:	4 × EV6
working pressure	0.38MPa
nozzle static flow volume	154.2 g/min

Sensor–1.5VCT

sensor:	
crankshaft sensor	UAES BOSCH Hall sensor acquiring signals from camshaft signal tire sidewalls
Camshaft sensor:	
manufacturer/model	UAES BOSCH Hall sensor acquiring from camshaft signal tire sidewalls
oxygen sensor:	
manufacturer/model	UAES BOSCH LSF4.2
heater element (standard value)	7 W
Sensor voltage high	≈ 800mv
Sensor voltage low	≈ 50mv
electronic throttle	
manufacturer	UAES BOSCH
track total resistance	1.25KΩ± 30%
Coolant temperature sensor:	TEMB / NTC
Manufacturer/model	
TMAP sensor:	UAES BOSCH
manufacturer	5V ± 4%
sensor service voltage	

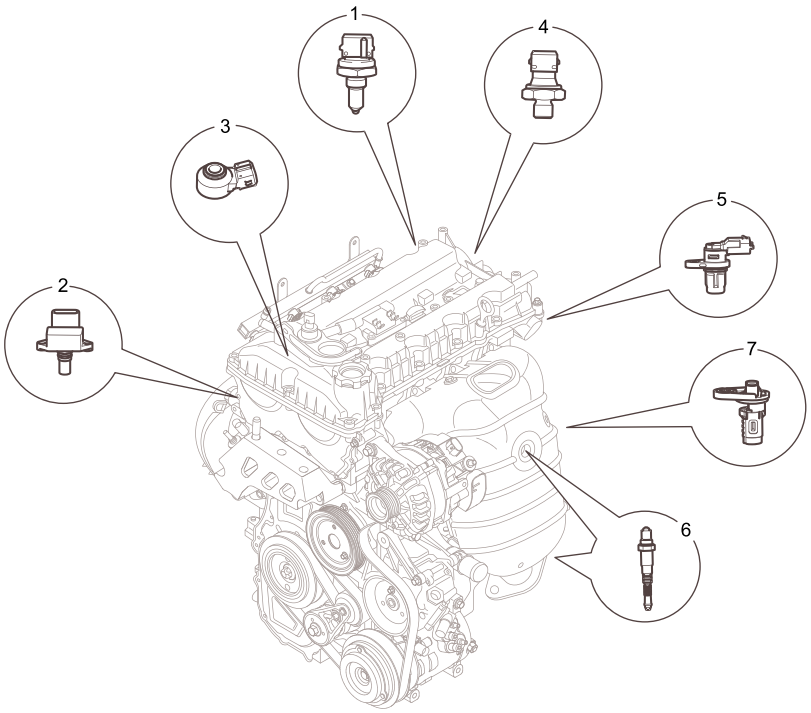
Fuel System–1.5VCT

system	There is no return oil system or multiple fuel injection.
fuel specification	93 RON lead-free
fuel rail	stainless steel pipe structure
nozzle:	4 × EV6
Static flow volume of the nozzle	154.2 g/min @ 0.38 MPa
dynamic flow volume of the nozzle	4.8 mg/pulse@2.5ms × 10ms
fuel pump	Continuous jet, electrically-driven turbo pump immerged into the gasoline in the tank
oil pressure	0.38 MPa/13.5 V
oil pressure adjustment	It is controlled by a pressure regulator inside the fuel tank
fuel pump delivery	0.65 liter/minute @ 0.3 MPa
fuel filter	external unreplaceable filter element

Description and Operation

System layout

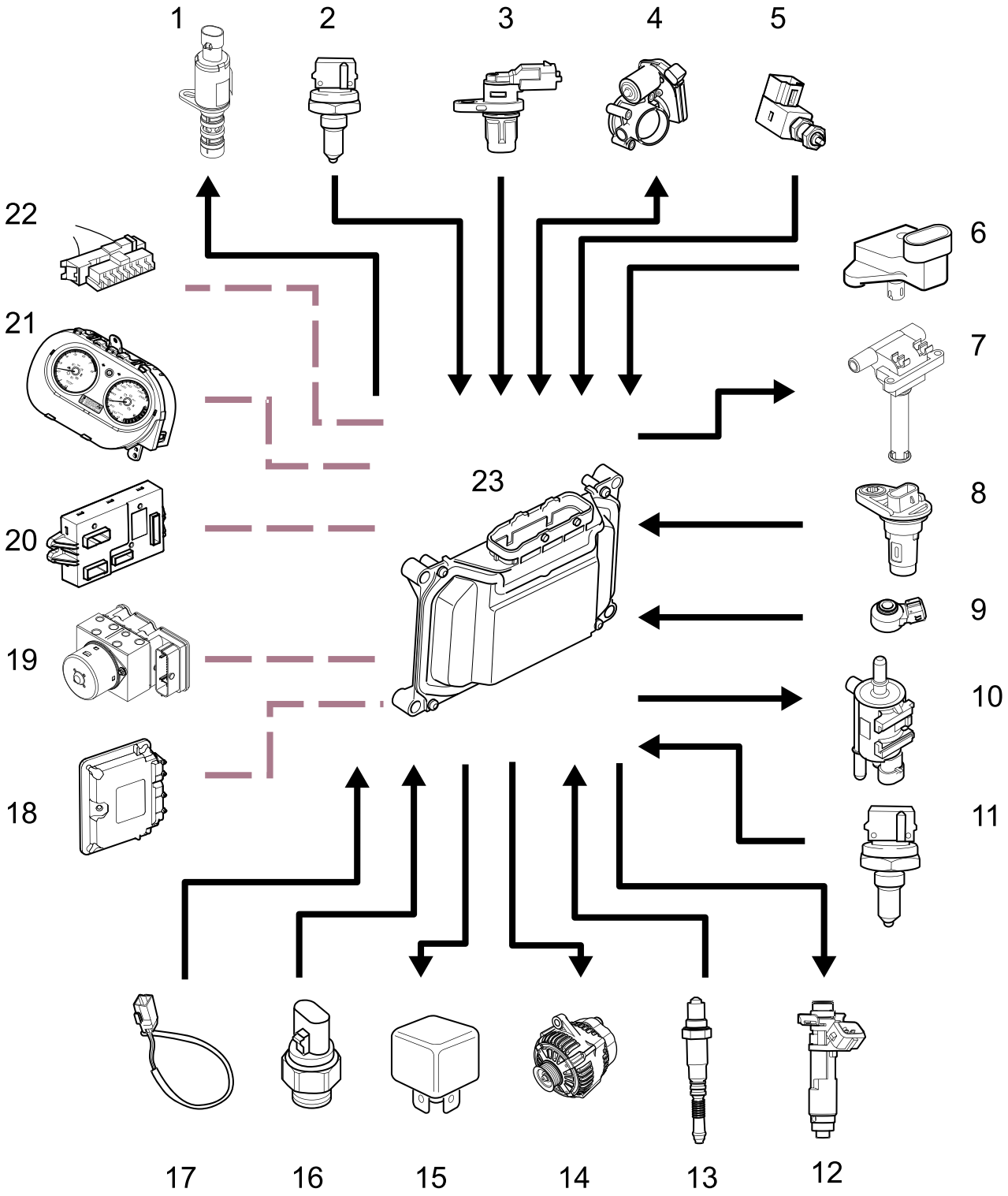
Sensor layout



1. Coolant Temperature Sensor
2. Intake Manifold Absolute Temperature and Pressure Sensors
3. Knock Sensor
4. Oil Pressure Switch
5. Cam Phase Senor
6. Oxygen Sensor
7. Crankshaft Sensor

Control diagram of system

Control diagram of engine control system



1. Variable Cam Timing Valve
2. Oil Temperature Sensor
3. Phase Sensor
4. Electronic Throttle
5. Brake Pedal Switch
6. Intake Air Pressure/Temperature Sensor
7. Ignition Coils 1 and 2
8. Engine Speed Sensor

9. Knock Sensor
10. Canister Control Valve
11. Engine Coolant Temperature Sensor
12. Fuel Injectors 1 - 4
13. Heated Oxygen Sensor **HO2S**
14. Alternator
15. Cooling Fan Relay Unit
16. Air Conditioning Pressure Sensor
17. Evaporator Temperature Sensor
18. Transmission Control Module (**TCM**) (Only Automatic Transmission)
19. **DSC**(**ABS**) Adjuster
20. Body Control Module (**BCM**)
21. Instrument Pack
22. Diagnostic Interface
23. Engine Control Unit (**ECM**)

Description and operation

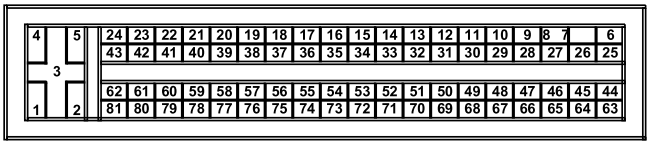
Overview

Engine management system (**ECM**) is used to control the operation of the engine from every respect. The system receives inputs from various sensors to decide outputs, including fuel quantity transmitted to the firebox, ignition time and boost control. NSE engine uses BOSCH ME 7.8.8**ECM** . It is a continuous, multiport fuel injection and is controlled by**ECM** and adopts speed/density principle integrating electronic throttle control. The control purpose of**ECM** is to improve power, reduce oil consumption and reduce exhaust pollution.

Engine Control Element (ECM)

The engine control element is the control center of the fuel injection. It monitors information coming from each sensor constantly and controls and affects each system of the vehicle performance. It also executes system diagnostic function. It can recognize operating troubles and remind drivers through malfunction indicator lamps (**MIL**) and store diagnostic trouble codes indicating failure parts so that the maintenance personnel can repair conveniently.

ECM terminal view



Detailed information sheet of connector pins

Pin number	Description
1	Upstream oxygen sensor heating
2	Ignition coil 2
3	Ignition circuit grounding
4	Downstream oxygen sensor heating
5	Ignition coil 1
6	Fuel injector 4 (the first cylinder)
7	Fuel injector 2 (the fourth cylinder)
8	Blank
9	Blank
10	Blank
11	Blank
12	Continuous power
13	Ignition switch
14	Main relay
15	Engine speed sensor
16	Accelerator pedal module signal
17	Sensor circuit grounding 1
18	Upstream oxygen sensor signal
19	Knock sensor terminal A
20	Knock sensor terminal B
21	Brake lamp
22	Oil temperature sensor
23	Blank
24	Blank
25	Blank
26	Blank
27	Fuel injector 1 (the third cylinder)
28	Blank
29	Blank
30	Blank
31	Blank
32	5V power 2
33	5V power 1
34	Blank
35	Sensor circuit grounding 3
36	Sensor circuit grounding 2
37	Intake pressure sensor
38	Electronic throttle body
39	Engine coolant temperature sensor
40	Accelerator pedal module signal
41	Blank
42	Intake temperature sensor
43	Blank
44	Power supply passing through the main relay
45	Power supply passing through the main relay
46	Canister valve
47	Fuel injector 3 (the second cylinder)
48	Variable camshaft timing(intake)
49	Blank
50	Low speed cooling fan relay
51	Electronic circuit grounding 2
52	Blank

53	Electronic circuit grounding 1
54	Electronic throttle body
55	Downstream oxygen sensor signal
56	Evaporator temperature sensor
57	Blank
58	Brake switch
59	Engine control input
60	Air conditioning medium-voltage switch
61	Power circuit grounding 1
62	**CAN** bus interface
63	Power supply passing through the main relay
64	Throttle actuator
65	Throttle actuator
66	Throttle actuator
67	Throttle actuator
68	High speed cooling fan relay
69	Air-condition compressor relay
70	Oil pump relay
71	Diagnosis K line
72	Blank
73	Anti-theft input power
74	Clutch switch (MT only)
75	Air conditioning switch
76	Blank
77	Blank
78	Sensor circuit grounding 4
79	Phase sensor
80	Power circuit grounding 2
81	**CAN** bus interface

According to the control principle, the engine management system is divided into six major parts, they are respectively:

- External control
- Engine gas supply control system
- Engine ignition control system
- Engine oil-feeding control system
- Auxiliary 1(heat management)
- Auxiliary 2 (external auxiliary)

External control

The engine external control mainly includes:

- Main relay
- Ignition switch
- Storage battery
- **CAN** communication
- Anti-theft power supply

The external control mainly refers to power supply and communication. One way power supply of the engine control element (**ECM** is directly connected to the power supply through fuse EF5 so as to ensure that**ECM** can stay at an energized state. When the ignition switch is set at ON or IGN position, the engine control element can control the opening of the main relay or is connected with the ignition power supply.

The engine control can carry out communications with controllers at other network nodes through high speed**CAN** so as to ensure each performance of the system. It can also be connected with the diagnose interface (DLC) so that the maintenance personnel can carry out diagnosis operation conveniently.

Main relay

The main relay is situated in neutral relay R2 in the engine cabin fuse box. This relay is a four-leg relay using DIN pin layout. This relay doesn't contain reverse rotational protection diodes, and this function is implemented by **ECM**. The relay coil is controlled by **ECM**.

When the engine control element inspects the position information of the ignition switch IGN,**ECM** outputs the low level signal to control relay to be switched on, the UBR pins (44,45,63) of**ECM** will be connected to the supply voltage so as to ensure that the startup conditions can be satisfied.

Failure

The main relay is likely to fail due to the following conditions:

- Shorted relay winding
- Open relay winding
- High relay winding resistance
- Normally open relay contact
- Normally close relay contact
- High relay contact resistance
- Open relay harness
- High relay harness resistance
- The relay harness is shorted when connecting with 12V power supply
- Shorted relay harness grounding
- **ECM** Grounded circuits have not been provided

In order to confirm whether the main relay are working normally, the following inspections can be carried out:

- Sound check — whether the fuel pump can work for 2 seconds when the ignition key is placed at the ignition startup position
- Whether the fuel injector or the ignition coil has power support

If the above items have been detected, it shows that the main relay works normally.

CAN Communication

The engine management system makes use of high speed**CAN** communication network to communicate with**ECM** ,**ABS** ,**BCM** and **TCM** , and diagnoses outputs through the diagnosis interface.

Anti-theft power supply

When the ignition switch is turned to the 2nd gear, the engine control module (**ECM**) communicates with the body control module (**BCM**) through**CAN** high-speed bus and carries out information verification with each other. After passing validations,**BCM** will control the work of starting the motor,**ECM** as well as ignition, oil injection and engine startup. The No. 73 pin of**ECM** is an anti-theft power supply switchin pin. If the wiring harness connected to this pin is disconnected, 5V power supply will not be obtained from No.32 pin, so the engine anti-theft function will not work, the verification information of**BCM** will not be received from**ECM** and the starting motor will not work and the engine will also not be able to start.

Engine gas supply control system

The engine gas supply control system mainly includes:

- Electronic throttle body
- Accelerator pedal module
- Intake pressure temperature sensor
- Phase sensor and oil temperature sensor
- Variable camshaft timing valve

When the ratio between the fuel and the air quality is 14.7:1, the fuel can be burnt sufficiently. And at this moment, the engine is staying at the optimum working state.

The gas supply part obtains the optimum air-fuel ratio mainly through controlling the air input and the main stroke of the oil cylinder.

Electronic throttle

The electronic throttle is composed of throttle, throttle actuator (direct current machine) and throttle position sensor and so on.

Instructions from**ECM** make the direct current machine work and affect the opening of the throttle through a transmission mechanism. There are two potentiometers used as position sensors and the two potentiometers are in opposite phase refit. When the position of the throttle changes, linear variation will take place in the resistances of both two lines with one increasing and the other one reducing. They will be transformed into voltage outputs which change according to the resistance value, after adding +5V voltage.

By making use of these two potentiometers along with two potentiometers used to monitor the accelerator pedal stroke on the accelerator pedal module, a part of the monitoring function of the entire electronic throttle control system is configured to provide the degree of redundancy desired by the system control.

Throttle position sensor

Throttle position sensor is used to provide**ECM** with throttle-alternator information. According to this information,**ECM** engine load information, working condition information (for example, starting, idling, towing astern, partial load and full load) as well as acceleration and deceleration information can be obtained.

The throttle sensor actually is an angle potentiometer with linear output characters. As the potentiometer rocker arm and the throttle are in coaxial mounting, when the throttle rotates, the potentiometer rocker arm will be brought to slide to some certain position and the potentiometer will output voltage signals which are in proportion to the throttle position.

Accelerator pedal module

There are two potentiometers used as sensors in the accelerator pedal module, in which their resistance values change according to the alternation of the electronic accelerator pedal position.**ECM** and can respond accurately to the displacement of the accelerator pedal, therefore, they can monitor the movement condition of the accelerator pedal.

As these two potentiometers are made in in-phase refit, when the accelerator pedal position changes, its resistance will increase or reduce linearly at the same time. They will be transformed into voltage outputs which change according to the resistance value after adding +5V voltage. By making use of these two potentiometers along with two potentiometers used to monitor the throttle position on the electronic throttle, a part of the monitoring function of the entire electronic throttle control system is configured to provide the degree of redundancy desired by system control.

Intake pressure temperature sensor (TMAP)

Intake pressure temperature sensor measures the absolute pressure of the intake manifold and the intake temperature and provides engine load and intake temperature information.

The intake pressure is measured by a piezoelectric sensor which can provide "load signal" to the controller according to the differences between the atmospheric pressure and the intake manifold pressure; 5V voltage is provided by the controller and the controller will receive voltage feedback of 0-5V according to different intake pressures. The intake temperature is measured by NTC type (Negative Temperature Coefficient) sensor which transmits a voltage indicating intake temperature variation to the controller according to the intake temperature variation. If pressure P is proportional to the output voltage, the temperature will be in inverse proportion to the output resistance.

Camshaft Position Sensor(CMP)

The phase sensor is used to cooperate with the speed sensor under the condition that there is no distributor and to provide**ECM** with crankshaft phase information, which is used to differentiate between the compression upper dead center and the exhaust upper dead center of cylinder 1.

Phase sensor is composed of a rotor which is made of a Hall sensor and a steel plate. The rotor is fit on the camshaft with the Hall sensor being fastened and a dummy club which has a radian of 36°. When the dummy club passes through the Hall sensor, the internal magnetic field of the Hall sensor will change, which will cause the signal voltage output to change. So thus two different upper dead centers are differentiated.

Failure

CMP sensor or the magnet ring is likely to fail or provide incorrect signals due to the following conditions:

- The sensor air-gap doesnot'meet specifications.
- The sensor is polluted by metal debrises
- The sensor Hall effect semiconductor is damaged
- The sensor magnetic field is too weak
- Sensor wiring harness open
- Shorted sensor harness
- High relay harness resistance
- The magnet ring is polluted by metal debrises
- The accuracy of the magnet ring becomes poor due to mechanical damage.
- Exhaust camshaft timing errors
- Intake camshaft timing errors

Oil temperature sensor (EOT)

Oil temperature sensor (EOT) is used to monitor the temperature of the engine oil and control the variable camshaft timing valve (namely, VCT valve). Optimum air inflow can be obtained by adjusting the variable camshaft timing valve under different temperatures.

Failure

EOT sensor is likely to fail or provide incorrect signals due to the following conditions:

- The system is lack of oil
- Open external wiring harness
- Shorted external wiring harness grounding
- The external wiring harness is shorted when connecting with 5V power supply
- High external wiring harness resistance
- Grounded circuits cannot be provided
- EOT sensor thermal resistor is damaged

Variable camshaft timing valve (VCT)

This solenoid valve is driven by the engine control module output pulse width modulation (PWM) signal and the opening of the solenoid valve can be adjusted by changing the duty ratio.

VCT system can improve the engine performance, especially the torque performance, during the process of reducing fuel consumption and exhaust emission, when the engine is running at a low speed.

ECM receives signals from**CKP** sensor and**CMP** sensor. Through these signals,**ECM** decide the valve timing by referring to the control diagram. Then**ECM** operate the VCT oil control valve fit on one side of the cylinder cover. These solenoid valves control the oil flowing into the phase modulator, change the position of the phase modulator in relation to the camshaft, so thus to adjust the valve timing.

Engine ignition control system

The engine ignition control system mainly includes:

- Ignition coil 1,2
- Engine speed sensor
- Knock sensor

Ignition coil

The ignition coil transforms low voltage direct current of the battery into high voltage, produces sparkles through the spark plug discharging and so thus to ignite the gas mixture inside the cylinder. Each ignition coil includes a pair of coil winding surrounding laminated cores.

Fit two ignition coils on the camshaft cover. Fit them on No.1 cylinder and No.3 cylinder and connect them with the camshaft sensor harness through a connector and an ignition coil. Below each coil, there is a spark plug connection which is connected to another spark plug through a high pressure(HT) lead.

The coil fit on No. 1 cylinder is connected to the spark plug of No.1 cylinder, while HT lead is connected to the spark plug of No. 4 cylinder. The coil fit on No. 3 cylinder is connected

to the spark plug of No.3 cylinder, while HT lead is connected to the spark plug of No. 2 cylinder.

Failure

The ignition coil is likely to fail due to the following conditions:

- Open primary winding
- Shorted primary winding
- The primary winding resistance is out of tolerance
- Open secondary winding
- Shorted secondary winding
- Shorted secondary winding connecting with the primary winding
- The secondary winding resistance is out of tolerance
- Insulation at the coil top is subjected to mechanical damage

Speed sensor, namely crankshaft position sensor (CKP)

CKP The sensor is used to provide the engine rotation speed information and the crankshaft upper dead center information in an ignition system without a distributor. It is a Hall-effect sensor and is used by cooperating with an pulse wheel. The pulse plate is a fluted disc with denticles on the magnet ring arranged by an interval of 6°. There are 58 denticles in total with a clearance of 2 denticles maintained. The oscillator is fit on the crankshaft, rotating with the crankshaft. When the tooth point passes close by the sensor top, the pulse plate made of ferromagnetic materials will cut the magnetic line of the permanent magnet inside the sensor. So thus induced voltage will be generated in the coil and output as rotating speed signals.

Failure

CKP sensor or the magnet ring is likely to fail or provide incorrect signals due to the following conditions:

- The sensor air-gap doen't meet specifications.
- The sensor is polluted by dust.
- The sensor Hall effect semiconductor is damaged
- The sensor magnetic field is too weak
- Open sensor wiring harness
- Shorted sensor harness
- High sensor harness resistance
- The magnet ring is polluted by dust.
- Due to erosion or mechanical damage, the magnet ring has a poor precision
- The flywheel or the driving disk is out-of-round,**CKP** which causes signal distortion to the sensor.
- As the crank moves radially, the sensor signal changes.

In order to inspect whether**ECM** the sensor signal is received,**CKP** the following operations can be carried out:

- Inspect the operation of the fuel pump during the engine starting process. If the fuel pump supplies oil under the condition that the ignition is turned on and does not run during the starting process, it means that**ECM** the sensor signal has not yet been received.

Knock sensor

The knock sensor is used to provide engine knock information to the electronic controller so as to control knocks.

The knock sensor is a kind of vibration and acceleration sensor. It is fit on the engine cylinder body. The sensing clement of the sensor is a piezocrystal. The vibration of the engine cylinder body is transmitted to the piezocrystal through a mass block inside the sensor. Voltage is generated on two polars by the piezocrystal due to the pressure brought by the mass block vibration, transforming vibration signals into voltage signals outputs.

Failure

Knock sensors are likely to fail or provide incorrect signals due to the following conditions:

- Open sensor
- Shorted sensor grounding
- Intermittent open sensor
- Incorrect refit of the knock sensor

If a failure occurs to the knock sensor signal, the following symptoms are likely to appear:

- Storage failure code
- Engine combustion knock can not be inspected
- Default setting is restored

Engine oil-feeding control system

The engine oil-feeding control system mainly includes:

- Upstream oxygen sensor
- Downstream oxygen sensor
- Fuel injector 1 4
- Canister valve
- Oil pump relay

Engine oil-feeding control system is mainly used to control the fuel delivery of the engine under different working conditions.

When the engine starts for the first time with the rotation speed higher than the desired speed, this system starts open-loop operation. The control module ignores signals from the heated oxygen sensor(**HO2S**). The control module calculates the air fuel ratio, according to the input signals from

ECT,**TMAP** and**TP** sensors. The system will maintain the open-loop state until the following conditions are satisfied:

- The output voltage changes, indicating that the temperature has already increased and is sufficient for normal operation
- **ECT** sensor's temperature is higher than the defined one
- A period of defined time has passed after the engine starts

For the above conditions, different engines have their own specific values which are stored in an erasable programmable read-only memory (**EEPROM**). After reaching these values, the system starts closed-loop operation. During closed-loop operation process, the control module calculates air fuel ratio as well as the fuel injector staring time according to signals from various sensors, but mainly from heated oxygen sensors. So that the air fuel ratio is always very close to 14.7: 1.

Oxygen sensor (HO2S)

The oxygen sensor is used to determine the oxygen content in the engine exhaust and confirm whether gasoline and air have been burnt completely. The electronic controller realizes closed-loop control with the target of excess air factor l =1 according to this information so as to ensure that the three-way catalyst can bring maximum conversion efficiency to three pollutants (HCCONO^{X})in the exhaust.

A ceramic pipe is its sensing element with the outside connecting with exhaust and the inside connecting with atmosphere. When the temperature of the sensing ceramic pipe reached 350℃, the sensing ceramic pipe will have solid electrolyte characteristics. Just by making use of this characteristic, the concentration difference of oxygen will be transformed into electric potential difference, forming electric signal output. If the concentration of the gaseous mixture is higher, the differential concentration of the oxygen ion inside and outside the ceramic pipe will be higher, so the electric potential difference will be higher, which causes large quantities of oxygen ion to move from inside to the outside, generating higher output voltage (close to 900mV); if the concentration of the gaseous mixture is lower, the differential concentration of the oxygen ion inside and outside the ceramic pipe will be lower, so the electric potential difference will be lower, which causes only a small amount of oxygen ion to move from inside to the outside, generating lower output voltage (close to 100mV).

The oxygen sensor is classified into front oxygen sensor and rear oxygen sensor. The former one is used to determine the oxygen content in the engine exhaust so as to realize closed-loop control, while the later one is used to monitor the transformation function of the three-way catalyst.

Failure

HO2S is likely to fail or provide incorrect signals due to the following conditions:

- It is polluted by leaded fuel
- It is polluted by carbon deposition or silica deposition
- Collision damage/mechanical impact
- Open external wiring harness
- The external wiring harness is shorted when connecting with 12V power supply
- Shorted external wiring harness grounding
- High external wiring harness resistance
- Open heating equipment
- Shorted heating equipment
- Grounded circuits have not been provided to the heating equipments
- The wiring harness shield has no earthing connection

Fuel injector

The fuel injector according to the instructions from,**ECM** injects fuel within the defined time so as to provide fuel to the engine and atomize it.**ECM** energize the fuel injector coil to form magnetic field force. When the magnetic field force increases to a level on which the magnetic field force can sufficiently overcome the release spring pressure, the resultant force consisted of gravity and force of friction of the needle valve, the needle valve starts to rise and the injection process starts. When the injection impulse ends, the release spring pressure causes the needle valve to close again.

Failure

The fuel injector is likely to fail due to the following conditions:

- The nozzle is polluted by dust or wax (reduce flow)
- The nozzle is offset (injection has not been positioned correctly)
- The fuel filter is blocked
- Open winding
- Shorted winding grounding
- The winding is shorted when connecting with 12V power supply
- The winding resistance is out of tolerance
- Open external wiring harness
- Shorted external wiring harness grounding
- The external wiring harness is shorted when connecting with 12V power supply

Electric fuel pump

The electric fuel pump is used to convey fuel from the oil box to the engine and provide sufficient fuel pressure and surplus fuel.

It is a vane pump which is driven by a direct current machine, placed inside the fuel tank and immersed by the fuel so as to make use of fuel heat emission and lubrication. The battery supplies power to the electric fuel pump through a fuel pump relay which makes the electric fuel pump circuit being energized only when it starts up and the engine is running. When the engine stops running due to accidents, the fuel pump will stop running automatically.

Failure

The inertia switch supplies 12V power to the fuel pump and provides fuel pump circuit state information through the connection with **BCM**. If the fuel pump relay fails, following symptoms will appear:

When starting up,

- if the fuel system pressure reduces to zero, the engine will not be able to ignite.
- If the fuel system pressure is lower than the normal operation pressure (0.38MPa), the engine might try to ignite, but it cannot work normally
- If the fuel system pressure is staying at a normal level, the engine will ignite to operate, however, with the reduction of the fuel pressure, it will finally be shut off and it will not be able to start up again.

During driving process

if the fuel pump relay fails in driving, the engine will lose power and will be shut off finally due to insufficient fuel.

The fuel pump relay is likely to fail due to the following conditions:

- Shorted relay coil
- Open relay coil
- High relay coil resistance
- Normally open relay contact
- Normally close relay contact
- High relay contact resistance
- Open relay harness
- High relay harness resistance
- The relay harness is shorted when connecting with 12V power supply
- Shorted relay harness grounding
- Grounded circuits cannot be provided

Identify whether the fuel pump relay works normally by carrying out the following inspections:

- Sound check — whether the fuel pump can work for 2 seconds when the ignition key is placed at the ignition startup position
- If there is no response, inspect the inertia switch to ensure that there is no accident touched off. If the fuel pump has not been indicated to work, but the inertia switch is set at "ON" (open) position, take down the fuel pump relay and check.

When the ignition key is placed at the ignition startup position (for 2 seconds) and during the startup process, inspect whether a grounded circuit has been provided to the fuel pump relay winding. Take down the fuel pump relay, connect a multimeter among 12V power supply provided by the vehicle, fuel pump pin 85 and the connected fuse box pin. After turning on the ignition, inspect outputs according to the circuit diagram.

As the internal drive circuit of the**ECM** will consume voltage, the voltage measured might be lower than the battery voltage.

Canister control valve

The canister control valve is used to control the flow of regenerating airflow of the fuel evaporation control system.

The canister in the fuel evaporation control system will absorb oil vapor from the fuel tank until reaching saturation.**ECM** open the control valve of controlling the canister, regenerating airflow will be formed by fresh air and saturated fuel vapor in the canister. Introduce an engine air inlet pipe again. The electronic controller controls the flow of regenerating airflow by changing the duty ratio of the impulse signal transmitted to the canister control valve magnet coil according to different working conditions of the engine. In addition, this flow is also affected by the pressure difference at two ends.

Failure

Canister control valve is likely to fail due to the following conditions:

- Open magnet winding
- Shorted magnet winding
- The external wiring harness is shorted when connecting with 12V power supply
- Shorted external wiring harness grounding
- High external wiring harness resistance
- No**PWM** signal is provided
- There are mechanical problems occurring in the valve.

Auxiliary 1 (heat management)

The heat management part mainly includes:

- Air-condition compressor relay

- Air conditioning request (switch)
- Coolant temperature sensor
- Cooling fan relay (low speed and high speed)
- Air-condition pressure sensor
- Evaporator temperature sensor

The engine adjusts opening or closing of the high speed and low speed cooling fan relays according to the high and low temperature of the coolant.

After the driver pushes the air-condition request (switch) on the instrument panel, the engine control unit will monitor the state of the air-condition pressure sensor signal and then make a decision on whether or not turning on the air-condition based on the information including the signal of the current engine coolant temperature sensor and the rotation speed signal of the engine.

Coolant temperature sensor

The coolant temperature sensor is used to provide engine coolant temperature information. So that the controller could correct oil injection and ignition accordingly. It is a thermal resistor with negative temperature coefficient (**NTC**), and its resistance value reduces with increasing temperature, but the relationship between the two is not linear relationship. This thermal resistor is fit inside a copper heat conducting sleeve.

Failure

The**ECT** sensor is likely to fail or provide incorrect signals due to the following conditions:

- Due to leakage, the system is lack of coolant
- Open external wiring harness
- Shorted external wiring harness grounding
- The external wiring harness is shorted when connecting with 5V power supply
- High external wiring harness resistance
- Grounded circuits cannot be provided by **ECM**
- The**ECT** thermal resistor is damaged

Cooling fan relay unit

The cooling fan relay unit is fit on the left side of the radiator and is equipped with two relays.

The cooling fan is controlled by**ECM** and is operated by the relay unit.**ECM** use information provided by**ECT** sensor **BCM** and the**A/C** pressure sensor to restrict the cooling temperature of the engine.

Evaporator temperature sensor

The principle of the evaporator temperature sensor is that the value of the sensor unit thermal resistor will change when it is being heated. After connecting with a fixed resistance in series, voltage output from the sensor will change with the temperature variation.

Auxiliary 2 (external auxiliary)

The external auxiliary part mainly includes:

- Alternator control input
- Clutch switch
- Brake pedal switch
- Brake lamp

Alternator control input

Alternator control input is**ECM** control the charge made to the battery by the alternator when the engine is working.

Brake switch

The brake switch is fit on the pedal case inside the driver's cabin.**ECM** monitors the switching state and transmit data to**CAN** through the bus,**TCM** so as to control the opening of the transmission clutch. The brake switch is activated in operating the brake pedal.

Clutch switch (only for manual transmission)

The clutch switch is located on the pedal assembly, which is the same as the brake switch. The clutch switch is activated in operating the clutch pedal.

Service Procedures

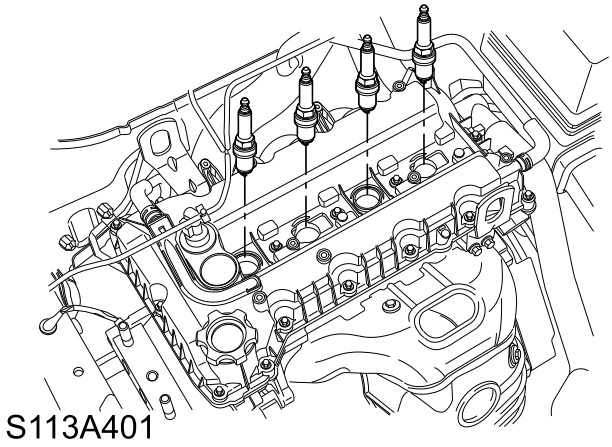
Spark Plug-1.5VCT

Remove

1. Disconnect battery earth lead.
2. Remove the ignition coil and the high tension coil.

☞**Ignition Coil Remove**

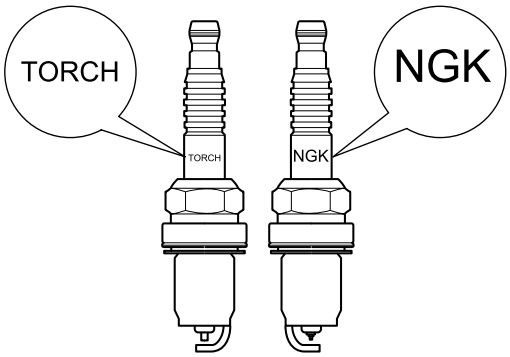
3. Clean the area around the spark plug, clear the dust around the spark plug with high-pressure gas.
4. Use a spark plug socket to remove four spark plugs.



S113A401

Refit

1. Before fitting the spark plug, identify the original spark plug type, and choose the same type of spark plug to replace.



2. The clearance of each new spark plug is adjusted to 0.80-0.90 mm.
3. Fit the spark plug and tighten it to **20–30Nm**.
4. Fit the ignition coil.

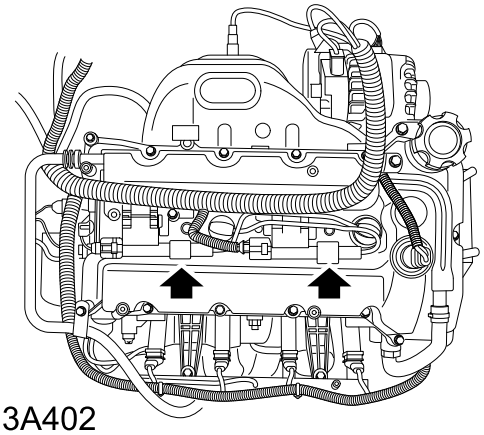
☞**Ignition Coils Refit**

5. Connect battery earth lead.

Ignition Coil

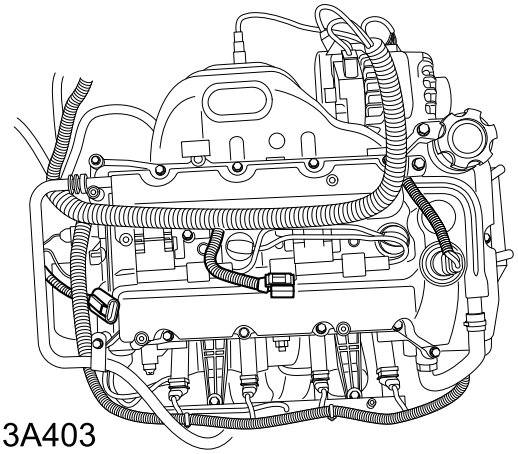
Remove

1. Disconnect battery earth lead.
2. Release the high voltage wire.



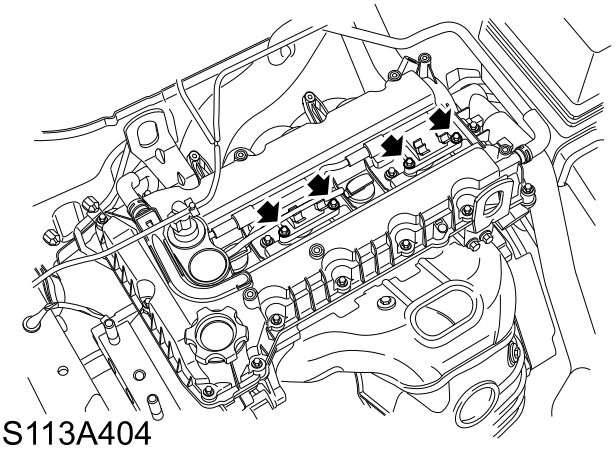
S113A402

3. Disconnect the wiring harness connectors.



S113A403

4. Remove the bolts and nuts of fixed ignition coils.



S113A404

5. Holding the root of the ignition coil rubber sheath, pull out the ignition coil from the spark plug.

Refit

1. Connect the high voltage wire to the ignition coil, with the 1-4 cylinder connected, and the 2-3 cylinder connected.

2. Fit the ignition coil to the spark plug, and connect the wiring harness connector.

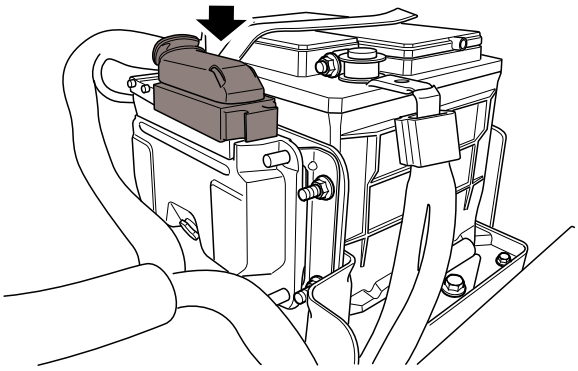
Caution: There is a bracket between the ignition coil and the camshaft housing cover.

3. Tighten the bolts securing the ignition coil to **8–12Nm**.
4. Connect the high voltage wire to the spark plug.
5. Connect battery earth lead.

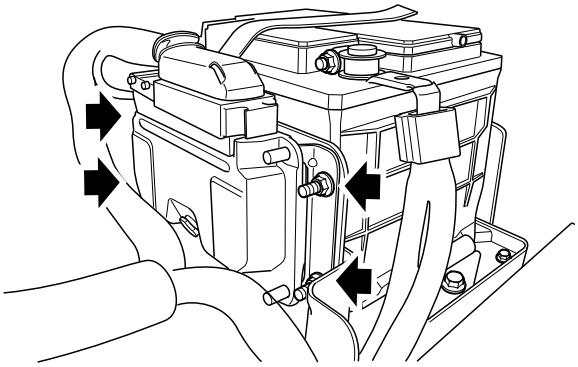
Engine control module (ECM)

Remove

1. Disconnect battery earth lead.
2. Disconnect connections of connectors from ECM.



3. Remove nuts fixing ECM to battery tray brackets.



4. Remove ECM from the battery tray brackets.

Refit

1. Position ECM and align mounting holes with battery trays.
2. Fit nuts fixing ECM to the tray and tighten them to **8–10Nm**.
3. Fit wire harnesses and connect them to ECM connectors.
4. Connect battery earth lead.
5. Fit ECM with a diagnostic tool.

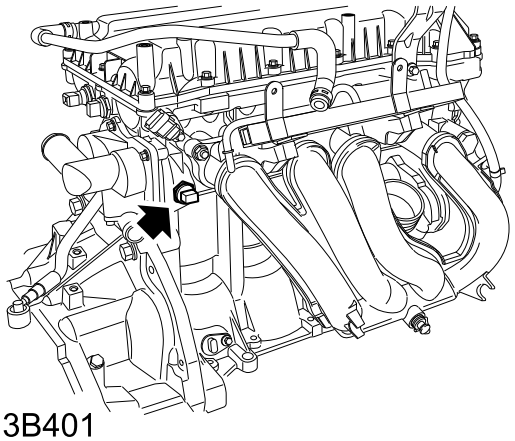
Engine Coolant Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Remove the coolant expansion tank lid to release the cooling system pressure, and then refit the lid.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

3. Disconnect the wiring harness connectors.
4. Place a suitable container to collect the coolant that might overflow.
5. Remove the engine coolant temperature sensor.



S113B401

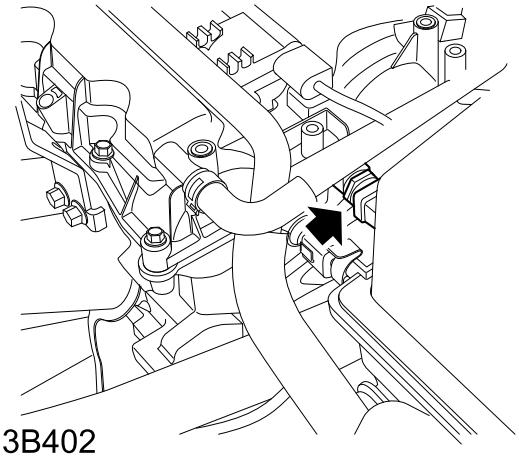
Refit

1. Clean the threads of the coolant temperature sensor.
2. Fit a new seal washer onto the coolant temperature sensor.
3. Fit the engine coolant temperature sensor and tighten it to**14–18Nm**.
4. Connect the wiring harness connector on the engine coolant temperature sensor.
5. Connect battery earth lead.
6. Inspect the coolant level, and add if necessary.

Engine Oil Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector from the oil temperature sensor.
3. Place the oil receiving trough under the switch to collect the spilled oil.
4. Remove the oil temperature sensor.



S113B402

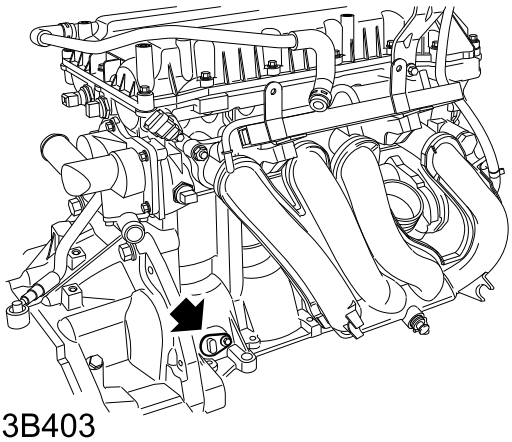
Refit

1. Clean the threads of the oil temperature sensor.
2. Fit a new seal washer onto the oil temperature sensor and tighten the switch to **14–18Nm**.
3. Connect the wiring harness connector of the oil pressure switch.
4. Remove the oil receiving trough.
5. Connect the battery negative terminal.
6. Check the engine oil level, and add if necessary.

Crankshaft Position Sensor

Remove

1. Disconnect battery earth lead.
2. Raise the vehicle on a lift.
3. Disconnect the wiring harness connector from the camshaft position sensor.
4. Remove the bolts securing the crankshaft position sensor to the cylinder block.
5. Remove the crankshaft position sensor.



S113B403

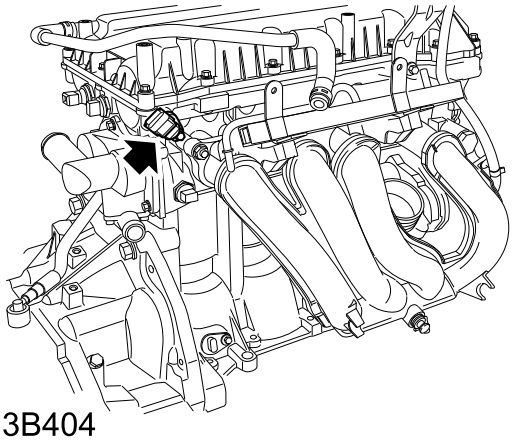
Refit

1. Clean the mating surface between the crankshaft position sensor and the cylinder block.
2. Locate the crankshaft position sensor, then fit the retaining bolt and tighten to **8–12Nm**.
3. Connect the wiring harness connector of the crankshaft position sensor.
4. Lower the vehicle.
5. Connect battery earth lead.

Camshaft Position Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector from the camshaft position sensor.
3. Remove the bolts securing the camshaft position sensor, and remove the camshaft position sensor, and dispose of the O-ring.



S113B404

Refit

1. Clean the camshaft position sensor and its mating surface and fit the O-ring to the camshaft position sensor.
2. Fit the camshaft position sensor to the cylinder head and tighten the bolts to **8–12Nm**.
3. Connect the wiring harness connector of the camshaft position sensor.
4. Connect battery earth lead.

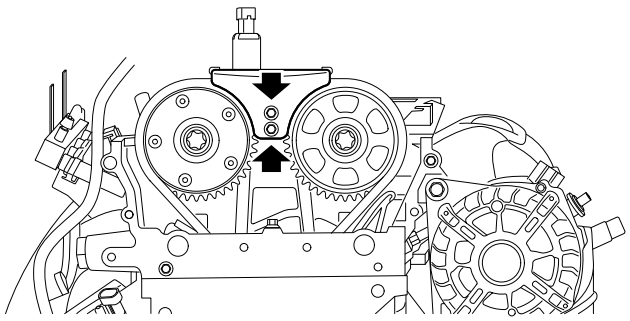
Camshaft Phase Modulator

Remove

1. Disconnect battery earth lead.
2. Remove the timing chain.

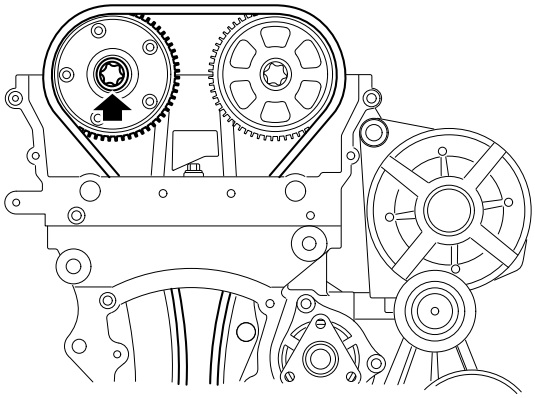
☞**Timing Chain Remove**

3. Remove the upper track.



S111J413

4. Remove the center bolts of the cam phase modulator and take out the cam phase modulator.



S111J421

Refit

1. Fit the bolts of the camshaft phase modulator and tighten them to**70–80Nm**.
2. Fit the upper track.
3. Fit the timing chain.

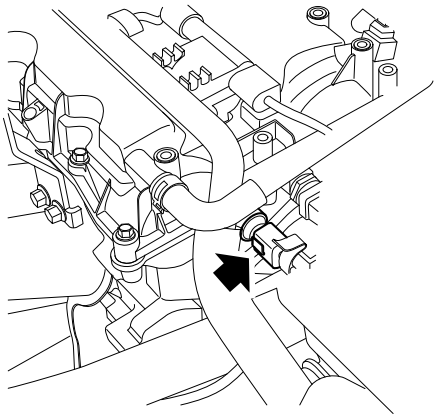
☞**Timing Chain Refit**

4. Connect battery earth lead.

Oil Pressure Switch

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector from the oil pressure switch.
3. Place the oil receiving trough under the switch to collect the spilled oil.
4. Remove the oil pressure switch.



S113B405

Refit

1. Clean the threads of the oil pressure switch.
2. Fit a new seal washer onto the oil pressure sensor and tighten the switch to**14–18Nm**.
3. Connect the wiring harness connector of the oil pressure switch.
4. Remove the oil receiving trough.
5. Connect battery earth lead.
6. Check the engine oil level, and fill it up if necessary.

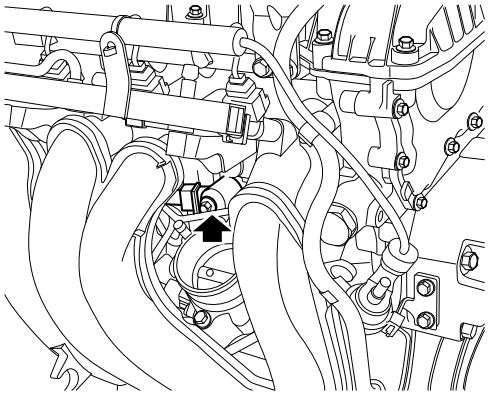
Knock Sensor

Remove

1. Disconnect battery earth lead.
2. Remove the intake manifold.

☞ **Intake Manifold Gasket Remove**

3. Disconnect the wiring harness connectors of the knock sensor.
4. Remove the bolts securing the knock sensor to the cylinder block, and remove the sensor.



S113B406

Refit

1. Clean the mating surface between the knock sensor and the cylinder block.
2. Fit the knock sensor, ensure the correct wiring harness layout and tighten the bolts to **15–25Nm**.
3. Connect the wiring harness connectors of the knock sensor.
4. Fit the intake manifold and replace a new gasket.

☞ **Intake Manifold Gasket Refit**

5. Connect battery earth lead.

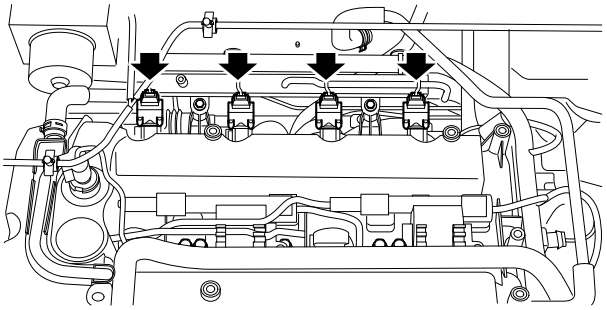
Fuel Rail

Remove

1. Disconnect battery earth lead.
2. Relieve the pressure of the fuel system.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

3. Disconnect the wiring harness connector from the fuel rail assembly.

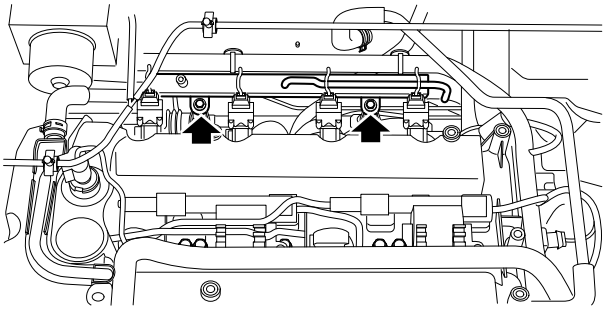


S113C401

4. Release the fuel inlet tube from the fuel rail.

Caution: Always fit plugs to open connections to prevent contamination.

5. Remove the 2 bolts used to secure the fuel rail to the intake manifold.



S113C402

6. Remove the fuel rail assembly.

Refit

1. Clean the grooves on the fuel injector and intake manifold.
2. Locate the fuel rail assembly onto the intake manifold, and push each fuel injector into the corresponding hole of the intake manifold.
3. Use 2 bolts to secure the fuel rail assembly on the intake manifold and tighten them to **8–12Nm**.
4. Connect fuel inlet tubes to the fuel rails.

5. Connect the wiring harness connectors of the fuel injector.
6. Connect battery earth lead.

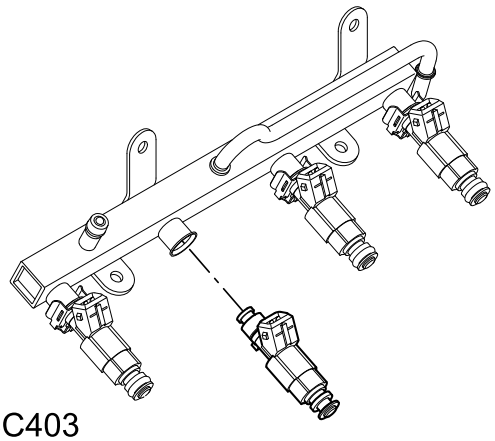
Fuel Injector

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector of the fuel injector.
3. Remove the fuel rail assembly.

☞**Fuel Rail Assembly Remove**

4. Release the spring clip securing the fuel injector to the fuel rail and remove the fuel injector.
5. Remove the two O-rings on each fuel injector and discard of them.
6. Fit the cap to the end of each fuel injector.



S113C403

Refit

1. Remove the cap from each fuel injector.
2. Clean the grooves on fuel injectors and fuel rails.
3. Lubricate the new O-rings with oil and fit them to both ends of each fuel injector.
4. Fit the fuel injector onto the fuel rail.
5. Fit the fuel injector to the fuel rail with a spring clip.
6. Fit the fuel rail assembly.

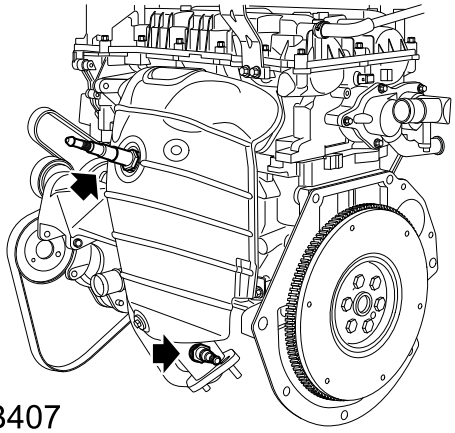
☞**Fuel Rail Assembly Refit**

7. Plug in the fuel injector connector harness.
8. Connect battery earth lead.

Oxygen Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connectors of the oxygen sensor.
3. Use of Oxygen Sensor Replacer**TEN00011** Remove the oxygen sensor.



S113B407

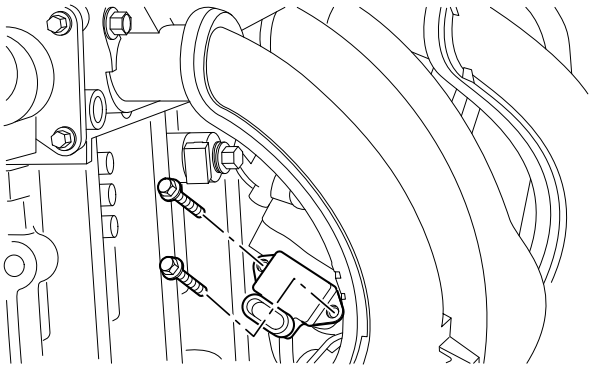
Refit

1. Use of Oxygen Sensor Replacer **TEN00011**Fit the oxygen sensor, and tighten the bolts to **50–60Nm**.
2. Connect the wiring harness connectors of the oxygen sensor.
3. Connect battery earth lead.

Manifold Absolute Pressure Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector of the manifold absolute pressure temperature sensor.
3. Remove the bolts securing the manifold absolute pressure temperature sensor onto the intake manifold, and remove the sensor.



S113B408

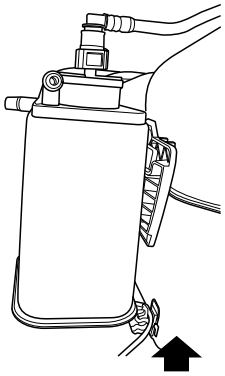
Refit

1. Clean the mating surface between the manifold absolute pressure temperature sensor and the intake manifold.
2. Fit the manifold absolute pressure temperature sensor, and tighten the bolts to **4–5Nm**.
3. Connect the wiring harness connector of the manifold absolute pressure temperature sensor.
4. Connect battery earth lead.

Charcoal Canister

Remove

1. Raise vehicles on the lift.
2. Pull out upwards canisters from fuel tanks and take away canisters.



3. Disconnect connections of air vent pipe..
4. Disconnect connections between purge valve pipe and fuel tank pipe from canisters.
5. Remove charcoal canisters.

Caution: Always fit plugs to open connections to prevent contamination.

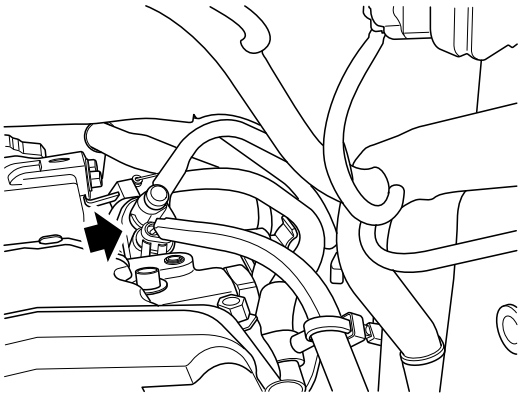
Refit

1. Ensure all components and mating faces are clean.
2. Connect fuel tank pipe, purge valve hoses as well as vent hoses to canisters.
3. Clamp canisters into slots on fuel tanks.
4. Lower the vehicle.

Purge Control Valve

Remove

1. Disconnect battery earth lead
2. Disconnect connections of purge control valve connectors;
3. Disconnect connections of vacuum pipe from purge control valves;
4. Disconnect connections of fuel ventilation pipe from purge control valves;
5. Take down purge control valves from engine block purge control valve bracket.



Refit

1. Connect a fuel ventilation pipe to a canister solenoid valve.
2. Connect a vacuum pipe to the canister solenoid valve.
3. Purge control valve connectors will be connnected.
4. Fix purge control valves to purge control valve bracket of engine blocks.

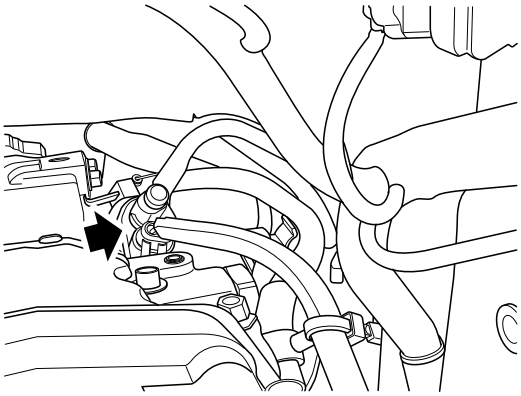
Pipe Assembly - Body Underfloor Fuel Lines

Remove

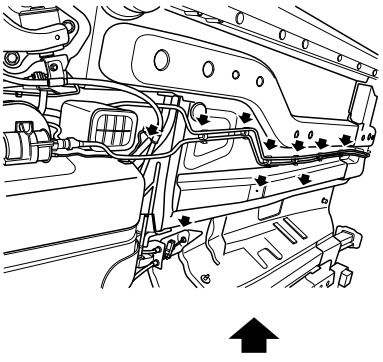
1. Drain the fuel system.

☞ **Drain & Refill**

2. Disconnect connections of canister ventilation pipe from Purge Control valves;



3. Disconnect fuel feed pipe from the fuel rail.
4. Lift the vehicle with a lift.
5. Disconnect connections between the fuel line and the fuel filter.
6. Disconnect connections between the fuel line and the fuel tank.
7. Release 11 clips securing underfloor pipe to (one is on the fuel tank, 10 are on the underbody and the underpart of the engine cabin) body underfloor.



8. Remove the floor lower fuel pipe.

Refit

1. Fit underfloor pipe to the 11 clips of the underbody and the fuel tank.
2. Connect connections between the fuel line and the canister.
3. Connect connections between fuel lines and the fuel filter.
4. Connect canister ventilation pipe to purge Control valves.
5. Connect fuel feed pipeline to fuel injector rail.

Fuel filter

Remove

1. Disconnect battery earth lead.
2. Depressurise fuel system.

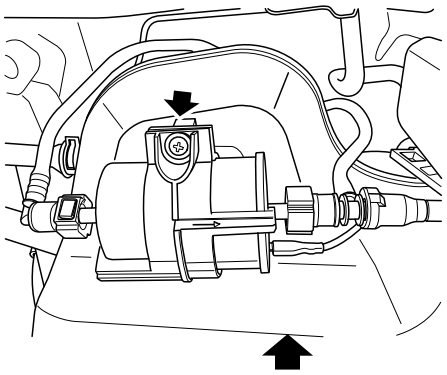
☞Check

3. Raise vehicle on a lift.
4. Disconnect fuel pipe joint from fuel filters.

Caution: Always fit plugs to open connections to prevent contamination.

Warning: Depressurise the system before disconnecting any components. Fuel pressure will be present in the system even if the ignition has been switched off for some time.

5. Remove one screw securing the fuel filter to a fuel tank clamp, release with care the clip and take away the fuel filter.



Refit

1. Position earth lead.
2. Position filter to filter clamp and tighten screw to **7–10Nm**.
3. Remove plugs and connect fuel pipe joint to the fuel filter.
4. Lower the vehicle.
5. Connect battery earth lead.

Tank - Fuel

Remove

1. Disconnect battery earth lead.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

2. Depressurise fuel system.

☞Check

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

3. Drain the fuel system.

☞Drain & Refill

Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

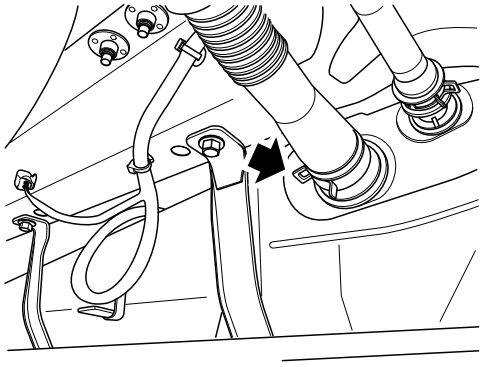
4. Raise vehicle on a lift.
5. Remove canisters.

☞Canister Remove

6. Remove fuel filter.

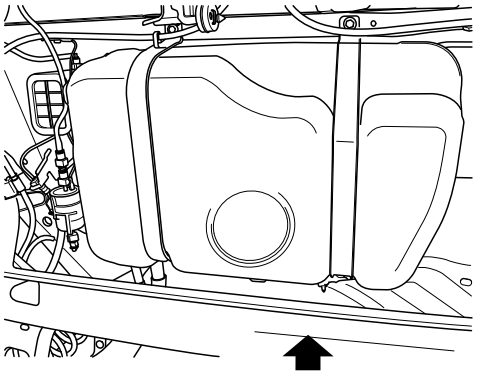
☞Fuel Filter Remove

7. Release clips within the range from filler pipe to the fuel tank hose and take away the pipe.

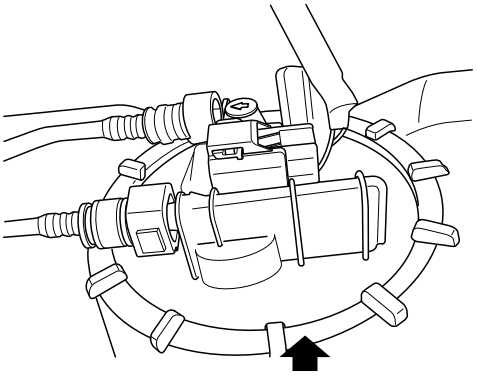


Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

8. Support the fuel tank.
9. Remove 4 bolts securing fuel tank straps to body and remove straps. Lower fuel tank to access top of tank.



10. Disconnect fuel pump connectors.



11. With assistance remove fuel tank.

Refit

1. Fit new seals to a fuel tank, fit a fuel pump and be careful not to damage seal.
2. Use**T18007** to fit fuel pump locking ring and tighten to **75–85Nm**.
3. Support the fuel tank with assistance.
4. Connect to fuel pump connectors.
5. Raise fuel tank and align straps.

Caution: Take care not to trap any pipes or cables when fitting fuel tank.

6. Raise the fuel tank assembly, align strap mounting hole with vehicle welding nut holes, and fit it with construction bolts and tighten them to **22–28Nm**.
7. Fit canisters.

☞**Canister Refit**

8. Fit a fuel filter.

☞**Fuel Filter Refit**

9. Connect a filler pipe to the fuel tank, and fix it with clips.
10. Lower the vehicle.
11. Refill fuel tank.
12. Connect battery earth lead.

Fuel pump

Remove

1. Disconnect battery earth lead.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

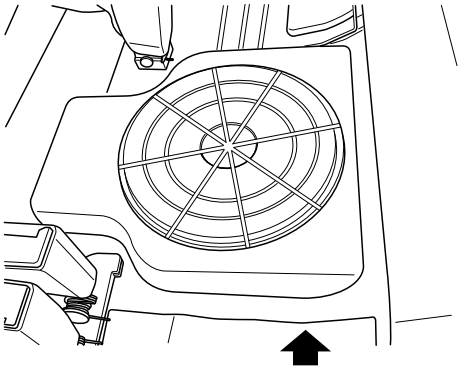
2. Depressurise fuel system.

☞**Check**

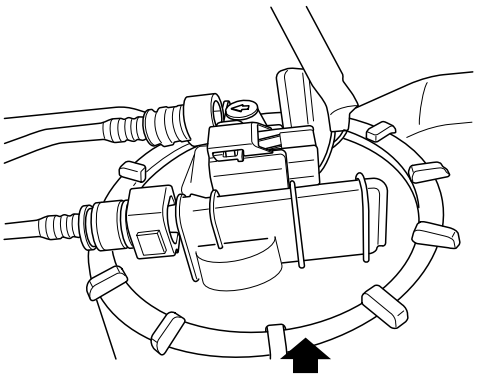
3. Remove rear seat cushions.

☞**Rear Seat Cushion Assembly Remove**

4. Pull back sound insulation and carpet.



5. Remove sealed plate with a screwdriver.
6. Cover surrounding area to protect against fuel spillage.
7. Disconnect connectors on fuel pumps.
8. Release feed fuel pipes and return pipe from fuel pumps.



Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

9. Use**T18007** to release and remove fuel pump locking ring.
10. Carefully release fuel pump assembly and discard seal.

Refit

1. Fit new seals to the fuel tank, fit the fuel pump and be careful not to damage the seal.
2. Use**T18007** to fit the fuel pump locking ring and tighten to **75–85Nm**.
3. Connect fuel feed and fuel return pipes to fuel pump.
4. Connect fuel pump connectors.
5. Stick sealed plate with glue.
6. Position sound insulation and carpet.
7. Fit rear seat cushions.

☞**Rear Seat Cushion Assembly Refit**

8. Connect battery earth lead.

Fuel System - Depressurise

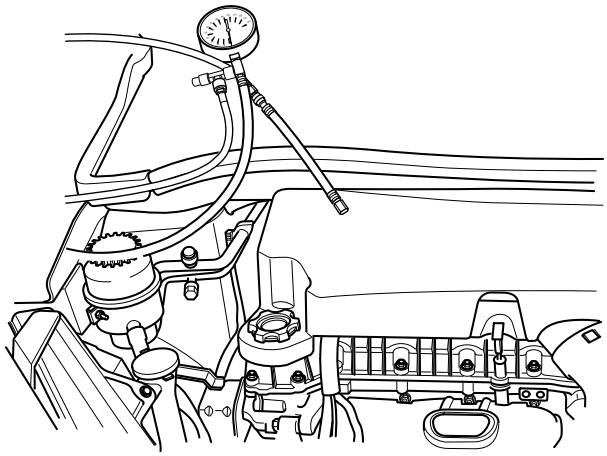
Check

1. Position absorbent cloth around fuel rail to catch any fuel spillage.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

2. Remove dust cover from fuel rail.
3. Connect **T18003**to fuel rail.



Caution: When connecting T18003 to fuel rail, do not use excessive force to tighten. Tighten only to ensure no leakage, overtightening will damage T18003 O-ring.

4. Position end of adaptor in a container.
5. Loosen thumb wheel to depressurise fuel system and collect fuel.
6. Tighten thumb wheel and remove container
7. Remove the connector**T18003** and refit dust cover.

Fuel System - Depressurise

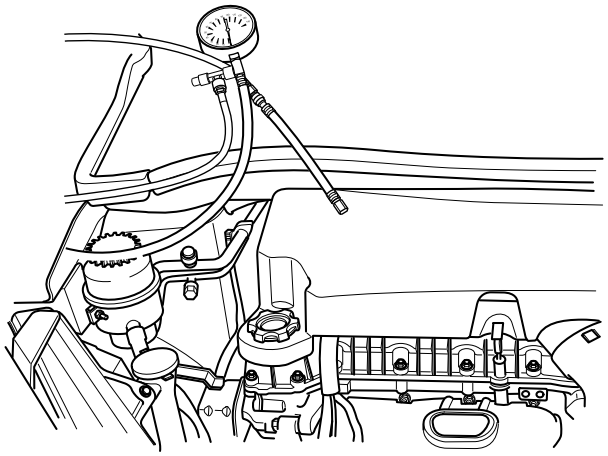
Inspection

1. Position absorbent cloth around fuel rail to catch any fuel spillage.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

2. Remove dust cover from fuel rail..



3. Connect**T18003** connector to**T18002** pressure gauge.
4. Fix the pressure gage **T18002**, and connect**T18003** to fuel rail.

Caution: When connecting T18003 to fuel rail, do not use excessive force to tighten. Tighten only to ensure no leakage, overtightening will damage T18003 O-ring.

5. Position drain tube in a container.
6. Start engine allow engine to idle, check reading and pressure drop over one minute, if the reading is between 3.5 bar and 3.9 bar above manifold pressure, the fuel system is normal.
7. Stop engine, if 20 minutes later the fuel system pressure is below 2 bar then this indicates ,the fuel system cannot maintain pressure.Check the fuel pump regulator valve.
8. Remove gauge**T18003** from fuel rail.
9. Fit the dust cover.
10. Drain fuel from gauge into drain tray.
11. Release clips and remove adaptor**T18003** from pressure gauge **T18002**.

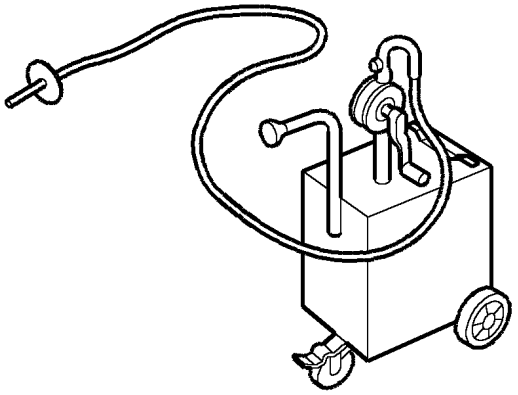
Tank-Drain & Refill

Drain & Refill

Warning: The capacity of containers must be more than adequate for the amount of fuel to be extracted or drained. The container should be clearly marked with its contents and placed in a safe storage area which meets the requirements of local authority regulation.

Warning: Proper fuel recovery equipment must be used, and make sure the necessary protective measures have taken to prevent fire and explosion.

1. Release fuel filler cap from the filler neck.



S183001

2. Using a fuel recovery appliance, drain fuel from the tank into a sealed container. Follow manufacturer's instructions for connection and safe use of appliance.
3. Refill fuel tank.

Filler Neck

Remove

1. Disconnect battery earth lead.
2. Depressurise fuel system.

☞Check

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

Warning: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

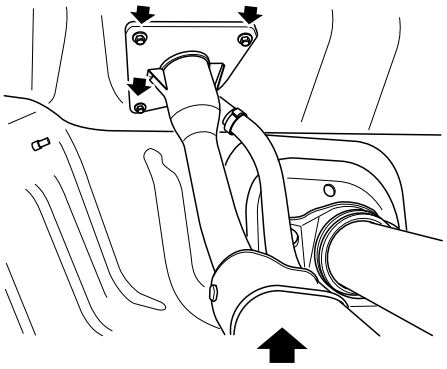
Caution: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

Caution: Always fit plugs to open connections to prevent contamination.

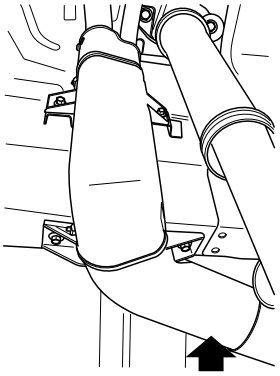
3. Drain fuel tank.

☞Drain & Refill

4. Release fuel filler cap from filler neck.
5. Remove rear wheel arch liner.
6. Remove bolts securing filler neck to body.

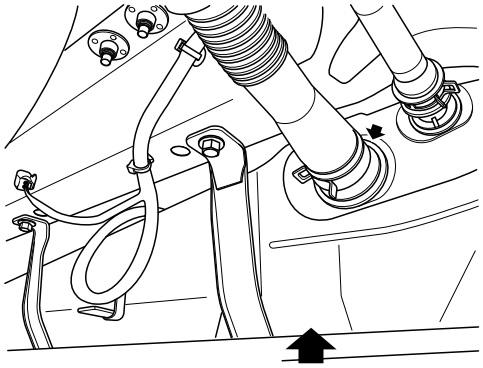


7. Remove bolts securing filler neck to body.



S163035

8. Release clips securing filler neck to fuel tank pipe.



9. Remove filler neck assembly.

Refit

1. Position filler neck. Connect filler hoses to tank and filler neck, secure clips.
2. From underside of wheel arch, fit bolt securing filler neck to body and tighten to**7–10Nm** .
3. Fit filler neck to body and tighten to **7–10Nm**.
4. Fit filler neck to filler cap aperture and fit grommet.
5. Fit rear wheel arch liner.

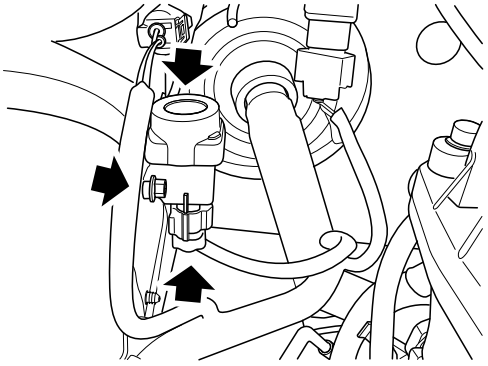
☞**Rear Wheel House Refit**

6. Refill fuel tank.
7. Fit filler cap.
8. Connect battery earth lead.

Switch - Inertia - Fuel Cut Off

Remove

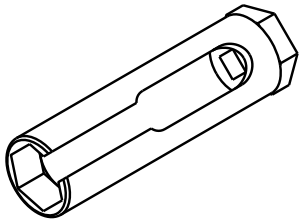
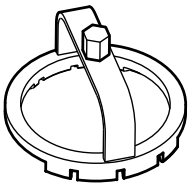
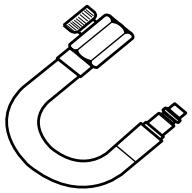
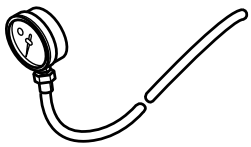
1. Open the bonnet.
2. Disconnect battery earth lead.
3. Remove 2 bolts securing inertia switch to fascia support, release switch to access multiplug.
4. Disconnect multiplug from inertia switch and remove switch.



Refit

1. Connect multiplug to inertia switch.
2. Position inertia switch to body. Fit bolts and tighten to **3–5Nm**.
3. Press top of switch to ensure it is set.
4. Connect battery earth lead.
5. Close the bonnet.

Special Tools

Tool Number	Description	Picture
TEN00011	Wrench O2 Sensor	 TEN00011
T18007	Wrench fuel tank lock ring	 T18007
T18003	Adaptor fuel pressure test	 T18003
T18002	Fuel Pressure Test Equipment	 T18002

Engine Fuel & Management-1.3 BASE

Specifications

Torque

Description	Value
Spark plugs	20–30Nm
Bolt - ignition coil	8–12Nm
Nut - ECM to ECM bracket	8–10Nm
Oil temperature sensor	14–18Nm
Bolt - crank sensor	8–12Nm
Bolt - camshaft.sensor	8–12Nm
Oil pressure sensor	14–18Nm
Bolt - knock sensor	15–25Nm
Bolt - rail fuel to inlet manifold	8–12Nm
Oxygen sensor	50–60Nm
Bolt - utterly temperature sensor to inlet manifold	4–5Nm

Parameter

Engine Management System–1.3 BASE

Manufacturer/Model	Bosch UAES/ME 7.8.8
Emission Standard	EU4
Spark Plug: Torch Clearance	 0.8 - 0.9 mm
Ignition Coil: Manufacturer Model	 BERU 2×double spark ignition coil, top stuffing type, cylinder 1 and 4 sharing, cylinder 2 and 3 sharing
Primary resistance (typical)	0.67 ± 0.07 Ω @ 20 ℃
Secondary resistance (typical)	10.2 ± 2 k Ω @ 20 ℃
Fuel Injection System: Model **ECM**	 without oil return system, multi-point fuel injection system, is electronic controlled by**ECM** Bosch non-contact type, electronic engine management system
Nozzle: Operation Pressure fuel static flow of the nozzle	4 × EV6 0.38 MPa 154.2 g/min

Sensor–1.3 BASE

Crankshaft Sensor: Manufacturer/Model	 UAES BOSCH, hall sensor obtained signal from side face of the signal plate
Camshaft Sensor: Manufacturer/Model	 UAES BOSCH, hall sensor obtained signal from side face of camshaft signal plate
Oxygen Sensor: Manufacturer/Model Heating Element (nominal value) Sensor Voltage - High Sensor Voltage - Low	 UAES BOSCH LSF4.2 7 W ≈ 800mv ≈ 50mv
Electronic Throttle: Manufacturer Track Total Resistance	 UAES BOSCH 1.25KΩ± 30%
Coolant Temperature Sensor Manufacturer/Model	 TEMB / NTC
TMAP Sensor: Manufacturer Sensor Supply Voltage	 UAES BOSCH 5V ± 4%

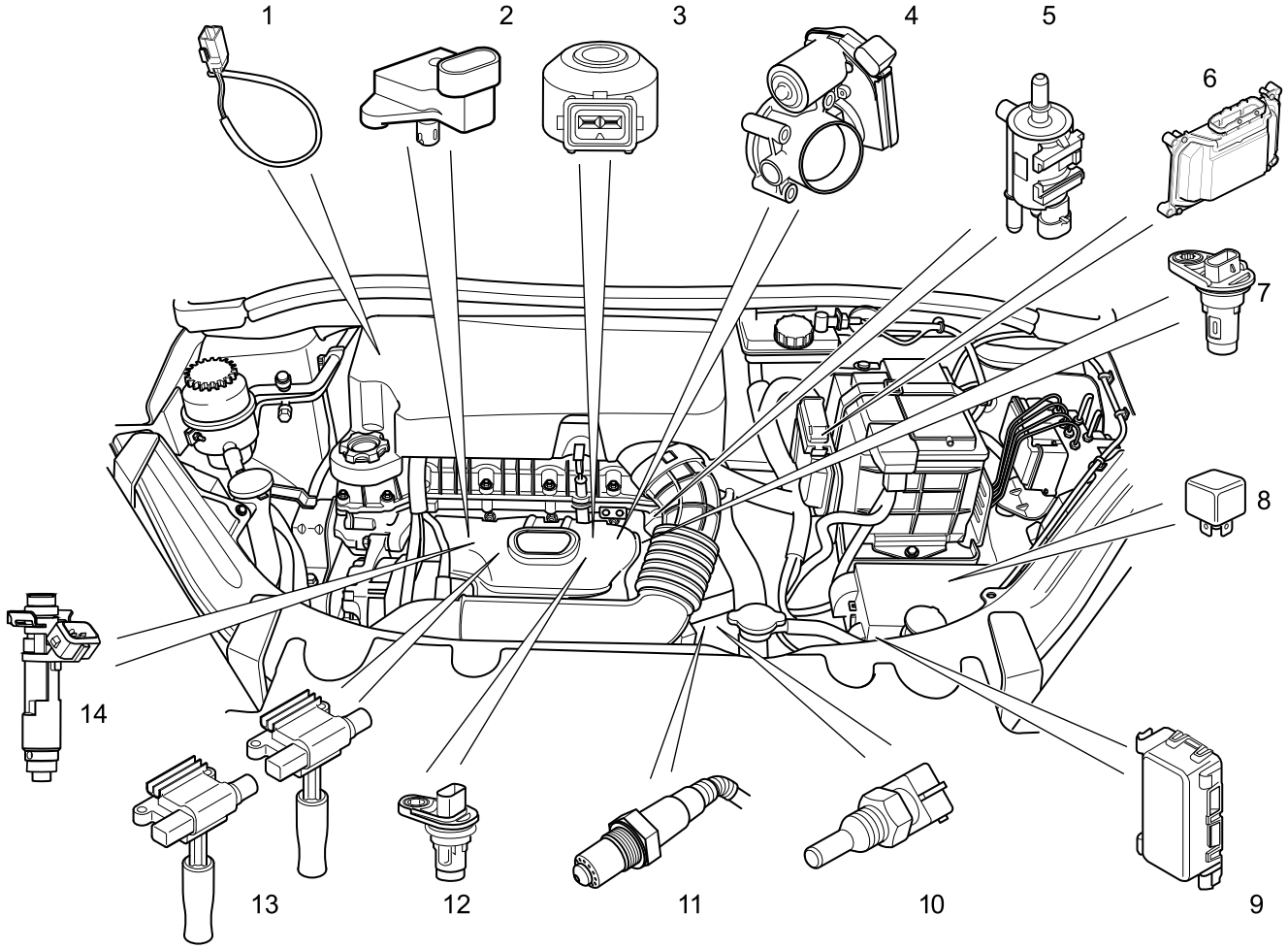
Fuel System–1.3 BASE

system	without oil return system, muti-point fuel injection, is electronic controlled by**ECM**
Fuel Specification	93 RON lead not contained
Fuel Rail	stainless steel tube struture
Nozzle	4 × EV6
fuel static flow of the nozzle	119 g/min @ 0.38 MPa
fuel dynamic flow of the nozzle	3.65 mg/pulse@2.5 ms × 10ms
Fuel Pump	continuous jet flow, electric-driven vane pump immersed in the fuel tank
Fuel Pressure	0.38 MPa/13.5 V
Fuel Pressure Adjustment	controlled by the pressure regulator in the fuel tank
Fuel Pump Delivery	0.65 L/Min @ 0.30 MPa
Fuel Filter	External placed, filter element can not be replaced

Description and Operation

System Component Layout

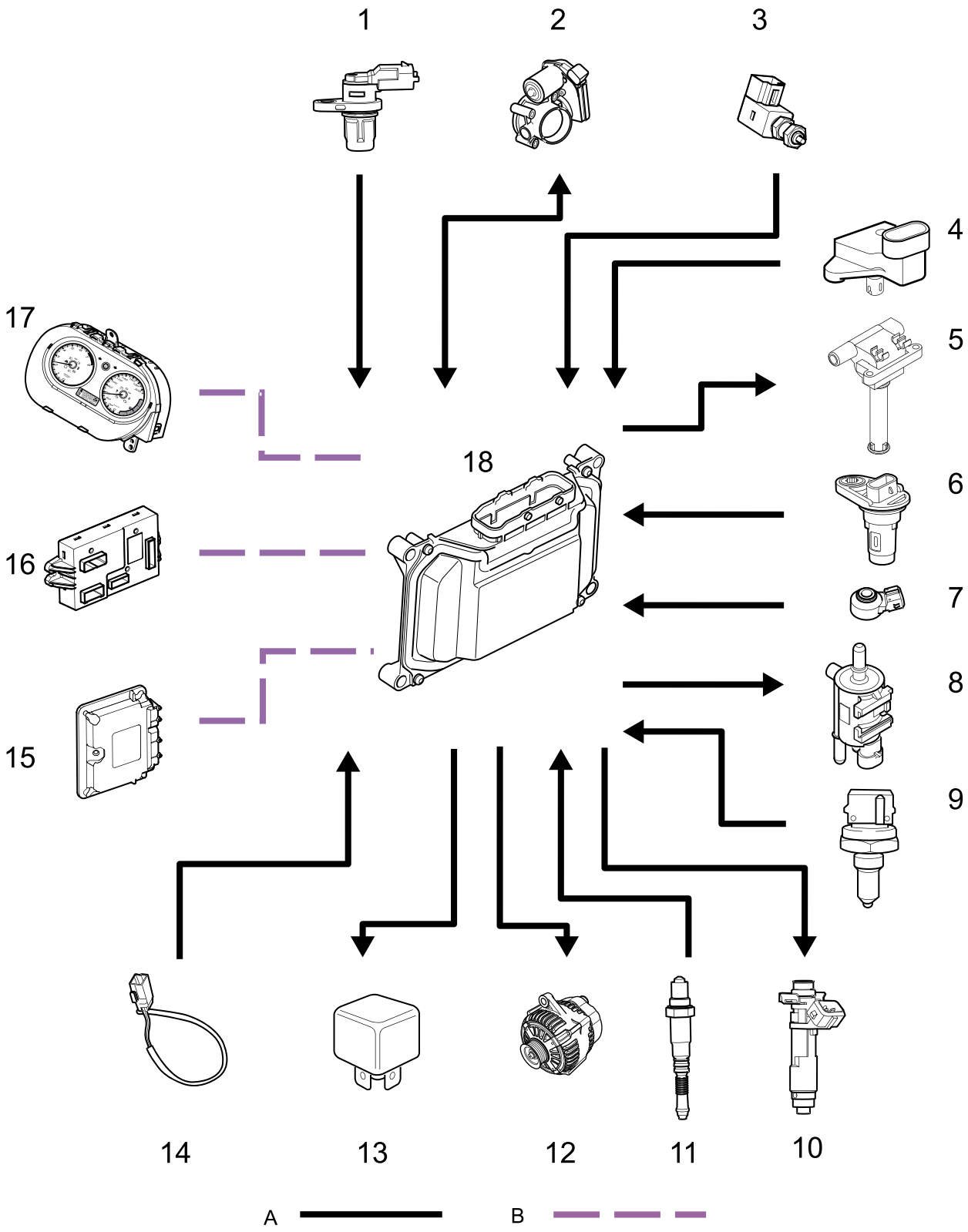
Engine Control System Component Layout



1. Evaporator Temperature Sensor
2. Intake Air Pressure Temperature Sensor
3. Knock Sensor
4. Electronic Throttle
5. Canister Control Valve
6. Engine Control Module (**ECM**)
7. Crankshaft Position Sensor
8. Relay Set
9. Fan Control Relay Set
10. Engine Coolant Sensor
11. Heated Oxygen Sensor
12. Camshaft Position Sensor
13. Ignition Coil
14. Fuel Injector

System Control Diagram

Engine Control System Control Diagram



*A Hard Wire, B **CAN**Bus*

1. Camshaft Position Sensor
2. Electronic Throttle
3. Brake Pedal Switch
4. Intake Air Pressure Temperature Sensor
5. Ignition Coil
6. Crankshaft Position Sensor

7. Knock Sensor
8. Canister Control Valve
9. Engine Coolant Sensor
10. Fuel Injector
11. Heated Oxygen Sensor
12. Alternator
13. Cooling Fan Relay Unit
14. Evaporator Temperature Sensor
15. Transmission Control Module
16. Body Control Module (**BCM**)
17. Instrument Cluster
18. Engine Control Module (**ECM**)

Description

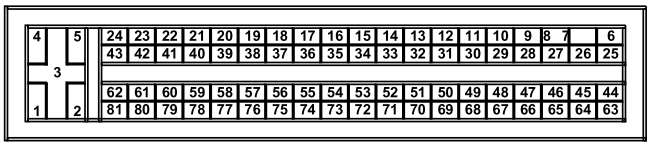
General Description

Engine Management System (**ECM**) is used to control all aspects of engine operation. The system receives inputs from all sensors and determines the outputs by using these inputs, including the fuel quantity to be transmitted to the combustion chamber, the duration of ignition and the boost control etc. 1.3L engine uses BOSCH ME 7.8.8 **ECM**. This is a continous and mutipoint fuel injection system, controlled by**ECM** and adopting the speed/density theory of combining the electronic throttle control. The control purpose of the engine management system: improving power performance, reducing oil consumption and exhaust pollution.

Engine Control Unit (ECM)

Engine control unit is the control center of the fuel injection system. It continuously monitors the information from all sensors and controls all systems influencing the vehicle performance. It also carries out the system diagnosis function. It can indentify the operating malfunction and inform the driver by the malfunction indicator (**MIL**), and storage the DTCs indicating the trouble location for service.

ECM Wire Connector End View



Connector Pin Detailed Information Chart

Pin No.	Description
1	Pre-oxygen Sensor Heating
2	Ignition Coil 2
3	Ignition ground
4	Post-oxygen Sensor Heating
5	Ignition Coil 1
6	Fuel Injector 4 (the first cylinder)
7	Fuel Injector 2 (the fourth cylinder)
8	Vacancy
9	Vacancy
10	Vacancy
11	Vacancy
12	Continuous power
13	Ignition Switch
14	Main Relay
15	Engine Speed Sensor
16	Accelerator Pedal Module Signal
17	Sensor Ground 1
18	Pre-oxygen Sensor Signal
19	Knock Sensor Terminal A
20	Knock Sensor Terminal B
21	Stop Lamp
22	Vacancy
23	Vacancy
24	Vacancy
25	Vacancy
26	Vacancy
27	Fuel injector 1 (the third cylinder)
28	Vacancy
29	Vacancy
30	Vacancy
31	Vacancy
32	5V power 2
33	5V power 1
34	Vacancy
35	Sensor Ground 3
36	Sensor Ground 2
37	Intake Air Pressure Sensor
38	Electronic Throttle Body
39	Engine Coolant Temperature Sensor
40	Accelerator Pedal Module Signal
41	Vacancy
42	Intake Air Temperature Sensor
43	Vacancy
44	Non-continuous power
45	Non-continuous power
46	Canister Valve
47	Fuel Injector 3 (the second cylinder)
48	Vacancy
49	Vacancy
50	Low Speed Cooling Fan Relay
51	Electronic Ground 2
52	Vacancy
53	Electronic Ground 1

54	Electronic Throttle Body
55	Post-oxygen Sensor Signal
56	Evaporator Temperature Sensor
57	Vacancy
58	Brake Switch
59	Generator Control Input
60	Air Conditioning Medium Pressure Switch
61	Power Ground 1
62	**CAN** Bus Interface
63	Non-continuous power
64	Throttle Actuator
65	Throttle Actuator
66	Throttle Actuator
67	Throttle Actuator
68	High Speed Cooling Fan Relay
69	Air Conditioning Compressor Relay
70	Oil Pump Relay
71	Diagnosis K Line
72	Vacancy
73	Anti-theft
74	Clutch SwitchMT only
75	Air Conditioning Switch
76	Vacancy
77	Vacancy
78	Sensor Ground 4
79	Phase Sensor
80	Power Ground 2
81	**CAN** Bus Interface

The engine management system can be divided into six parts according to the control theory, and they are as follows:

- Exterior Control
- Engine Air Supply Control System
- Engine Ignition Control System
- Engine Fuel Supply Control System
- Auxiliary 1 (Thermal Management)
- Auxiliary 2 (External Auxiliary)

Exterior Control

The exterior controls of the engine mainly includes:

- Main Relay
- Ignition Switch
- Battery
- **CAN** Communication
- Anti-theft Power Supply

The external control mainly are power supply and communication. One circuit of the power supply of the engine control unit (**ECM**) is directly connected with the power supply through fuse EF05, to make sure**ECM** state of receiving electricity. When the ignition switch is ON or IGN, the engine control unit can control the main relay opening or connects with the ignition power.

The engine control can maintain**CAN** all performances by fast communicating with controllers on other nodes of the network. It can also connect with DLC to help the serviceman carry out diagnosis operation.

Main Relay

Main relay locates in the fuse block of the engine compartment. The relay is a four-pin relay with DIN pin layout. The relay does not include reverse protection diode, and this function is provided by **ECM**. The resistance of the relay coil is 84-124Ω ±10%, controlled by **ECM**.

When the engine control unit (**ECM**) detects the position information of the ignition switch IGN, it will output the low level signal, control relay open, the UBR pins (44, 45, 63) of the**ECM** will connect to the power pressure to ensure to meet the starting condition.

Malfunction

The main relay may go wrong because that:

- relay winding short
- relay winding open
- Relay contact winding resistance high
- Relay contact point normally open
- Relay contact point normally closed
- Relay contact point resistance high
- Relay hardness open
- Relay hardness resistance high
- Relay harness connects to 12V power short
- Relay harness short to ground
- **ECM** grounded circuit not provided

In order to identify whether the relay works normally, you can check the following:

- Voice check - whether the fuel pump works for 2 seconds when the ignition key is ON
- whether the fuel injector or the ignition coil has power to support (detect the battery voltage with multimeter)

If the items above are detected, it indicates that the relay works normally.

CAN Communication

By utilizing high-speed**CAN** communication network, the engine management system makes**ECM** and**ABS BCM TCM** communicate and diagnose the output at diagnosis port.

Anti-theft power supply

When the ignition switch is on the second gear, the engine control module (**ECM**) and the body control module (**BCM**) communicate via**CAN** high speed bus to verify information between each other, and after the verification is passed,**BCM** controls the starter motor operate, and**ECM** controls the ignition, fuel injection and the engine starting.**ECM** No.73 pin is the access pin for the anti-theft power supply. If the harness connected with the pin is disconnected, 5V power supply would not got from No.32 pin and the anti-thefit function of the engine will not work,**BCM** can not get the verification information from**ECM** and the starter motor can not work and the engine can not start.

Engine Air Supply Control System

The engine air supply control system mainly includes:

- Electronic Throttle Body
- Accelerator Pedal Module
- Intake Air Pressure Temperature Sensor
- Phase Sensor

When the mass ratio of fuel and air is 14.7:1, the fuel can combust sufficiently and the engine is in the best working condition.

The air supply section gets the best fuel-air ratio mainly through controlling the main stroke of the air inflow and the cylinder.

Electronic Throttle

The electronic throttle is composed of throttle, throttle driver (DC motor) and throttle position sensor.

The command from the**ECM** make the DC motor act and control the throttle's opening by the transmission mechanism. Two potentiometers are used as position sensors which are phase-reversal fit. When the throttle changes, the two resistances all have linear change, one of which increases and another decreases. When 5V power is applied, they are converted into the voltage output changing along with the resistance value.

These two potentiometers and the other two potentiometers which monitor accelerator pedal motion stroke on the accelerator pedal module constitute one part of the whole throttle control system monitoring function, which can provide the redundancy expected by the system control.

Throttle Position Sensor

Throttle position sensor is used to provide throttle rotating angle information for**ECM** . According to this information,**ECM** can obtain information about the engine load, operating condition (such as starting, idling, reverse towing, partical load and full load) as well as the acceleration and deceleration information.

The throttle sensor is in fact an angle potentiometer with linear output characteristics. Potentiometer tumbler is coaxial fit with the throttle. The throttle rotating will make the potentiometer tumbler slip to a certain position. The potentiometer outputs the voltage signal proportional to the throttle position.

Accelerator Pedal Module

The accelerator pedal module has two potentiometers as its sensors, whose resistance values change along with the electronic throttle pedal position.**ECM** can make accurate responses to the accelerator pedal displacement so as to monitor the motions of the accelerator pedal.

As the two potentiometers are in-phase fit, the resistances will have linear increase or decrease when the accelerator pedal position changes. When 5V power is applied, they are converted into the voltage output changing along with the resistance value. These two potentiometers and the other two potentiometers which monitor the throttle position on the electronic throttle constitute one part of the whole electronic throttle control system monitoring function, which can provide the redundancy expected by the system control.

Intake Air Pressure Temperature Sensor (TMAP)

The intake air pressure temperature sensor measures the intake manifold absolute pressure and the intake air temperature, providing information about the engine load and intake air temperature.

The piezoelectric sensor measures the intake air pressure, providing load signal to the controller according to the pressure difference of the atmospheric pressure and intake manifold pressure; The controller provides 5V voltage and 0 5V voltage is feedbacked to the controller acccording to the different intake pressure. NTC (negative temperature coefficient) sensor measures the intake air temperature. Its resistance value changes along with the intake air temperature and the sensor transmits a voltage indicating intake air temperature changes to the controller. The pressure is in direct proportion to the output pressure, and the temperatuer is in inverse proportion to the resistance.

Camshaft Position Sensor (CMP)

the phase sensor is used to cooperate with the speed sensor when there is no distributor, providing the crankshaft phase

information to**ECM** so as to differentiate the compression TDC and exhaust TDC.

The phase sensor is composed of a Hall sensor and a rotator made of steel plate. The hall sensor is fixed; the rotator is fit on the camshaft and there is a boss with 36°radian on the rotator. When the boss goes throught the hall sensor and the internal magnetic field of the hall sensor changes, making the output signal of voltage change. Then the two different TDCs distinguish from each other.

Valve timing is the corresponding crankshaft angle when the intake valve and exhaust valve open and close according to the engine working cycle, which is also called valve timing angle. The accuracy of the valve timing greatly influences the power performance, economy and environment protection performance of the engine. Improper valve timing will lead to insufficient intake air, exhausting air not smooth. It will influence formation quality of the mixed air, cause incomplete combustion, reduce the power performance of the engine, and increase fuel consumption and the quantity of carbonic oxide,nitrogen oxides and hydrocarbon in the emissions.

Engine Ignition Control System

The engine ignition control system mainly includes:

- Ignition Coil 1, 2
- Engine Speed Sensor
- Knock Sensor

Ignition Coil

The ignition coil converts the low-voltage DC of the battery into high voltage current and generates sparks through the spark plug, thus ignite the mixed gas in the cylinder. Each ignition coil includes a pair of coil windings surrounding the laminated steel core. The primary resistance is 0.7Ω, and the secondary resistance is 10kΩ.

Two igntion coils are fit on the camshaft cover. They are fit on the cylinder 1 and 3. The igntion coil connects with the camshaft sensor harness with the connector. Below each coil, there is a spark plug connecting with it, which is also connected with another spark plug through a HT wire.

The coil fit on the cylinder 1 connects with the spark plug of the cylinder 1, while HT wire connects with the spark plug of cylinder 4. The coil fit on the cylinder 3 connects with the spark plug of the cylinder 3, while HT wire connects with the spark plug of cylinder 2.

Malfunction

The ignition coil may go wrong because that:

- Primary winding open
- Primary winding short
- Primary winding resistance exceeds the tolerance
- Secondary winding open
- Secondary winding short
- Connection between the secondary winding and the primary winding short
- Secondary winding resistance exceeds the tolerance
- The insulation of the coil top is physically damaged

Speed sensor is crankshaft position (CKP) Sensor

CKPThe sensor is used to provide information about the engine speed and crankshaft TDC when there is no distributor in the ignition system. It is a hall sensor and works together with the pulse wheel. The pulse wheel is a fluted disc. The small tooth arranges on the magnetic ring with 6°interval between each other. There are 58 small tooth in total and a space of 2 tooth width is left. The pulse wheel is fit on the crankshaft and revolves along with the crankshaft. When the tooth tips pass next to the end of the sensor, the pulse wheel made of the ferromagnetic material cut the magnetic line of the permanent magnet in the sensor, and induced voltage in the coil is produced as speed signal output.

Malfunction

CKP sensor or magnetic ring may fail because of the following conditions or because incorrect signal is provided:

- The air-gap of the**CKP** sensor does not conform to the specifications
- **CKP** sensor is polluted by the dirt
- **CKP** sensor's hall-effect semiconductor is damaged
- The magnetic field of the**CKP** sensor is too weak
- **CKP** Sensor hardness open
- **CKP** Sensor hardness short
- **CKP** Sensor hardness resistance high
- Magnetic ring is polluted by the dirt
- The accuracy of the magnetic ring is low because of the erosion or mecahnical failure.
- the flywheel or drive plate is out of roundness The**CKP** sensor signal is distorted
- Because the crank moves radically,**CKP** The sensor signal changes

to check whether**ECMCKP** sensor signal has been received, you may carry out the following operations:

- Check the fuel pump operation during the engine starts. If during the starting process, the fuel pump supplies fuel when the igniton switch is On but does not work, it indicates that the sensor signal of**ECMCKP** is not received.

Knock Sensor

The knock sensor is used to provide engine knock information to the electronic controller to control the knock.

The knock sensor is vibration acceleration sensor. It is fit on the cylinder block of the engine. The sensitive element of the sensor is a piezoelectric crystal. The vibration of the engine cylinder block is passed to the piezoelectric crystal through the mass block in the sensor. Because the pressure produced by the mass block vibration is applied on the piezoelectric crystal, voltage is produced on the two pole faces and the vibration signal is converted into the voltage signal output.

Malfunction

The knock sensor may fail because of the following conditions or because incorrect signal is provided:

- The sensor open
- The sensor is short to ground
- The sensor intermittent open
- The knock sensor is incorrectly fit

If the knock sensor signal fails, the following symptoms may apprear:

- Trouble code is stored
- **ECM** engine combustion knock can not be detected
- **ECM** Return to the default setting

Engine Fuel Supply Control System

The engine fuel supply control system mainly includes:

- Pre-Oxygen Sensor
- Post-Oxygen Sensor
- Fuel injector 1 4
- Canister Valve
- Fuel pump Relay

The engine fuel supply control system mainly controls oil supply of the engine in different operating conditions.

When the engine starts the first time and the engine speed is higher than the predetermined speed, the system begins open-loop operation. THe control module ignores the signal from the heated oxygen sensor (**HO2S**). The control module calculates the air-to-fuel ratio according to the input signals from sensors**ECT TMAP** and **TP**. The system will keep open-loop until the following conditions are met:

- **HO2S** The ouput voltage changes, indicating**HO2S** temperature has risen to the extent that it can operate normally
- The temperature of the**ECT** sensor is higher than the specified temperature
- A period of specified time has been passed after the engine starts

For the conditions above, different engine has its specified values which are stored in the electrically erasable programmable read-only memory (**EEPROM**). When those specified values are achieved, the system will begin closed-loop operation. When the system is in closed-loop operation, the control module calculates the air-to-fuel ratio and the fuel injector start-up time according to the signals from all sensors, mainly from the heated oxygen sensor. Thus, the air-to-fuel ratio will always be close to 14.7:1.

Oxygen Sensor

The oxygen sensor measures oxygen content in the engine exhaust gas to check whether the fuel and air has been completely combusted. According to the information, the electronic controller realizes the closed-loop control with the aim of excess air coefficient l =1 so as to make sure the 3-way catalytic converter has the biggest conversion efficiency for the**HC CO** and**NOx** and the three pollutants.

Its sensing element is ceramic tube, ventilating the exhaust outside and the air inside. When the sensing ceramic tube is at 350℃, it has the characteristics of solid electrolyte. Just because of this feature, it converts the oxygen concentration difference into potential difference and outputs the electrical signal. If the mixed gas is thick,the oxygen ion concentration difference inside and outside the ceramic tube will relatively high, which means the potential difference will be higher, and large quantity of oxygen ion will move from the inside to the outside and the output voltage will be higher (nearly 900mV). If the mixed gas is thin, the oxygen ion concentration difference inside and outside the ceramic tube will relatively low, which means the potential difference will be lower, and only small amount of oxygen ion will move from the inside to the outside and the output voltage will be lower (nearly 100mV).

The oxygen sensors are divided into front oxygen sensor and rear oxygen sensor; the former measures the oxygen content in the engine exhaust to realize closed loop control; the latter is used to monitor the conversion function of the 3-way catalyst.

Malfunction

HO2S It may fail because of the following conditions or because incorrect signal is provided:

- polluted by leaded fuel.
- polluted by carbon or silicon deposition
- collision damaged/mechanical collision
- external harness open
- external harness connecting to 12V power short
- external harness short to ground

- external harness resistance high
- heating device open
- heating device short
- **ECM** heating device grounded circuit not provided
- harness shield is not connected to ground

Fuel Injector

According to the order of**ECM** , the fuel injector injects fuel within specified time to provide fuel to the engine and atomize the fuel.**ECM** The coil of the fuel injector is electrified to form magnetic force. When the magnetic rises enough to overcome the pressure of return spring and the resultant force of the needle valve gravity and frictional force, the needle valve begins to rise and the fuel injection process also starts. When the fuel injection pulse ends, the pressure of return spring makes the needle valve close again.

Malfunction

The fuel injector may go wrong because that:

- The nozzle is polluted by dirt or wax (the flow is reduced)
- nozzle skewing (Injection is not properly oriented)
- The fuel filter is blocked
- The winding open
- The winding short to ground
- The winding connecting to 12V power short
- Winding resistance exceeds the tolerance
- external harness open
- external harness short to ground
- external harness connecting to 12V power short

Electric fuel pump

The electric fuel pump delivers the fuel from the fuel tank to the engine and provides enough fuel pressure and surplus fuel.

It is the vane pump driven by DC motor in the fuel tank and immersed in the fuel. It uses the fuel to dissipate heat and lubricate itself. The battery supplies power to the electric fuel pump through fuel pump relay. The relay puts through the electric fuel pump circuit only when it starts and the engine runs. When the engine stops running because of accidents, the fuel pump will automatically shut down.

Malfunction

The inertia switch provides 12V power to the fuel pump and provides the information about the fuel pump circuit status when it connects with**BCM** . The coil resistance of the fuel pump relay is 155Ω±10%. If the fuel pump relay has malfunction, the following symptoms will appear:

During the engine starts

- if the fuel system pressure drops to zero, the engine will not ignite
- If the fuel system pressure drops below the normal operation value 0.38 MPa, the engine may try to ignite but can not run normally
- If the fuel system pressure is under the normal level, the engine will ignite and run, but along with the fuel pressure dropping, it will eventually turn off and can not restart.

During driving

- If the fuel pump relay has malfunction during driving , the engine will loose power and eventually turn off because of insufficient fuel.

Fuel pump relay may go wrong because that:

- Relay Coil Short
- Relay Coil Open
- Relay Coil Resistance High
- Relay Contact Point Normally Open
- Relay Contact Point Normally Closed
- Relay Contact Point Resistance High
- Relay Harness Open
- Relay Harness Resistance High
- Relay harness connects to 12V power short
- Relay harness short to ground
- **ECM** grounded circuit can not be provided

The following items may be checked to ensure that the fuel pump relay works normally:

- Voice check - whether the fuel pump works for 2 seconds when the ignition key is ON
- If there is no response, check the inertia switch to ensure it does not trigger unexpectedly. If it shows that the fuel pump does not work but the inertia switch is ON, take down the fuel pump relay and examine it.

When the ignition key is in Start-up position (for 2 seconds) and during the starting process, check whether the fuel pump relay winding is provided with the grounded circuit. Take down the fuel pump relay, and connect the multimeter between the 12V power provided to the vehicle, pin 85 of the fuel pump and fuse box pin connected. After the ignition starts, check the output according to the circuit diagram.

Because the internal drive circuit will consume voltage so the measured voltage will lower than the battery pressure.

Canister Control Valve

The canister control valve is used to control the flow rate of regenerated airflow of the fuel evaporation control system.

The canister in the fuel evaporation control system absorbs the fuel vapor from the fuel tank until saturated.**ECM** then opens the canister control valve, and fresh air and the

saturated fuel vapor form the regenerated air flow which is re-introduced into the engine intake pipe. According to the different operating condition, the electronic controller changes the duty cycle of the pulse signal delivered to the canister control valve magnetic coil so as to control the flow rate of the regenerated air flow. Besides, the flow rate is also influenced by the pressure difference of the both ends.

Malfunction

The canister control valve may go wrong because that:

- The electromagnetic winding open
- The electromagnetic winding short
- external harness connecting to 12V power short
- external harness short to ground
- external harness resistance high
- **ECM** signal**PWM** not provided
- There are mechanical problems in the valve

Auxiliary 1 (Thermal Management)

Thermal Management mainly includes:

- Air Conditioning Compressor Relay
- Air Conditioning Switch
- Coolant Temperature Sensor
- Cooling Fan Relay (Low Speed, High Speed)
- Air Conditioning Pressure Sensor

The engine adjusts the close or open of the high-speed and low-speed cooling fan relay according to the coolant temperature.

After the driver presses down the Air-Conditioning Request (switch) on the instrument panel, the engine control unit monitors the status of the air conditioning pressure sensor at the same time and then decides whether to open the air conditioning according to the current engine coolant temperature sensor signal and engine speed signal.

Coolant Temperature Sensor

The coolant temperature sensor is used to provide the information of the engine coolant temperature. So accordingly the controller can correct the fuel injecting and igniton. It is a negative temperature co-efficient (**NTC**) thermistor, and its resistance value decreases when the temperatue rises but not in a linear relation. The thermistor is mounted in a copper heat conducting sleeve.

Malfunction

ECT The sensor may fail because of the following conditions or because incorrect signal is provided:

- The system lacks coolant because of the leakage.
- external harness open
- external harness short to ground
- external harness connecting to 5V power short
- external harness resistance high
- **ECM** grounded circuit can not be provided
- **ECT** The thermistor is damaged

Evaporator Temperature Sensor

The evaporator temperature sensor delivers the information about the temperature of the gas through the evaporator to:

- **ECM** to manage the frost safety and
- the air-conditioning controller so that the computer can confirm the temperature of the wind blown out.

It is fixed on the right side of the air conditioner, fit on the evaporator. This is a thermistor and the sensor gets the electricity from 5V DC,**ECM** measure the voltage at the sensor wiring foot and the voltage changes along with the sensor's resistance.

Cooling Fan Relay Unit

The cooling fan relay unit is fit on the left of the radiator and two relays are equipped.

The cooling fan is controlled by**ECM** , and operated through the relay unit.**ECM** uses the information provided by**ECT** sensor,**BCM** and**A/C** to limit the cooling temperature of the engine.

The fan strategy includes that when the fan is switched on, the engine idling speed will be adjusted to compensate additional load. After the ignition key is removed, the cooling fan can run for more than 5 minutes to make engine with the high temperature cool.

Auxiliary 2 (External Auxiliary)

External auxiliaries mainly include:

- Alternator Control Input
- Clutch Switch
- Brake Pedal Switch
- Stop Lamp

Alternator Control Input

Alternator control input is**ECM** to control the alternator about charging the battery when the engine runs.

Brake Switch

The brake switch is on the pedal box in the cab compartment.**ECM** monitors the switch status and delivers the data through**CAN** bus to**TCM** which controls the gear box clutch's opening. The brake switch is activated when the brake pedal is operated.

Clutch Switch

The clutch switch is fixed on the pedal assembly, which is the same with the brake switch.

Service Procedures

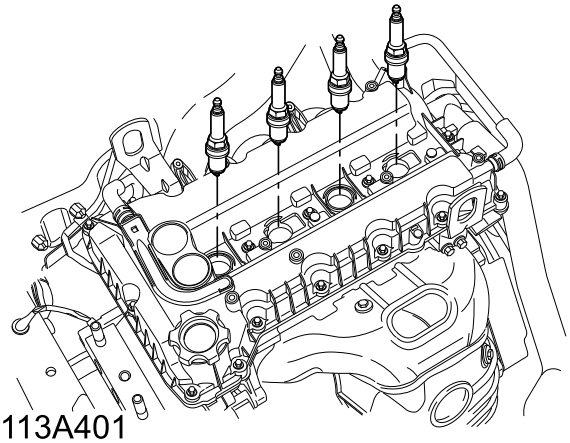
Spark Plug

Remove

1. Disconnect battery earth lead.
2. Remove the ignition coil and high-voltage coil.

☞ **Ignition Coil Remove**

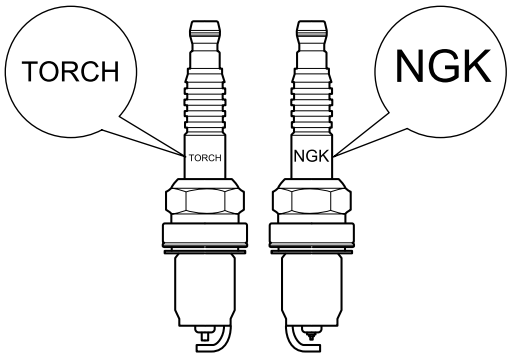
3. Clean the area around the spark plug; clear away the dirt around the spark plug with high-pressure gas.
4. Remove 4 spark plugs with spark plug socket.



S113A401

Refit

1. Before fitting the spark plug, identify the original spark plug type, and choose the same type of spark plug to replace.



2. The clearance of each new spark plug is adjusted to 0.80-0.90 mm.
3. Fit the spark plug and tighten it to **20–30Nm**.
4. Fit the ignition coil.

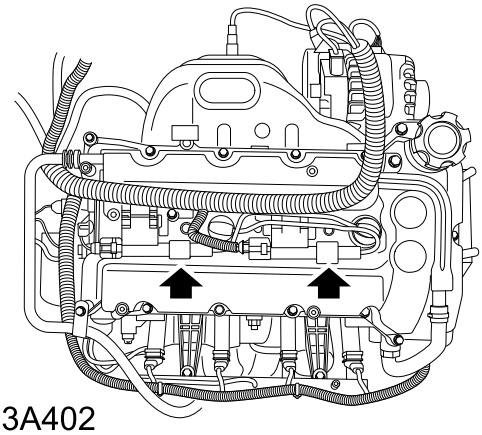
☞ **Ignition Coils Refit**

5. Connect battery earth lead.

Ignition Coil

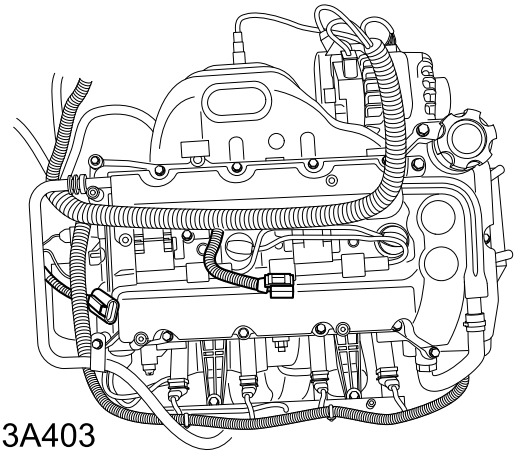
Remove

1. Disconnect battery earth lead.
2. Release the high-voltage wire.



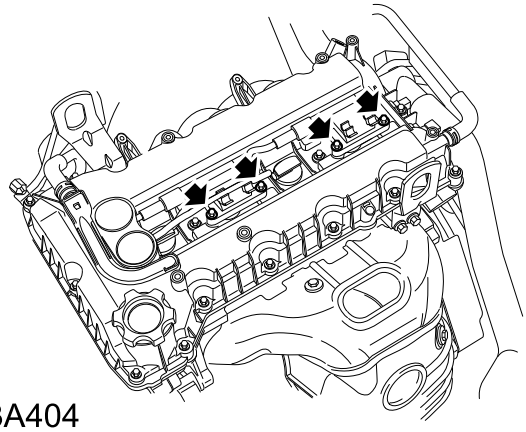
S113A402

3. Disconnect the connector assembly of the wire connector.



S113A403

4. Remove the bolt and nut securing the ignition coil.



S113A404

5. Hold the bottom of the ignition coil rubber sleeve and pull out the ignition coil from the spark plug.

Refit

1. Connect the high-voltage wires with the ignition coil; cylinder 1 and 4 connect; cylinder 2 and 3 connect.

2. Fit the ignition coil on the camshaft cover; put the ignition coil on it and then fit it on the spark plug. Connect the connector assembly of the wire connector.

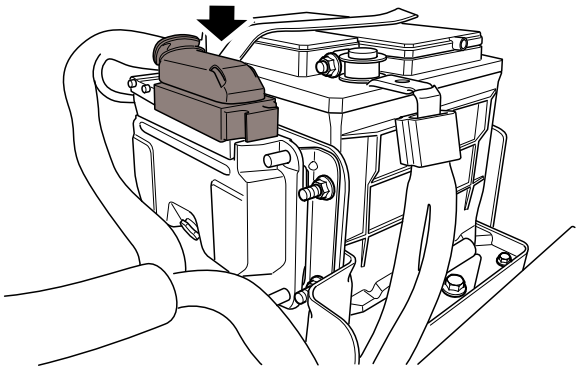
Caution: There is a bracket between the ignition coil and the camshaft housing cover.

3. Tighten the bolt securing the ignition coil to **8–12Nm**
4. Connect the high-voltage wire to the spark plug.
5. Connect battery earth lead.

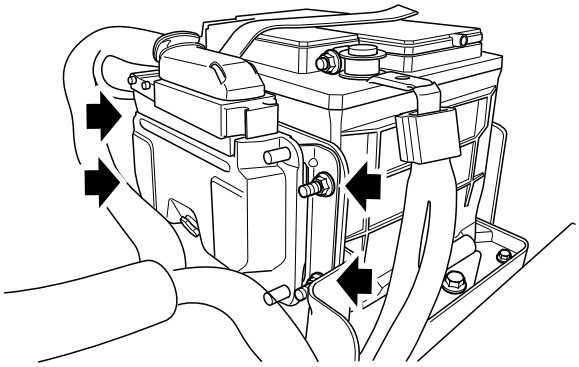
Engine control module (ECM)

Remove

1. Disconnect battery earth lead.
2. Disconnect connections of connectors from ECM.



3. Remove nuts fixing ECM to battery tray brackets.



4. Remove ECM from the battery tray brackets.

Refit

1. Position ECM and align mounting holes with battery trays.
2. Fit nuts fixing ECM to the tray and tighten them to **8–10Nm**.
3. Fit wire harnesses and connect them to ECM connectors.
4. Connect battery earth lead.
5. Fit ECM with a diagnostic tool.

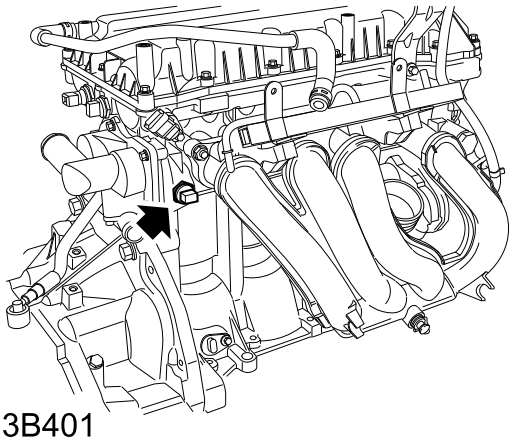
Engine Coolant Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Remove the coolant expansion tank lid to release the cooling system pressure, and then refit the lid.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

3. Disconnect the wiring harness connectors.
4. Place a suitable container to collect the coolant that might overflow.
5. Remove the engine coolant temperature sensor.



S113B401

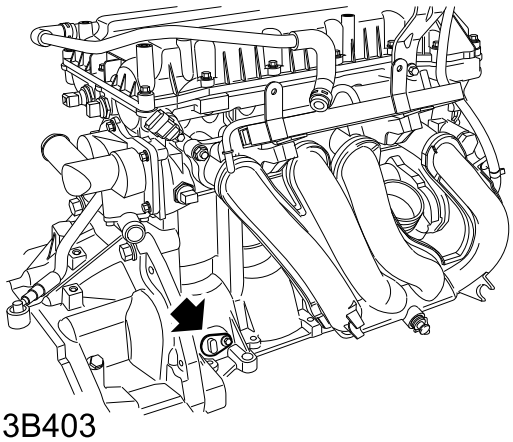
Refit

1. Clean the threads of the coolant temperature sensor.
2. Fit a new seal washer onto the coolant temperature sensor.
3. Fit the engine coolant temperature sensor and tighten it to**14–18Nm**.
4. Connect the wiring harness connector on the engine coolant temperature sensor.
5. Connect battery earth lead.
6. Inspect the coolant level, and add if necessary.

Crankshaft Position Sensor

Remove

1. Disconnect battery earth lead.
2. Raise the vehicle on a lift.
3. Disconnect the wiring harness connector from the camshaft position sensor.
4. Remove the bolts securing the crankshaft position sensor to the cylinder block.
5. Remove the crankshaft position sensor.



S113B403

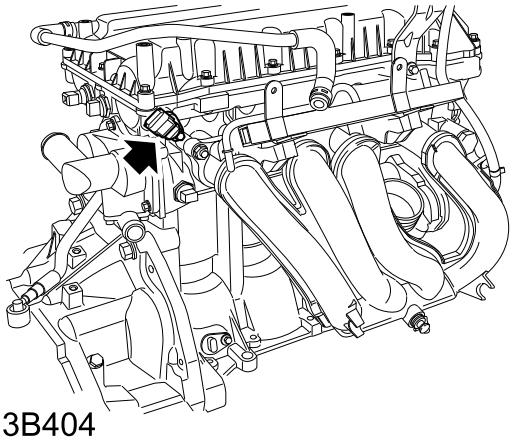
Refit

1. Clean the mating surface between the crankshaft position sensor and the cylinder block.
2. Locate the crankshaft position sensor, then fit the retaining bolt and tighten to **8–12Nm**.
3. Connect the wiring harness connector of the crankshaft position sensor.
4. Lower the vehicle.
5. Connect battery earth lead.

Camshaft Position Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector from the camshaft position sensor.
3. Remove the bolts securing the camshaft position sensor, and remove the camshaft position sensor, and dispose of the O-ring.



S113B404

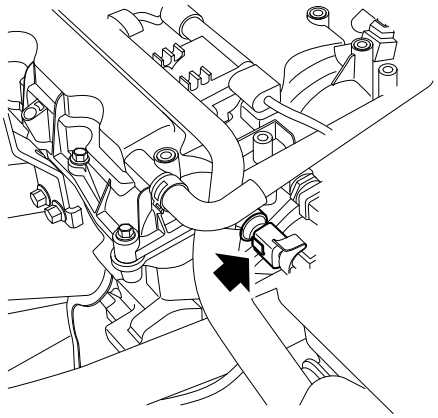
Refit

1. Clean the camshaft position sensor and its mating surface and fit the O-ring to the camshaft position sensor.
2. Fit the camshaft position sensor to the cylinder head and tighten the bolts to **8–12Nm**.
3. Connect the wiring harness connector of the camshaft position sensor.
4. Connect battery earth lead.

Oil Pressure Switch

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector from the oil pressure switch.
3. Place the oil receiving trough under the switch to collect the spilled oil.
4. Remove the oil pressure switch.



S113B405

Refit

1. Clean the threads of the oil pressure switch.
2. Fit a new seal washer onto the oil pressure sensor and tighten the switch to**14–18Nm**.
3. Connect the wiring harness connector of the oil pressure switch.
4. Remove the oil receiving trough.
5. Connect battery earth lead.
6. Check the engine oil level, and fill it up if necessary.

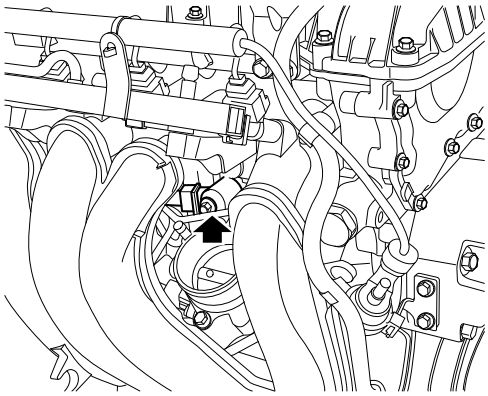
Knock Sensor

Remove

1. Disconnect the battery negative terminal.
2. Remove the intake manifold.

☞ **Intake Manifold Gasket Remove**

3. Disconnect the knock sensor harness connector.
4. Remove the bolts securing the knock sensor to the cylinder block and transfer the sensor.



S113B406

Refit

1. Clean the mating surface of the knock sensor and the cylinder block.
2. Fit the knock sensor and ensure correct harness layout and tighten the bolts to **15–25Nm**.
3. Connect the knock sensor harness connector.
4. Fit the intake manifold and replace the gasket with new one.

☞ **Intake Manifold Gasket Refit**

5. Connect battery earth lead.

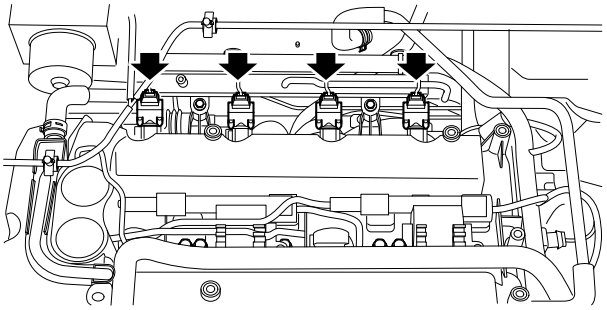
Fuel Rail

Remove

1. Disconnect battery earth lead.
2. Fuel system pressure release.

Warning: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO2, gas or powder close

3. Disconnect the wire connector from the fuel rail assembly.

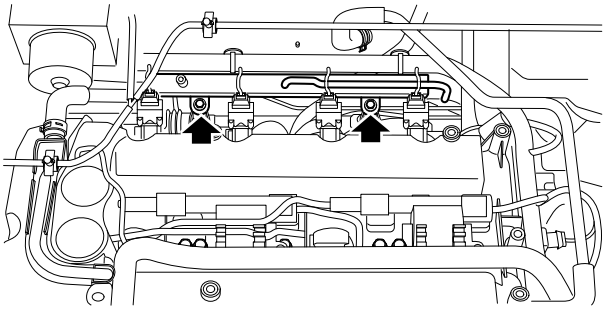


S113C401

4. Release fuel inlet tube from the fuel rail.

Caution: Always fit plugs to open connections to prevent contamination.

5. Remove 2 bolts securing the fuel rail to the intake manifold.



S113C402

6. Remove the fuel rail assembly.

Refit

1. Clean the groove on the fuel injector and intake manifold.
2. Position the fuel rail assembly on the intake manifold and push every fuel injector into the corresponding holes of the intake manifold.
3. Secure the fuel rail assembly to the intake manifold with two bolts and tighten to **8–12Nm**.
4. Connect the fuel inlet tube to the fuel rail.

5. Connect the fuel injector wire connector.
6. Disconnect battery earth lead.

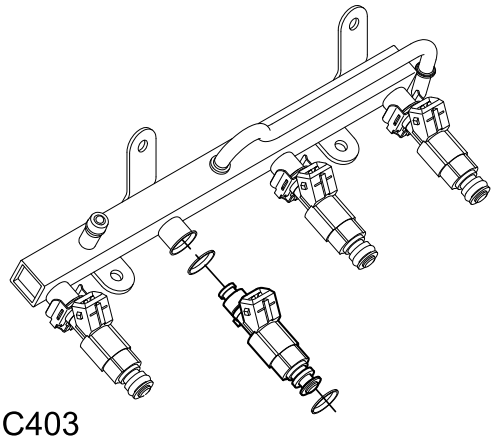
Fuel Injector

Remove

1. Disconnect battery earth lead.
2. Disconnect the fuel injector connector harness.
3. Remove the fuel rail assembly.

☞**Fuel Rail Assembly Remove**

4. Loosen the spring clip securing the fuel injector to the fuel rail and remove the fuel injector.
5. Remove 2 O-rings on each fuel injector and discard them.
6. Install the plugging cap on the end of each fuel injector.



S113C403

Refit

1. Transfer the plugging cap from every fuel injector.
2. Clean the groove on the fuel injector and the fuel rail.
3. Lubricate the new O-ring with the oil and fit onto both sides of each fuel injector.
4. Fit the fuel injector on the fuel rail.
5. Secure the fuel injector to the fuel rail with spring clip.
6. Fit the fuel rail assembly.

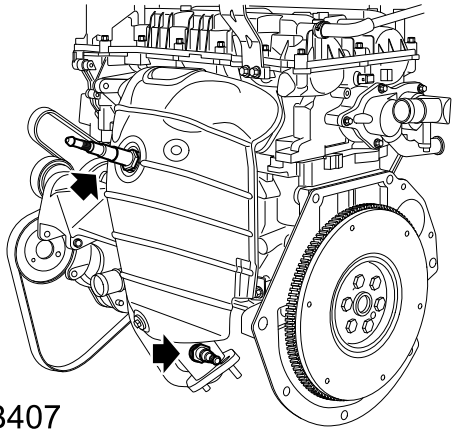
☞**Fuel Rail Assembly Refit**

7. Plug the connector harness of the fuel injector in.
8. Connect battery earth lead.

Oxygen Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connectors of the oxygen sensor.
3. Use of Oxygen Sensor Replacer**TEN00011** Remove the oxygen sensor.



S113B407

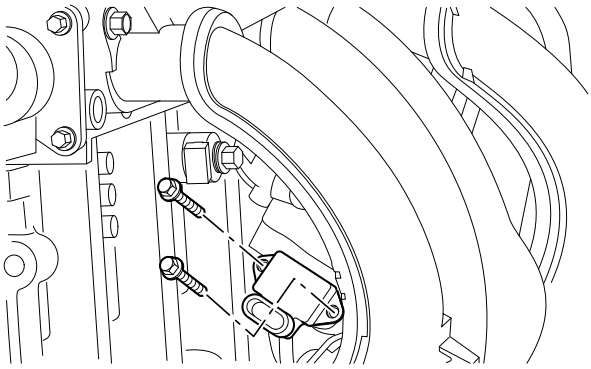
Refit

1. Use of Oxygen Sensor Replacer **TEN00011**Fit the oxygen sensor, and tighten the bolts to **50–60Nm**.
2. Connect the wiring harness connectors of the oxygen sensor.
3. Connect battery earth lead.

Manifold Absolute Pressure Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Disconnect the wiring harness connector of the manifold absolute pressure temperature sensor.
3. Remove the bolts securing the manifold absolute pressure temperature sensor onto the intake manifold, and remove the sensor.

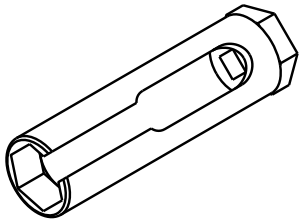


S113B408

Refit

1. Clean the mating surface between the manifold absolute pressure temperature sensor and the intake manifold.
2. Fit the manifold absolute pressure temperature sensor, and tighten the bolts to **4–5Nm**.
3. Connect the wiring harness connector of the manifold absolute pressure temperature sensor.
4. Connect battery earth lead.

Special Tools

Tool Number	Description	Picture
TEN00011	Wrench O2 Sensor	 TEN00011

Engine Manifold & Exhaust-1.5 VCT

Specifications

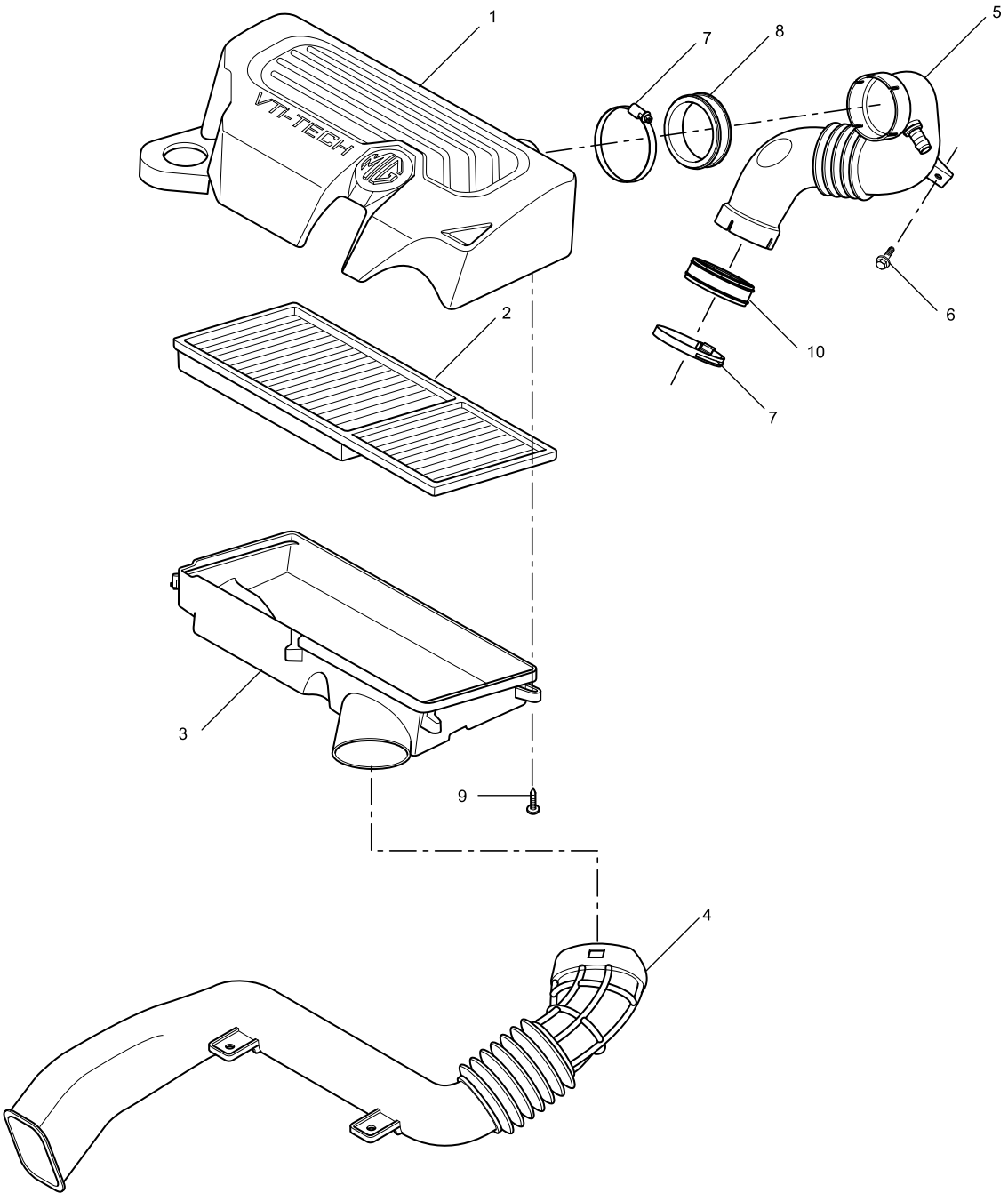
Torque

Description	Value
Bolt - charge air cooler inlet duct to radiator asm	3–5Nm
Nut - exhaust manifold to exhaust front pipe	45–55Nm
Nut - exhaust front pipe to muffler	50–60Nm
Nut - exhaust heat shield board	4–6Nm

Description and Operation

System layout-1.5L

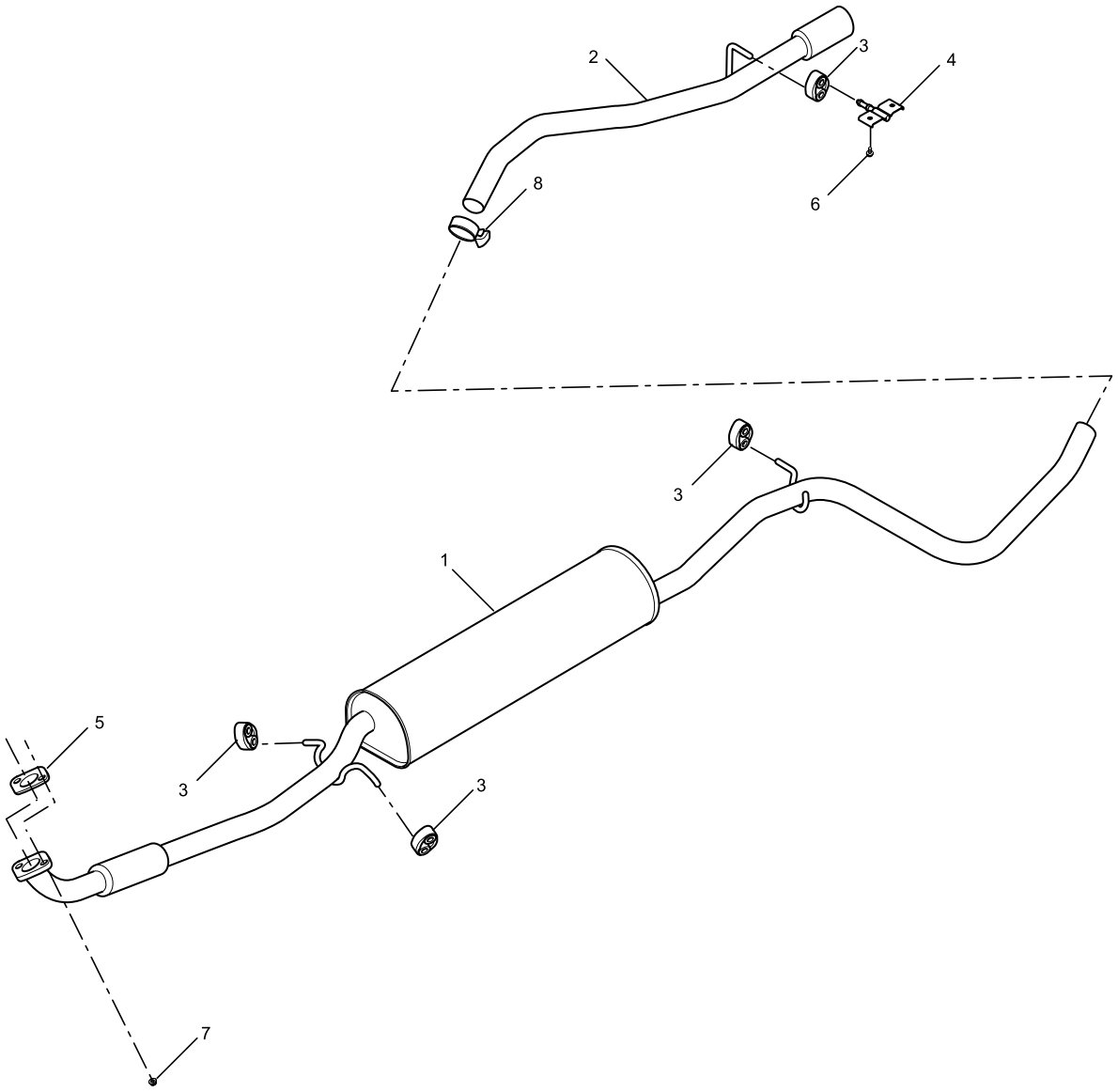
Air Intake system layout



1. Air Cleaner Upper Cover
2. Air Cleaner Element

3. Air Cleaner Lower Cover
4. Air Cleaner Inlet Duct
5. Air Cleaner Exhaust Pipe Assembly
6. Bolt - Air Cleaner Bracket to Body
7. Air Cleaner Outlet Duct Clamp
8. Air Cleaner Outlet Duct Rubber Sleeve
9. Air Cleaner Filter Screw
10. Air Cleaner Exhaust Pipe Interface Locator

Exhaust system layout



1. Front Exhaust Pipe
2. Rear Exhaust System - 1.5L
3. Exhaust System Hanger
4. Exhaust System Rear Hanger Bracket
5. Gasket - Exhaust Pipe to Manifold
6. Bolt - Exhaust System Rear Hanger Bracket

7. Nut - Front Manifold to Front Exhaust Pipe
8. Exhaust System Clamp

Description

Air cleaner

Fit the air cleaner air outlet pipe between the air cleaner and the throttle body and fix it with a worm drive clamp. The air cleaner assembly is fixed on the upper part of the engine through four air cleaner fitting pins.

Exhaust system

The exhaust system is composed of two sections of a front vent-pipe and a rear vent-pipe which are connected with clips. The muffler of the exhaust system is situated on the front vent-pipe with the exhaust tail pipe adopting stainless polishing integral single-cell design. The exhaust system is connected with the vehicle through four rubber lugs which can reduce vent-pipe vibration generated during the vehicle driving process. Two heat insulating plates are fit on the upper part of the exhaust muffler and the external surface of the oil tank respectively to reduce heat radiation from the vent-pipe and ensure safety of the gearshift device and the fuel system.

Operation

Air Cleaner

Air enters into the air cleaner through an air cleaner air intake pipe located on the side of the front cooling module. Impurities in the air will be filtered and stored in the lower air cleaner housing during the process of passing through the air cleaner element.

Gas filtered from the air cleaner enters into a throttle body through an air cleaner air outlet pipe.

Exhaust Manifold and Exhaust System

High temperature and high pressure gas generated during the operation process of the engine will enter into the exhaust manifold by passing each vent. Manifold branches will gather into a flange and enter into the exhaust system through a three-way catalytic converter and will be exhausted finally through an exhaust tail pipe. When the gas flows through a muffler in the exhaust system, the gas flow-induced noise can be reduced greatly, finally meeting requirements of relevant noise regulations.

Three-way Catalyst Converter (TWC)

Warning: TWCs operate at very high temperatures; therefore, extreme caution is necessary when handling this component.

Caution: For a catalytic converter to work efficiently and to prevent premature failure do not run on leaded fuel and do not allow unburnt fuel to pass through the exhaust system.

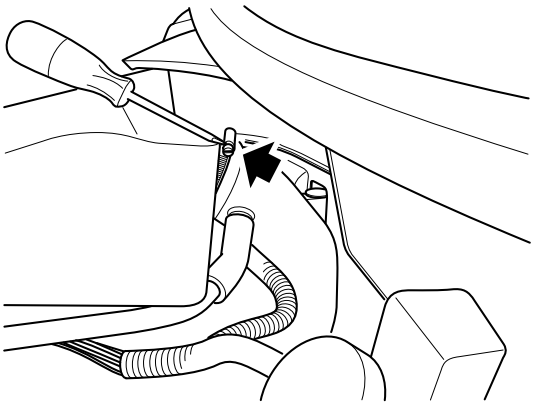
The main combustion takes place inside a firebox with the exhausted gas entering into () through the exhaust manifold. **TWC**.**TWC** It can not work effectively until its minimum working temperature is reached. The exhausted gas enters into an integral structure coated with platinum and rhodium (catalyzer) to carry out two procedures of reduction and oxidation. Nitrogen oxide (**NOx**) is reduced to nitrogen and forms carbon dioxide**CO** by combing its oxygen molecule with carbon monoxide. Hydrocarbon (**HC**) and**CO** continue to burn in the three-way catalytic converter by making use of the residual oxygen in the air. Hydrogen and carbon are oxidated into water and **CO2**.

Service Procedures

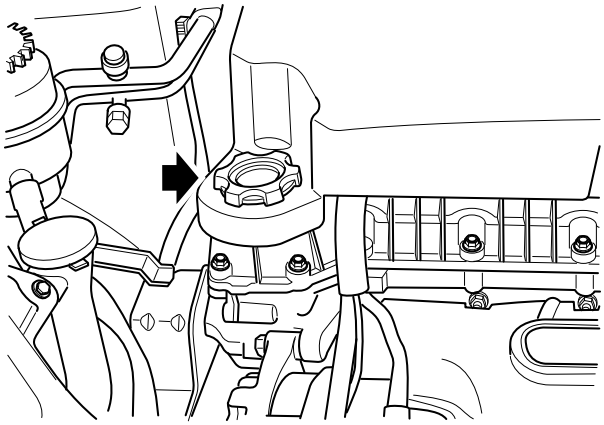
Air cleaner filter assembly

Remove

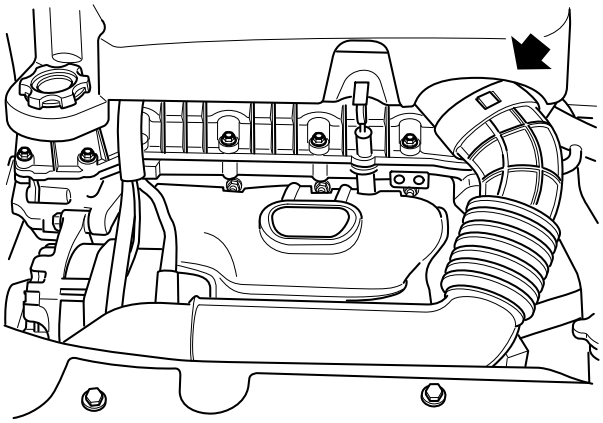
1. Release clamps fastening the air cleaner filter gas outlet tube and the air cleaner filter outlet.



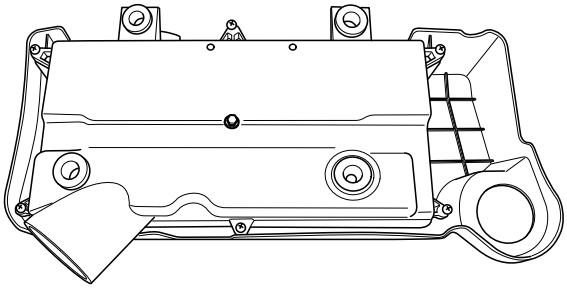
2. Remove the filler cap.



3. Release the air cleaner filter air intake pipe split pins.



4. Take down the air cleaner filter assembly.



Refit

1. Fit the air cleaner filter assembly to four locating pins on the engine assembly.
2. Connect air cleaner filter air intake pipe split pins.
3. Connect the air cleaner filter outlet with the air cleaner filter gas outlet tube with clamps.
4. Close the filler cap.

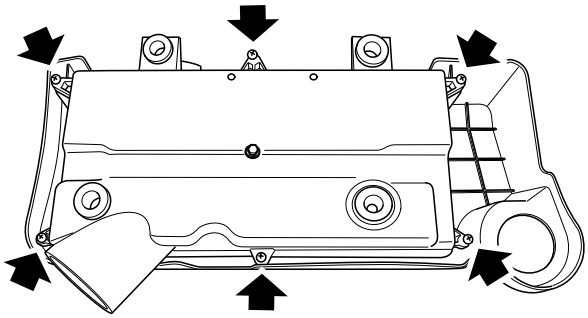
Air cleaner element

Remove

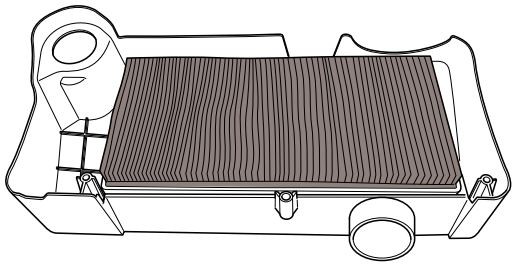
1. Remove the air cleaner assembly.

☞**Air Cleaner Assembly Remove**

2. Remove 6 bolts so as to open the cover to reach the air cleaner element.



3. Take out the element.



Refit

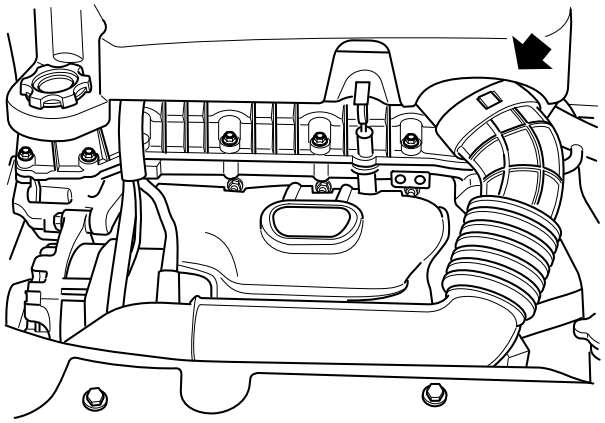
1. Fit the element to the air cleaner.
2. Fit the cover to the housing with six bolts.
3. Fit the air cleaner assembly.

☞**Air Cleaner Assembly Refit**

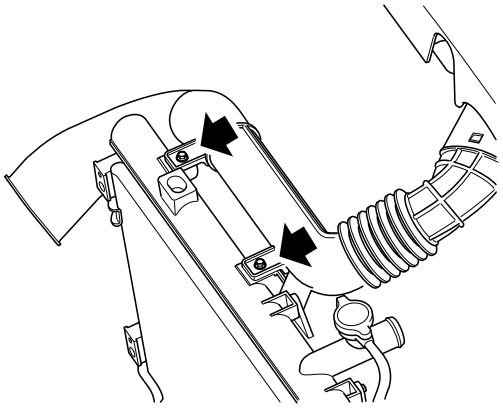
Air intake pipe assembly

Remove

1. Release the air cleaner air intake pipe split pins.



2. Remove bolts fixing the air cleaner's air intake pipe to the cooling assembly and take down the air intake pipe assembly.



Refit

1. Place air cleaner's air intake pipes to the refit position.
2. Align mounting holes, tighten air cleaner's air intake pipe split pins.
3. Fit the air cleaner air intake pipe to the cooling assembly with bolts and tighten them to **3–5Nm**.

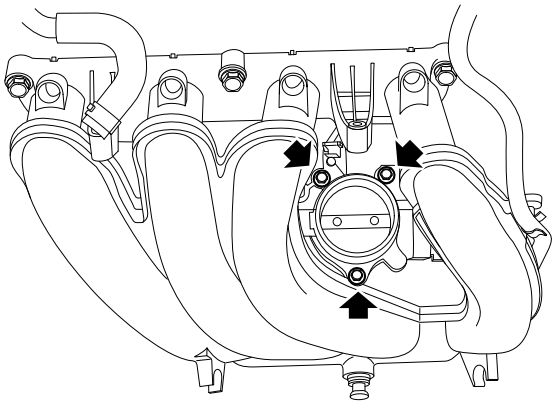
Electronic throttle -1.5VCT

Remove

1. Disconnect battery earth lead.
2. Disconnect the connection of the electronic throttle wiring harness connector assembly.
3. Remove the intake manifold and the electronic throttle.

☞ **Intake Manifold Gasket Remove**

4. Remove three bolts connecting the electronic throttle to the intake manifold and remove the electronic throttle.



S111Q402

Refit

Tip: In order to protect against being frozen the disassembly of the throttle must be operated at a surroundings' temperature of 6 ℃ at least.

1. Fit new electronic throttle washers to the intake manifold groove (sealing surfaces shall be clean).
2. Clean the junction plane between the electronic throttle and the intake manifold, fix three bolts connecting the electronic throttle to the intake manifold and fit the electronic throttle.
3. Fit the intake manifold and the intake manifold gasket.

☞ **Intake Manifold Gasket Refit**

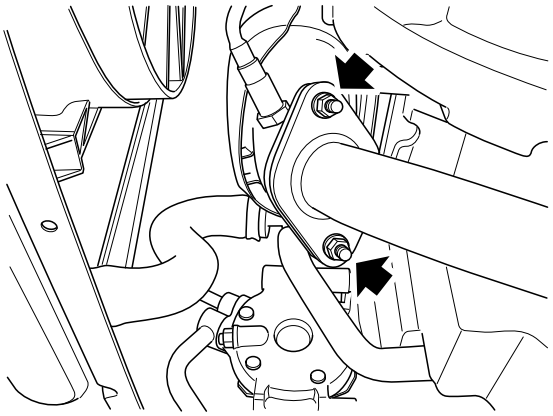
4. Connect the electronic throttle wiring harness connector.
5. Connect battery earth lead.

Front exhaust pipe assembly

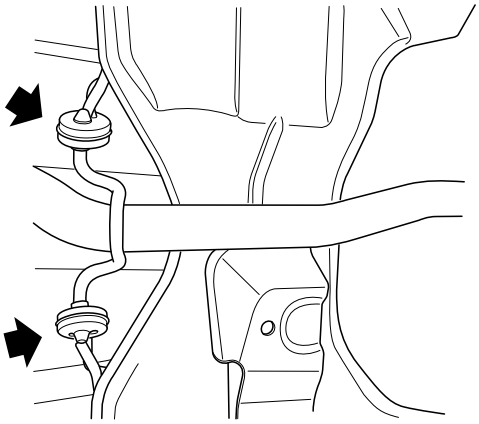
Remove

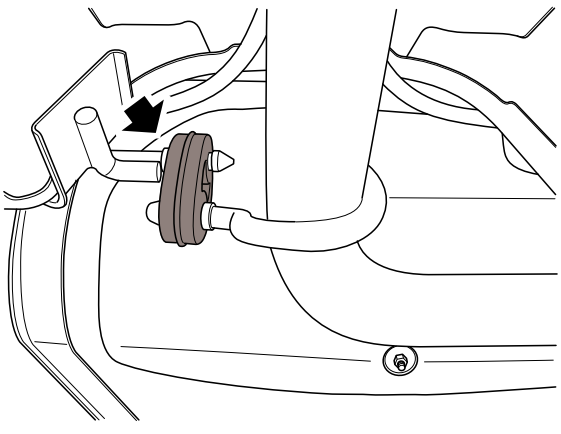
Warning: Exhaust components get extremely hot during operation. Ensure exhaust components are sufficiently cooled before handling.

1. Lift up the vehicle with a lifter.
2. Remove two nuts fixing the front exhaust pipe assembly to the exhaust manifold.

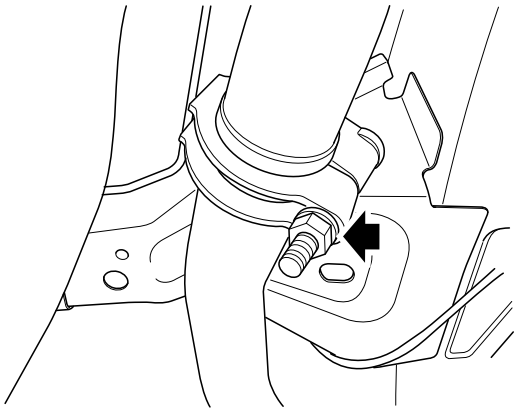


3. Remove 3 rubber lugs fixing the front exhaust pipe assembly to the vehicle.





4. Remove nuts connecting the front exhaust pipe assembly to the rear exhaust pipe assembly clamps and release clamps.



5. Remove the front exhaust pipe assembly.

Refit

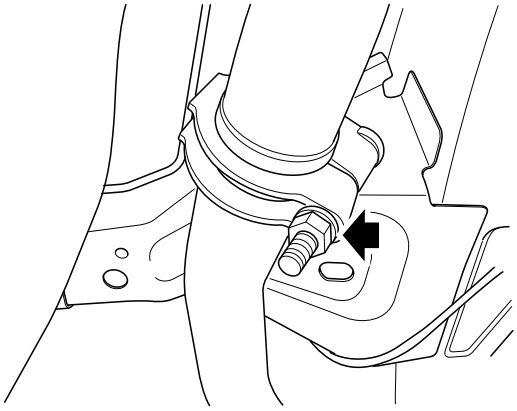
1. Clean flange faces of the front exhaust pipe assembly.
2. Align holes on the front exhaust pipe assembly flange faces with bolts on the exhaust manifold flange faces.
3. Fit and tighten flange nuts to **45–55Nm**.
4. Tighten clip nuts connecting the front exhaust pipe assembly to the rear exhaust pipe assembly to **50–60Nm**.
5. Connect front pipes to vehicle body bottom hooks with rubber lugs.
6. Remove the backstop and Lower the vehicle.

Rear exhaust pipe assembly

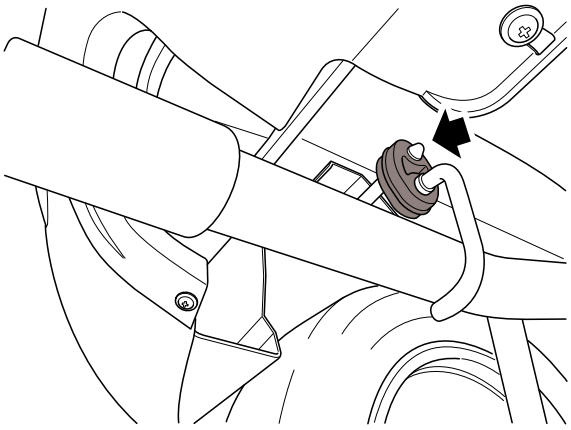
Remove

Warning: Exhaust components get extremely hot during operation. Ensure exhaust components are sufficiently cooled before handling.

1. Lift up the vehicle with a lifter.
2. Remove nuts fixing the front exhaust pipe assembly to the rear exhaust pipe assembly clips and release clips.



3. Remove 1 rubber lug fixing the rear exhaust pipe assembly to the vehicle support.



4. Take down the rear exhaust pipe assembly.

Refit

1. Fit the rear exhaust pipe support to the vehicle in advance with two hexagon flange nuts.
2. According to the limit identification, insert the front exhaust pipe assembly into the rear exhaust pipe assembly and tighten clamp nuts to **50–60Nm**.
3. Fit rubber lugs on the exhaust tail pipe to the rear exhaust pipe assembly support, ensuring that rubber lugs are naturally vertical.

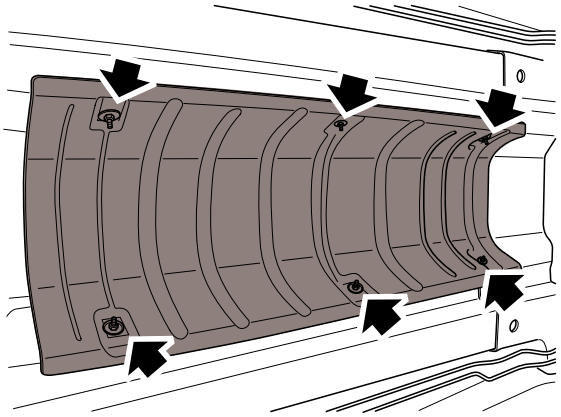
Exhaust path heat shield

Remove

1. Remove the front exhaust pipe assembly.

☞**Front Exhaust Pipe Assembly Remove**

2. Remove 6 nuts fixing the exhaust path heat shield to the floor under the vehicle and take down the heat shield.



Refit

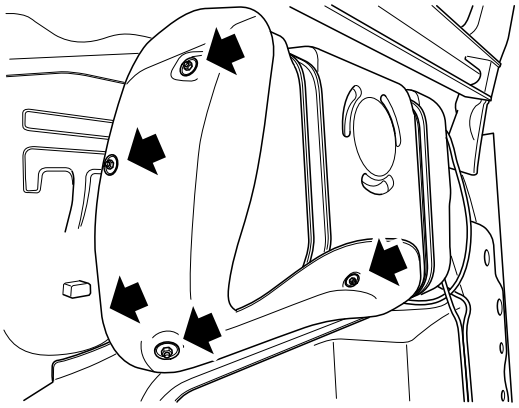
1. Fit the exhaust path heat shield to the floor under the vehicle, fit nuts and tighten them to **4–6Nm**.
2. Fit the front exhaust pipe assembly.

☞**Front Exhaust Pipe Assembly Refit**

Fuel tank heat shield

Remove

1. Remove 5 nuts fixing the fuel tank heat shield to the fuel tank assembly.



2. Remove the fuel tank heat shield.

Refit

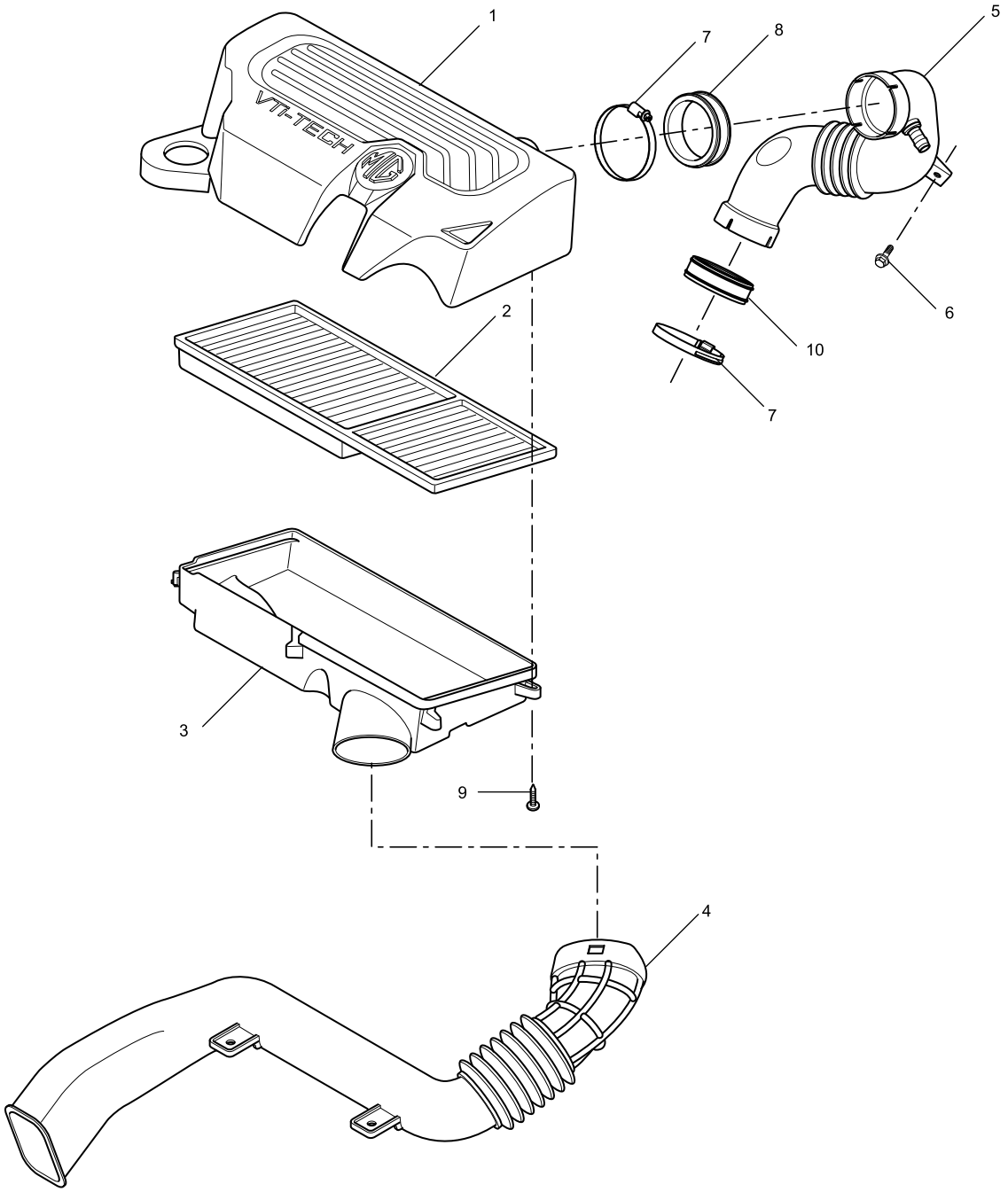
1. Align location holes of the fuel tank heat shield with bolts on the fuel tank, fit nuts and tighten them to **4–6Nm**.

Engine Manifold & Exhaust-1.3 BASE

Description and Operation

System Component Layout - 1.3L

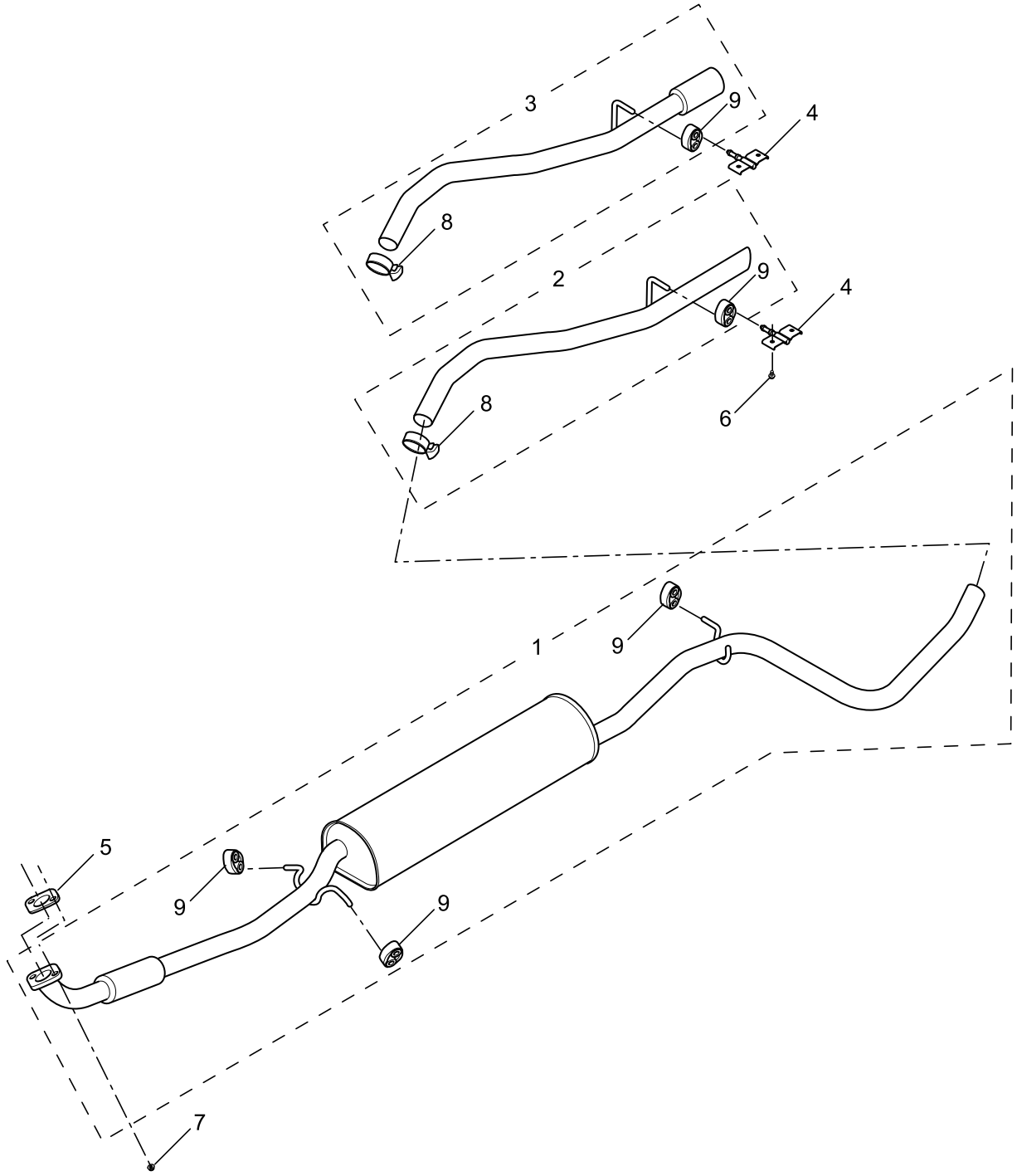
Intake System Component Layout



1. Air Cleaner Upper Cover
2. Air Cleaner Element

3. Air Cleaner Lower Cover
4. Air Cleaner Inlet Duct
5. Air Cleaner Exhaust Pipe Assembly
6. Bolt - Air Cleaner Bracket to Body
7. Air Cleaner Outlet Duct Clamp
8. Air Cleaner Outlet Duct Rubber Sleeve
9. Air Cleaner Filter Screw
10. Air Cleaner Exhaust Pipe Interface Locator

Exhaust System Component Layout



1. Exhaust Pipe Front Pipe
2. Rear Exhaust System - MT
3. Rear Exhaust System - AMT
4. Exhaust System Rear Hanger Bracket
5. Seal Washer - Exhaust Pipe to Manifold
6. Bolt - Exhaust Pipe Rear Hanger Bracket
7. Nut - Front Manifold to Front Exhaust Pipe
8. Exhaust System Clamp
9. Exhaust System Hanger

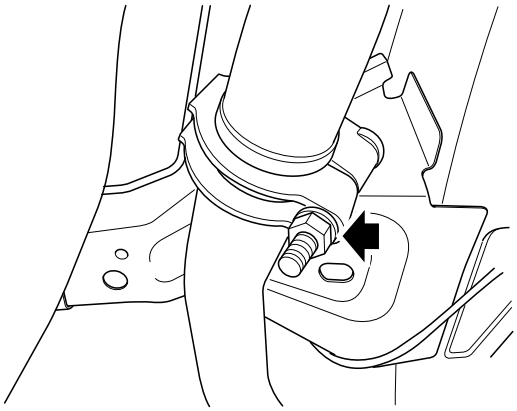
Service Procedures

Rear Muffler Assembly - 1.3L

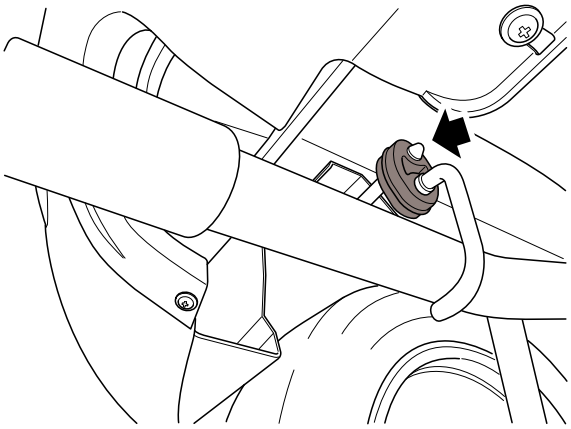
Remove

Warning: Exhaust components get extremely hot during operation. Ensure exhaust components are sufficiently cooled before handling.

1. Lift the vehicle on a raiser.
2. Remove the nut securing the exhaust front pipe assembly to the exhaust rear pipe assembly clamp and release the clamp.



3. Remove the rubber lug securing the exhaust rear pipe assembly to the body bracket.



4. Remove the exhaust rear pipe assembly.

Refit

1. Clean the flange face of the exhaust middle muffler and exhaust rear muffler.
2. Fit the new gasket on the flange face of the exhaust middle muffler.
3. Fit the nut on the flange and tighten to **45–55Nm**.
4. Fit the exhaust tail pipe and connect it with the body hanger with rubber ring.
5. Lower the vehicle.

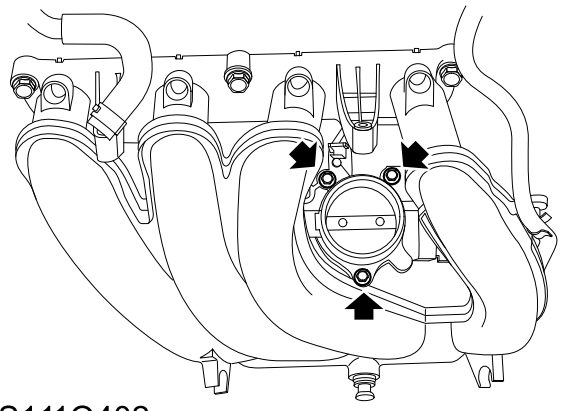
Electronic Throttle - 1.3 BASE

Remove

1. Disconnect battery earth lead.
2. Disconnect the electronic throttle harness connection.
3. Move out the intake manifold and the electronic throttle.

☞**Intake Manifold Gasket Remove**

4. Remove the 3 bolts connecting the electronic throttle with the intake manifold and remove the electronic throttle.



S111Q402

Refit

Tip: In order to protect against being frozen the disassembly of the throttle must be operated at a surroundings' temperature of 6 ℃ at least.

1. Fit the new electronic throttle washer in the intake manifold groove (ensure the sealing surface is clean).
2. Clean the mating surface of the electronic throttle and intake manifold and secure the 3 bolts connecting the electronic throttle to the intake manifold, the torque is **8–12Nm**, and then fit the electronic throttle.
3. Fit the intake manifold and the intake manifold gasket.

☞**Intake Manifold Gasket Refit**

4. Connect the electronic throttle harness connector.
5. Connect battery earth lead.

Engine Electrical System-1.5 VCT

Specifications

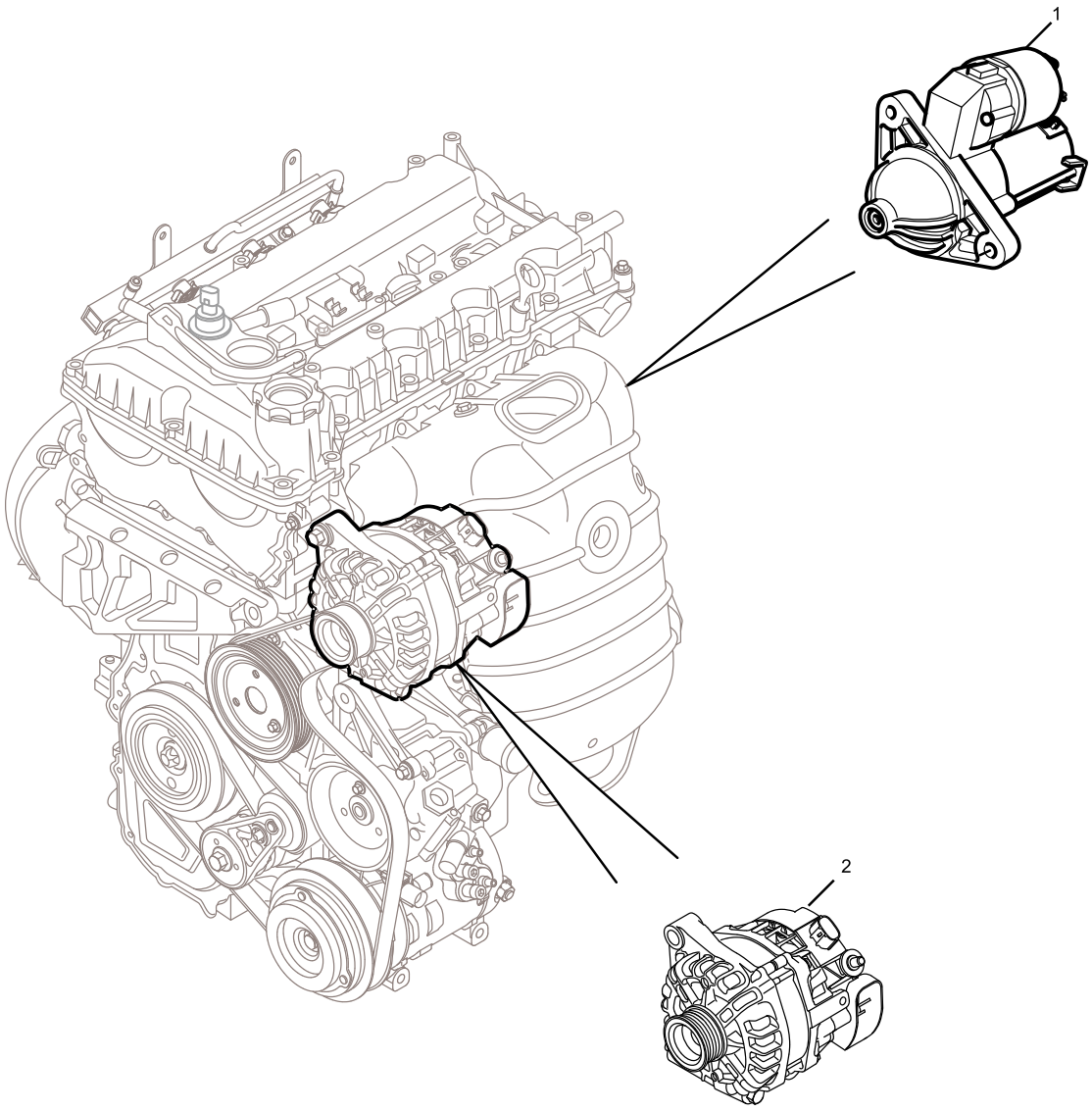
Torque

Description	Value
Bolt - start harness bracket	7–10Nm
Bolt - starter	25Nm
Bolt - battery clip	20–28Nm
Bolt - battery	20–28Nm
Nut - ECM to ECM bracket	8–10Nm
Bolt - battery tray	20–28Nm
Bolt - fuse box to battery tray	6–8Nm
Bolt - battery tray front bracket to transmission mounting	20–28Nm
Bolt - battery tray rear bracket to front sidemember	20–28Nm

Description and Operation

System layout

starting and charging system layout



1. Starter Motor
2. Generator

Description

General Description

The vehicle starting system contains a starter motor with 12V voltage, which converts electric energy to mechanical energy and drives the engine running and beginning combustion process. The vehicle electric system must provide enough electric energy to ensure that the starter motor can overcome engine resistance and reach to starting speed.

Charging system includes a 12V battery pack and an alternator. The battery must have enough energy to drive the starter motor and other electrical system. The alternator will work when the engine runs, outputting electricity to charge the battery and provide electricity to all electrical devices. The charging warning lights fit on the instrument pack will be on when the alternator does not output electricity or the output voltage is too low.

Alternator

The alternator is fit on the front right side of the engine. The drive pulley is fit on one side of the rotor and driven by V-type multi-slot belt lead out by the crankshaft. The alternator is fixed and the belt tension is maintained by automatic belt tensioner.

All alternators are similar in structure, including a rotor, a stator, a rectifier and a regulator. One-way output terminal is connected to the battery positive pole through a 150A fuse by a thick cable. The alternator is grounded through its support. Three-pin connector is the load signal connecting end for charging warning light output, ignition signal input and alternator output.

The rotor is formed through a magnetic coil twisting the iron core and fit on the crankshaft. The iron core extends at both ends, which forms the north and south pole of magnetic lines. The rotor is in the stator and fit on the bearing for smooth running. At the same time, one side of the rotor bears heavy load brought by drive belt, providing support for the rotor.

The stator includes a stator iron core and a stator coil with support at two ends. The stator is made of thin soft iron sheet and has slots suitable for stator coil and is fixed on the alternator housing. The stator has three groups of coil, and insulating paint is applied on the copper wire. Three coil windings are connected in star type, so each end of every winding connect together. Output current is provided through the other end of each winding. The stator coil allows magnetic flux generated by the magnetic pole to flow through it. The rotor spins and generates alternating current in the coil.

The rectifier locates behind the alternator, converting AC generated in the stator coil into DC required by vehicle electrical system. The rectifier includes 8 semiconductor diodes that are fit on the heat dissipation panel. Three diodes are on the frontage, three on the reverse side and another two in the center. The rectifier also prevents the current from flowing to the alternator from the alternator when the output voltage of the alternator is lower than the battery voltage.

Integrated circuit regulator also locates behind the alternator to control the alternator's output voltage so as to prevent the battery from overcharging and protect the vehicle electrical system. The regulator optimizes charging battery by appropriate temperature. It sets 14.5V as rated output voltage and changes the voltage according to the load condition of the battery and requirement of the vehicle electrical system.

The transistor in the regulator may regulate the output voltage by changing the switch rapidly using inner induced voltage. The regulator can control warning light operation through output terminal of the charging warning light. The warning light will be on if the alternator output voltage is lower than the battery voltage. The regulator provides the generator load signal output, and it also provides output data to the engine control module which adapts all kinds of electric load by adjusting idle appropriately.

In the ignition system, the collector ring on the generator rotor shaft provides excitation current to the rotor when the generator runs at low speed. When the generator speed increases, the generator became self-excited.

Starter Motor

The starter Motor locates on the left rear side of the engine and is fixed in the mounting hole of the transmission housing by two flange bolts.

The starter motor is electromagnetic meshing type, including a solenoid valve, a one-way clutch and a motor. When the ignition switch is on the start position and the engine requires start, the body control module with anti-theft function outputs signal to put through the starter relay after it passes the anti-theft verification.

Battery

The battery is fit on a tray and in a heat shield. The battery is located on the left side of the engine. Battery heat shield protect the battery from thermal radiation for extending battery's life. Battery terminals are connected with special cable connector and connection or disconnection needs appropriate tool.

All vehicles are equipped with a Lead-acid maintenance-free battery. Each battery is the same in structure. Only the battery capacity may be different because of different requirements of engine and transmission accessories. The battery applies Calcium expansion technology. Its positive and negative pole are made of lead-calcium alloy grid. This technology improves mechanical integrity and extreme durability of metal

plate group, and reduces water loss compared with previous technology.

The battery is completely sealed, but the vent hole on the head cover allows releasing oxygen and hydrogen generated when battery is overcharged so as to reduce the inner pressure of battery.

The battery uses a complete hydrometer with temperature compensation to provide direct instruction about electrolyte's density and fluid level. Different colors displayed on the indicator means different conditions of the battery as followings:

- Green - indicates the battery is in a good charging condition and can be used.
- Darken (becoming black) - indicates the lower battery and need to be charged.
- Transparent or yellow - indicates the battery can not be used and must be replaced. If the indicator shows transparent or yellow, the inner of the battery is damaged. In this case, do not attempt to charge the battery or start the vehicle by external power.

If the indicator shows transparent or yellow, the inner of the battery is damaged. In this case, do not attempt to charge the battery or start the vehicle by external power.

Warning: Battery fluid (electrolyte) contains sulphuric acid. It may cause severe burns if it gets on your skin or in your eyes. Wear protective clothing and a face shield. If electrolyte gets on your skin or clothes, immediately rinse it off with water. If electrolyte gets in your eyes, immediately flush eyes with water for at least 15 minutes and seek medical help.

When removing the battery, ensure the alarm has been disarmed and the ignition is off. Always disconnect negative terminal first and then disconnect positive terminal. When refitting the battery, always fit the positive terminal first, and then the negative terminal. If the battery lacks of power, remove it from the vehicle then perform the recharging. Recharge the battery in constant current with one charger. Do not use the quick charger, or it will result the permanent damage.

Operation

Alternator

An alternators makes use of an autonomous system in which diodes provide the rotor with part current generated by an alternator. The alternator cannot provide initial current for staring charging procedures. This initial current is provided by the ignition switch at the input end of a battery and will provide and activate a field winding so as to start charging procedures. When the ignition switch is turned on, battery voltage is also provided by a charging warning light and is grounded by alternator field windings so as to make LED warning lights turn on.

When the engine is started up to make a rotor inside a stator rotate, 3-phase alternating current will be generated. When the rotation speed of the rotor increases, the output voltage will increase rapidly, increasing the potential difference at the output terminal of a magnetic-field diode. When the voltage rises, the charging warning light will dim down. And when the output voltage of the alternator is equal to the battery voltage, the light will go out. At this moment, the alternator will generate enough self excitation current from the magnetic-field diode and start to charge the battery. If the charging warning light is still on, there must be a problem with the charging system and you must inspect it, otherwise, the battery will be damaged.

Starter Motor

When the ignition switch is turned to the startup position, a pinion will be caused to engage with a toothed flywheel with power provided by a coil. The pinion will move in spirals on a motor shaft, so thus engagement will be provided by the motor shaft through the tooth ring. On the starter motor, the motor drives the pinion through the transmission rather than the motor shaft directly.

During the process of starting the engine, the unidirectional clutch will prevent the motor armature from overspeed operation, so drivers should not move keys away from the starting position so as to maintain continuous operation of the starter motor.

After starting the engine, when the ignition switch is released, energy will be released from the magnetic coil and the pinion will exit from the tooth ring.

Service Procedures

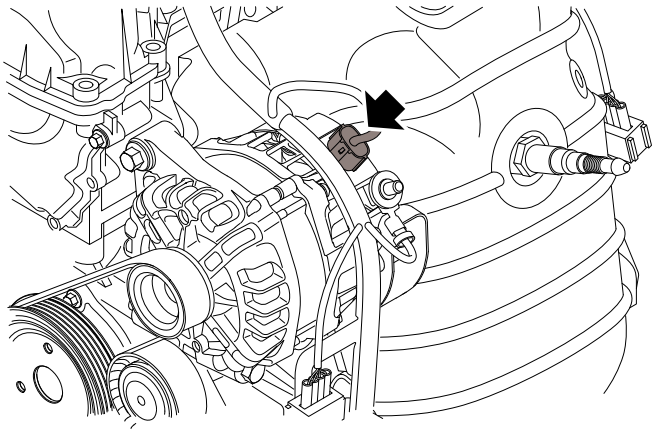
Generator

Remove

1. Raise the vehicle on a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

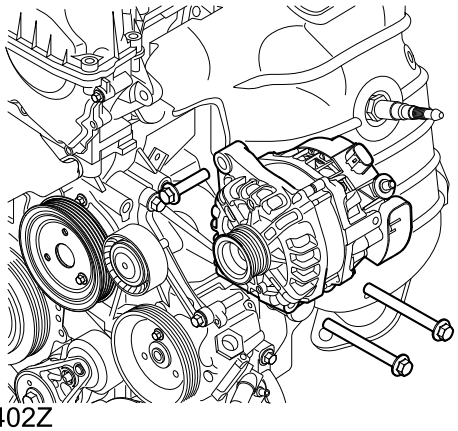
2. Disconnect the battery earth lead.
3. Remove the connector between the generator and the engine wiring harness.



4. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

5. Remove 3 bolts connecting the generator to the cylinder head and cylinder block.



S841A402Z

6. Remove the generator.

Refit

1. Clean the mating surface between the generator and cylinder head and cylinder block.
2. Fit 3 bolts connecting the generator to the cylinder head and cylinder block.
3. Fit the accessory drive belt.

☞**Accessory Drive Belt Refit**

4. Fit the connector between the generator and the engine wiring harness.
5. Connect the battery earth lead.
6. Lower the vehicle.

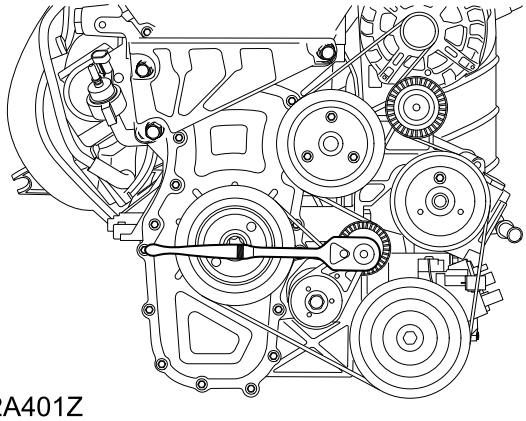
Accessory Drive Belt

Remove

1. Lift the vehicle to the height suitable for operating on.

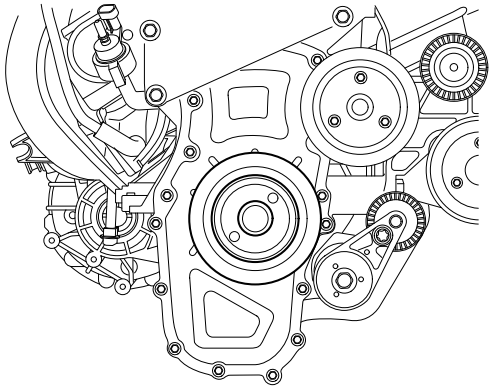
Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Disconnect battery earth lead.
3. Insert the replacer into the square hole within the tensioner, pull the torque wrench counterclockwise and the pulling torque is no more than 82 Nm, so that the tensioner is detached from the belt.



S112A401Z

4. Remove the belt.

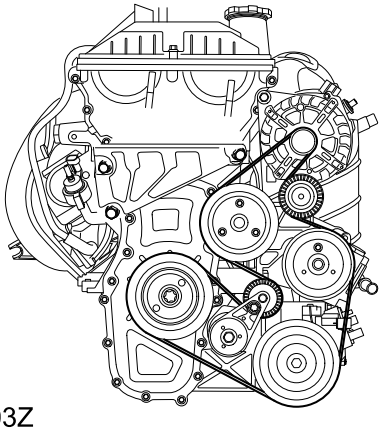


S112A402Z

5. Slowly return the tensioner back to position, and remove the tool.

Refit

1. Insert the replacer into the square within the tensioner, pull the torque wrench counterclockwise and the pulling torque is no more than 82 Nm.
2. Fit the accessory drive belt into pulley grooves and on tension pulley, idler pulley in the arrangements as shown in the illustration.



S112A403Z

3. Slowly loosen the tensioner, making sure that the belt should be basically located in the middle of the tension pulley after refit, with at least 2 mm margin exposed on both sides of the tension pulley.
4. Take out the tool.
5. Connect battery earth lead.
6. Lower the vehicle.

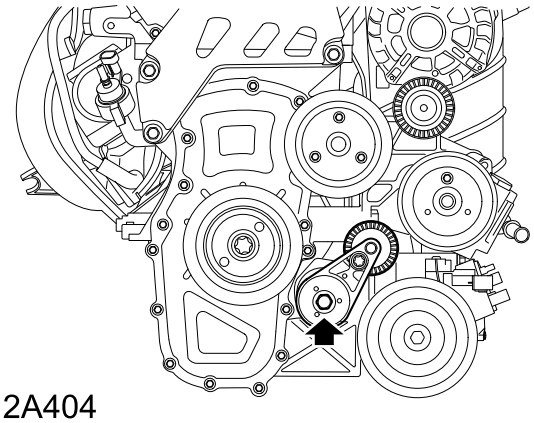
Accessory Drive Belt Tensioner

Remove

1. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

2. Remove the bolts of the accessory drive belt tensioner.



S112A404

3. Remove the accessory drive belt tensioner.

Refit

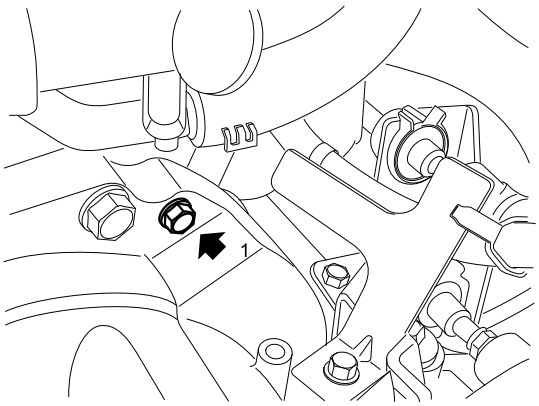
1. Tighten the bolts of the auxiliary drive belt tensioner.
2. Fit the auxiliary drive belt.

☞**Accessory Drive Belt Refit**

Starter Motor

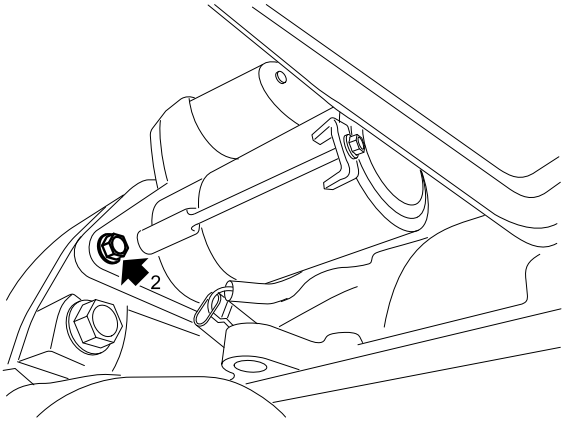
Remove

1. Disconnect battery earth lead.
2. Remove the nut and disconnect the battery wire connections from the starter motor solenoid coils.
3. Remove the starter motor retaining bolt 1.



S112B401

4. Remove the starter motor retaining bolt 2 from the vehicle bottom.



S112B402

5. Remove the connecting cable on the starter.

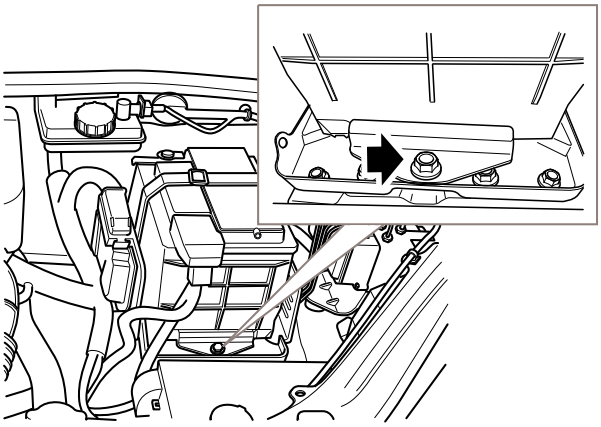
Refit

1. Clean the mating surface between the starter motor and the transmission, clean the pins and pin holes.
2. Secure the battery wiring harness to the starter motor solenoid coil, and tighten the nut to **7–10Nm**. Connect the engine wiring harness with the starter connector.
3. Fit the starter motor, fit and tighten the bolt to **25Nm**.
4. Connect battery earth lead.

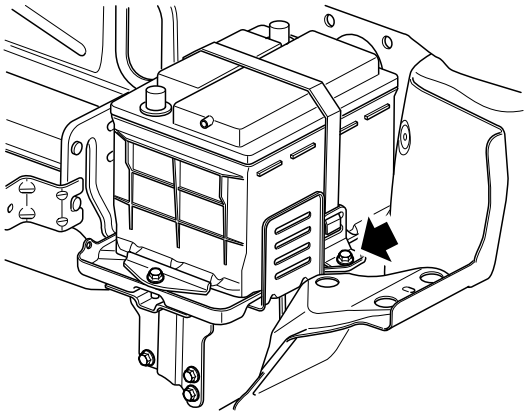
Battery

Remove

1. To disconnect two leads of the battery, firstly disconnect the earth lead.
2. Remove bolts fixing batteries, take down battery retaining clips.



3. Remove bolts fixing battery strap clamps, loosen the battery straps.



4. Remove the battery.

Refit

1. Place battery to an appropriate position of a battery tray.
2. Fit the battery to the battery tray with battery retaining clips, fit bolts and tighten them to **20–28Nm**.
3. Fit a battery strap clamp to the battery tray, fit bolts and tighten them to **20–28Nm**.

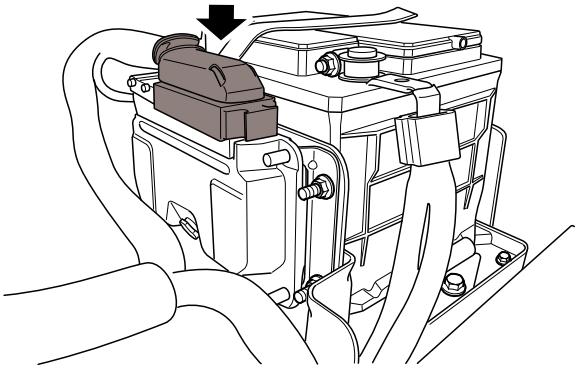
Battery Tray

Remove

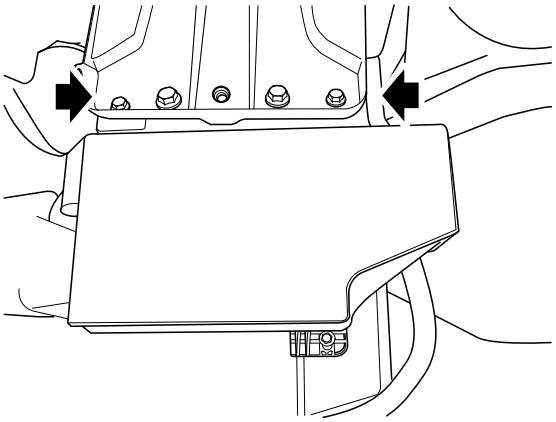
1. Remove the battery.

☞**Battery Remove**

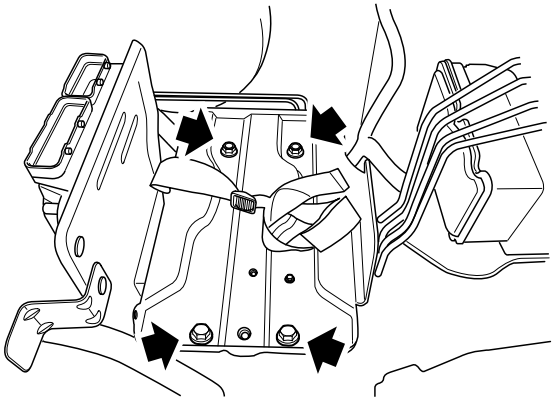
2. Disconnect the connection of the connector from the ECM.



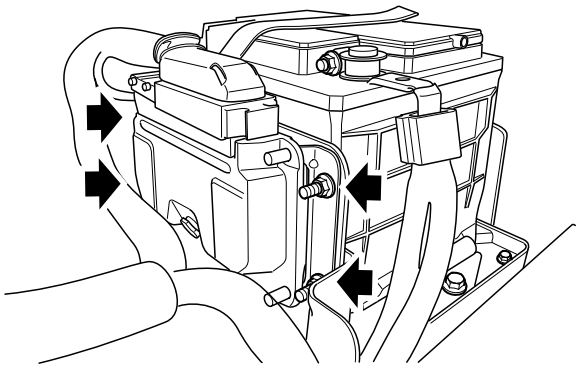
3. Remove the bolts fixing the fuse box inside the engine compartment to the battery tray.



4. Remove the bolts fixing the battery tray and Engine Control Module (ECM) bracket to the front side and rear side of the tray, and remove the battery tray and ECM bracket.



5. Remove the nuts fixing the Engine Control Module (ECM) to the battery tray.



Refit

1. Fit the Engine Control Module (ECM) to the battery tray. Fit the nuts and tighten to **8–10Nm**.
2. Fit the Engine Control Module (ECM) bracket and the battery tray to the battery tray front and rear brackets. Screw on bolts and tighten to **20–28Nm**.
3. Fit the fuse box inside the engine compartment and tighten the bolts to **6–8Nm**.
4. Connect the ECM connector.
5. Fit the battery.

☞**Battery Refit**

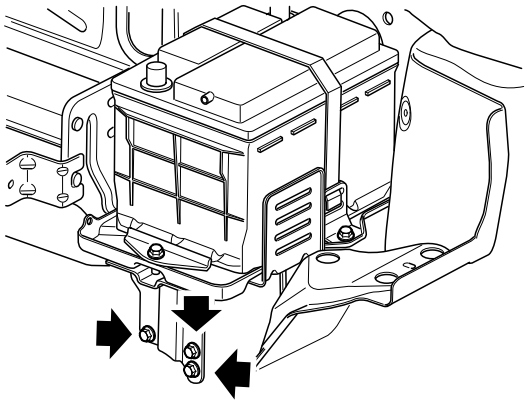
Battery Tray Front Bracket

Remove

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Remove the bolts fixing the battery tray front bracket to the transmission mounting.



Refit

1. Fit the battery tray front bracket to the transmission mounting. Fit bolts and tighten to **20–28Nm**.
2. Fit the battery tray.

☞**Battery Tray Refit**

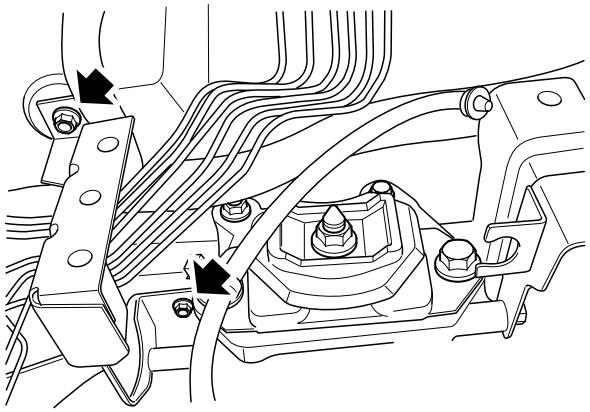
Battery Tray Rear Bracket

Remove

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Remove the bolts fixing the battery tray rear bracket to the front side rail, and remove the battery tray.



Refit

1. Fit the battery tray rear bracket to the front side rail. Fit the bolts and tighten to **20–28Nm**.
2. Fit the battery tray.

☞**Battery Tray Refit**

Engine Electrical System-1.3 BASE

Specifications

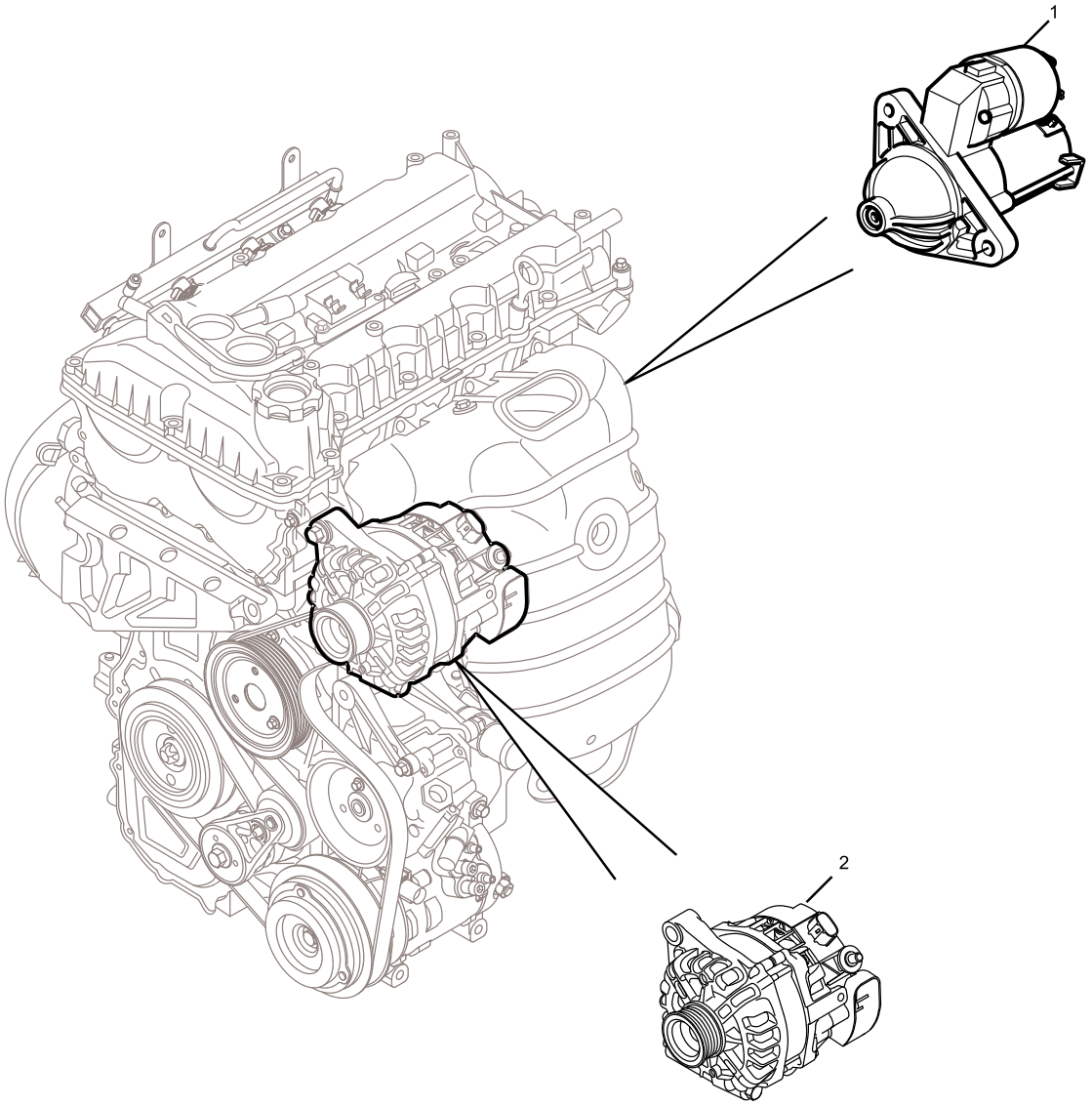
Torque

Description	Value
Bolt - ancillary belt tensioner	45–55Nm
Bolt - start harness bracket	7–10Nm
Bolt - starter	25Nm

Description and Operation

System Component Layout

Starting and Charging System Component Layout



1. Starter Motor
2. Generator

Service Procedures

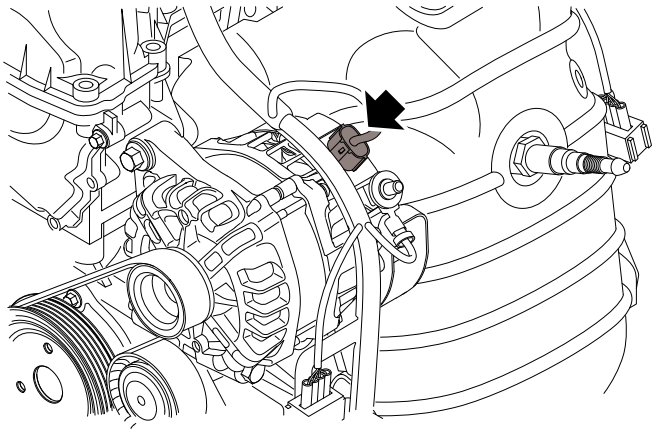
Generator

Remove

1. Raise the vehicle on a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

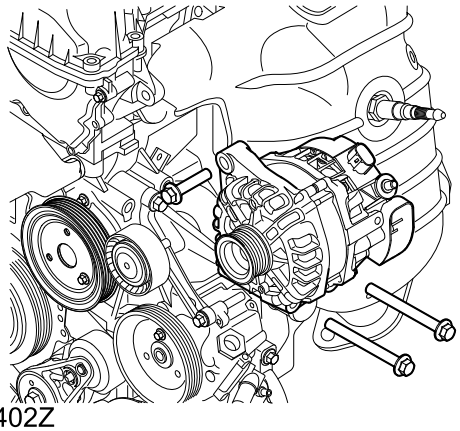
2. Disconnect the battery earth lead.
3. Remove the connector assembly between the generator and the engine harness.



4. Remove the accessory drive belt.

☞**Accessory Drive Belt Remove**

5. Remove 3 bolts connecting the generator with the cylinder head and the cylinder block.



S841A402Z

6. Remove the generator.

Refit

1. Clean the mating face of generator and cylinder head and cylinder block.
2. Fit 3 bolts connecting the generator with the cylinder head and the cylinder block.
3. Fit the accessory drive belt.

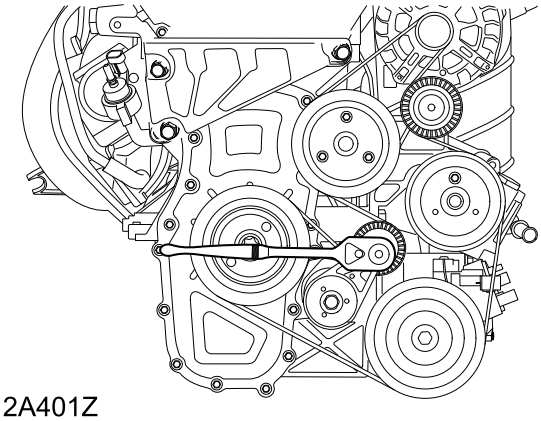
☞**Accessory Drive Belt Refit**

4. Fit the connector between the generator and the engine harness.
5. Connect battery earth lead.
6. Lower the vehicle.

Accessory Drive Belt

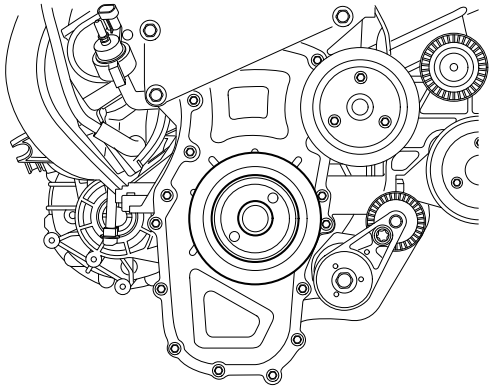
Remove

1. Lift the vehicle to a height suitable for operation.
2. Insert the mounting tool into the square hole of the tensioner as shown, and rotate the tensioner counterclockwise to separate the tensioner from the pulley.



S112A401Z

3. Remove the pulley.

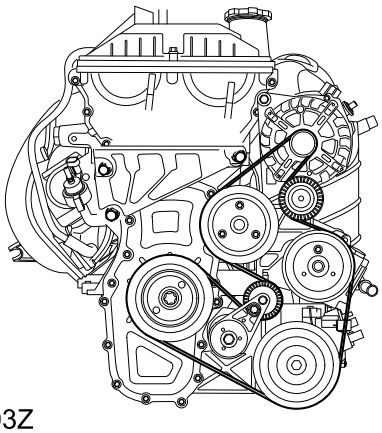


S112A402Z

4. Slowly make the tensioner return and remove the tool.

Refit

1. Insert the mounting tool into the square hole of the tensioner, and rotate the tensioner counterclockwise.
2. Fit the accessory drive belt into the all pulley grooves and on the tension pulley and the idle pulley according to the direction as shown.



S112A403Z

3. Slowly release the tensioner. Note to ensure that the pulley should be in the middle of the tension pulley after Fitting, and both sides of the tension pulley should have 2 mm margin.
4. Remove the tool.
5. Lower the vehicle.

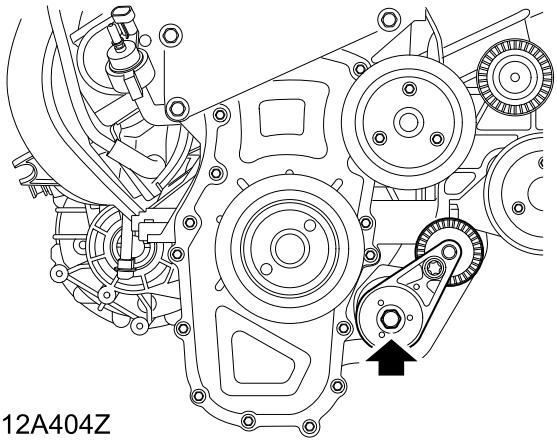
Accessory Drive Belt Tensioner

Remove

1. Remove the accessory drive belt.

☞Accessory Drive Belt Remove

2. Remove the accessory drive belt tensioner bolt.



S112A404Z

3. Remove the accessory drive belt tensioner.

Refit

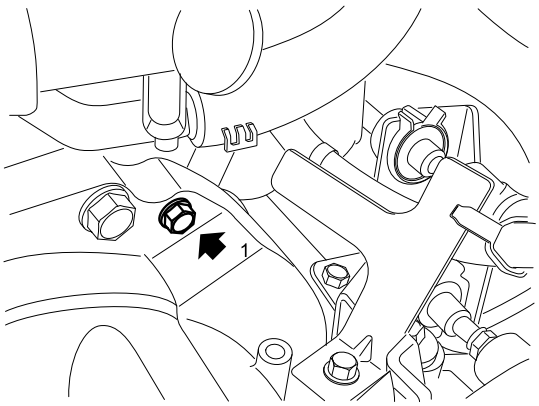
1. Tighten accessory drive belt tensioner bolt and the tighten to **45–55Nm**.
2. Fit the accessory drive belt.

☞Accessory Drive Belt Refit

Starter Motor

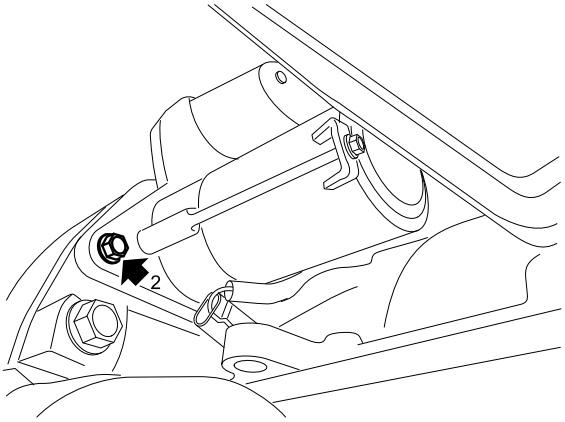
Remove

1. Disconnect battery earth lead.
2. Remove the nut and disconnect the battery wire connections from the starter motor solenoid coils.
3. Remove the starter motor retaining bolt 1.



S112B401

4. Remove the starter motor retaining bolt 2 from the vehicle bottom.



S112B402

5. Remove the connecting cable on the starter.

Refit

1. Clean the mating surface between the starter motor and the transmission, clean the pins and pin holes.
2. Secure the battery wiring harness to the starter motor solenoid coil, and tighten the nut to **7–10Nm**. Connect the engine wiring harness with the starter connector.
3. Fit the starter motor, fit and tighten the bolt to **25Nm**.
4. Connect battery earth lead.

Shift Lock Control-AMT

Specifications

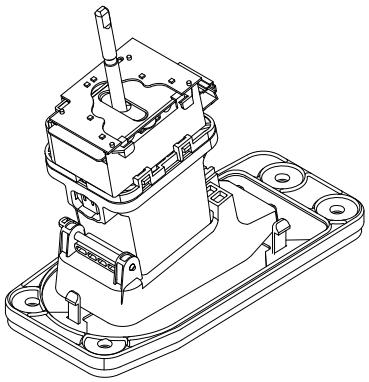
Torque

Description	Value
Bolt - gear change mechanism to floor	7–10Nm

Description and Operation

Description

Selector Lever Assembly



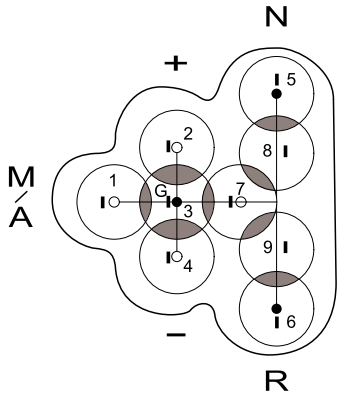
The selector lever assembly includes a control lever and a lever boot connected with the base. The selector lever base is fixed to the body central channel by four bolts with washer.

Position operation of the selector lever is as follows:

Six optional positions are provided to drivers by the electronic selector lever: N (neutral), R (reverse), + (upshift), - (down shift), G (drive) as well as M/A (auto or manual mode). The selector lever has three stable positions and three unstable positions. The unstable position refers to the position 'G'(it is situated between two unstable positions of '+' and '-') where the selector lever returns once it is released. They are respectively '+', '-' and 'M/A'. Three stable positions respectively correspond to positions of 'N', 'R' and 'G'.

- N : neutralthere is no torque transmitted to the wheels
- R : reverseit is selected only when the vehicle is stationary and the engine is idle
- + : Upshift
- - : Downshift
- G : Selector lever reset and normal driving position
- M/A : Auto or manual mode

Selector lever output valid value



- Hall position sensor (black rectangle)
- Stable position (black circularity)
- Unstable position (white circularity)

With the selector lever set at a certain position, when magnets above it trigger a certain Hall sensor on the circuit board, the input signals consisted of 9 Hall sensors on the circuit board will be caused to change. After MCU (microprocessor control unit) on the circuit board collects the input signals from 9 switch Hall sensors, it will send different 4 digital gear output signals according to different input signals. TCM decides which gear the selector lever is staying according to the combination of the 4 digital gear signals so as to realize driving control of the vehicle.

The selector lever decides the current effective gear signals according to the combinations in the table below:

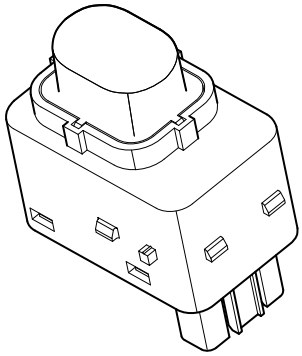
	Gear Selector Lever output (valid value)			
Gear Selector lever	GSL0	GSL1	GSL2	GSL3
1= M/A Auto or manual mode	0	1	1	0
2= + Upshift	0	0	1	1
3= G Driving	0	1	0	1
4= - Down shift	1	0	1	0
5= N Neutral gear	1	0	0	1
6= R Reverse gear	1	1	0	0
7= NAA2 Non-gear position 2	1	1	1	0
8= NAA3 Non-gear position 3	1	1	1	0
9= NAA4 Non-gear position 4	1	1	1	0

Auto or manual mode

After the selector lever enters to 'M/A' position, it returns to the stable position 'G'. If it is in auto mode at this moment, the system will automatically shift gears according to parameters including throttle opening and vehicle speed. After manual mode is activated, manual shifting control will be

provided. Turn the selector lever forward (+) to accomplish upshift process, while turn the selector lever backward (-) to accomplish down shift process. To exit from auto or manual mode, just turn the selector lever back to position 'M/A'.

Mode Control Switch



Automated mechanical transmission can select manually two driving modes in auto normal mode with the mode control switch:

- Vehicles equipped with 1.3L engine: Economic(E) and Winter(W)
- Vehicles equipped with 1.5L engine: Sport(S) and Winter(W)

The mode control switch is fit on the selector lever trim panel and is connected with TCM directly through a wiring harness.

In auto normal mode ('A' is displayed in the instrument pack message centre), the system will start to enter into economic mode(E) or sport mode(S) with different gearshift parameters by pushing the mode control switch. To exit from the current mode, push the mode control switch to return to auto normal mode.

In auto normal mode(A), enter into winter mode(W) by pushing the mode control switch twice. To exit from winter mode to return to auto normal mode, push the mode control switch twice again.

Economic mode

Push the mode control switch to select economic mode ('E' is displayed in the instrument pack message centre). The economic mode is used in routine driving and can provide optimum fuel consumption and emission.

Sport mode

Push the mode control switch to select sport mode ('S' is displayed in the instrument pack message centre). In sport mode, the transmission is more sensitive to the action of the pedal. Shifting into a lower gear occurs earlier than shifting into a higher gear so as to obtain better acceleration performance.

Winter mode

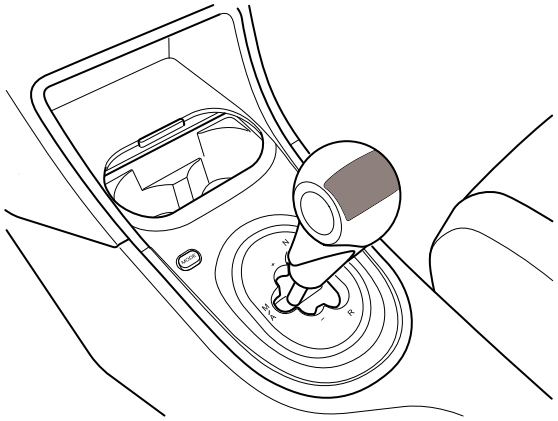
Push the mode control switch twice in succession to select winter mode ('W' is displayed in the instrument pack message centre). Select this mode when driving on a soft and slippery ground. The vehicle will start from 2nd gear and will be shifted to a higher gear under a lower rotation speed so as to reduce tire slippage.

Service Procedures

Selector Lever Knob - AMT

Remove

1. Disconnect battery earth lead.
2. Put the selector lever to 'G' position.



3. Pull the selector lever knob upward with care to release it from the selector lever and remove the ball joint.

Warning: Gear knob will be released suddenly, keep face clear of gear knob during removal.

Refit

1. Fit the selector lever knob to the selector lever.
2. Put the gear into the neutral position.
3. Connect the battery earth lead.

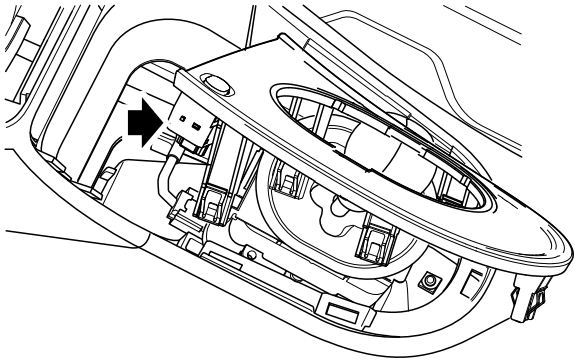
Selector lever assembly - AMT

Remove

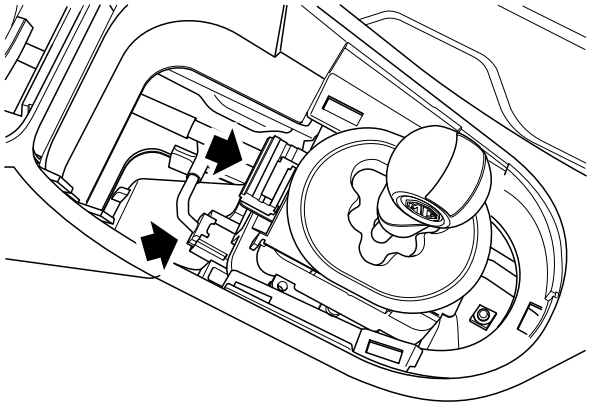
1. Remove the selector lever knob.

☞**AMT Selector Lever Knob Remove**

2. Remove selector lever trim panel.



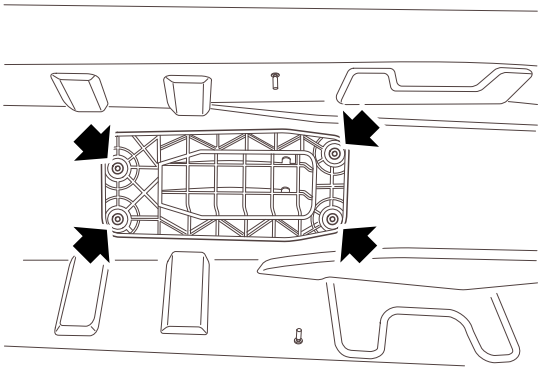
3. Disconnect the mode switch connector.
4. Remove the saucer assembly.
5. Disconnect connectors of the shift level assembly and the body wiring harness respectively.



6. Remove exhaust path heat shield.

☞**Exhaust Path Thermal Insulation Board Remove**

7. Remove four bolts fixing the selector lever assembly to the central channel and take down the shift level assembly.



Refit

1. Embed clip nuts into two holes of the central channel.
2. Position the selector lever assembly to the central channel and tighten four fixing bolts to **7–10Nm**.
3. Connect two connectors on the selector lever assembly to the body wiring harness.
4. Connect the connector of the mode switch.
5. Fit the saucer assembly.
6. Fit the selector lever trim panel to the console assembly.
7. Fit the ball to the selector lever of the shift mechanism.

☞**AMT Selector Lever Knob Refit**

8. Fit exhaust heat shield.

☞**Exhaust Path Heat Shield Refit**

9. Clear the historical data in TCM with a authorized diagnostic tool.

Shift Lock Control-MT

Specifications

Torque

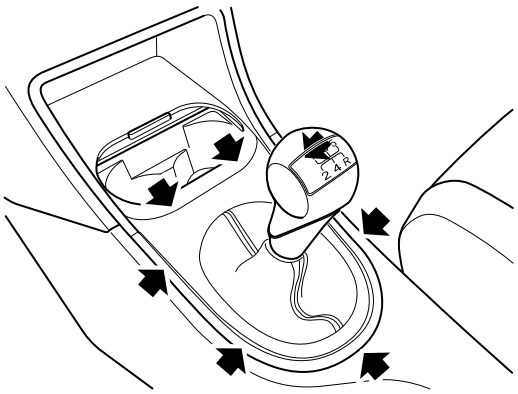
Description	Value
Bolt - gear change mechanism to floor	7–10Nm

Service Procedures

Selector Lever Knob and Boot - Manual

Remove

1. Put the selector lever into neutral gear.
2. Release 10 clips fixing the selector lever knob and boot assembly to the console and release the boot.



3. Pull the selector lever ball upward with care to release it from the selector lever and remove the ball joint boot assembly.

Warning: Gear knob will be released suddenly, keep face clear of gear knob during removal.

Refit

1. Position the selector lever knob to the selector lever and embed it to the selector lever.
2. Position the boot assembly to the console and fix it with clips.

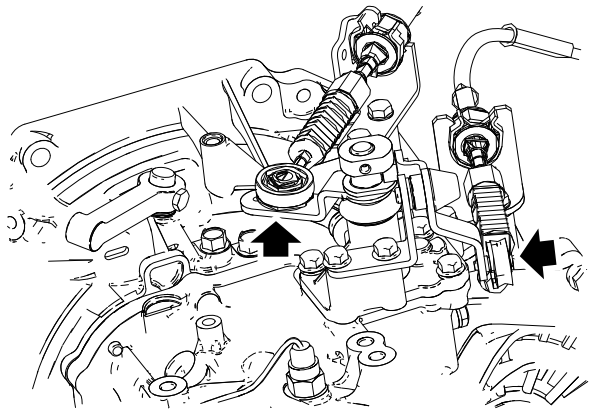
Shift Lever Assembly — Manual

Remove

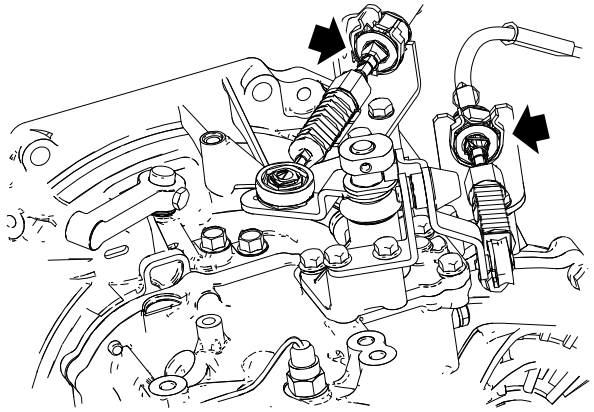
1. Remove the selector lever knob and boot.

☞**Hand-gear Selector Lever Knob and Boot Remove**

2. Pay attention to the refit position and release the cable ball joint from the manual transmission gear selecting and shifting rocker.



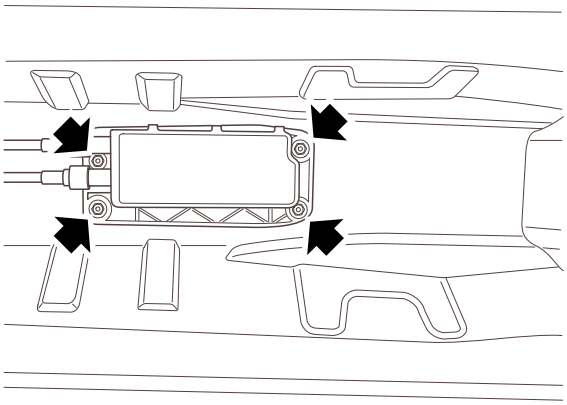
3. Release clips fixing the gear selecting and shifting cable to the support.



4. Take down the cable from the cable bracket.
5. Remove intermediate heat shields.

☞**Exhaust Path Heat Shield Remove**

6. Remove four bolts fixing the shifting mechanism assembly to the central channel and take down the shifting mechanism assembly.



Refit

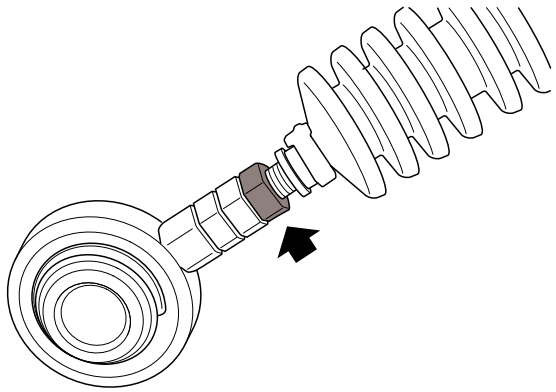
1. Embed clip nuts into two holes of the central channel.
2. Position the shifting mechanism assembly to the central channel and fit and tighten bolts to **7–10Nm**.
3. Fit a selector lever knob and boot.

☞**Hand-gear Selector Lever Knob and Boot Refit**

4. Fix the gear selection cable to the cable bracket.
5. Fit exhaust path heat shield.

☞**Exhaust Path Heat Shield Refit**

6. Fix the gear selecting and shifting cable to the support with clips.
7. Pay attention to the refit position, connect the cable ball joint to the gear selecting and shifting rocker.
8. Adjust the length of the gear selecting and shifting cable to an appropriate length.



Automated Mechanical Transmission
AMT
Specifications
Torque

Description	Value
Bolt - transmission mounting bracket to transmission	55–65Nm
Bolt - gearbox to engine	75–90Nm
Nut - transmission bracket to transmission mounting	90–110Nm
Bolt - tie bar lower to transmission	55–65Nm
Bolt - tie bar lower to tie bar lower bracket	90–110Nm
Bolt - battery earth lead	15–20Nm
Bolt - TCM clamp to bracket	8–10Nm
Reverse lock shaft	15–22Nm
Bolt - oil block plate to control cover	4–6Nm
Bolt - control cover to rear housing	15–25Nm
Drain plug	25–35Nm
Filler plug	25–35Nm
Switch - reverse light	12–18Nm
Self-locking bolt	15–20Nm
Bolt - reverse gear lever to front housing	22–28Nm
Bolt - front housing to rear housing	22–28Nm
Bolt - selector and shift cable support bracket to front housing	22–28Nm
Bolt - reverse idler shaft to rear housing	15–22Nm
Bolt - rear bearing baffle to rear housing	10–15Nm
Nut - output shaft	80–100Nm
Screw plug - 5th gear selector fork	5–8Nm
Bolt - rear cover to rear housing	8–13Nm
Bolt - final drive gear to differential housing	90–110Nm
Bolt - electro hydraulic unit to gearbox	22–28Nm
Screw - selection actuator plug	5.8–6.2Nm
Bolt - clutch sensor to rear housing	6–10Nm
Oil pressure sensor	15–16.5Nm
Screw - gear position sensor	3.6–4.2Nm
Screw - shift position sensor	3.6–4.2Nm
Screw - clutch position sensor	1.8–2.2Nm
Accumulator	90–99Nm
Union - high pressure pipe	14–15Nm
Screw - high pressure pipe clamp	9–11Nm
Screw - reservior	10Nm
Screw - electric pump assembly	9–11Nm
Screw - electromagnetic valve	3–4.2Nm

Parameter

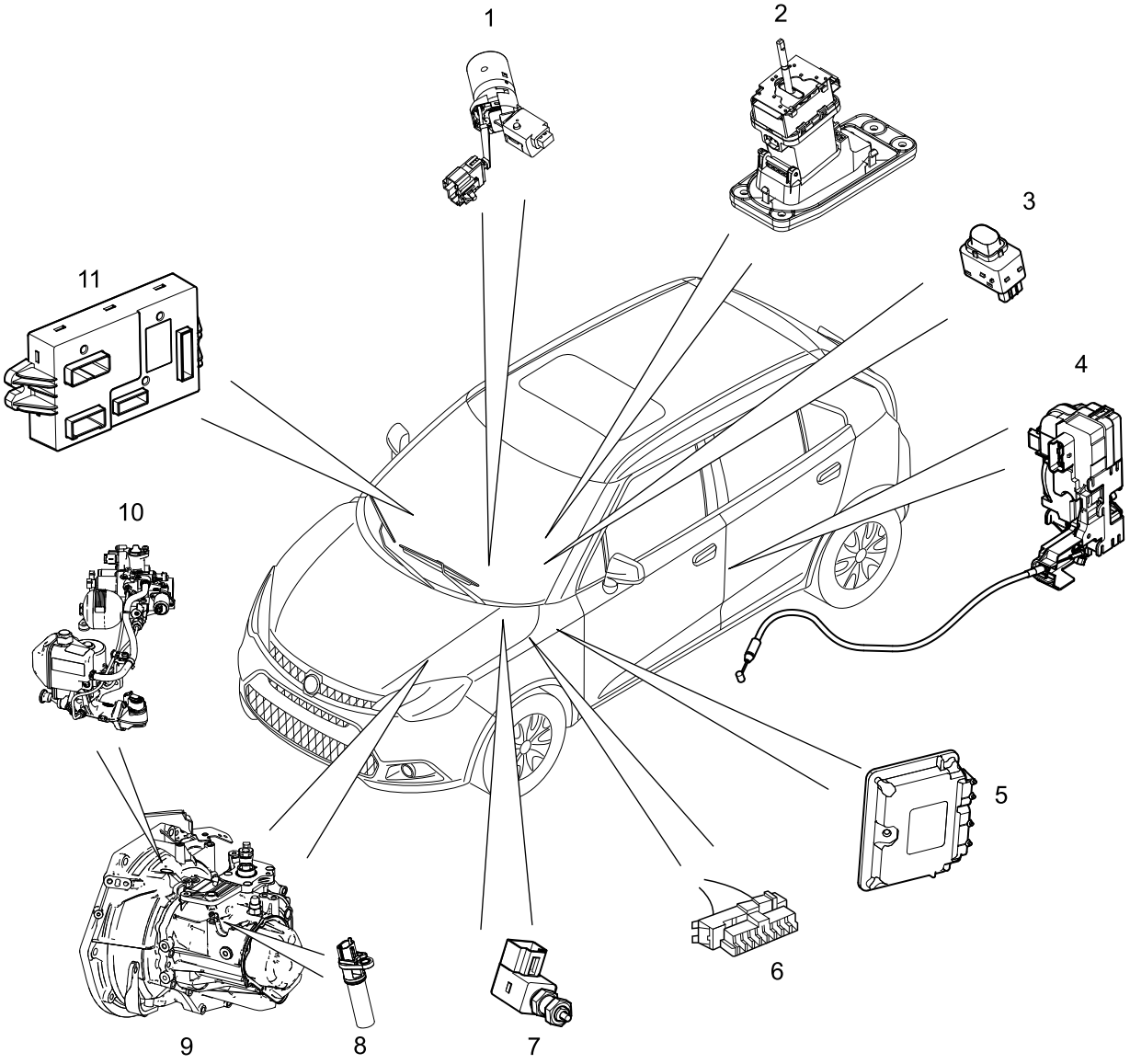
Model	AMT (1.3L) AMT (1.5L)
Gear position	five forward gears(synchronizer engagement), one reverse gear
Gear Ratio-AMT (1.3L):	
· 1st gear	3.462
· 2nd gear	1.862
· 3rd gear	1.242
· 4th gear	0.973
· 5th gear	0.756
· Reverse gear	3.455
· Final Drive	3.737
Gear Ratio-AMT (1.5L):	
· 1st gear	3.462
· 2nd gear	1.952
· 3rd gear	1.323
· 4th gear	0.973
· 5th gear	0.795
· Reverse gear	3.455
· Final Drive	4.118
Transmission center distance	63mm
Maximum input torque	
· AMT (1.3L)	120Nm
· AMT (1.5L)	135Nm
Maximum input speed	6000r/min
Weight (without oil)	38.6kg
Transmission lubricating oil	MTF 94
Standard oil capacity of the transmission:	
· Drain and refill	1.8L
· Dry fill	2.0L
Maximum overall dimension of the transmission:	
· Length	356mm
· Width	522mm
· Height	490mm
Hydralic Fluid of electro hydraulic kit	TUTELA CS–SPEED FF hydraulic oil
Oil capacity of the hydraulic oil	0.5L
Grease:	

· Clutch rocker arm shaft sleeve inner bore	Lithium based grease
· Release bearing hole and fork junction surface	Lithium based grease
Mating face sealant:	
· Joint face between the front and the rear housing	Kesaixin 1596F
· Rear end plate - rear housing	Kesaixin 1596F
· Selector lever cover - rear housing	Kesaixin 1596F
Thread sealant:	
· Reverse idler gear shaft bolt - rear housing	Kesaixin 1243C
· Self-locking bolt - front housing	Kesaixin 1243C
· Gearshift limit bolt–rear housing	Kesaixin 1243C
· Four reverse bolts on the front housing	Kesaixin 1243C
Non-reusable part:	Clutch rocker arm shaft sleeve Input shaft oil seal Differential oil seal Input shaft rear bearing adjustment shim Circlip Ø29 Shaft retaining ring Ø18.5 Output shaft rear bearing adjustment shim Circlip Ø32 Output shaft lock nut Differential rear bearing adjustment shim Spring pin Pin Ø3×22 Gear selecting and shifting shaft bearing Gear selecting and shifting shaft oil seal Combination spring pin Dust-proof gasket1 Dust-proof gasket2

Description and Operation

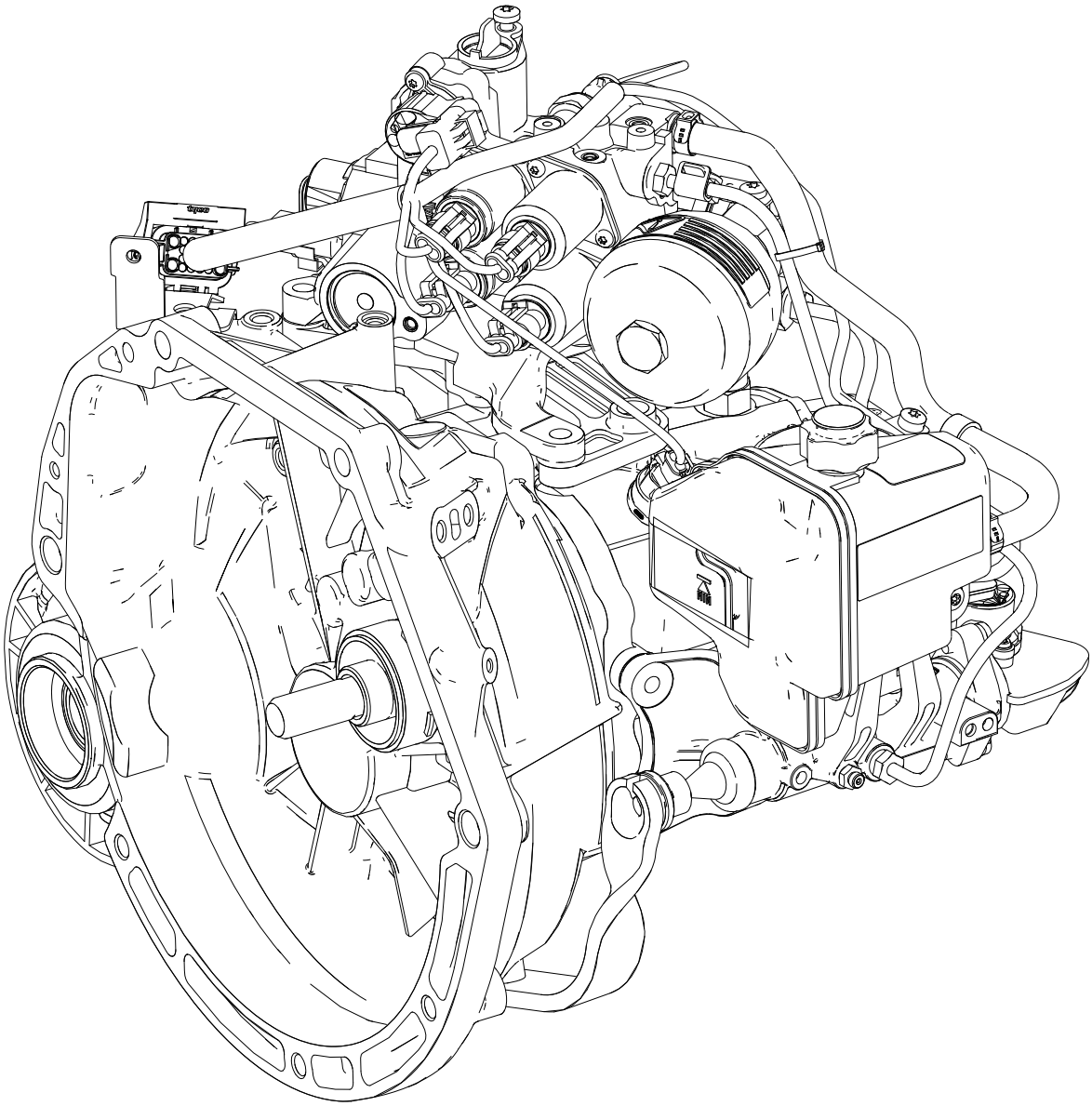
System layout

Automated mechanical transmission component layout

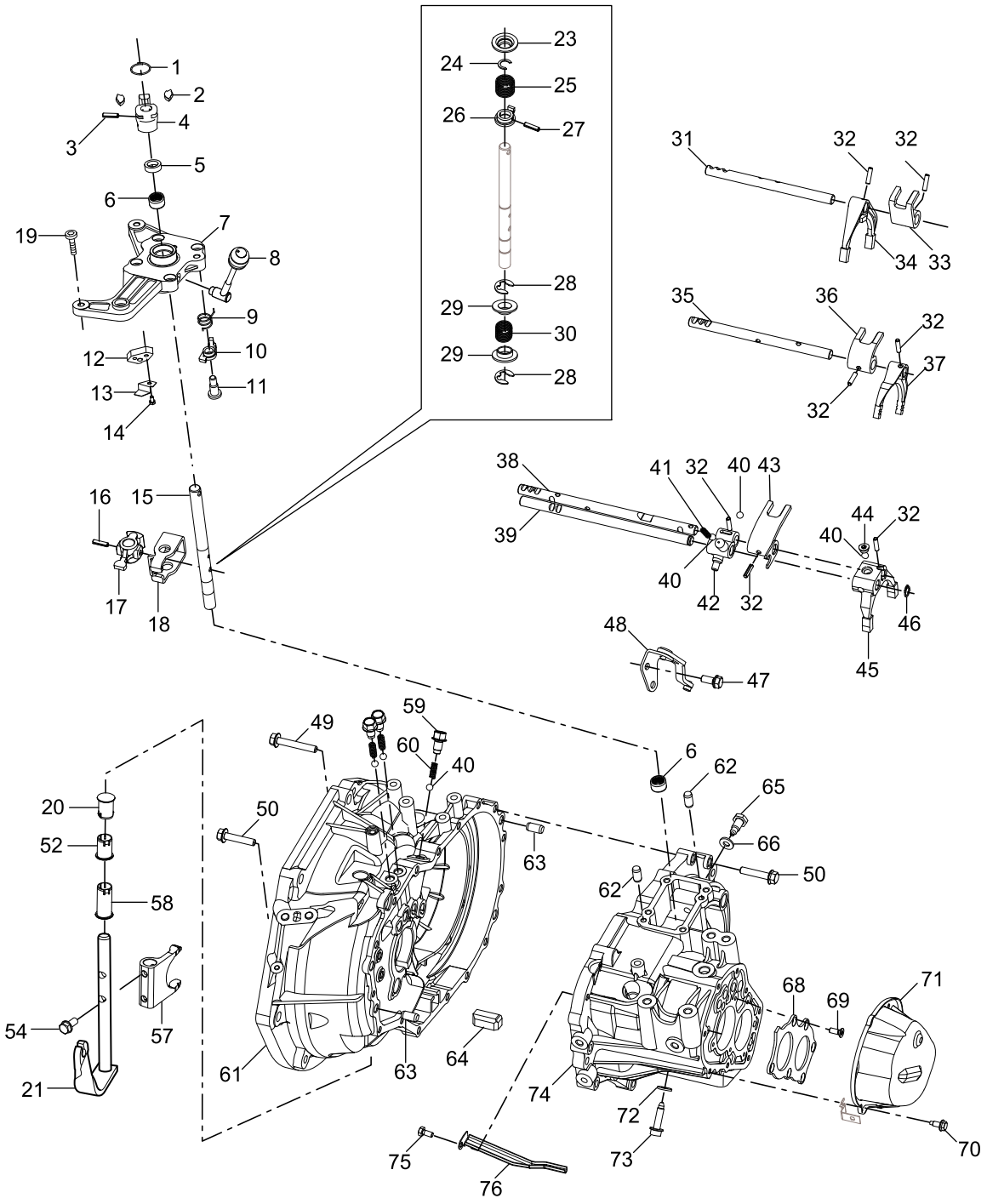


1. Ignition switch
2. Electronic gear selector lever
3. Mode switch
4. Driver side door lock switch
5. Transmission control module(TCM)
6. Diagnostic socket
7. Brake pedal switch
8. Clutch speed sensor
9. Transmission machine body
10. Electric control hydraulic unit assembly
11. Body control module(BCM)

Transmission assembly layout



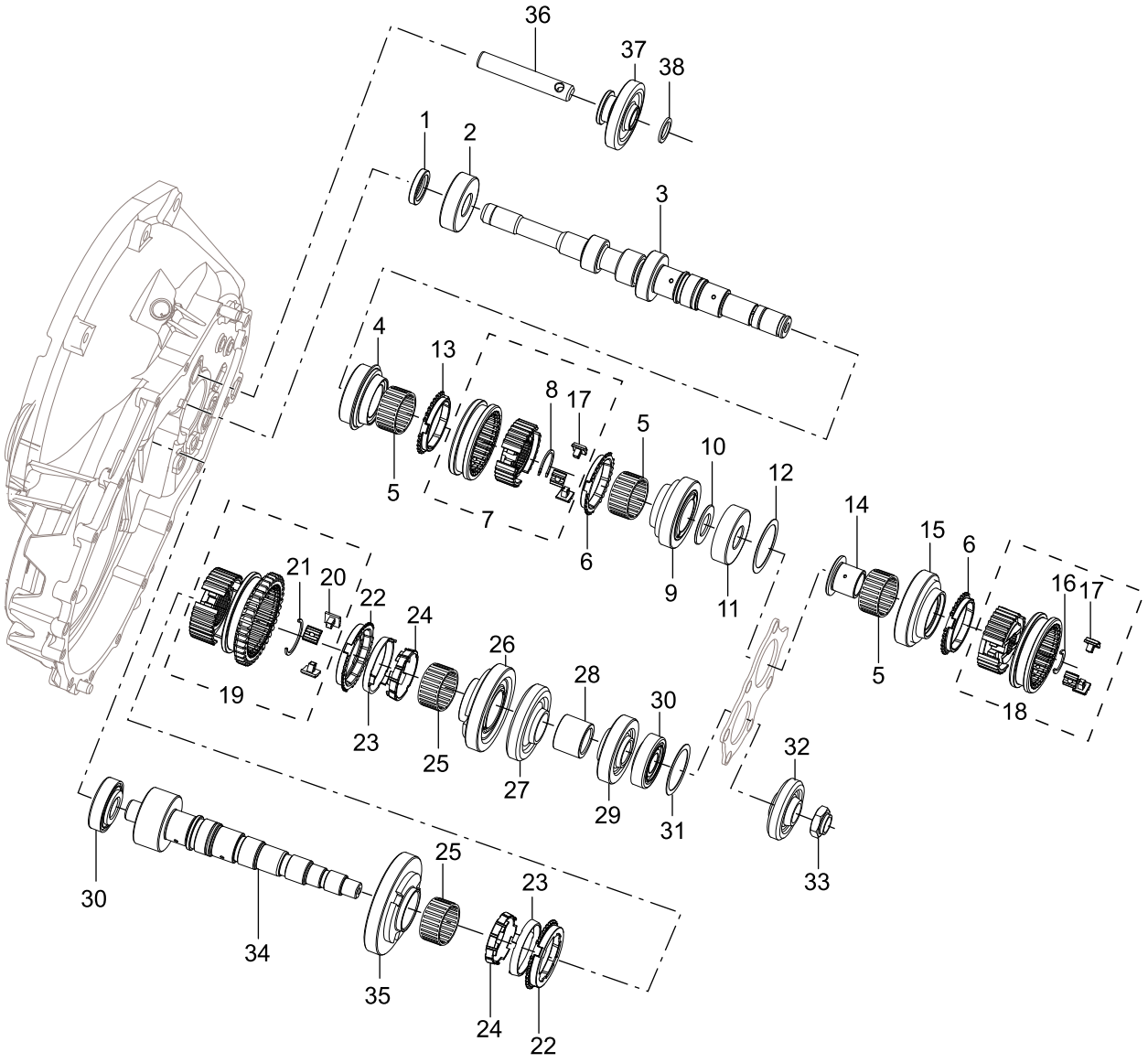
Component diagram of transmission operating and housing



1. Shift Finger Lock Block Retainer
2. Shift Finger Lock Block
3. Combination of Spring Pin
4. Shift Finger
5. Oil Seal - Gear Selection/Shift Shaft
6. Bearing - Gear Selection/Shift Shaft
7. Control Cover
8. Vent Plug Package
9. Reverse Gear Limit Torsion Spring
10. Reverse Gear Lock
11. Reverse Gear Lock Shaft
12. Oil-baffling Plate
13. Fluid Spacer Plate
14. Bolt - Oil-baffling Plate
15. Gear Selection/Shift Shaft
16. Combination of Spring Pin

17. Shifting Block for Gear Selection/Shift
18. Shift Chain Guard
19. Screw - Control Cover
20. Clutch Rocker Arm Shaft End Cap
21. Clutch Separating Rocker Arm Package
22. N/A
23. 5th/Reverse Gear Selection Limit Spring Pad
24. 5th/Reverse Gear Selection Limit Retainer
25. 5th/Reverse Gear Selection Return Spring
26. 5th/Reverse Gear Selection Return Spring Pad
27. Pin Ø3×22
28. Retainer
29. 1st/2nd Gear Selection Return Spring Pad
30. 1st/2nd Gear Selection Return Spring
31. 1st/2nd Gear Shift Shaft
32. Spring Pin
33. 1st/2nd Gear Shifting Block
34. 1st/2nd Gear Fork
35. 3rd/4th Gear Shift Shaft
36. 3rd/4th Gear Shifting Block
37. 3rd/4th Gear Fork
38. 5th Gear Shift Shaft
39. Reverse Gear Shift Shaft
40. Balls
41. Locking Spring - Reverse Gear Shifting Pin
42. Reverse Gear Shifting Pin
43. Reverse Gear Shifting Block
44. 5th Gear Fork Plug
45. 5th Gear Fork
46. Fixed Retainer
47. Bolt - Reverse Gear Rocker Arm Package
48. Reverse Gear Rocker Arm Package
49. Bolt - Housing Connecting Bolt
50. Bolt - Housing Connecting Bolt
51. N/A
52. Clutch Rocker Arm Bushing
53. N/A
54. Bolt - Separating Fork
55. N/A
56. N/A
57. Clutch Separating Fork
58. Clutch Rocker Arm Bushing
59. Self-locking Bolt
60. Self-locking Spring
61. Front Housing
62. Positioning Pin - Rear Housing
63. Positioning Pin - Front Housing
64. Magnetic Steel
65. Gear Shift Limit Bolt
66. Shim - Gear Shift Limit Bolt
67. N/A
68. Rear Bearing Guard
69. Screw - Rear Bearing Guard
70. Bolt - Rear Cover Panel
71. Rear Cover Panel
72. Aluminum Shims
73. Bolt - Reverse Idler Gear Shaft
74. Rear Housing
75. Bolt - Oil Lead Tank
76. Oil Lead Tank

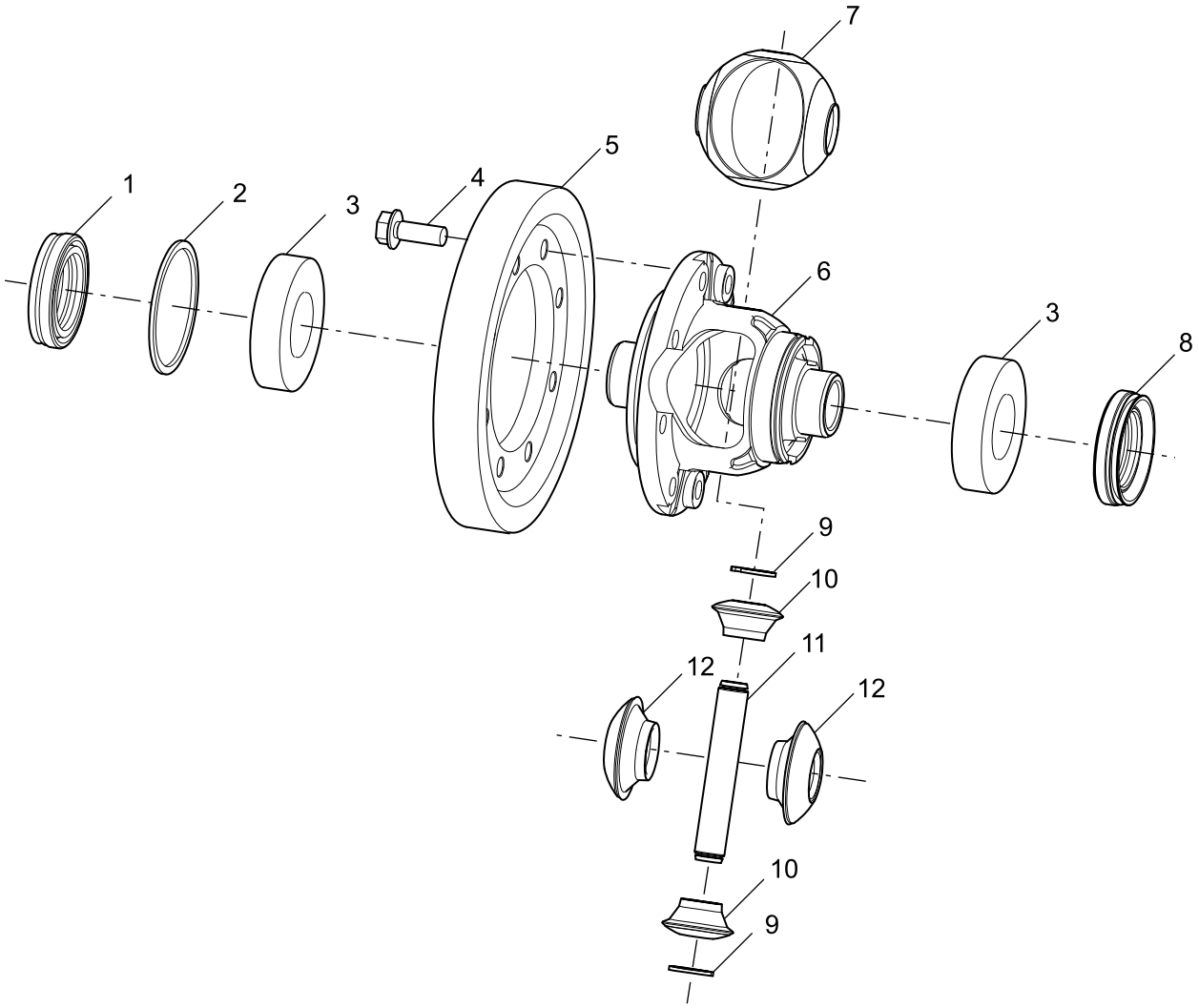
Gear transmission mechanism component diagram



1. Drive Shaft Oil Seal
2. Drive Shaft Front Bearing
3. Drive Shaft
4. Drive 3rd Gear Assembly
5. 3rd/4th/5th Gear Needle Bearing
6. 4th/5th Gear Synchronizer Ring Gear
7. 3rd/4th Gear Synchronizer Assembly
8. Retaining Ring Ø29
9. Drive 4th Gear Assembly
10. 4th Gear Spacer
11. Drive Shaft Rear Bearing
12. Adjusting Shim - Drive Shaft Rear Bearing
13. 3rd Gear Synchronizer Ring Gear
14. 5th Gear Bushing
15. Drive 5th Gear Assembly
16. Shaft Retaining Ring Ø18.5

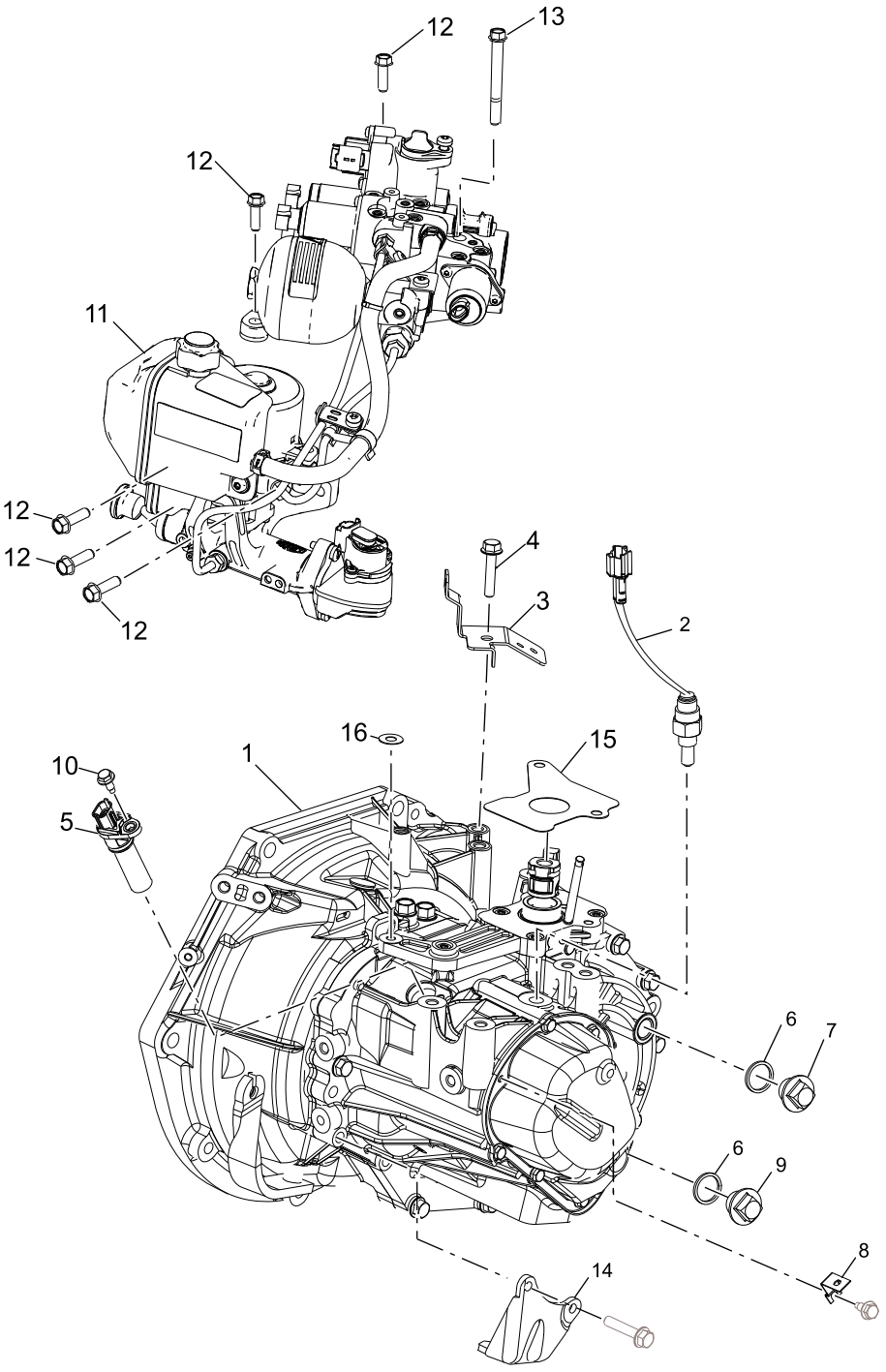
17. 4th/5th Gear Synchronizer Slider
18. 5th Gear Synchronizer Assembly
19. 1st/2nd Gear Synchronizer Assembly
20. 1st/2nd Gear Synchronizer Slider Assembly
21. Retaining Ring Ø32
22. 1st/2nd Gear Synchronizer Outer Cone Ring
23. 1st/2nd Gear Synchronizer Mid Ring
24. 1st/2nd Gear Synchronizer Inner Cone Rings
25. 1st/2nd Driven Gear Needle Bearing
26. Driven 2nd Gear
27. Driven 3rd Gear
28. 3rd/4th Gear Spacer
29. Driven 4th Gear
30. Output Shaft Bearing
31. Adjusting Shim - Output Shaft Rear Bearing
32. Driven 5th Gear
33. Nut - Driven Shaft Lock
34. Driven Shaft
35. Driven 1st Gear
36. Reverse Idler Gear Shaft
37. Reverse Idler Gear Shaft Assembly
38. Nylon Washers - Reverse Idler Gear

Differential assembly component diagram



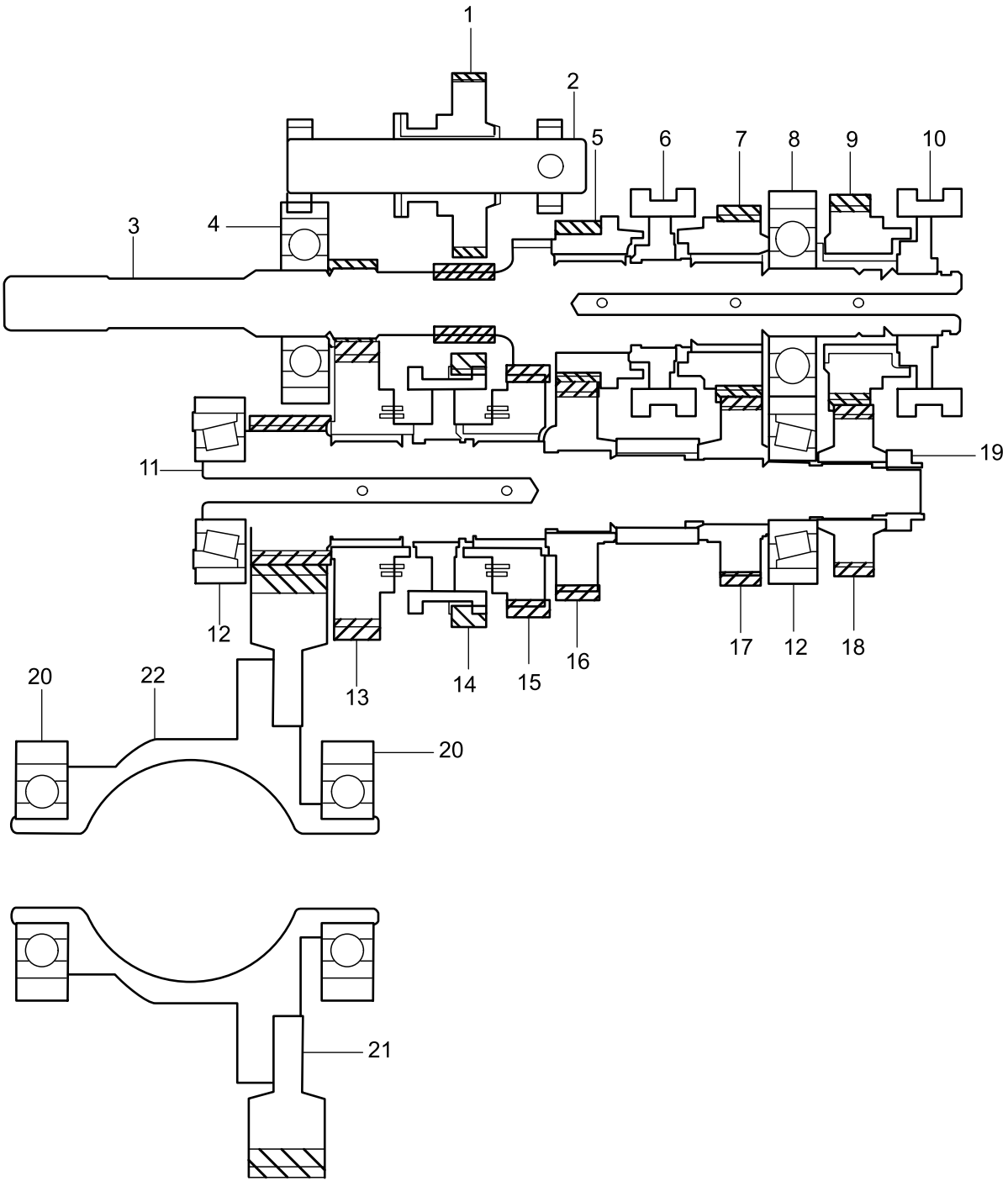
1. Oil Seal - Left Differential
2. Differential Rear Bearing Adjusting Shim
3. Differential Bearing
4. Bolt - Differential Housing to Final Drive Gear
5. Final Drive Gear
6. Differential Housing
7. Differential Washer
8. Oil Seal - Right Differential
9. Retainer
10. Planetary Gear
11. Planetary Gear Shaft
12. Side Gear

Transmission accessories layout



1. AMT Mechanical Base
2. Reverse Light Switch Assembly
3. Harness Bracket
4. Bolt - Harness Bracket
5. Clutch Speed Sensor
6. Washer - Oil Plug
7. Refill Plug
8. Clip - Reverse Lamp Harness
9. Drain Plug
10. Bolt - Clutch Speed Sensor
11. Electron Hydraulic Kit
12. Bolt-Electron Hydraulic Kit
13. Bolt-Electron Hydraulic Kit
14. Clutch Limit Bracket
15. Dust Gasket 1
16. Dust Gasket 2

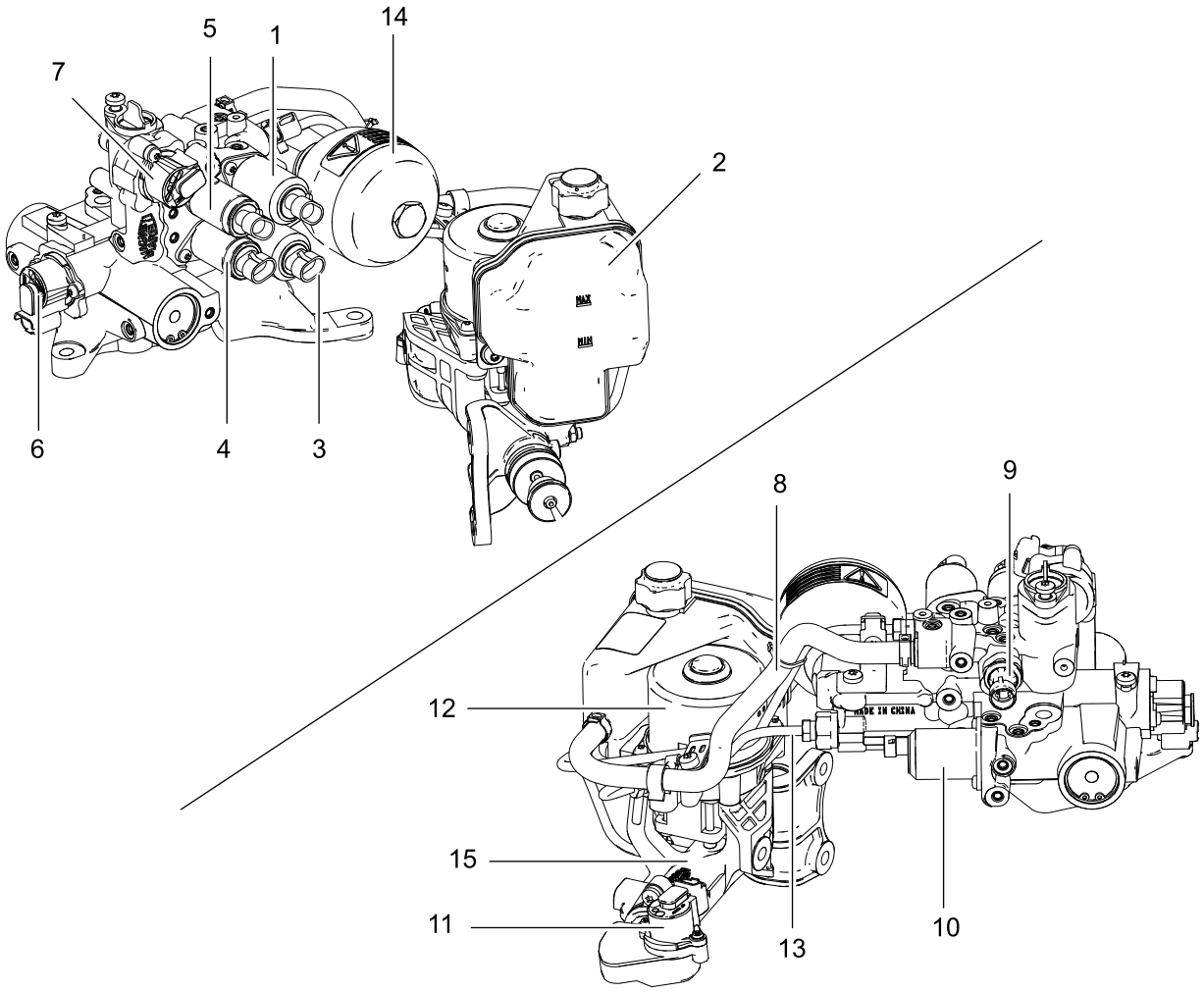
Transmission sectional view



1. Reverse Idler Gear
2. Reverse Idler Gear Shaft
3. Drive Shaft
4. Drive Shaft Front Bearing
5. Drive 3rd Gear
6. 3rd/4th Gear Synchronizer Assembly
7. Drive 4th Gear
8. Drive Shaft Rear Bearing
9. Drive 5th Gear
10. 5th Gear Synchronizer Assembly
11. Driven Shaft
12. Driven Shaft Front Bearing
13. Driven 1st Gear
14. 1st/2nd Gear Synchronizer Assembly and Driven Reverse Gear
15. Driven 2nd Gear
16. Driven 3rd Gear

17. Driven 4th Gear
18. Driven Shaft Rear Bearing
19. Driven Shaft Lock Nut
20. Differential Bearing
21. Main Speed Reduction Driven Gear
22. Driven 5th Gear

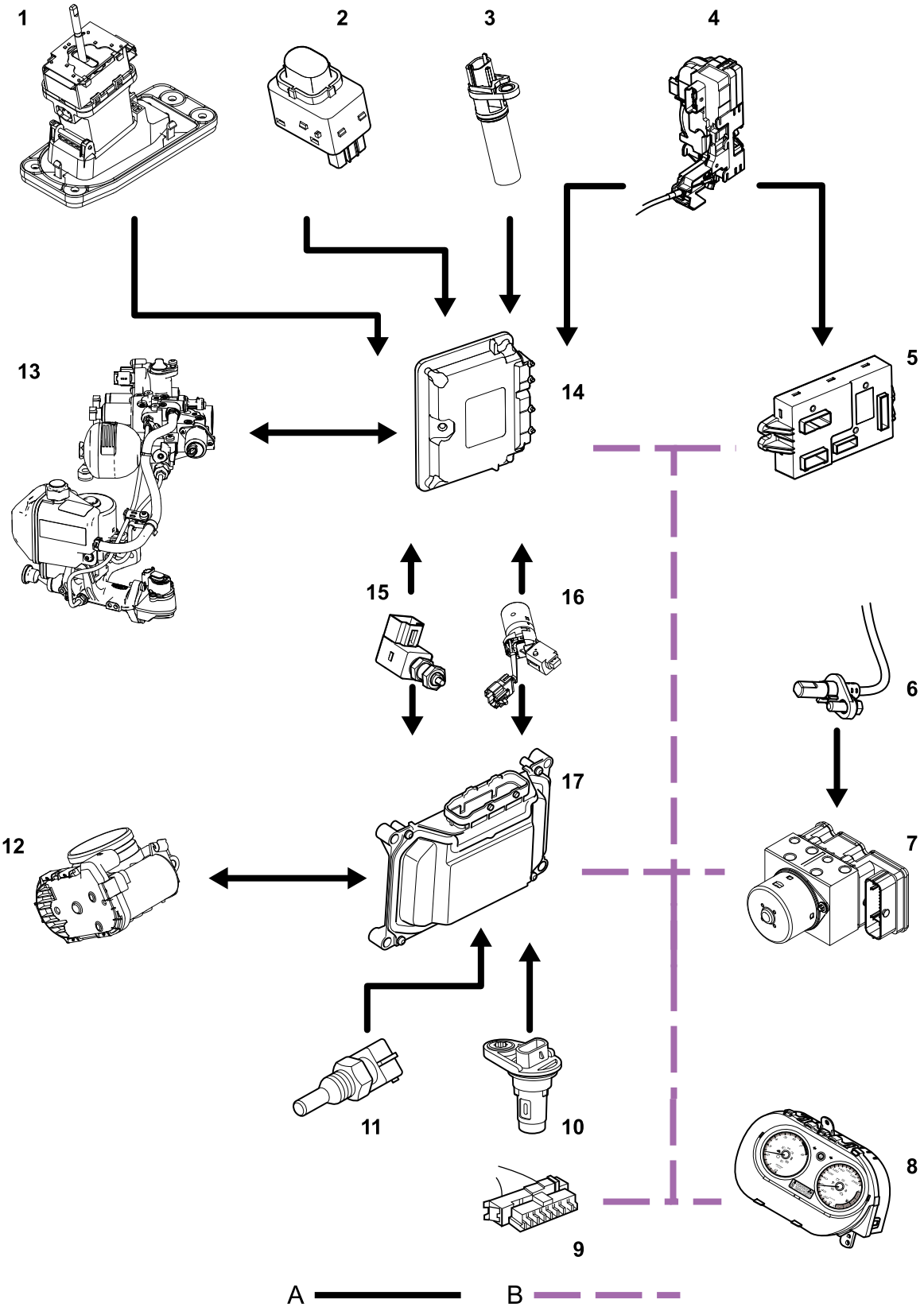
Electron hydraulic kit assembly component layout



1. Clutch solenoid valve (EV0)
2. Hydralic fluid reservoir
3. Odd gear shift control solenoid valve (EV1)
4. 5-R gear zone select solenoid valve (EV4)
5. 1-2 gear zone select solenoid valve (EV3)
6. Gear position sensor (GPS)
7. Shift position sensor (SPS)
8. Low pressure pipe
9. Oil pressure sensor
10. Even gear shift control solenoid valve (EV2)
11. Clutch position sensor (CPS)
12. Electric pump assembly
13. High pressure pipe
14. Accumulator
15. Clutch actuator

Control diagram of system

Control diagram of automated mechanical transmission

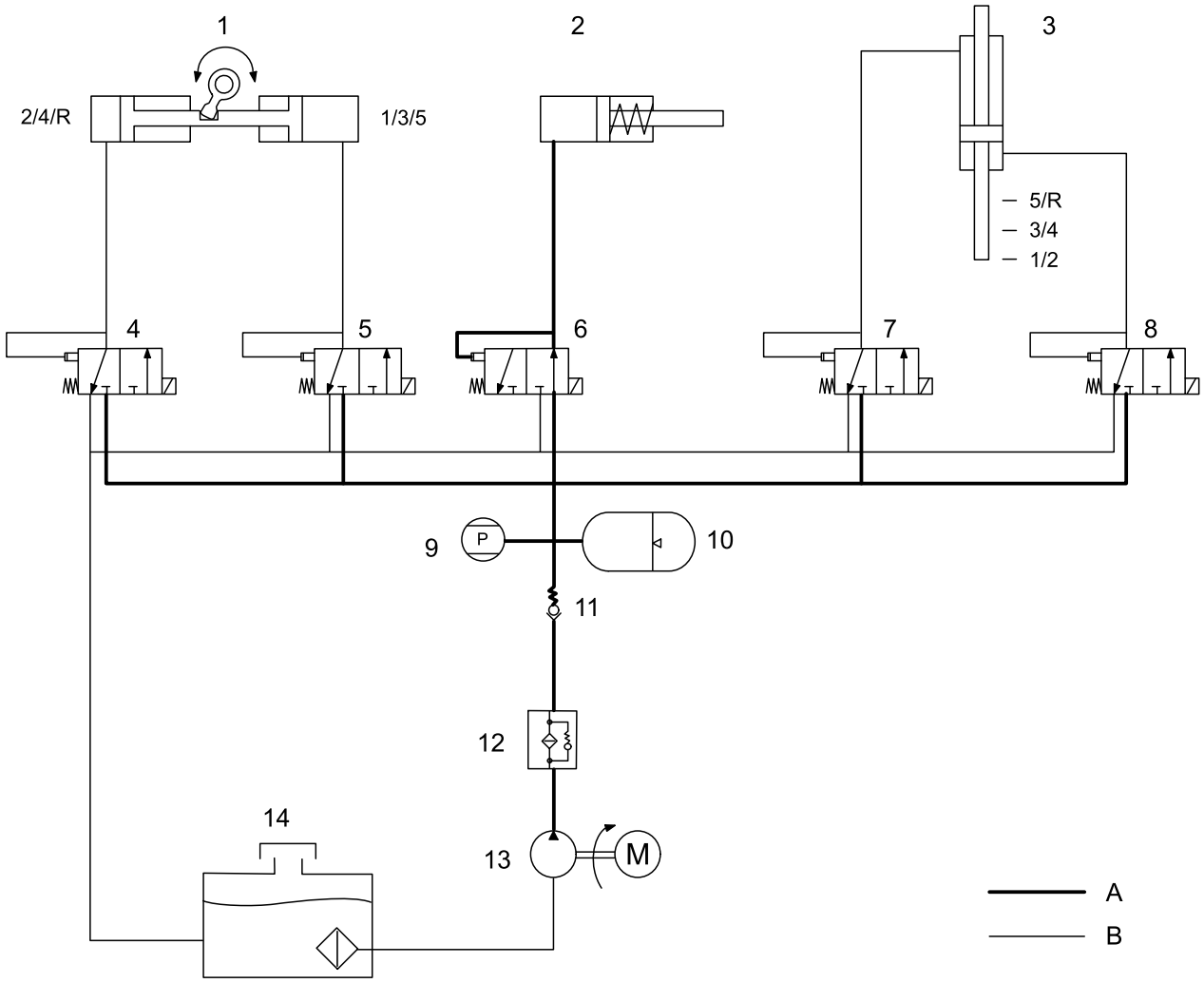


A= hard wire B= CAN bus line

1. Electronic gear selector lever
2. Mode switch
3. Clutch speed sensor
4. Driver side door lock switch
5. Body control module (BCM)
6. Wheel speed sensor

7. ABS ECU
8. Instrument pack
9. Diagnostic socket
10. Crankshaft position (CKP) sensor
11. Engine coolant temperature (ECT) sensor
12. Electronic control throttle
13. Electric control hydraulic unit assembly
14. Transmission control module (TCM)
15. Brake pedal switch
16. Ignition switch (KL15)
17. Engine control module (ECM)

Oil circuit of electro hydralic kit



A = High-pressure Oil Circuit; B = Low-pressure Oil Circuit

1. Gear Engagement Piston
2. Clutch Piston
3. Gear Selection Piston
4. Even Gear Shift Control Solenoid Valve EV2
5. Odd Gear Shift Control Solenoid Valve EV1
6. Clutch Control Solenoid Valve EV0
7. 1-2 gear zone select solenoid valve EV3
8. 5-R gear zone select solenoid valve EV4
9. Oil Pressure Sensor
10. Accumulator
11. One-way Valve
12. Filter
13. Electric Pump Assembly
14. Fluid Reservoir

Description

Overview

Being equipped with a 5-speed automated mechanical transmission(AMT) which is equipped with an electron hydraulic kit, this vehicle automatically controls the clutch of the traditional manual transmission and gear selecting and shifting operation through the electronically controlled hydraulic power. This transmission is used to drive the vehicle in front-engine, front-wheel drive layout.

TCM controls the system in a working way that is the same as that of other ECU fit on the vehicle. Message is received from the sensor or other control modules, calculation is carried out according to the pulse spectrum message stored in TCM and then signals are output to each executor or other ECU. The process of receiving or sending signals to other control modules is mainly carried out by the controller area network(CAN) bus. The diagnostic test can be carried out through diagnose interfaces. When some faults occur to the transmission, relevant diagnostic trouble codes(DTC) will be stored in TCM. These diagnostic trouble codes can be re-acquired by making use of a authorized diagnostic tool.

The process of gear selecting can be carried out by making use of the electronic selector lever on the console. Six optional positions are provided to drivers by the electronic selector lever: N (neutral), R (reverse), + (upshift), -(down shift), G (drive, between '+' and '-') as well as M/A (manual or auto mode).

TCM controls the driving mode according to one of three sets of parameters programmed in advance:

- Normal(A), Economic(E) and Winter(W) - Vehicles equipped with 1.3L engine
- Normal(A), Economic(E) and Winter(W) - Vehicles equipped with 1.5L engine

After the vehicle starts, the current mode and the selected gear state can be displayed in the instrument pack.

Note: *The gear information displayed in the instrument pack is the actual engagement gear position of the transmission rather than the position selected by the selector lever. When the position of the selector lever is not consistent with the actual gear position of the transmission, the buzzer will send a sound alert (twice) and the message centre will glitter the gear position (for 4 seconds).*

Transmission Assembly

Adding electronically controlled hydraulic power equipments which control gear selecting and shifting as well as the clutch based on the manual transmission reserves advantages of all clutches and manual transmissions at aspects of weight, intensity, reliability and low energy consumption and can realize gear automatic shifting as well.

The clutch pedal and the gear selecting and shifting cable are cancelled and the mechanical selector lever is replaced by an electronic selector lever. The gear shifting operation without the need of controlling the clutch pedal and the traditional manual transmission by the driver simplifies usage and reduces driving fatigue, especially in city driving cycles.

Driving safety has been improved from the aspect of controlling, while wrong and incorrect operations of the driver have been prevented.

This transmission has two gear shifting modes:

- Auto mode, the driver can realize driving modes of different logics including normal, economic/sport and winter modes.
- Manual mode, the driver shifts the gear manually through the control handle on the console.

Auto mode

In auto gear shifting mode, selection can be made in five forward gears automatically according to the vehicle speed and the accelerator pedal position. After the vehicle starts, the auto normal mode (A) is selected as the default mode. However, the driver can also select economic(E)/sport(S) and winter (W) driving modes through the mode control switch.

Turn the selector lever from 'G' to 'M/A' position and release it immediately after keeping for about 0.5 second so as to initiate auto normal mode. To cancel the auto mode and return to the manual mode, just turn the selector lever from 'G' to 'M/A' position.

Manual mode

Turn the selector lever from 'G' to 'M/A' position and release it immediately after keeping for about 0.5 second so as to initiate manual mode.

In manual mode, release the selector lever immediately after moving it from 'G' to '+' direction, which will cause the transmission rise to a adjacent higher gear. Release the selector lever immediately after moving it from 'G' to '-' direction, which will cause the transmission reduce to a adjacent lower gear.

If the gear shifting time that the driver selects is not reasonable, for example, rise the gear when the rotation speed of the engine is too low or lower the gear when the vehicle speed is too high, the transmission will not respond and the vehicle will still run at the original gear, meanwhile, the message centre will flash to display the gear for 4 seconds. When the vehicle is running at a certain gear and the rotation speed of the engine is lower than a certain value, the transmission will reduce to a adjacent lower gear automatically so as to prevent flameout of

the engine. To cancel manual mode and return to auto mode, just turn the selector lever from 'G' to 'M/A' position. After returning to auto mode, the driving mode is the mode selected in auto mode before switching.

Vehicle starting

Before starting the vehicle, the brake pedal must be stepped on and the selector lever must be placed at 'N' position.

Emergency Start

When the battery voltage is not sufficient to start the engine or a fault occurs in the starter motor, the engine can be started by towing astern at a speed generated by pushing the vehicle.

Necessary condition: the system has enough pressure to ensure gearshift operation and the battery voltage can maintain the operation of TCM.

Operating procedure: turn on the ignition switch, shift into the neutral gear, release the park brake and drive the vehicle. When the vehicle reaches a certain speed (not lower than 10 km/h), move the selector lever into 'G' (don't depress the brake pedal), the system will automatically select an appropriate gear to start the engine by towing astern at the vehicle speed.

Vehicle move off

Depress the brake pedal, put the selector lever to N gear and switch on the ignition switch (position 2). The gear and mode of the vehicle when the vehicle stalls last time will be displayed in the message centre at this moment. Start the engine.

After the engine is started, 'N' will be displayed in the message centre. Depress the brake pedal and shift the transmission selector lever from 'N' to 'G'. At this moment, the transmission will be automatically put into 1st gear with '1' displayed in the message centre. To start from 2nd gear, push the selector lever to '+' direction, '2' will be displayed in the message centre; depress the brake pedal and shift the transmission selector lever from 'N' to 'R'. At this moment the transmission will be put into the reverse gear and 'R' will be displayed in the message centre.

After putting into the gear, release the park brake, and then release the service brake to start.

Note: *When the vehicle engine is idle after starting and the selector lever is moved without depressing the brake pedal, the transmission will not respond with gear shifting, and meanwhile the buzzer sounds for two times with the current gear flash in the message centre for 4 seconds.*

Creeping function

After starting the engine to put into 1st gear or R gear, release the park brake and then release the brake pedal. The vehicle will automatically move forward or backward to start if the accelerator pedal has not been depressed.

Note: *If the hand brake is applied to start, the system will stop creeping function; the system will restore creeping function after releasing the hand brake.*

Note: *If the vehicle moves off at 2nd gear, the creeping function will not work.*

Put the gear into neutral when the vehicle is running

When driving at a vehicle speed lower than 80 km/h, if the driver releases the accelerator pedal and moves the selector lever to the neutral gear without depressing the brake pedal, the transmission will be allowed to be put into the neutral gear. 'N' will be displayed in the message centre after putting into the neutral gear.

When driving at a speed higher than 80 km/h, if the driver moves the selector lever to neutral gear without depressing the brake pedal, the buzzer will send a sound alert with the transmission still maintained at the former gear position.

If the driver steps on the accelerator pedal to put the gear into neutral gear, the transmission will not accept this request, the transmission will be maintained at the former gear position, meanwhile, the buzzer will send a sound alert with the current gear flash for 4 seconds to warn the driver.

During the driving process, if the driver needs to put the gear into other non-reverse gears from neutral gear, the driver only needs to move the selector lever from 'N' to 'G' position and doesn't need to depress the brake pedal. And the transmission will be automatically put into a gear which is matched with the current vehicle speed and the engine rotation speed.

Reverse gear request

Depress the brake pedal under driving condition:

- If the vehicle is requested to reverse when the vehicle speed is higher than 10 km/h, the system will not accept and still maintain at the former gear.
- If the vehicle is requested to reverse the gear when the vehicle speed is lower than 10 km/h but higher than 3 km/h, the system will be put into neutral gear.
- If the vehicle is requested to reverse the gear when the vehicle speed is lower than 3 km/h, the system will be put into reverse gear.

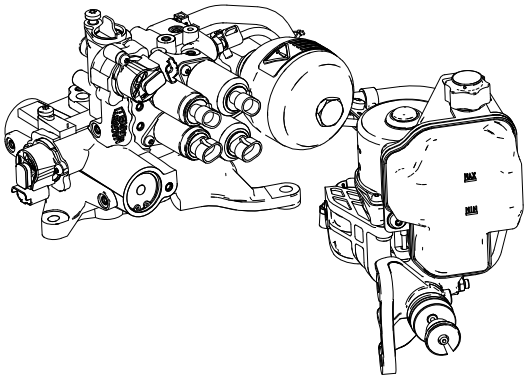
If the brake pedal is not stepped on:

- If the vehicle is requested to reverse the gear when the vehicle speed is higher than 10 km/h, the system will not accept and still maintain at the former gear;

- If the vehicle is requested to reverse the gear when the vehicle speed is lower than 10 km/h, the system will be put into neutral gear.

When the reverse gear request fails, the buzzer will sound for 4 times with the gear flash to give a hint in the message centre.

Electron hydraulic kit



The electron hydraulic kit is mainly composed of valve body assembly, clutch actuator and power unit and so on.

- Power unit: it includes motor, accumulator, gear pump and fluid reservoir and provides the function of a hydraulic actuator;

  Clutch actuator: it mainly controls the separation and combination of the clutch;

- Valve body assembly: execute gear selecting and shifting operations.

Valve body assembly

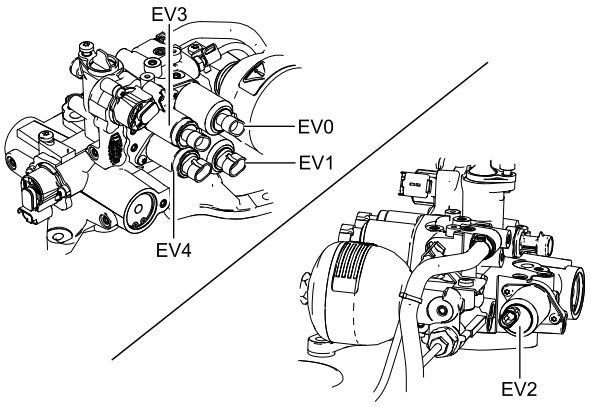
The main part of the valve body is casting and the valve body is used to provides interfaces with the transmission.

Parts used to realize gear selecting and shifting function are:

- Clutch control solenoid (electromagnetic) valve(EV0)
- Odd gear shift control solenoid valve (EV1)
- Even gear shift control solenoid valve (EV2)
- 1st-2nd gear zone selecting control solenoid valve (EV3)
- 5th-R gear zone selecting control solenoid valve (EV4)
- Shift position sensor(SPS)
- Gear position sensor(GPS)
- Pressure sensor
- Valve block

Solenoid valve

The transmission makes use of five solenoid valves on the valve body. The solenoid valve is activated or deactivated by TCM and used to control the clutch and the gear select or shift. All five solenoid valves can be classified into two categories, in which two are proportional solenoids, one is flow solenoid valve and the rest two are on-off solenoid valves. Each solenoid valve includes one inside coil and one needle valve. The needle valve is activated by the voltage passing through the magnetic coil to switch on or switch off the hydraulic circuit.



Proportional solenoid valve:

- Odd gear shift control solenoid valve (EV1)
- Even gear shift control solenoid valve (EV2)

EV1, EV2

When the shift solenoid valve is working, the high voltage circuit inside the solenoid valve is switched on and the low voltage circuit inside the solenoid valve is switched off. The high pressure oil inside the accumulator enters into the shift piston inside the valve body through an oil path inside the valve body, pushing the piston and rotating the selector lever shaft which connects with the gear shifting fork assembly inside the transmission and pushes the gear synchronizer to realize gearshift. When the solenoid valve doesn't work, the high voltage circuit is switched off and the low voltage circuit is switched on. The high pressure oil inside the shift piston and the high pressure pipeline will be depressurized and flow back to the fluid reservoir through the low pressure hose. At this moment, the shift piston loses pressure, but it still maintains at the current gear shifting position. Odd gear shift solenoid valve(EV1) works when shifting into 1st/3rd/5th gear or exiting from 2nd/4th/R gear. Odd gear shift solenoid valve(EV2) works when shifting into 2nd/4th/R gear or exiting from 1st/3rd/5th gear.

Flow solenoid valve:

- Clutch control solenoid valve(EV0)

EV0

When the clutch solenoid valve is working, the high voltage circuit inside the solenoid valve is switched on and the low voltage circuit inside the solenoid valve is switched off. The high pressure oil in the accumulator enters into the clutch actuator piston through the high pressure hose, pushing the

piston to make it operate the clutch so as to cause the clutch separated. When the solenoid valve doesn't work, the high voltage circuit is switched off and the low voltage circuit is switched on. The high pressure oil inside the clutch actuator piston and the high pressure pipeline is depressurized and flows back to the fluid reservoir through the low pressure hose. At this moment, the clutch actuator piston loses pressure and returns under the action of the return spring and the clutch is staying at engagement position.

On-off solenoid valve:

- 1st-2nd gear zone selecting control solenoid valve (EV3)
- 5th-R gear zone selecting control solenoid valve (EV4)

When the gear selecting solenoid valve is working, the high voltage circuit of the solenoid valve is switched on and the low voltage circuit is switched off. The high pressure oil inside the accumulator enters into the gear selecting piston through the oil path inside the valve body, pushing the piston to make the gear shifting shaft move downward vertically to connect with fork assemblies at different gear positions inside the transmission so as to operate synchronizers at different gears. When the solenoid valve doesn't work, the high voltage circuit is switched off and the low voltage circuit is switched on. The high pressure oil inside the shift piston and the high pressure pipeline will be depressurized and flow back to the fluid reservoir through the low pressure hose. At this moment, the shift piston loses pressure, but it still maintains the connection with the current gear fork assembly. The 1st-2nd gear zone gear selecting solenoid valve(EV3) works when shifting to the zone range from 3rd-4th gear zone to 1st-2nd gear zone or from 5th-R gear zone to 3rd-4th gear zone. The 5th-R gear zone gear selecting solenoid valve(EV4) works when shifting to the zone range from 1st-2nd gear zone to 3rd-4th gear zone or from 3rd-4th gear zone to 5th-R gear zone.

Clutch actuator

The clutch actuator is fit on the rear housing of the transmission through bolts with the actuating mechanism driven by the hydraulic oil. The wire drawing is converted into position signals through the clutch position sensor(CPS). According to these signals, TCM controls the hydraulic flow flowing into the actuating mechanism through EV0 solenoid valve.

Power unit

The power unit mainly provides hydraulic energy so that the hydraulic actuator could execute actions made to the transmission. The power unit is mainly composed of electric pump assembly, accumulator and fluid reservoir.

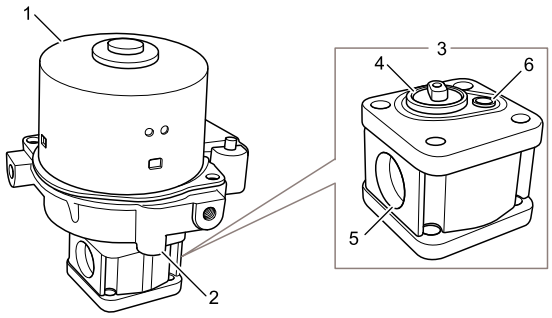
Main working parameters of the power unit:

- Working hydraulic pressure: 36.5–46bar (3.65–4.6MPa)
- Working temperature range: -30–105℃
- Minimum starting temperature: -30℃
- Accumulator capability: 250cm³ (under 24bar (2.4MPa) and 20℃ conditions)

Hydraulic pipe

Two high pressure tubes are connected respectively with the electric pump assembly, clutch actuator and valve body assembly and used to transmit high pressure operating oil. One low pressure rubber hose used for oil return is connected with the valve body assembly and the fluid reservoir.

Electric pump assembly



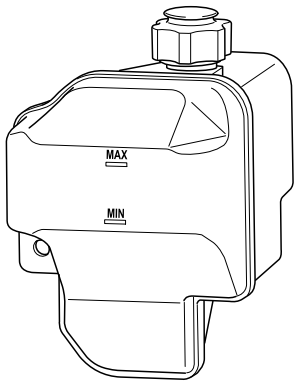
1. Direct current machine
2. Motor power connection
3. Gear pump
4. Power coupling
5. Oil return hole (connected with the fluid reservoir)
6. High pressure oil outlet

The electric pump assembly is mainly used to produce hydraulic power, the gear pump is connected with a 12V direct current machine, TCM controls the motor through a relay, the electric pump assembly is driven by TCM when the accumulator pressure is lower than a certain pressure value and stops working after the pressure reaching a certain value. The motor and the gear pump are connected mutually with each other and fixed through mechanical flanges. The motor positive pole is connected with the relay, while the negative pole is grounded by contacting with the transmission housing through a flange.

Accumulator

The accumulator is fit on the valve body directly through a screw thread with the accumulator capacity of 250cm³ (under 24bar (2.4MPa)and 20℃ conditions)

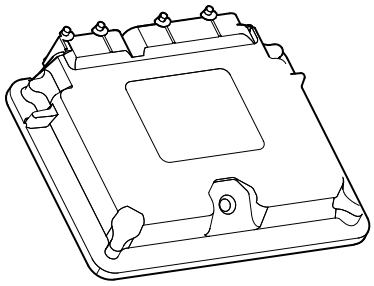
Fluid reservoir



The fluid reservoir has a filter of about 150 micron at the oil outlet. 'MIN' mark indicates the lowest fluid level when the system has pressure, while 'MAX' mark indicates the highest fluid level when the system do not have pressure. After depressurizing the accumulator with a authorized diagnostic tool, the fluid level should be between the two marks under normal condition.

Caution: *Normal operation of the hydraulic system can only ensured by making use of the specified hydraulic oil.*

Transmission control module (TCM)



TCM is situated in the driver side A pole closing board and is connected with the transmission harness through two connectors which have 80 pins in total.

TCM makes use of an electrically erasable programmable read-only memory (EEPROM). In this way new and replaced TCM can be used to carry out external configuration. EEPROM can also make TCM update new information and market specific data. In order to input new information, TCM must use a diagnostic tool to configurate. EEPROM can make TCM re-configurate for many times as required so as to meet parameters and codes which are changed constantly.

TCM stores signal values of the transmission sensor and executor. These storage signals ensure that the transmission can always obtain optimum performance. If the battery voltage is too low and the battery discharges, information will be lost. When the battery discharges or start the engine for the first time after disconnecting, TCM will revert to default. EEPROM inside TCM makes the storage value can be obtained again quickly.

Input and output

The sensor signal makes TCM can monitor the transmission state. TCM processes signals and compares them with data stored in the storage. If these signals are not within the parameters stored in TCM, TCM will adjust the operation of the transmission through the executor so as to provide optimum driving performance and other performances.

TCM adjusts the operation of the transmission through the following executors:

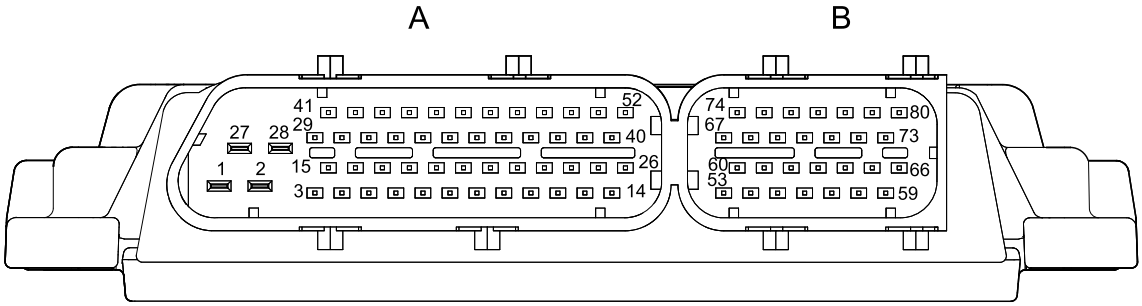
- Clutch control solenoid valve(EV0)
- Odd gear shift control solenoid valve (EV1)
- Even gear shift control solenoid valve (EV2)
- 1st-2nd gear zone gear selecting control solenoid valve (EV3)
- 5th-R gear zone gear selecting control solenoid valve (EV4)
- Electric pump

TCM is also connected with the following devices through CAN bus:

- ECM
- BCM
- ABS ECU
- Instrument pack
- Diagnostic socket

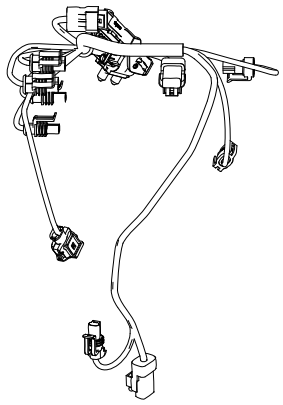
TCM receives input signals including throttle opening, engine coolant temperature, engine speed as well as engine torque from ECM. TCM also receives input signals including brake switch, pressure sensor, clutch speed, oil temperature, valve body solenoid valve state as well as mode switch. In addition, TCM outputs torque control request, gearshift information and fault alerting information to ECM and outputs signals including executing signal to the valve body solenoid valve.

Transmission control module (TCM) connecting terminal



Connector 'A'	Connector 'B'
1: Power ground 1	53–58: Unused
2: Power ground 2	59: Clutch position sensor ground
3: 5th-R gear zone selecting control solenoid valve (EV4) signal	60-64: Unused
4-25: Unused	65: Electronic selector lever sensor ground
26: Selector lever position GSL0	66: Sensor ground
27: KL30	67: Selector lever position GSL1
28: KL15	68: Selector lever position GSL3
29: 1st-2nd gear zone selecting control solenoid valve (EV3) signal	69: Brake pedal switch signal
30: Unused	70-72: Unused
31: Electric pump signal	73: 5V Sensor power supply
32: Odd gear shift control solenoid valve(EV1)signal	74: Selector lever position GSL2
33: CAN Communication signal(low)	75: Unused
34-37: Unused	76: KL50
38: Clutch speed signal(+)	77: Sport mode switch
39: Gear position sensor(GPS)signal	78: Driver side door switch signal
40: Oil pressure sensor signal	79: 5V Sensor power supply
41-42: Unused	80: Unused
43: Clutch control solenoid valve(EV0)signal	
44: Even gear shift control solenoid valve (EV2)signal	
45: CAN Communication signal(high)	
46-49: Unused	
50: Clutch speed signal(-)	
51: Shift position sensor(SPS) signal	
52: Clutch position sensor	

Transmission wiring harness



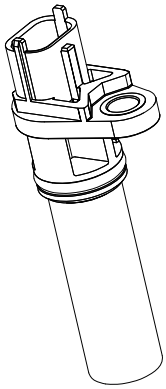
The transmission connects the clutch control solenoid valve(EV0), odd gear shift control solenoid valve(EV1), even gear shift control solenoid valve(EV2), 1st-2nd gear zone selecting control solenoid valve(EV3), 5th-R gear zone selecting control solenoid valve(EV4), shift position sensor(SPS), gear position sensor(GPS), clutch position sensor(CPS) as well as pressure sensor to the transmission control module (TCM).

Sensor

TCM sets a correct gear shifting sequence by making use of outputs of the following two speed signals:

- Clutch speed
- Vehicle speed (calculate through the wheel speed)

Clutch speed sensor

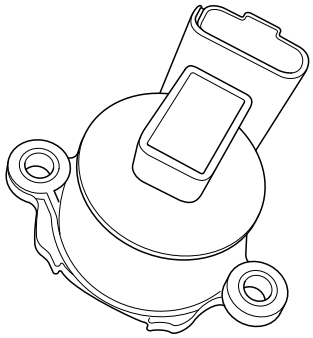


Clutch speed sensor is fit on the rear housing of the transmission, and inputs sine wave signals to TCM when sensing the rotation of the transmission driving shaft 2nd gear. TCM converts waveforms into pulses and identifies finally them as clutch speed signals.

Caution: *The tooth number of the transmission driving shaft 2nd gear of vehicles equipped with 1.5 L engine is different from that of vehicle equipped with 1.3 L engine, so the speed signals that the clutch speed sensor identifies are also inconsistent. Therefore, refit can not be confused between the driving shafts of the two, and also is the TCM.*

The electronl hydraulic kit sensor is composed of a position sensor and an oil pressure sensor.

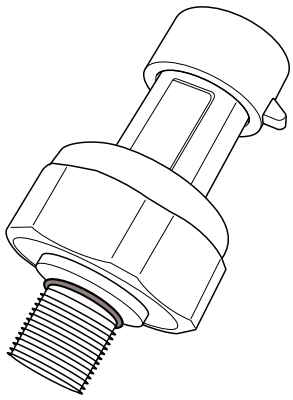
Position sensor



- Shift position sensor(SPS)
- Gear position sensor(GPS)
- Clutch position sensor (CPS)

The position sensor is Hall type with SPS inspecting the position of the gear selection piston, GPS inspecting the position of the gear engagement piston and CPS inspecting the clutch position sensor. Through these position sensors, TCM estimates the current gear selecting information of the transmission and the separation and combination state of the clutch.

Pressure sensor



The pressure sensor is fit directly on the valve body with the maximum test pressure of 80bar(8MPa). Through this sensor, TCM estimates the pressure value inside the current electron hydraulic kit. When the accumulator pressure is lower than the minimum working pressure, the system will pressurize through the electric pump assembly.

Operation

Overview

TCM controls the following functions:

- Gear selecting control
- Gear engagement control
- Clutch control
- Hydraulic system oil pressure
- Engine torque control
- Self learning
- Driving mode
- Gear position display
- Driving mode display
- Fault state
- DTC storage
- Urgency/failure safe

Engine torque control

During shifting, the transmission control module (TCM) will send an instruction to the engine management system (EMS) through CAN bus to control the output torque. When the clutch is separated, the torque will reduce; when the clutch is closed and gearshift is accomplished, the torque will increase.

Hydraulic system pressurization

When the pressure of the electric control hydraulic unit is lower than the working pressure, the system will pressurize through the following two different ways:

1. When the driver side door is opened, the system will pressurize automatically to a specific pressure so as to be able to start the vehicle at any time. If the engine is requested to be started up at this moment, you can release the clutch and shift into the neutral gear.
2. When the ignition lock is turned on, TCM will supply power to the electric pump through a relay according to the oil pressure until the ignition lock is turned off and speeds of engine and vehicle become zero.

System(accumulator) depressurization

Caution: *Before carrying out any maintenance to the electron hydraulic kit, it is necessary to depressurize the accumulator with a authorized diagnostic tool firstly.*

When the ignition key is turned to ON, the engine is off. Identify that there is no clutch fault code (P1758, P1743) in TCM. Switch on and switch off the clutch for 35 cycles with the authorized diagnostic tool, at this moment, you can hear regular actions of the clutch solenoid valve with the actions lasting for about 1 minute. After the clutch stops, the accumulator will depressurize with the pressure of about 2–3bar(0.2–0.3MPa) at this moment. The oil pump doesn't work during this process. After accomplishing depressurization, you must pull out the ignition key, wait for at least 15 seconds and ensure that the driver side door is closed, then turn the key to ON position again. At this moment, the oil pump is running and pressure will be built up again by the system.

The following conditions must be satisfied during executing processes:

1. The ignition switch is turned to ON
2. The engine is off
3. The brake pedal is depressed
4. Clutch position sensor (CPS) has no fault
5. The clutch actuator has no fault

After completing the executing operation successfully, the authorized diagnostic tool will notify.

Clutch Purge

After replacing parts, clutch purge must be executed:

- Electromagnetic valve (Solenoid valve)
- Oil pressure sensor
- Accumulator

When the ignition key is turned to ON, the engine is off. Identify that there is no clutch fault code (P1758, P1743) in TCM with the diagnostic tool and switch on and switch off the clutch for 15 cycles with the diagnostic tool, at this moment, you can hear regular actions of the clutch solenoid valve with the actions lasting for about 1 minute. After the clutch stops, exhaust is completed. During this process, the oil pump keeps working. After accomplishing exhaust, you must pulled out the ignition key and wait for at least 15 seconds, then turn on the key to ON position again. The exhaust process is accomplished successfully.

The following conditions must be satisfied during executing processes:

1. The ignition switch is turned to ON
2. The engine is off
3. The brake pedal is depressed
4. Clutch position sensor (CPS) has no fault
5. The clutch actuator has no fault

After completing the executing operation successfully, the authorized diagnostic tool will notify.

Self Learning

The transmission control system has self learning functions as follows:

- Gearbox grid self learning

- Clutch kiss point self learning

Gearbox grid self learning

After replacing the following parts, gearbox grid self learning must be executed:

- Electric control hydraulic unit
- Oil pressure sensor
- Accumulator
- Transmission wiring harness
- Gear position sensor
- Engagement position sensor
- Clutch actuator
- TCM
- Solenoid valve
- Transmission

Gearbox grid self learning executes the following procedures through the authorized diagnostic tool

- Clutch closed position self learning
- Clutch stroke test
- Clutch exhaust
- Clutch EV current self learning
- Gearbox grid self learning

The whole self learning process lasts for about 5 minutes. During the gearbox grid self learning process, you can hear the clutch is separated and engaged for multiple times, then you can hear that the transmission shifts gear rhythmically according to a certain frequency. After accomplishing self learning, you must pull out the ignition key, wait for at least 15 seconds and then turn on the key to ON position again. The entire maintenance self learning process is accomplished successfully.

The following conditions must be satisfied during executing processes:

1. Battery voltage is within the working range
2. Oil pressure is within 36–46bar(3.6–4.6MPa) so as to execute gear shifting
3. The ignition switch is turned to ON

Self learning is likely to fail due to the following causes:

1. Failures of engagement, gear selecting and clutch position sensors
2. Failures of engagement, gear selecting and clutch actuators
3. Executor drive circuit failure
4. Failures of the power supply of TCM, sensor and executor

Clutch kiss point self learning

Carry out clutch self-adjusting through calculating the clutch meshing point, to be exactly, the clutch position when starting transmitting the engine torque.

After replacing the following parts, clutch kiss point self learning must be executed:

- Electric control hydraulic unit
- Transmission wiring harness
- Clutch position sensor
- Clutch actuator
- TCM
- Clutch assembly
- Solenoid valve
- Transmission

Turn on the ignition switch and identify that there is no fault code in TCM with the diagnostic tool. When the vehicle is stationary and shifted into the neutral gear, start the engine. Accomplish Clutch kiss point self learning through a authorized diagnostic tool. After accomplishing self-learning, you must pull out the ignition key and wait for at least 15 seconds, then turn on the key to ON position again. The self-learning process is accomplished successfully.

The following conditions must be satisfied during executing processes:

1. The ignition switch is turned to ON
2. The engine is running
3. The vehicle is stationary
4. No gearshift
5. The gear position is in neutral gear

Caution: *If any one of the above conditions is not satisfied, self-learning will not be executed until all conditions are satisfied.*

During self-learning execution period, the system will always inspect the following conditions:

1. The ignition switch is turned to ON
2. The gear position is in neutral gear
3. The clutch position sensor (CPS) has no fault
4. The engagement executor has no fault
5. The power supply of TCM, sensor and executor has no fault

Caution: *If the above conditions are not satisfied, self-learning will fail. After executing self-learning, the diagnostic tool cannot interrupt this process and during the executing process, gearshift request will not be executed.*

New clutch actuator learning

After replacing the following parts, this procedure must be executed:

- Electric control hydraulic unit
- Solenoid valve

The following conditions must be satisfied during executing processes:

1. The ignition switch is turned to ON
2. The engine is off

This procedure makes the leakage value of the solenoid valve match with a new solenoid valve. This procedure lasts for about 5 seconds. After accomplishing, you must pull out the ignition key, wait for at least 15 seconds and then turn on the key to ON position again. The new executor procedure is accomplished successfully.

Diagnosis

If any fault is detected by TCM, relevant diagnostic trouble codes(DTC) will be stored in TCM storage. The diagnostic tool can be used to download these failure codes so as to identify failure causes.

Diagnostic sockets produced according to ISO 15765 standard is located in the driver side footwell. After connecting the socket with CAN bus, diagnostic information can be acquired again and some certain functions waiting to be executed can be programmed.

Transmission failure state

If any fault is detected by TCM in the transmission system, for example, when the solenoid valve or the sensor becomes invalid, fail-safe mode will be initiated. TCM can adopt multiple fail-safe modes. TCM will adopt the most acceptable fail-safe mode among drivers and ensure damage as small as possible caused to the transmission. When any failure is detected, TCM will send CAN information to the instrument pack. Then warning lights are displayed in the instrument pack to notify the driver that the transmission fails. But not all DTC will turn on warning lights of the instrument pack.

Limp home mode

When there are some certain faults existing in the transmission, the system will enter into limp mode. In limp mode, during the driving process, only 1st gear, 2nd gear, 3rd gear, neutral gear and reverse gear can be used. If the gear is higher than 3rd gear, the system will only allow down shift. After returning to the 3rd gear, the request of gearing up will not be accepted any longer.

Security features

The transmission has security features as follows:

- The vehicle is stationary, the engine is idle speed and the transmission is put into 2nd gear. If the driver has not carried out any operation for more than 3 minutes, the transmission will be shifted into the neutral gear automatically. The message centre glitters to display the current mode and 'N gear' for four seconds.
- The vehicle is stationary, the engine is idle speed and the transmission is put into a certain gear position (for example,1st gear, 2nd gear and reverse gear). The transmission will be put into the neutral gear automatically if the driver depress the brake pedal and doesn't carry out any other operations (for example, waiting) for more than 10 minutes. The message centre glitters to display the current mode and 'N gear' for four seconds.
- The vehicle is in creeping state (1st gear or reverse gear). When the driver side door is opened, the system will stop creeping function and meanwhile the buzzer will send a sound alert to remind the driver; when the vehicle speed is near to 0 km/h, the system will start timing and 2.5 minutes later, the transmission will be put into the neutral gear automatically. The message centre glitters to display the current mode and 'N gear' for four seconds.
- After the vehicle is started with 2nd gear, and if the driver has not carried out any other operations, after the driver side door is opened, the buzzer will send a sound alert to remind the driver; when the vehicle speed is near to 0 km/h, the system will start timing. And 2.5 minutes later the transmission will be put into the neutral gear automatically. The message centre glitters to display the current mode and 'N gear' for four seconds.
- If the vehicle is diagnosed with failure brake pedal switch or signal errors by the system when starting the vehicle, the vehicle can be started only after keeping the ignition key at the startup position for about 10 seconds. After the vehicle starts up, TCM will notify the driver through malfunction indicator lights (MIL).
- The engine is off when the transmission is in neutral gear without pulling up the parking brake lever, and the buzzer sounds when the driver side door is opened with the 'brake system failure' warning lights on the instrument pack glittering at the same time, which reminds the driver of the potential dangers (for example, parking in neutral gear on a ramp) existing when parking in neutral gear.
- When the clutch is overheat, the system will warn through the buzzer. Stop the operations that might cause the clutch is in slip state at once, including starting and gear shifting, and stop the vehicle to cool down the clutch or move on by keeping at a certain gear to cool down the clutch.

Caution: *With the clutch is overheat, if the clutch continue to stay in slip state after the buzzer sounds, the clutch may be burnt out.*

Routine inspection and typical faults

Inspect the system fluid level

Whether the hydraulic control system can work normally depends on the availability of appropriate amount of hydraulic oil in the system, therefore, it is extremely important to inspect whether the system is leaking and whether there is sufficient oil in the system.

When the hydraulic actuator has pressure, the fluid reservoir fluid level is maintained above the lowest fluid line mark 'MIN'; after the system is depressurized, the highest fluid level can not exceed the highest fluid level line mark 'MAX'. If the hydraulic oil is not enough, please supply the designated hydraulic oil to the appropriate position. Under normal circumstances, the fluid level must be between the highest fluid level 'MAX' and the lowest fluid level 'MIN'.

If the system hydraulic oil is not sufficient, please check if the system is leaking.

In addition, there are bleed screws (if they are fit) on the clutch actuator, therefor it is necessary to inspect whether they are closed correctly.

Inspect whether the hydraulic system is working normally.

Drive normally in a region with heavy traffic for about 10 minutes or simulate city driving cycles when conditions don't allow that, and then check the estimated value of the oil temperature with the diagnostic tool. When the hydraulic oil is between 30℃ to 50℃, stop the vehicle and maintain the engine at idle speed. Start the oil pump after gear shifting for several times, put the gear into the neutral gear quickly after starting the oil pump. Don't carry out any operation after shutting down the oil pump until the oil pump is started next time, and measure the duration from shutting down the oil pump to starting it next time for at least three times.

If all three measured times of shutting down the electric pump are larger than 20 seconds, the system works normally. If all three measured times of shutting down the electric pump are smaller than 20 seconds, the system has problems and needs to be replaced.

Inspect the system hydraulic pressure and oil pump efficiency

Under normal circumstances, after turning the ignition key to ON, the system hydraulic pressure should be between 36–48bar(3.6–4.8MPa). This hydraulic pressure value is related to the current temperature, but generally speaking, it will not be lower than 36bar(3.6MPa). Once it is lower than this value, the system pressure is small. The battery voltage should be higher than 11V, if the voltage is small, it is also likely to cause insufficient pressure.

Carry out continuous gearshift actions under static working conditions and inspect the working time of the oil pump. When the electric pump is starting, inspect whether the hydraulic pressure is also increasing accordingly with a diagnostic tool until it reaches about 36–48bar(3.6–4.8MPa) (with different temperatures, the pressure of the electric pump when it stops working is also different, but the overall pressure is within this interval). If the working time of the electric pump is shorter than 6 seconds and the battery voltage is higher than 12.5V, the electric pump can working normally without any efficiency problem. Repeat the test for two times so as to validate.

If the oil pump doesn't work, the pressure is not normal (for example, the pressure doesn't increase or has not reached the above limit value), the oil pump rotates slowly or rotates intermittently, you should inspect whether there are pin refit defects, loose, oxidation or virtual connection existing in the relevant wiring harness of the oil pump, fuse and relay, inspect whether the oil pump connector voltage is higher than 11V and inspect whether there is a problem in the relay by replacing a new relay. If it's not true in all above cases, replace the electric pump.

The engine is started up, but the gear can not be engaged.

If TCM is set with DTC of P1745(GSL0), P1746(GSL1), P1747(GSL2) or P1748(GSL3), the system has following recovery strategies: After depressing the brake pedal and turning the ignition key to position 3 (crank) and keeping this condition for a period of time, the engine can be started. After starting, the vehicle enters into 1st gear automatically and shifts to auto mode. It can run under auto mode at this moment, but the system will refuse reverse gear request.

If no problem is found after the above inspections, please firstly inspect the fluid reservoir fluid level, hydraulic pressure, oil pump efficiency as well as the brake pedal switch signal. If no fault is found from the above inspections, it is necessary to validate whether the transmission has any mechanical failure finally.

Engine stall

The vehicle speed is low

If P1810 and P1743 coexist, please inspect the wiring harness connected to the clutch position sensor. If there is P1810 fault, this DTC indicates problems related to the clutch. The potential causes are the clutch has not been released, the clutch can not be engaged or clutch heat dissipation problem. Please check the oil level firstly. If any air is found in the fluid pipe, the clutch pressure release valve shall be turned on.

Inspect the Clutch kiss point self learning data through the authorized diagnostic tool and carry out Clutch kiss point self learning again. Inspect the wiring harness condition (especially the wiring harness between the control unit and the position sensor). Open the connector assembly, inspect its integrity and check to see if there are bent pins, poor contact or damage (oxidation and corrosion). Inspect the wiring harness by checking its conductibility, grounding, battery positive pole or the availability of short circuit among pins. If no problem is found after the above inspections, replace the clutch position sensor. If problems remain, please check the condition of clutch facings. If there is P1818 fault, this DTC indicates problems related to the transmission. It might be caused by the system or the transmission. The potential causes are unnecessary reverse gear, reverse gear failure, gear selection or engagement errors or overhigh rotational speed of the clutch. Inspect gearbox grid self learning and carry out self-learning again. Inspect the wiring harness condition. If P1818 display remains, replace the gear selecting sensor and the gear shifting sensor. If problems remain at this moment, please inspect the transmission.

If the system is in neutral gear, please inspect engine idle speed control quality (snap-acceleration, accelerator release and so on) or the engine control upon the occurrence of instantaneous load (switching on, air conditioning disconnection, windshield heating resistance wire as well as steering to the end quickly). Inspect whether there are errors existing in EMS. If the system is not in neutral gear, the potential causes for engine flameout include the following points: clutch engagement and engine idle speed problem. Inspect according to the following procedures: connect the authorized diagnostic tool, start the vehicle and shift to neutral gear. Inspect whether the clutch rotation speed is larger than 0 (the engine is in idle speed) with the authorized diagnostic tool. If it is larger than 0, the clutch is in engagement state. Carry out Clutch kiss point self learning again at this moment and inspect again. If it is still in engagement state, the clutch mechanism should be replaced. Under the condition that the clutch has not been engaged, make the engine reach the normal working temperature, heat the clutch quickly (maintain for a period of time at full throttle), inspect the clutch rotation speed again. Similarly, if the rotation speed exceeds 0, the clutch mechanism should be replaced. Inspect engine idle speed control quality (snap-acceleration, accelerator release and so on) or the engine control upon the occurrence of instantaneous load (switching on,air conditioning disconnection,windshield heating resistance wire as well as steering to the end quickly). Inspect if there is any error in EMS, inspect whether there are other systems requiring the engine to flame out.

The vehicle speed is high

Inspect if there is any fault in EMS, inspect whether other systems require flameout of the engine. If all the above faults have not occurred, problems might be related to the condition that the clutch can not be controlled by the system sometimes. It is caused by one of the following reasons: hydraulic oil leakage existing at the clutch actuator, faults occurring to the clutch position sensor wiring harness sometimes (for example, temporary virtual connection), faults occurring to the clutch position sensor sometimes, clutch actuator jamming as well as clutch mechanical failure. Inspect whether there is fluid leakage existing below the clutch actuator. If there is a fluid leakage problem, it is necessary to replace the executor assembly. If there is no fluid leakage problem, it is necessary to inspect the condition of the clutch position sensor wiring harness. If there are wiring harness problems, maintain and replace relevant parts of the wiring harness. If there is no wiring harness problem, replace the clutch position sensor.

Gear seizure or limitation in driving

Note that the system will be caused to enter into recovery strategies due to system failure, to be exactly, only 1st gear, 2nd gear, 3rd gear, neutral gear and reverse gear can be used during the driving process. If the gear position is higher than 3rd gear when this fault occurs, the system will only allow down shift. After returning to 3rd gear, upshift request will not be accepted any longer. If this fault is intermittent, the driver will find that the gear position is limited intermittently in gearing up. Therefore, please read the fault code on TCM firstly with the authorized diagnostic tool. If it doesn't exist, please inspect the brake pedal switch signal, carry out Clutch kiss point self learning, inspect the selector lever state, inspect whether the hydraulic system is normal, inspect oil pump efficiency and inspect whether there is any transmission mechanical failure.

Transmission fault indicator lamp or buzzer alarm

The buzzer will give an alarm under one of the following conditions:

- When the vehicle stops and the engine runs with the transmission in 2nd gear, if the condition that there are no other operations carried out lasts for more than 3 minutes, the system will shift neutral gear automatically. The message centre will flash to display 'N' gear and the current mode for four seconds.
- When the vehicle stops and the engine runs with the transmission in a certain gear (for example, 1st gear, 2nd gear and reverse gear), if the driver depress the brake pedal without carrying out any other operations (for example, waiting) for more than 10 minutes, the system will shift neutral gear automatically. The message centre will flash to display 'N' gear and the current mode for four seconds.

- When the vehicle is in creeping state (1st gear or reverse gear), if the driver side door is opened, the system will stop creeping function with the buzzer activated to remind the driver at the same time; when the vehicle speed is close to 0, the system will enter into neutral gear automatically 2.5 minutes after starting timing with the message centre flash to display 'N' gear and the current mode for four seconds; the system will restore creeping function after closing the driver side door, depressing the brake pedal and releasing.
- Under some cases, when the clutch is overheat (for example, during starting stage or when shifting the gear), the system will monitor the temperature of the clutch. If overheating is found (the clutch temperature exceeds 250℃), the buzzer will warn. When the clutch temperature returns to the allowable range, the buzzer will stop. Therefore, it is necessary to ensure that incorrect operations will not be carried out to the automobile, for example, applying hand brake in moving off, depressing the brake pedal with left foot in moving off, making the throttle fully open suddenly when the vehicle is stationary. Inspect the rotation speed of the clutch with the authorized diagnostic tool to see if the clutch rotation speed exceed than 0rpm after starting the engine. If it exceeds 0rpm, it is necessary to carry out clutch kiss point self learning. If the problem remains, it is necessary to replace the clutch. After completing the above inspections, warm up the engine and the clutch, and repeat above inspections by carrying out a series of operations of depressing the acceleration pedal (about half throttle) and releasing, if the clutch rotation speed is found to exceed 0rpm, it is necessary to replace the clutch.

Overspeed is caused in gear shifting

Overspeed in gear shifting may occur as a result of the following reasons: faults occurring to EMS torque control, clutch meshing point learning errors or clutch abrasion. At this moment fault code in TCM should be analyzed and damaged parts should be maintained or replaced. Carry out Clutch kiss point self learning with the diagnostic tool.

If problems still appear, and there is no fault code appearing in TCM, it is necessary to inspect whether there is a problem with the clutch and replace the invalid parts.

The clutch slips and shakes in starting

If there is no fault code, the potential cause is clutch meshing point learning errors or clutch abrasion. At this moment faults in TCM should be analyzed and damaged parts should be maintained or replaced. Carry out Clutch kiss point self learning with the diagnostic tool.

If problems still appear, and there is no fault code appearing in TCM, it is necessary to inspect whether there is a problem with the clutch and replace the invalid parts.

Service Procedures

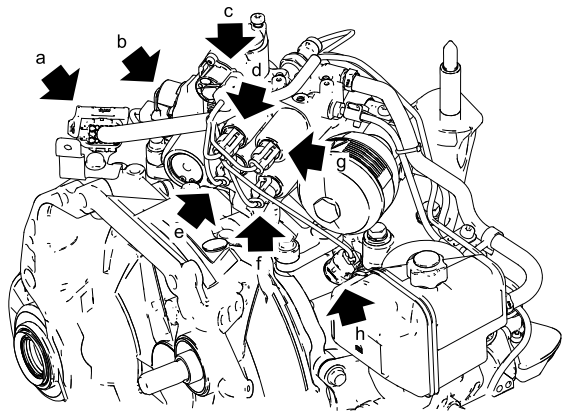
Automated mechanical transmission assembly

Remove

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect the reverse light switch connector.
3. Disconnect the connection between the transmission wiring harness and the body wiring harness (a).



4. Release bolts connecting battery earth lead to the transmission housing.
5. Drain the transmission oil.

☞**Transmission Oil Drain**

6. Remove the drive shaft assembly.

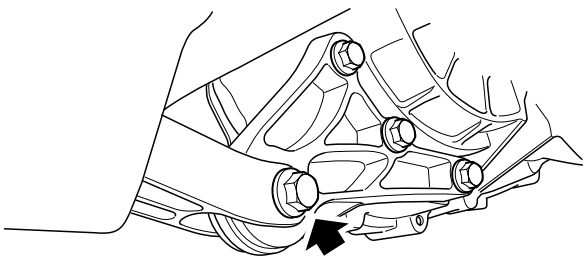
☞**Left Drive Shaft Assembly Remove**

☞**Right Drive Shaft Assembly Remove**

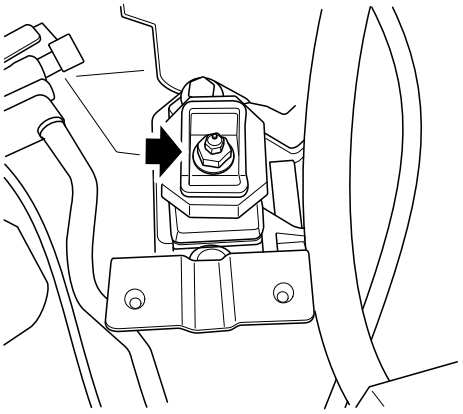
7. Remove the starter motor.

☞**Starter Motor Remove**

8. Support the engine with a sling.
9. Support the transmission with a jack.
10. Remove 7 connecting bolts connecting the engine and the transmission.
11. Release one connecting bolt between the mounting bracket of engine mount lower support and the engine mount lower support.



12. Remove nuts from the transmission mounting bracket to the suspension.



13. Release the transmission from the engine, adjust the jack height and lower the transmission slowly to the floor with care.
14. Release three fixed bolts and remove the transmission mounting bracket.
15. Release three fixed bolts and remove the transmission the mounting bracket of engine mount lower support.

Refit

1. Clean the junction surface between the engine and the transmission.
2. Clean locating pins and pinholes of the transmission.
3. Support the engine with a sling.
4. Fit fixing bolts from the transmission mounting bracket to the transmission and tighten them to **55–65Nm**.
5. Fix the transmission on a jack and adjust with care the jack and position the transmission locating pin.
6. Insert the input shaft of the transmission to the splined hole of the clutch driven disc.
7. Fit 7 bolts connecting the engine to the transmission and tighten them respectively to **75–90Nm**.
8. Fit the connecting nuts connecting the mounting to the transmission mounting bracket and tighten them to **90–110Nm**.
9. Fit three connecting bolts from lower tie bar refit bracket to the transmission and tighten to **55–65Nm**.
10. Tighten the connecting bolt for connecting lower tie bar and the lower tie bar refit bracket to **90–110Nm**.
11. Fit the starter motor.

☞**Starter Motor Refit**

12. Connect the connector between the transmission wiring harness and the body wiring harness.
13. Connect the reverse light switch connector.
14. Fit bolts fixing the battery earth lead to the transmission housing and tighten them to **15–20Nm**.

15. Fit the drive shaft assembly.

☞**Left Drive Shaft Assembly Refit**

☞**Right Drive Shaft Assembly Refit**

16. Fill in transmission oil.

☞**Transmission Oil Filling**

17. Fit the battery tray.

☞**Battery Tray Refit**

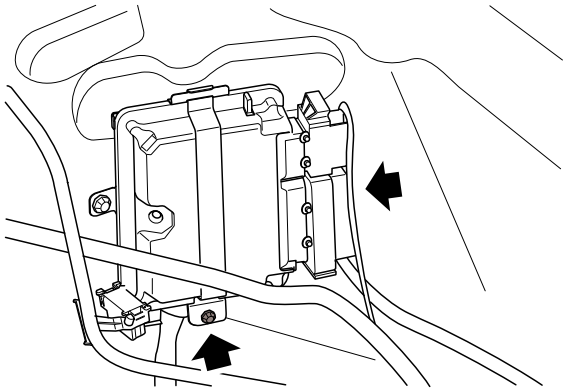
18. Clear history data in TCM with a authorized diagnostic tool and carry out clutch kiss point and gear position self-learning.

Transmission control module (TCM)

Warning: The Transmission Control Module (TCM) is uniquely coded to this vehicle and therefore will not work if fitted to another vehicle.

Remove

1. Disconnect the battery earth lead.
2. Remove the driver side sealing panel assembly.
3. Disconnect two connectors of the TCM.
4. Remove one bolt fixing TCM retaining clip to the support and take away the retaining clip.



5. Remove the TCM.

Refit

1. Position TCM to the support, fit the support retaining clip and tighten fixing bolts to **8–10Nm**.
2. Position the wiring harness and connect the connector to TCM.
3. Fit the driver side sealing panel assembly.
4. Connect the battery earth lead.
5. Carry out clutch kiss point and gear grid self-learning with a authorized diagnostic tool.

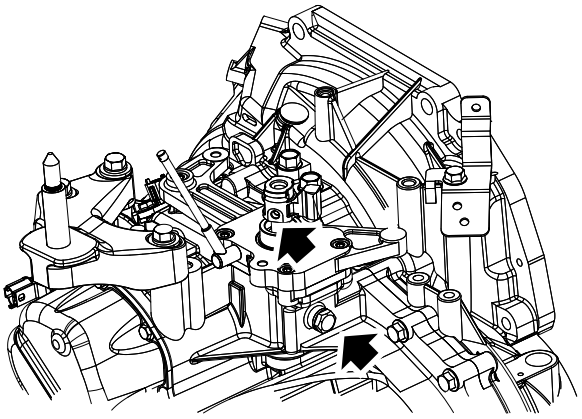
Gear Shift Shaft Oil Seal - AMT

Remove

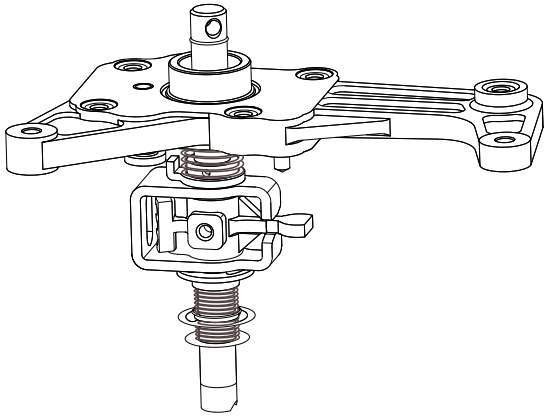
1. Remove the electronic controlled hydraulic unit assembly.

☞**Electronic Controlled Hydraulic Unit Assembly Remove**

2. Collect all the gaskets between the electronic controlled hydraulic unit assembly and the control cover.
3. Punch down the spring pin securing the gear shift finger, and then remove the gear shift finger.
4. Remove the five bolts securing the control cover assembly to the rear housing.
5. Remove the gear shift limit bolts and the gaskets.



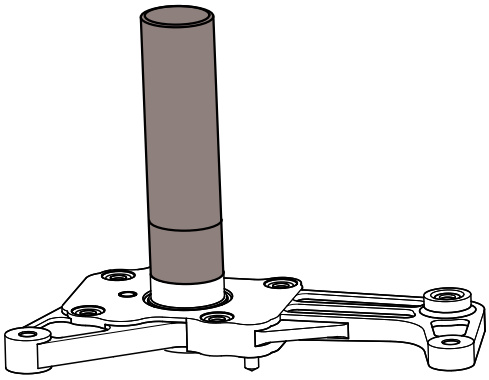
6. Shift the selector to the neutral position and remove the control cover.
7. Remove the gear shift shaft assembly.



8. Release the reverse lock shaft, remove the reverse locking plate and reverse limit spring.
9. Pull out the gear shift shaft assembly.
10. Release oil baffle and the bolt securing spacer plate to control cover, then remove the oil baffle and spacer panel.
11. Remove the gear shift shaft oil seal.

Refit

1. Use**TPT00066** and hammer to fit the oil seal of gear shift shaft.



2. Position the reverse limit spring and locking plate on the control cover and tighten the reverse lock shaft to **15–22Nm**.
3. Put the gear shift shaft assembly to the neutral position.
4. Clean the mating face of the control cover and rear housing.
5. Put the gear shift shaft assembly into the upper operating window of the rear housing.
6. Fit the oil baffle and panel on the control cover and tighten them to **4–6Nm**.
7. Apply sealant on the upper operating window surface of the rear housing. Fit the control cover into the rear housing, then put five connecting bolts and tighten them to **15–25Nm**.
8. Position the gear shift finger to gear shift shaft and use**T24026** to fit a new spring pin.
9. Fit the electronic controlled hydraulic unit assembly.

☞**Electronic Controlled Hydraulic Unit Assembly Refit**

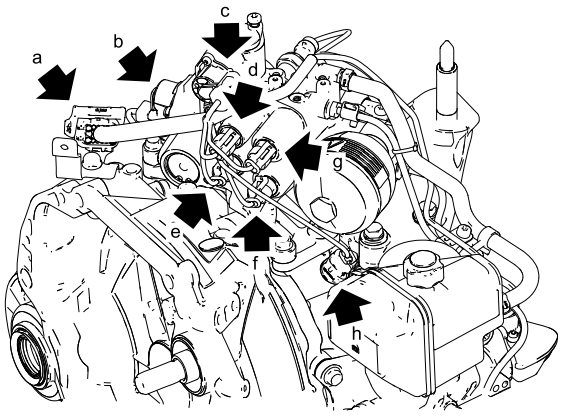
Automated mechanical transmission wiring harness

Remove

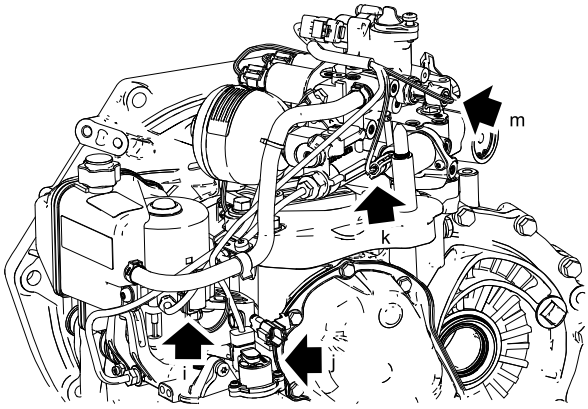
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Make corresponding marks before releasing the wiring harness connector so as to avoid inserting a wrong connector.
3. Disconnect respectively connectors of the body wiring harness (a), GPS (b), SPS (c), EV3 (d), EV4 (e), EV1 (f), EV0 (g) and clutch sensor (h).

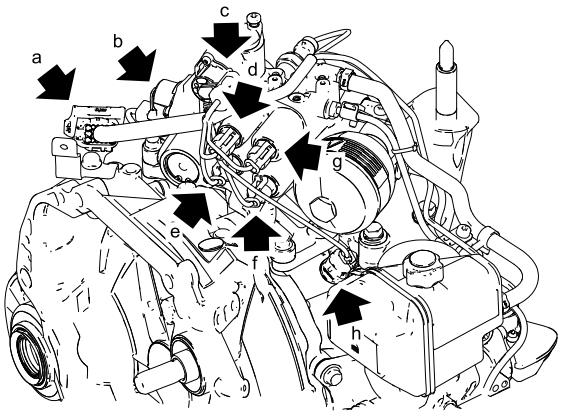


4. Disconnect respectively connectors of the electric pump assembly (i), CPS (j), EV2 (i) and oil pressure sensor (m).

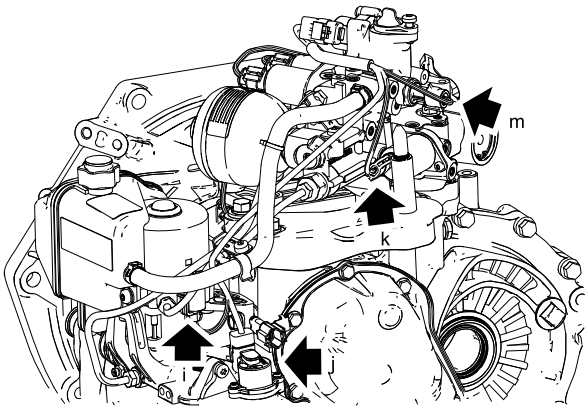


Refit

1. Connect respectively connectors of the body wiring harness (a), GPS (b), SPS (c), EV3 (d), EV4 (e), EV1 (f), EV0 (g) and clutch sensor (h).



2. Connect respectively connectors of the electric pump assembly (i), CPS (j), EV2 (i) and oil pressure sensor (m).



3. Fit the battery tray.

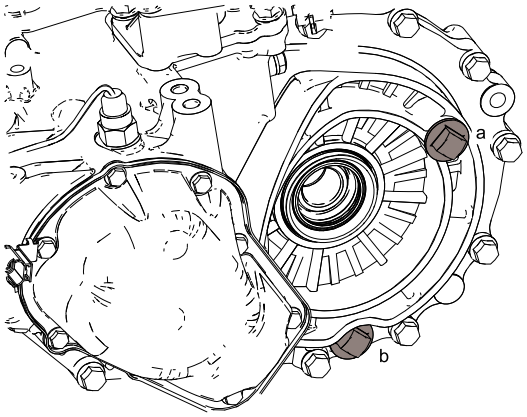
☞**Battery Tray Refit**

4. Carry out clutch kiss point and gear grid self-learning with a authorized diagnostic tool.

Transmission oil Draining and filling

Draining and filling

1. Lift the vehicle and place an appropriate container under the transmission.
2. Clean areas surrounding the oil filler plug, remove the oil filler plug (a) and abandon sealing spacers.
3. Clean areas surrounding the oil drain plug, remove the oil drain plug (b) and abandon sealing spacers.



4. Drain the transmission oil.
5. Clean the filler and the oil drain plug.
6. Place new sealing spacers on the oil drain plug, fit and tighten the oil drain plug to **25–35Nm**.
7. Through the filler, the transmission oil can be filled to the transmission conveniently with an appropriate and clean funnel to the specified value.

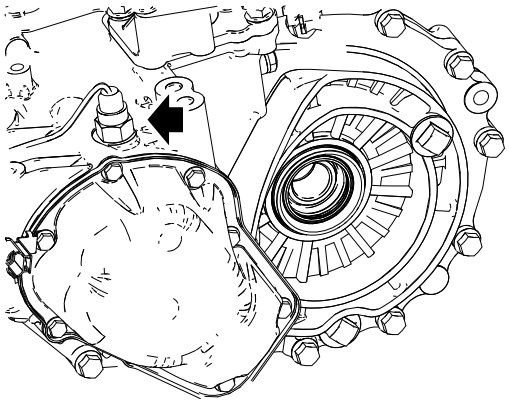
· Drain and refill	1.8 L
· Dry fill	2.0 L

8. Place new sealing spacers on the oil filler plug, fit and tighten the oil filler plug to **25–35Nm**.
9. Lower the vehicle.

Reverse Light Switch

Remove

1. Disconnect the battery earth lead.
2. Release the reverse light switch harness from the cable clamp.
3. Disconnect the reverse light switch harness connector.
4. Remove the reverse light switch assembly from the transmission.



Refit

1. Clean the joint surface of the reverse light switch and the transmission.
2. Apply sealant on the reverse lamp thread, fit reverse light switch to the transmission and tighten it to **12–18Nm**.
3. Connect the reverse light switch harness connector.
4. Fit reverse lamp harness to the cable clamp.
5. Connect the battery earth lead.

LH Differential Oil Seal

Disassembly

1. Remove the left drive shaft.

☞**Left Drive Shaft Assembly Remove**

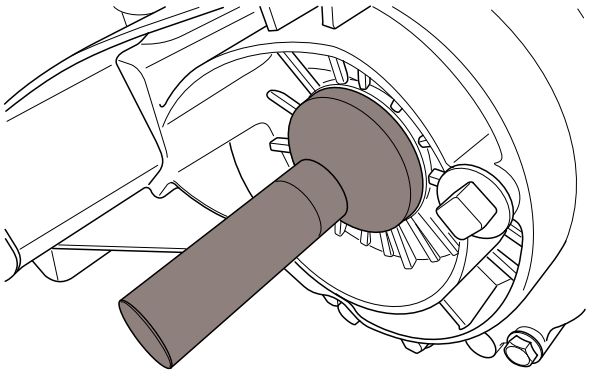
2. Carefully remove and discard the oil seal, taking care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: Oil seals are waxed and must not be lubricated prior to fitting.

2. Use**TPT00064** to fit a new oil seal.



3. Fit the left drive shaft.

☞**Left Drive Shaft Assembly Refit**

4. Fill the transmission fluid.

☞**Transmission Fluid Adding**

RH Differential Oil Seal

Remove

1. Remove the right drive shaft.

☞**Right Drive Shaft Assembly Remove**

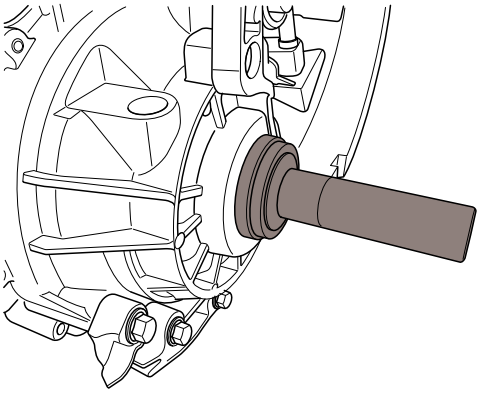
2. Carefully remove and discard the oil seal, taking care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: Oil seals are waxed and must not be lubricated prior to fitting.

2. Use**TPT00069** to fit a new oil seal.



3. Fit the right drive shaft.

☞**Right Drive Shaft Assembly Refit**

4. Fill the transmission fluid.

☞**Transmission Fluid Adding**

AMT Transmission Dismantling

Remove

1. Remove the electric control mechanical automatic transmission assembly.

☞**Electric Control Mechanical Automatic Transmission Assembly Remove**

2. Remove the electric hydraulic unit assembly.

☞**Electric Hydraulic Unit Assembly Remove**

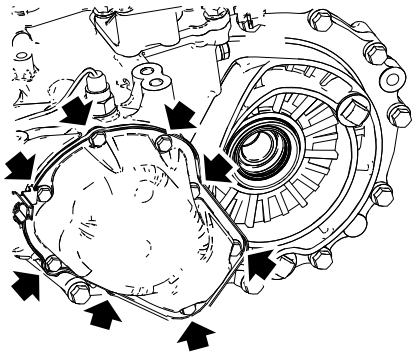
3. Remove the reverse lamp switch.

☞**Reverse Lamp Switch Remove**

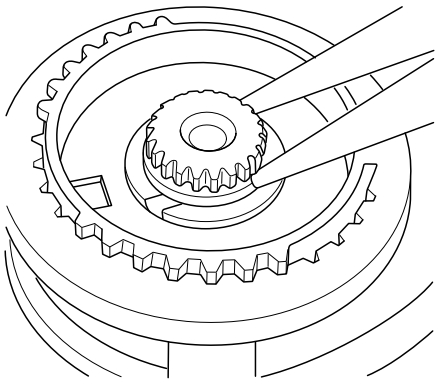
4. Remove the clutch release bearing.

☞**Clutch Release Bearing Remove**

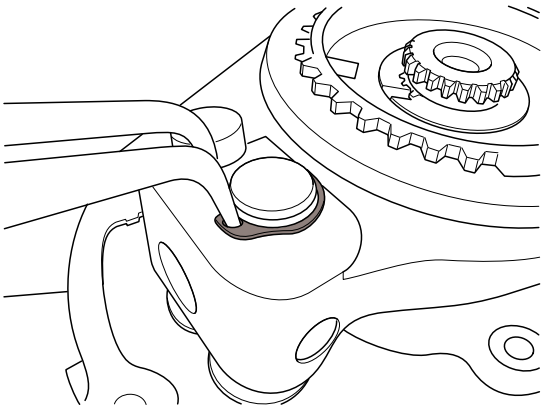
5. Remove 8 bolts securing the rear cover plate and the rear cover plate.



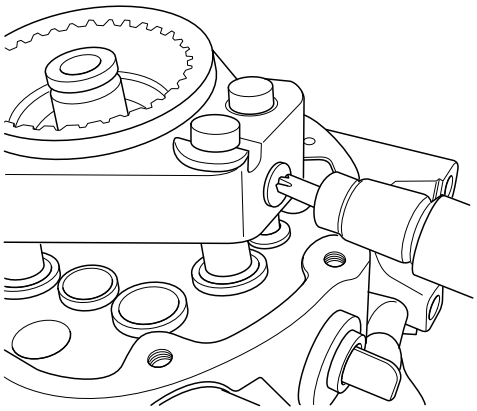
6. Remove the retainer ring at the 5th gear synchronizer hub.



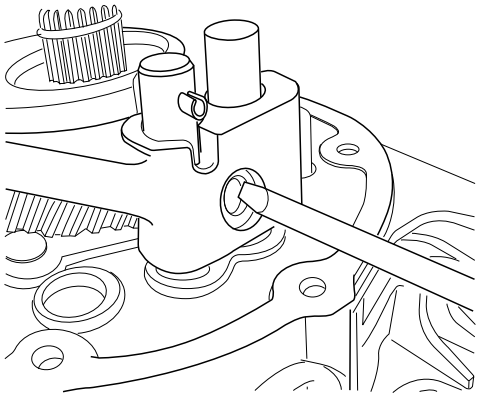
7. Use a circlip plier to remove the fixed circlip from the reverse gear fork shaft.



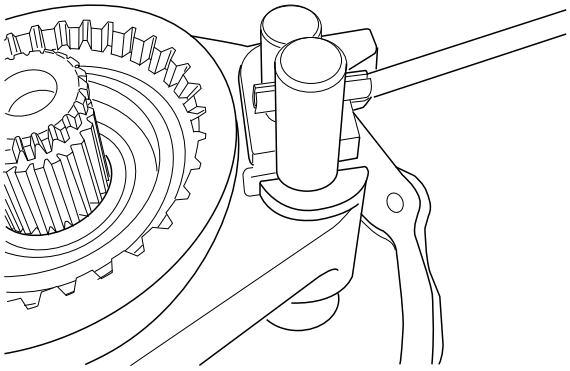
8. Put the gear at the neutral position, and loosen bolts of the 5th gear fork shaft.



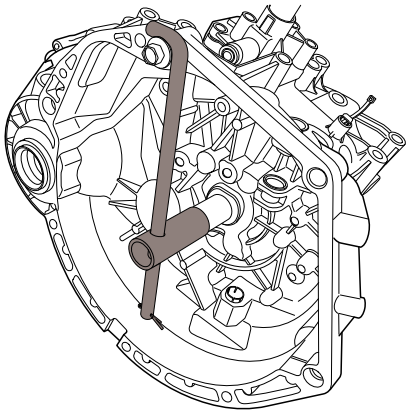
9. Take out steel balls with a magnetic screwdriver.



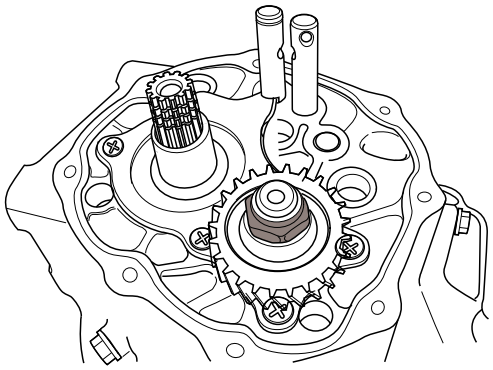
10. Put the gear at 5th gear position, and use a punch and a hammer to remove the spring pin from the 5th gear fork shaft by knocking.



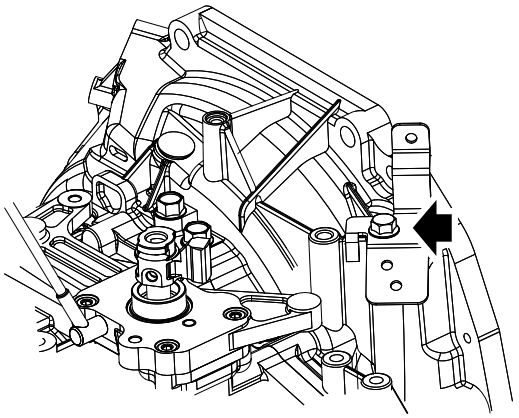
11. Remove the 5th gear fork shaft with the 5th gear synchronizer together.
12. Remove the drive 5th gear and needle bearings.
13. Put the gear position to 4th gear and use **TPT00068** to lock the transmission drive shaft.



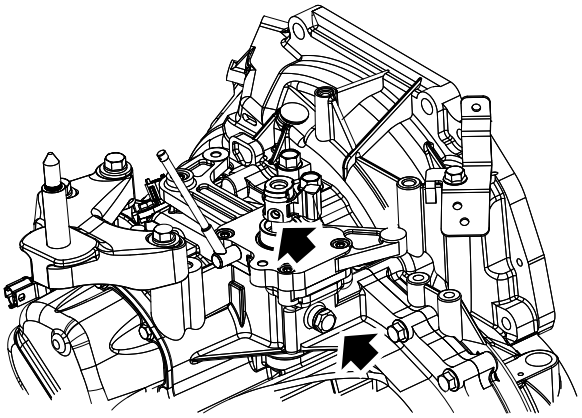
14. Remove and discard the lock nut of the driven shaft.



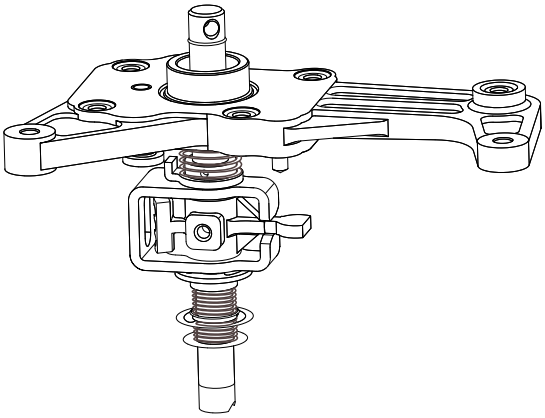
15. Remove the driven gear of 5th gear.
16. Loosen 6 screws securing the rear bearing baffle.
17. Remove the bear bearing baffle and rear bearing adjusting shim.
18. Loosen the bolts, and remove the harness retaining bracket.



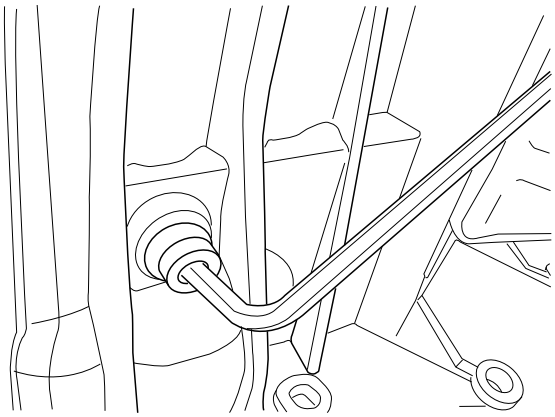
19. Remove the spring pin of Shift Finger, and remove the Shift finger.
20. Remove the five bolts securing the control cover assembly to the rear housing.
21. Remove the gear shift limit bolt and washers.



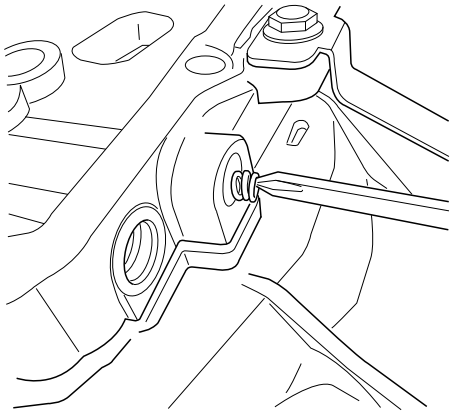
22. Shift it to the neutral position and remove the control cover. Take out the gear shift shaft assembly.



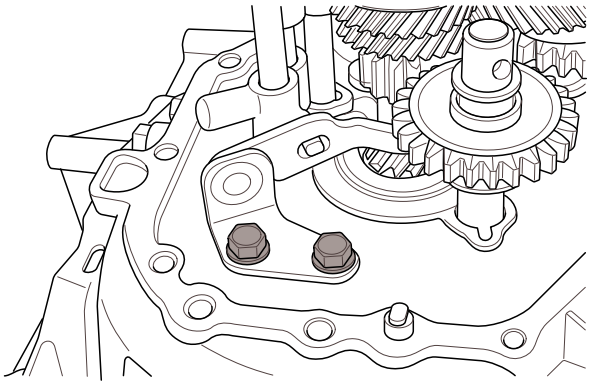
23. Release the bolts securing the oil-baffling plate and spacer plate to the control cover, and remove the oil-baffling plate and spacer plate.
24. Remove the reverse idler gear shaft and shim.



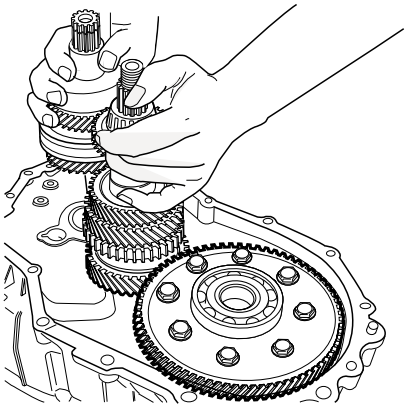
25. Remove the connection bolts of the front and rear housing.
26. Remove the clutch limit bracket.
27. Lightly knock the platform of the large end face of the front housing with a nylon hammer, and then separate the rear housing from the front housing and take it out.
28. Loosen the three self-locking bolts of the side of the front housing.
29. Take out the three self-locking springs and three steel balls from the holes.



30. Loosen the two bolts at the reverse rocker components.



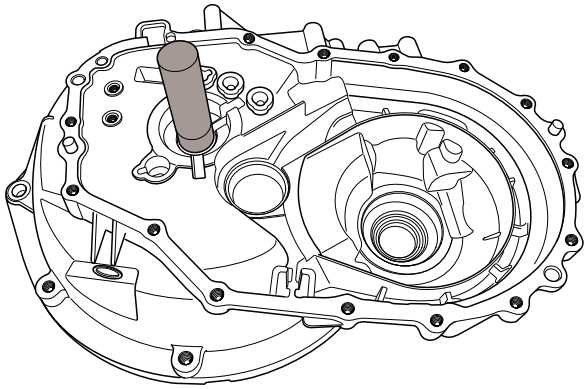
31. Respectively remove the reverse rocker components, reverse idler assembly, reverse idler wheel axle and washer.
32. Put the gear at 4th gear position, and take out the fork shaft of the 5 gear and reverse gear components upward.
33. Lift the driven shaft assembly, drive shaft assembly , 1st/2nd gear fork shaft component and 3rd/4th gear fork shaft component out of the front housing with two hands . When separate is hard, you can use a nylon hammer to knock the rib of the front housing to detach it.



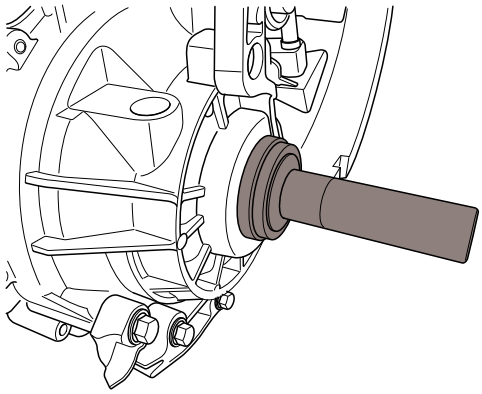
34. Take out the differential assembly out of the front housing, if it is difficult to do so, you can moderately shock the differential assembly and lightly knock the bearing to detach it.

Refit

1. In the front housing, use**TPT00066** to fit the drive shaft oil seal.



2. Use**TPT00069** to fit the front housing oil seal.



3. Fit the driven shaft front bearing outer race through the driven shaft bearing hole of the front housing, and then lightly knock it to its position with a nylon hammer.
4. Fit the differential assembly in the front housing, and when it is difficult to fit it, please use a nylon hammer to put it in its position by lightly knocking.
5. Put the 1st/2nd gear fork shaft component in the 1st/2nd gear shaft assembly synchronizer of the driven shaft, put the 3rd/4th gear fork shaft component in the 3rd/4th gear synchronizer of the drive shaft assembly, mate the two shafts with each other and put them in the front housing with two hands, when putting them please note that the fork shafts shall align to the shaft holes of the housing, and the bearings of the two shafts shall align to the bearing holes of the two shafts.
6. Push the 3rd/4th gear fork shaft component to the 4th gear position, and then fit the 5th gear and reverse gear fork shaft components into the front housing.
7. Respectively fit the steel balls and self-locking spring in the three self-locking holes of the side of the front housing. Coat screw thread sealant on the screw thread, and fit the self-locking bolts and screw them to **15–20Nm**.
8. Fit the reverse idler gear assembly, reverse idler nylon washer and reverse shaft into the front housing.
9. Fit the reverse rocker components into the front housing, and fit two bolts and screw them to **22–28Nm**. After fitting the reverse rocker components, the reverse idler must be flexible for rotation, and the reverse idler shaft bolt hole direction must be perpendicular to the gear and be outward.
10. Measure the plane distance from the plane of the front housing to the rear bearing outer washer with a differential adjusting shim measuring tool, and the rear bearing hole of the rear housing differential, select the adjusting shims, and the selection principle is that the pre-tension is 0.1 mm. After coating an appropriate amount of grease on the shim, put it within the rear bearing hole of the rear housing differential.
11. Clean the mating surface of the housing, coat surface sealant on the front housing and cover the rear housing. Position the clutch check bracket to the housing, coat screw sealant on the four reverse bolts on the front housing, and fit 11 connecting bolts and screw down them to **22–28Nm**.
12. Fit the selector and shift cable brackets and screw the set bolts and tighten to **22–28Nm**.
13. Align the hanging hole of the reverse idler gear shaft with the reverse part of the rear housing, coat screw thread sealant on the screw thread of the hanging bolts of the reverse idler gear shaft, fit the bolts and aluminum washer and tighten to **15–22Nm**.
14. Use adjusting shim measurement tools to measure the height difference between the drive shaft rear bearing cup plane and rear housing plane, also the depth of the rear bearing guard groove. and then match the corresponding adjusting shim, base on the principle that is 0-0.05mm gap. when put onto the drive shaft bearing, should apply with moderate amount grease. The refit process of driven shaft adjusting shim is the same as above, which difference is that the matching principle is pretension of 0.05-0.15mm.

Drive Shaft Rear Bearing Adjusting Shim

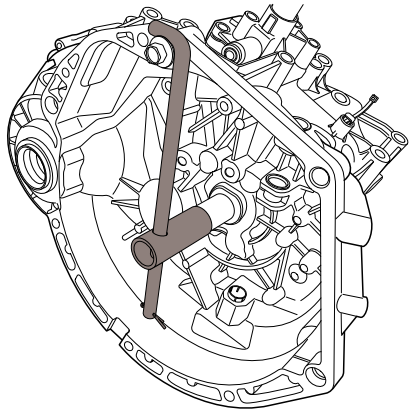
Thickness (mm)
0.1
0.15
0.2
0.3
0.4
0.5
0.8

Driven Shaft Rear Bearing Adjusting Shim

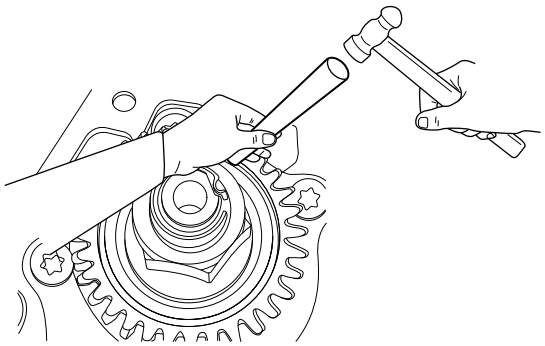
Thickness (mm)
0.1
0.2
0.3
0.4
0.5
0.6

15. Press on the rear bearing guard, and fit six bolts and tighten to **10–15Nm**.
16. Turn the 3rd/4th gear fork shaft, and put the

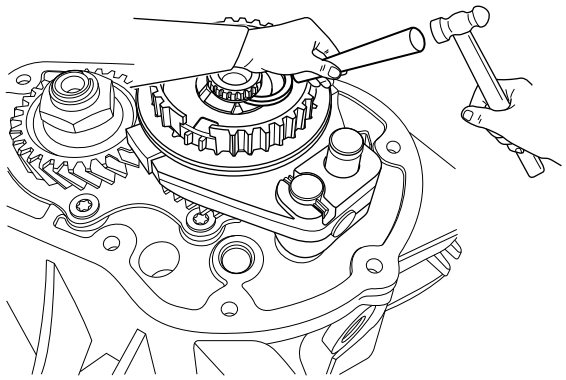
transmission gear position to 4th gear and use**TPT00068** to lock the the transmission drive shaft.



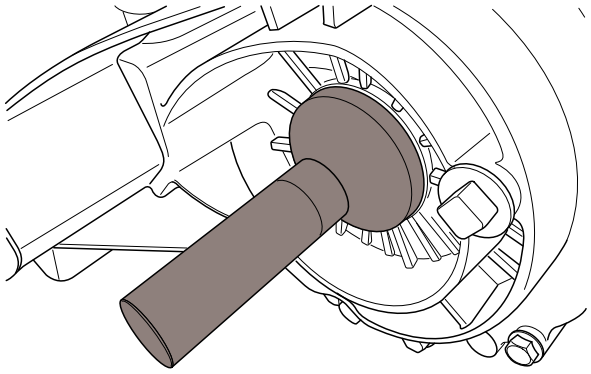
17. Fit the driven 5th gear in the driven shaft, fit the 3rd/4th gear needle roller bearing in the 5th gear bush, screw the lock nuts of the driven shaft from the driven shaft, and insert a rubber pad in the mating part between the drive and driven gears, meanwhile screw down the bolts to **80–100Nm**.
18. Use puncher to lock up the locknut.



19. Coat an appropriate amount of gear grease on the inner cone surface of the 3rd, 4th and 5th gear synchronizer gear ring, and then fit them on the 5th gear drive gear mating gear cone surface; insert the 5th gear fork in the sleeve of the 5th gear synchronizer, and put them in the 5 and reverse gear fork shaft component together.
20. Select an appropriate retainer ring in the 5th gear synchronizer hub.



21. Press the new spring pin into the pin hole of the 5th gear fork shaft. And then put the steel balls in the holes in the side surface of the 5th gear shaft, and meanwhile fit 5th gear fork bolts and tighten to **5–8Nm**.
22. Fit the fixed circlip with a circlip plier.
23. Put the gear shift shaft assembly in the operation window of the rear housing.
24. Fit the grease baffle and spacer plate in the control cover and tighten bolts to **4–6Nm**.
25. Coat surface sealant on planes of the control windows of the rear housing. Fit the control cover in the rear housing, and screw 5 connection bolts to **15–25Nm**.
26. Position and shift the gear to the gear shift shaft and use**T24026** to put the new spring pin by knocking.
27. Use**TPT00069** to fit the new rear housing oil seal.



28. Apply surface sealant on the rear planes of the rear housing. Fit the rear cover plate assembly, and screw 8 bolts and tighten to **8–13Nm**.
29. Fit the harness retaining bracket and tighten bolts to **22–28Nm**.
30. Fit the clutch release bearing.

☞**Clutch Release Bearing Refit**

31. Fit the reverse lamp switch.

☞**Reverse Lamp Switch Refit**

32. Fit the electric hydraulic unit assembly.

☞**Electric Hydraulic Unit Assembly Refit**

33. Fit the electric control mechanical automatic transmission assembly.

☞**Electric Control Mechanical Automatic Transmission Assembly Refit**

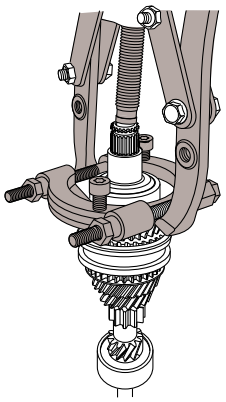
Drive Shaft Assembly

Remove

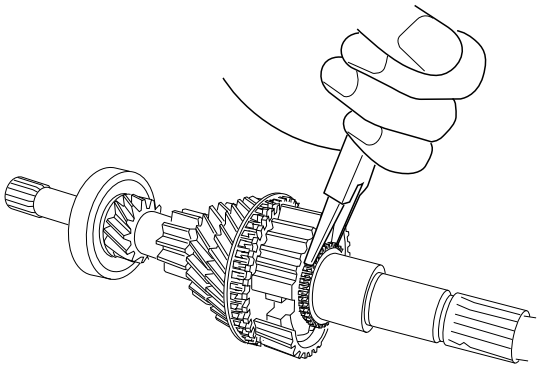
1. Remove the drive shaft assembly.

☞**Transmission Remove**

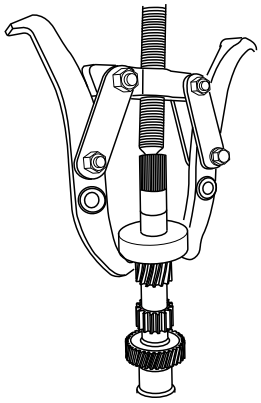
2. Use puller and**T32001** to take the drive shaft rear bearing and 5th gear bushing out together.



3. Remove the 4th gear spacer.
4. Respectively take the drive 4th gear, needle bearings, 4th gear synchronizer gear ring out.
5. Remove the 3rd/4th gear synchronizer gear sleeve and slider assembly.
6. Knock the synchronizer retainer out.

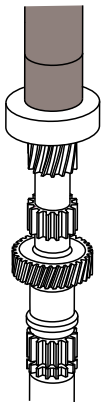


7. Remove the 3rd/4th gear synchronizer gear hub.
8. Respectively take the 3rd gear synchronizer gear ring, drive 3rd gear, needle bearings out.
9. Use puller and**T32001** to pull drive shaft front bearing out.

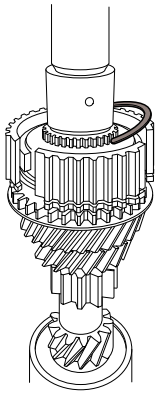


Refit

1. Use**TPT00065** to fit drive shaft front bearing into correct position.



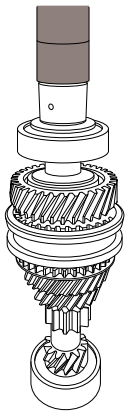
2. Lubricate needle roller bearings, fit needle bearings and drive 3rd gear.
3. Fit 3rd gear synchronizer gear ring, synchronizer gear hub.
4. Select the appropriate retainer and fit it in correct position.



5. Fit 3rd/4th gear synchronizer gear sleeve and slider assembly, to ensure that the slider assembly is right placed in the slider groove of gear sleeve and synchronizer gear hub.

Caution: Ensure parts are fitted in correct order and orientation.

6. Lubricate needle roller bearings, and then successively put into 4th gear synchronizer gear ring, needle roller bearings, drive 4th gear and 4th gear spacer.
7. Use**TPT00065** to fit the drive shaft rear bearing and 5th gear bushing into place.



8. Fit the drive shaft assembly.

☞Transmission Assembly Refit

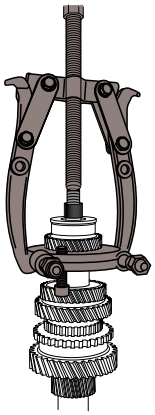
Driven Shaft Assembly

Remove

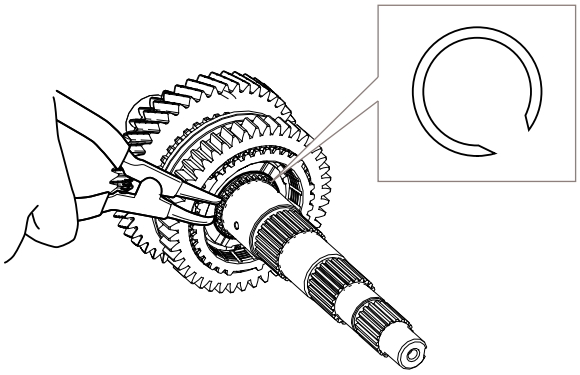
1. Remove the driven shaft assembly.

☞Transmission Remove

2. Use puller and**T32001** to pull the driven shaft rear bearing and slave 4th gear out together.



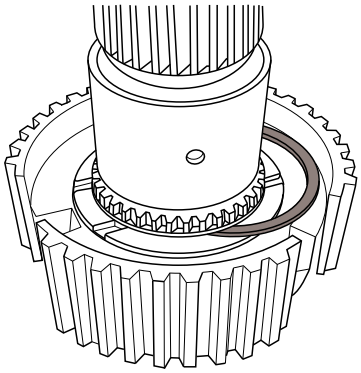
3. Take the 3rd/4th gear spacer out.
4. Use puller and**T32001** to pull the driven 3rd gear out.
5. Successively take the driven 2nd gear, 1st/2nd gear synchronizer gear ring out.
6. Remove synchronizer gear sleeve and slider.
7. Remove the synchronizer retainer, remove the synchronizer gear hub.



8. Successively take the 1st/2nd gear synchronizer gear ring, driven 1st gear, needle bearings out.
9. Use puller and**T32001** to pull the driven shaft front bearing inner ring out.

Refit

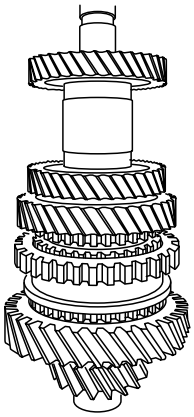
1. Use**TPT00065** to fit the drive shaft front bearing inner ring into correct position.
2. Lubricate the needle bearings, and then successively fit needle bearing, driven 1st gear, 1st/2nd gear synchronizer gear ring.
3. Fit 1st/2nd gear synchronizer gear hub and select the appropriate retainer to knock into correct position.



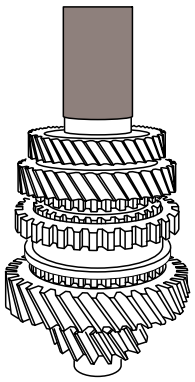
4. Fit synchronizer gear sleeve, slider and synchronizer gear ring, to ensure that the slider assembly is right placed in the slider groove of gear sleeve and synchronizer gear hub.

Caution: Ensure parts are fitted in correct order and orientation.

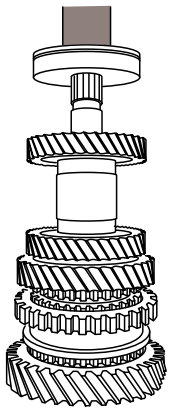
5. Lubricate the needle bearings, and then successively fit needle bearing, driven 4th gear, 3rd/4th gear spacer.



6. Use**TPT00066** to fit the driven 3rd gear into correct position.



7. Use**TPT00065** to fit input shaft rear bearing into correct position.



8. Fit the driven shaft assembly.

☞Transmission Assembly Refit

Differential Assembly

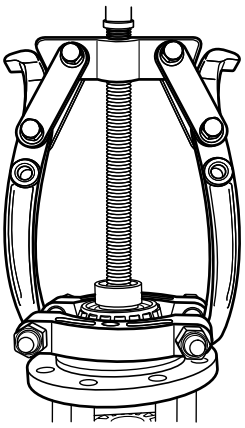
Remove

1. Remove the differential assembly.

☞Transmission Remove

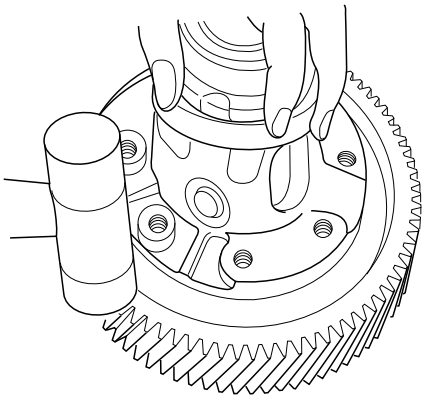
2. Use puller and**T32001** to pull the bearing of both ends out respectively.

Caution: Support bolt of the drawing die (T32001) cannot be used to support the propeller shaft hole directly, place a spacer block between them.

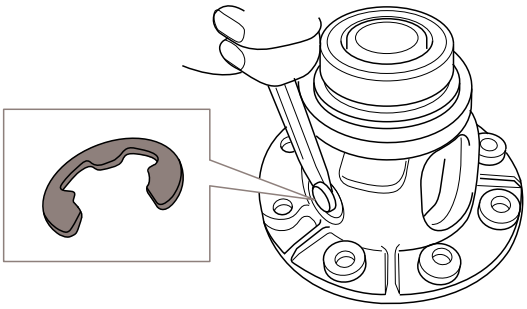


S243024

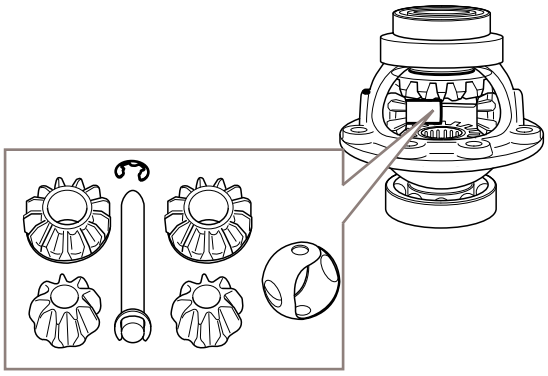
3. Remove the eight bolts which fix the final drive gear to the differential housing.
4. Use the nylon hammer to knock the final drive gear down from the differential housing.



5. Knock out the retainers at both ends of the planetary gear shaft.



6. Remove the planetary gear shaft, and take side gears, planetary gears and washer in the differential housing out in an orderly manner.



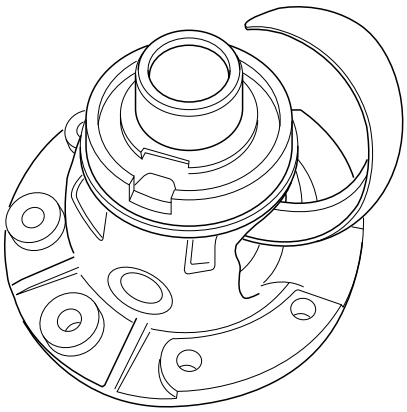
Refit

1. Check if the differential rear bearing adjusting shim indicates wear or scratch, replace the shim if necessary.

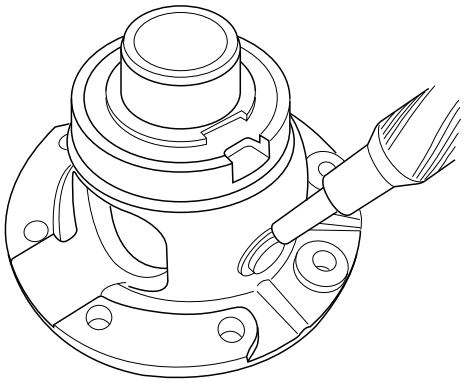
Differential Rear Bearing Adjusting Shim

Thickness (mm)
0.1
0.15
0.2
0.3
0.4

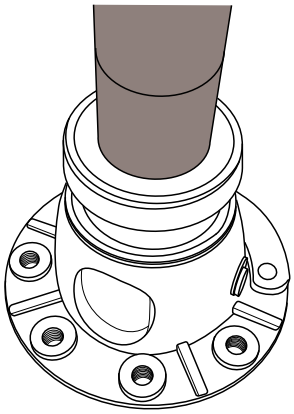
2. Put the differential washers into the differential housing cavity.



3. Successively put the planetary gear, side gear into the differential housing cavity.
4. Insert the planetary gear shaft and fix the both ends with retainers.



5. Use**TPT00067** to knock two differential bearings into correct position respectively.



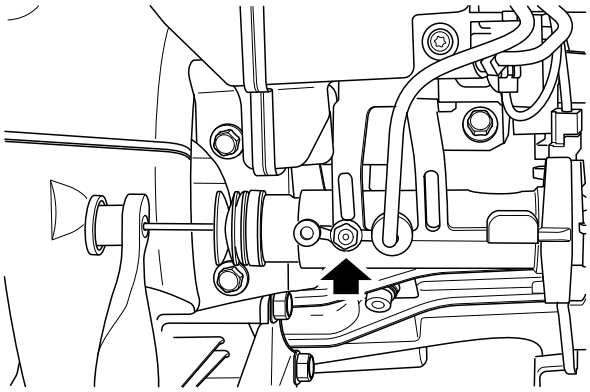
6. Fit final drive gear to the differential housing, and tighten the eight fixing bolts to **90–110Nm**.
7. Fit the differential assembly.

☞Transmission Assembly Refit

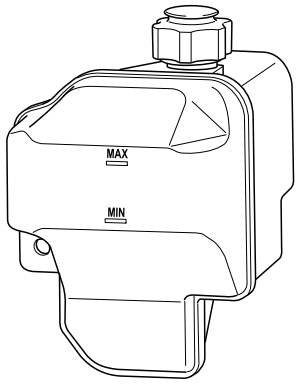
Hydraulic Fluid Topup

Inspection and Adding

1. Check whether the air bleed screws on the clutch actuator are correctly tightened (if fit).



2. When the system is under normal working pressure, check whether the fluid level is above the 'MIN' mark.



3. If it is below the 'MIN', remove the fluid reservoir cover.
4. Add specified TUTELA CS–SPEED FF hydraulic fluid, until the fluid level is between the 'MIN' and 'MAX' mark.

Caution: *The normal operation of the hydraulic actuator can be ensured only when the stipulated hydraulic fluid is used.*

5. Fit the fluid reservoir cover.
6. Check fluid level after the pressure is released with a authorized diagnostic tool. The fluid level shall not be above the 'MAX' mark.
7. After the fluid level is normal, please ensure the driver side door is closed, and open the ignition switch to ON position to increase the pressure of the hydraulic system to the normal working pressure.

Electron Hydraulic Kit

Remove

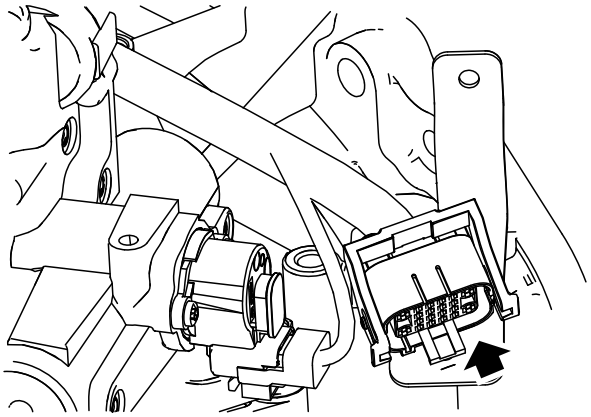
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

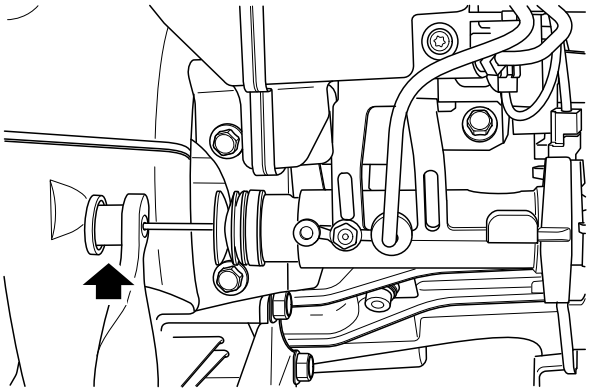
1. Put the selector lever into neutral position.
2. Remove the battery tray.

☞**Battery Tray Remove**

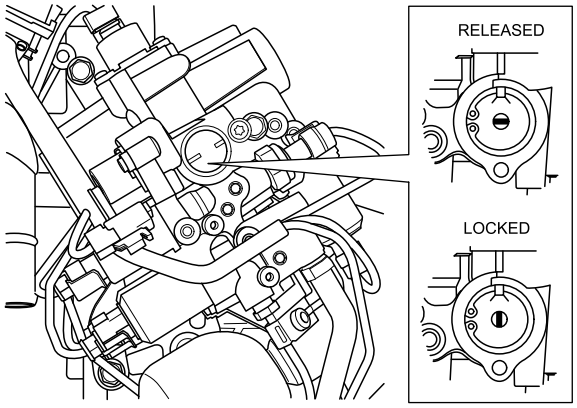
3. Release the transmission wire harness connector from the wire harness support.



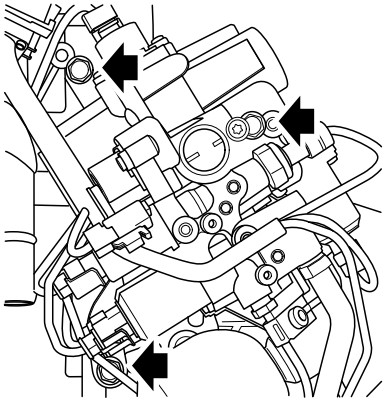
4. Disconnect the connection between the clutch actuator cable and the release rocker arm.



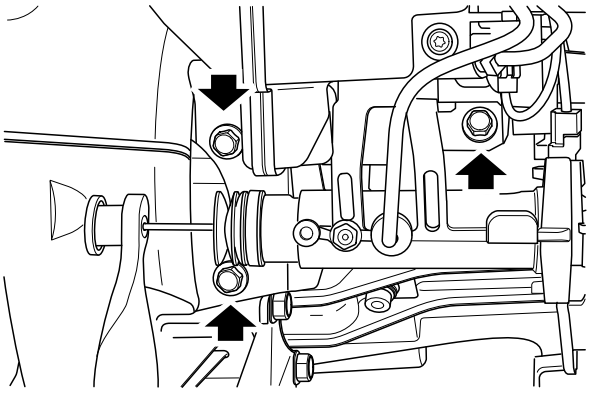
5. Release the screw, and open the selector actuator sealing cap. Push the selector piston to the bottom and rotate it by 90 degrees to 'RELEASED' position using a straight screwdriver, and then release the connection of the mechanism.



6. Release 3 bolts fixing the hydraulic kit control assembly to the top of the transmission.



7. Release 3 bolts fixing the hydraulic kit control assembly to the front end of the transmission.



8. Take away the hydraulic kit control assembly from the transmission.
9. Remove the transmission wire harness.

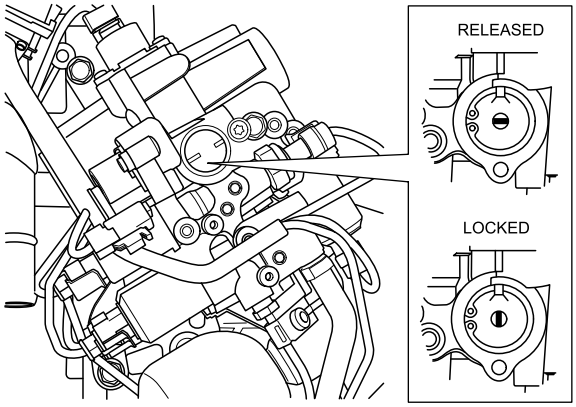
☞**Electronic Mechanical Automatic Transmission Wire Harness Remove**

Refit

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

Caution: *Make sure that the gasket at the connected point between the hydraulic kit control assembly and the transmission is complete before fitting the hydraulic kit control assembly. in order to prevent the entering of dust or water due to incomplete gasket, which can cause damage of the shift piston.*

1. Position the hydraulic kit control assembly to the transmission.
2. Push the shift piston to the bottom and rotate it by 90 degrees to 'LOCKED' position using a straight screwdriver, making the mechanism being connected.



3. Fit 6 bolts fixing the hydraulic kit control assembly to the transmission, and tighten to **22–28Nm**.
4. Cover the shift actuator sealing cap and tighten the screw to **5.8–6.2Nm**.
5. Connect the clutch actuator cable to the release rocker arm.
6. Fit the transmission wire harness.

☞**Electronic Mechanical Automatic Transmission Wire Harness Refit**

7. Fit the battery tray.

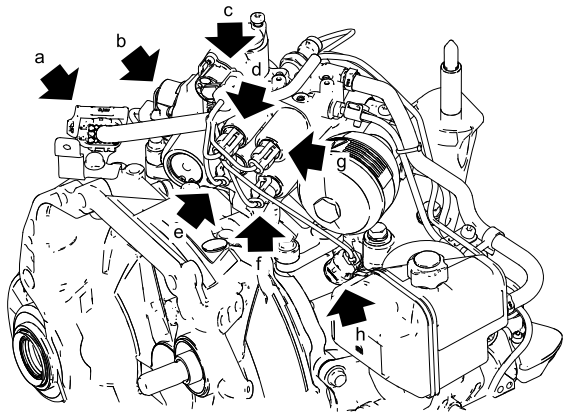
☞**Battery Tray Refit**

8. Complete the clutch kiss point and gear grid self-learning by using a authorized diagnostic tool.

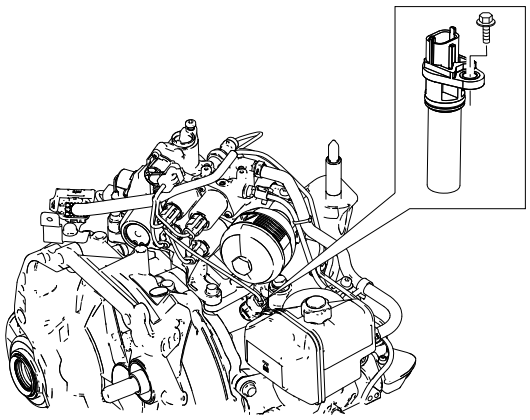
Clutch speed sensor

Remove

1. Disconnect the battery earth lead.
2. Disconnect the connector of the clutch speed sensor (h).



3. Release one bolt fixing the sensor to the transmission and remove the sensor.



Refit

1. Fix the sensor to the bolt on the transmssion and tighten to **6–10Nm**.
2. Connect the connector of the clutch speed sensor.
3. Connect the battery earth lead.

Oil Pressure Sensor

Remove

Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

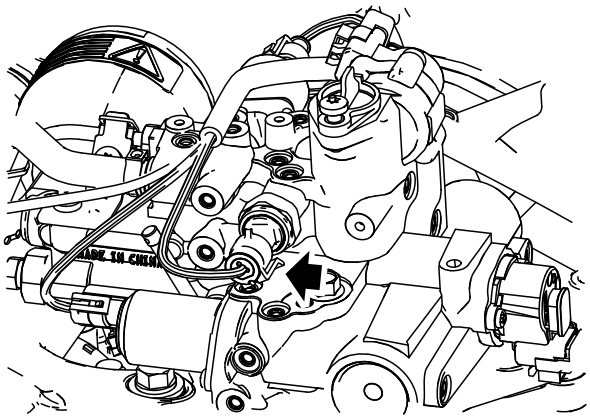
Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

Caution: *Cleaning with gasoline and other liquids is prohibited.*

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect oil pressure sensor connector.



3. Remove oil pressure sensor.

Refit

1. Check the oil pressure sensor O-ring, ensure the O-ring is intact.
2. Fit and tighten oil pressure sensor to **15–16.5Nm**.
3. Connect oil pressure sensor connector.
4. Fit the battery tray.

☞**Battery Tray Refit**

5. When there is pressure in the accumulator, the liquid level must be close to the 'MIN' mark. Check the fluid level of oil reservoir, and if necessary, add hydraulic oil.

☞**Check and Addition of Hydraulic Oil**

6. Use the authorized diagnostic tool to conduct the gear grid self-learning and the clutch purge.
7. After the self-learning is completed, oil pot liquid level should be close to the 'MIN' mark.
8. Perform several shifts, observe oil pressure change with the authorized diagnostic tool, and make sure the sensor is functioning properly.

Shift Position Sensor

Remove

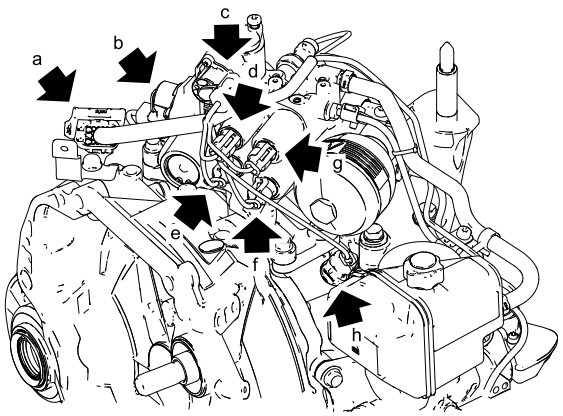
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

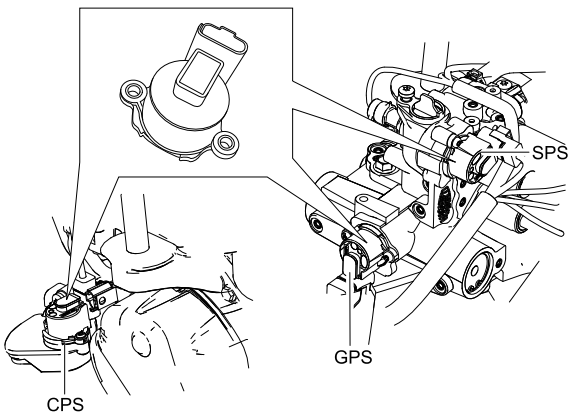
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect the shift position sensor SPS connector (c).



3. Loosen the 2 screws fixing sensor, remove the sensor.



Refit

1. Align the marking surface of the selector position sensor with the marking surface of the mounting flat axis, after fitting the selector position sensor, turn the sensor clockwise along the flat axis until it aligns with the refit hole.
2. Fit and tighten the set bolt to **3.6–4.2Nm**.
3. Connecting sensor connector.
4. Fit the battery tray.

☞**Battery Tray Refit**

5. When pressure exists in the accumulator, the fluid level must be close to the 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞**Hydraulic Fluid Inspection and Adding**

6. Perform the gearbox grid self learning with a authorized diagnostic tool.
7. After the completion of the self learning, the fluid level in the reservoir shall be close to the 'MIN' mark.

Gear Position Sensor

Remove

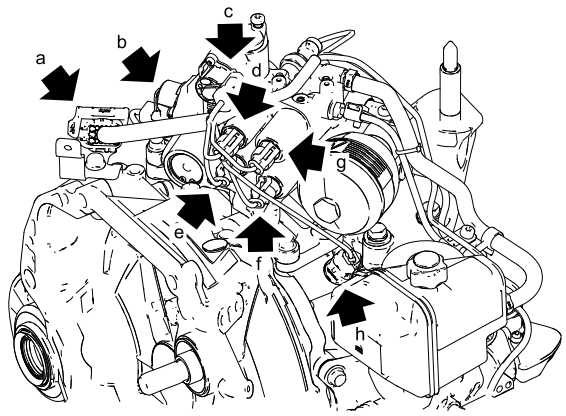
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

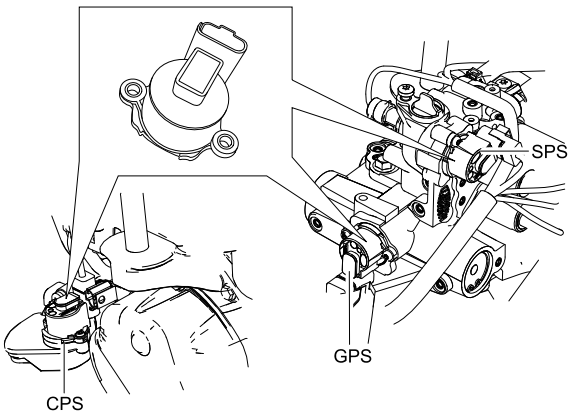
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect the connector GPS (b) of the selector position sensor.



3. Unfasten the set bolt of the sensor, and remove the sensor.



Refit

1. Align the marking surface of the shift position sensor with the marking surface of the mounting flat axis, after fitting the shift position sensor, turn the sensor clockwise along the flat axis until it aligns with the refit hole.
2. Fit and tighten the set bolt to **3.6–4.2Nm**.
3. Connecting the sensor connector.
4. Fit battery tray.

☞**Battery Tray Refit**

5. When pressure exists in the accumulator, the fluid level must be close to the lowest 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞**Hydraulic Fluid Inspection and Adding**

6. Perform the gear grid self-learning with authorized diagnostic tool.
7. After the completion of the self-study, the fluid level in the fluid reservoir shall be close to the lowest 'MIN' mark.

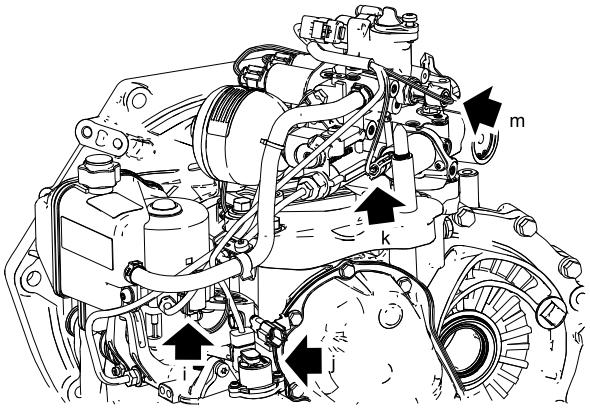
Clutch Position Sensor

Remove

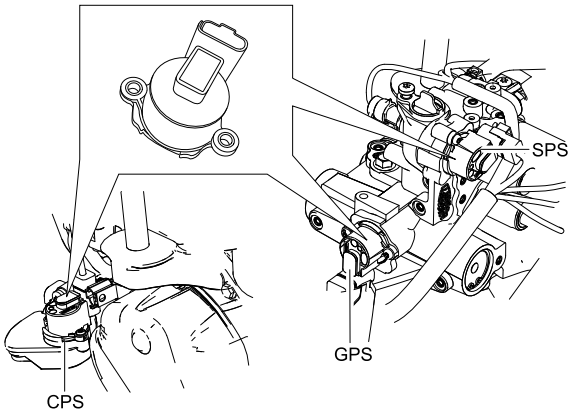
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

1. Raise the vehicle on a lift.
2. Disconnect the clutch position sensor connector CPS (j).



3. Loosen the clamping screws of the sensor, remove the sensor.



Refit

1. Ensure that the clutch position sensor seal washer is located in the sensor retainer.
2. Align the marked side of the clutch position sensor with that of the refit flat shaft, and after fitting the clutch position sensor, turn the sensor along the flat shaft clockwise until the mounting holes are aligned.
3. Fit and tighten the clamping screws to **1.8–2.2Nm**.
4. Connect sensor connector.
5. When there is pressure in the accumulator, the liquid level must be close to the minimum 'MIN' mark. Check the fluid level of oil reservoir, and if necessary, add hydraulic fluid.

☞**Check and Addition of Hydraulic Oil**

6. Perform clutch kiss point self learning with an authorized diagnostic tool.
7. After the self-learning is completed, oil reservoir liquid level should be close to the 'MIN' mark.
8. Lower the vehicle.

Accumulator

Remove

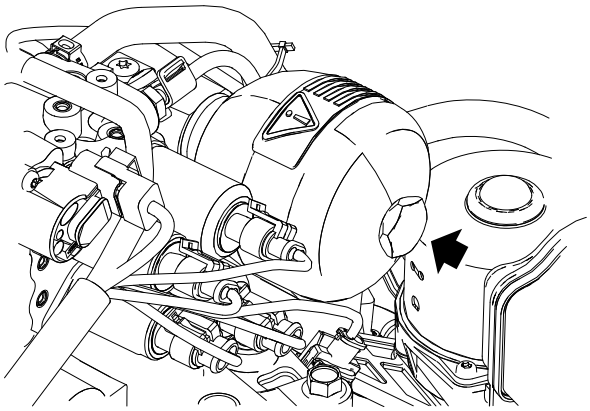
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Use the diagnostic tool to relieve accumulator pressure.
3. Drain the hydraulic oil in electro-hydraulic unit.
4. Remove accumulator.



Refit

1. Remove the bolt plug at the oil inlet and outlet of accumulator.
2. Check whether the accumulator seal ring is intact.
3. Fit and tighten the accumulator to **90–99Nm**.
4. Fit the battery tray.

☞**Battery Tray Refit**

5. When there is pressure in the accumulator, the liquid level must be close to the minimum 'MIN' mark. Check the fluid level of oil reservoir, add hydraulic fluid if necessary.

☞**Check and Addition of Hydraulic Oil**

6. Perform clutch purge and gearbox grid self learning with an authorized diagnostic tool.
7. After the self-learning is completed, fluid level should be close to the 'MIN' mark.

High Pressure Oil Tube

Remove

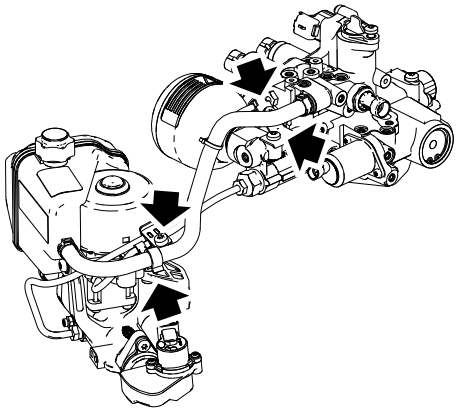
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

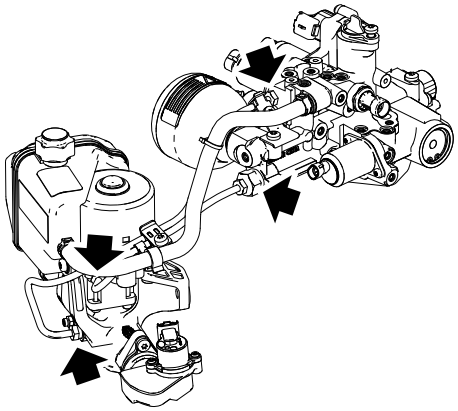
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Release the straps fixing the low-pressure hoses and clutch actuator high-pressure pipes.
3. Release the snap fit of the low-pressure hoses and high-pressure pipes, release the screws on clips at both ends of high-pressure pipes, to release the clips.



4. Loosen the nuts at both ends of high-pressure pipes.



5. Remove the high-pressure pipes.

Refit

1. Fit high pressure pipes and tighten the nuts at both ends to **14–15Nm**.
2. Fix the high-pressure pipes with clips and tighten the clip screws to **9–11Nm**.
3. Bind the low-pressure hoses and clutch actuator high-pressure pipes with straps.

4. Fit the battery tray.

☞Battery Tray Refit

5. When there is pressure in the accumulator, the liquid level must be close to the 'MIN' mark. Check the fluid level of reservoir, and if necessary, add hydraulic fluid.

☞Check and Addition of Hydraulic Oil

6. Use the authorized diagnostic tool to conduct the self-learning.
7. After the self-learning is completed, reservoir fluid level should be close to the 'MIN' mark.

Low-pressure Oil Pipe

Remove

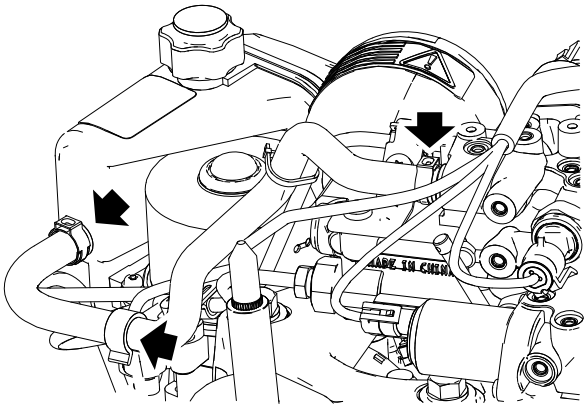
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

1. Remove the battery tray.

☞Battery Tray Remove

2. Disconnect the clamps at the two ends of the low-pressure oil pipe and release the buckle on the fixed pipe line.



3. Remove the low-pressure oil pipe.

Refit

1. Position the two ends of the low-pressure hose to the fluid reservoir and valve and fix them with clamps.
2. Position the clamp clips to the low-pressure hose.
3. Fit the battery tray.

☞Battery Tray Refit

4. When pressure exists in the accumulator, the fluid level must be close to the 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞Hydraulic Fluid Inspection and Adding

5. Perform the self-learning with an authorized diagnostic tool.
6. After the completion of the self-learning, the fluid level in the reservoir shall be close to the 'MIN' mark.

Fluid Reservoir

Remove

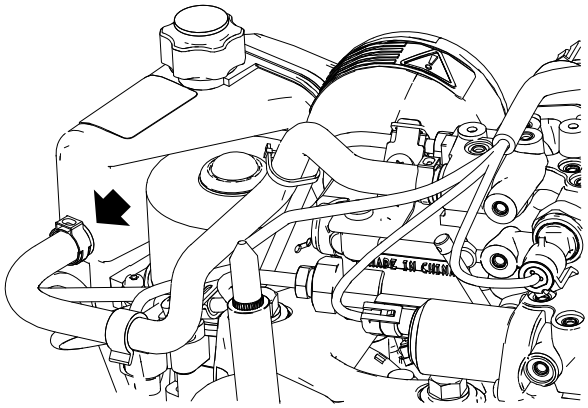
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

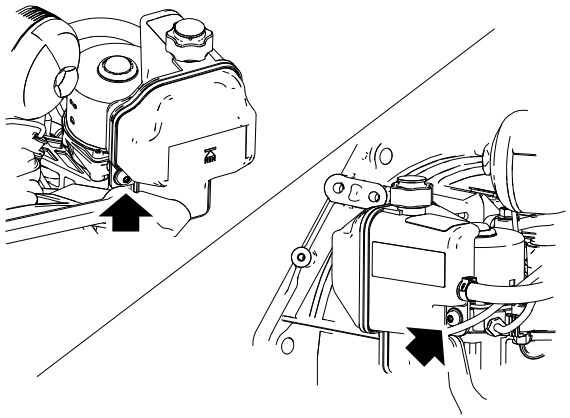
1. Removing the battery tray.

☞**Battery Tray Remove**

2. Remove the cover of the fluid reservoir and drain the hydraulic fluid in the reservoir.
3. Disconnect the low-pressure oil pipe to the fluid reservoir end.



4. Release 2 screws securing the fluid reservoir and remove the fluid reservoir.



5. Check whether the O-ring seal at the outlet of the fluid reservoir is in the oil pump's connector, if it is in the connector, please take it out.

Refit

1. Check whether the O-ring seal at the outlet of the fluid reservoir is intact or not.
2. Position the fluid reservoir, fit and tighten the bolts to **10Nm**.
3. Connect the low-pressure oil pipe to the fluid reservoir and secure it with a clamp.
4. Fit the battery tray.

☞**Battery Tray Refit**

5. When pressure exists in the accumulator, the fluid level must be close to the 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞**Hydraulic Fluid Inspection and Adding**

6. Perform the clutch purge self-learning with an authorized diagnostic tool.
7. After the completion of the self-learning, the fluid level in the reservoir shall be close to the 'MIN' mark.

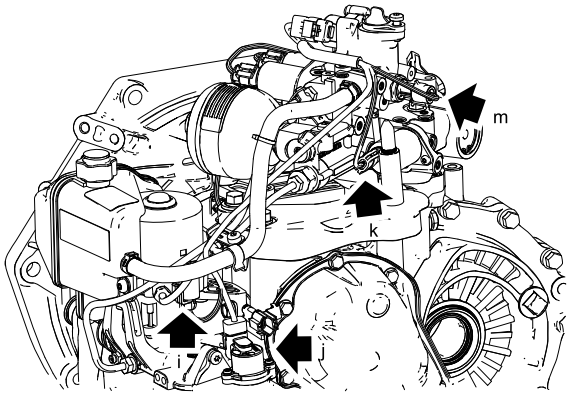
Electric Pump Assembly

Remove

Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

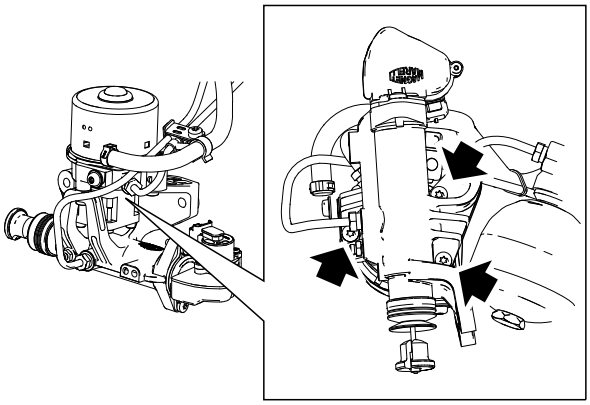
1. Disconnect the connector of the electric pump assembly (i).



2. Remove the fluid reservoir.

☞**Fluid Reservoir Remove**

3. Disconnect the high-pressure pipe to the electric pump.
4. Loosen 3 screws securing the electric pump assembly.



5. Move the electric pump assembly and remove it.

Refit

1. Fit the electric pump and screw three bolts to **9–11Nm**.
2. Connect the high-pressure pipe to the electric pump and tighten it to **14–15Nm**.
3. Connect the connector of the electric pump assembly.
4. Fit the fluid reservoir.

☞**Fluid Reservoir Refit**

5. When pressure exists in the accumulator, the fluid level must be close to the 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞**Hydraulic Fluid Inspection and Adding**

6. Perform the clutch purge self-learning with an authorized diagnostic tool.
7. After the completion of the self-learning, the fluid level in the reservoir shall be close to the 'MIN' mark.

Solenoid Valve

Remove

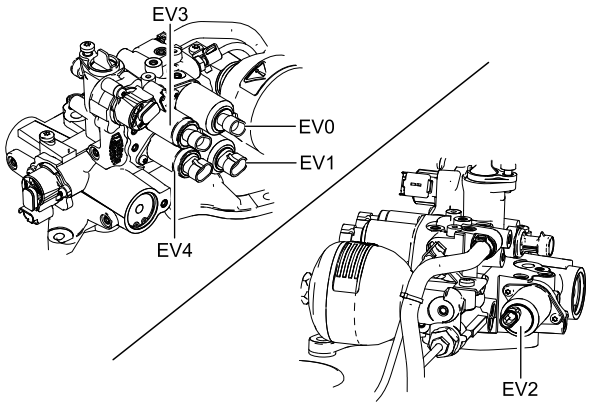
Caution: Care must taken to ensure that accumulator depressurization by diagnostic tool before servicing electron hydraulic kit.

Caution: To avoid contamination, clean electron hydraulic kit and accessory parts during servicing electron hydraulic kit.

1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect the connector of the corresponding solenoid valve and mark it.



3. During the remove process, the collision between the solenoid valve and valve shall be avoided, the cleanness of the operating environment shall be maintained, without any filth residing on the solenoid valve rod. Release the two bolts securing the solenoid valves, and remove the corresponding valves.

Refit

1. During the refit process, the collision between the solenoid valve and valve shall be avoided as much as possible, the cleanness of the operating environment during the entire process shall be maintained, without any filth residing on the solenoid valve rod, and the O-ring seal shall be ensured to be intact.
2. Fit the corresponding solenoid valve and screw the set bolts to **3–4.2Nm**.
3. Note the orders between the solenoid valve and wire connectors, and connect the corresponding solenoid valve connectors.
4. Fit the battery tray.

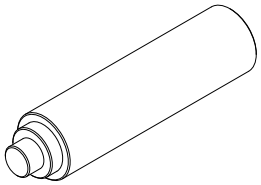
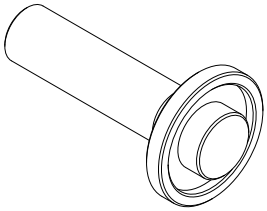
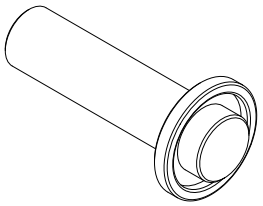
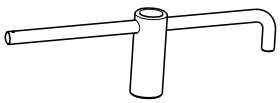
☞**Battery Tray Refit**

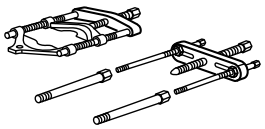
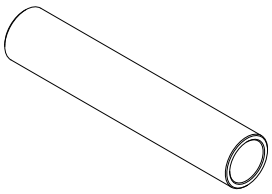
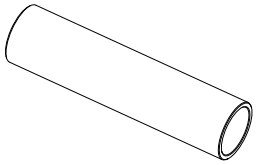
5. When pressure exists in the accumulator, the fluid level must be close to the 'MIN' mark. Check the fluid level in the reservoir, and add hydraulic fluid if necessary.

☞**Hydraulic Fluid Inspection and Adding**

6. Perform clutch kiss point and gearbox grid self learning with an authorized diagnostic tool.
7. After the completion of the self-learning, the fluid level in the reservoir shall be close to the 'MIN' mark.

Special Tools

Tool Number	Description	Picture
TPT00066	Replacer, oil seal, input shaft and control cover	
T24026	Replacer, Ø5 spring pin	T24026
TPT00064	Replacer, LH oil seal, differential	
TPT00069	Replacer, RH oil seal, differential	
TPT00068	Locking plate, input shaft	

Tool Number	Description	Picture
T32001	Puller universal	 T32001
TPT00065	Replacer, input and output shaft bearing	
TPT00067	Replacer, differential bearing	

Transmission-MT

Specifications

Torque

Description	Value
Bolt - transmission mounting bracket to transmission	55–65Nm
Bolt - gearbox to engine	75–90Nm
Nut - transmission bracket to transmission mounting	90–110Nm
Bolt - tie bar lower to transmission	55–65Nm
Bolt - tie bar lower to tie bar lower bracket	90–110Nm
Bolt - slave cylinder bracket to rear housing	40–50Nm
Bolt - battery earth lead	15–20Nm
Reverse lock shaft	15–22Nm
Bolt - control cover to rear housing	15–25Nm
Bolt - gear selector lever to control cover	15–25Nm
Drain plug	25–35Nm
Filler plug	25–35Nm
Switch - reverse light	12–18Nm
Self-locking bolt	15–20Nm
Bolt - reverse gear lever to front housing	22–28Nm
Bolt - front housing to rear housing	22–28Nm
Bolt - selector and shift cable support bracket to front housing	22–28Nm
Bolt - reverse idler shaft to rear housing	15–22Nm
Bolt - rear bearing baffle to rear housing	10–15Nm
Nut - output shaft	80–100Nm
Screw plug - 5th gear selector fork	5–8Nm
Bolt - rear cover to rear housing	8–13Nm
Bolt - final drive gear to differential housing	90–110Nm

Parameter

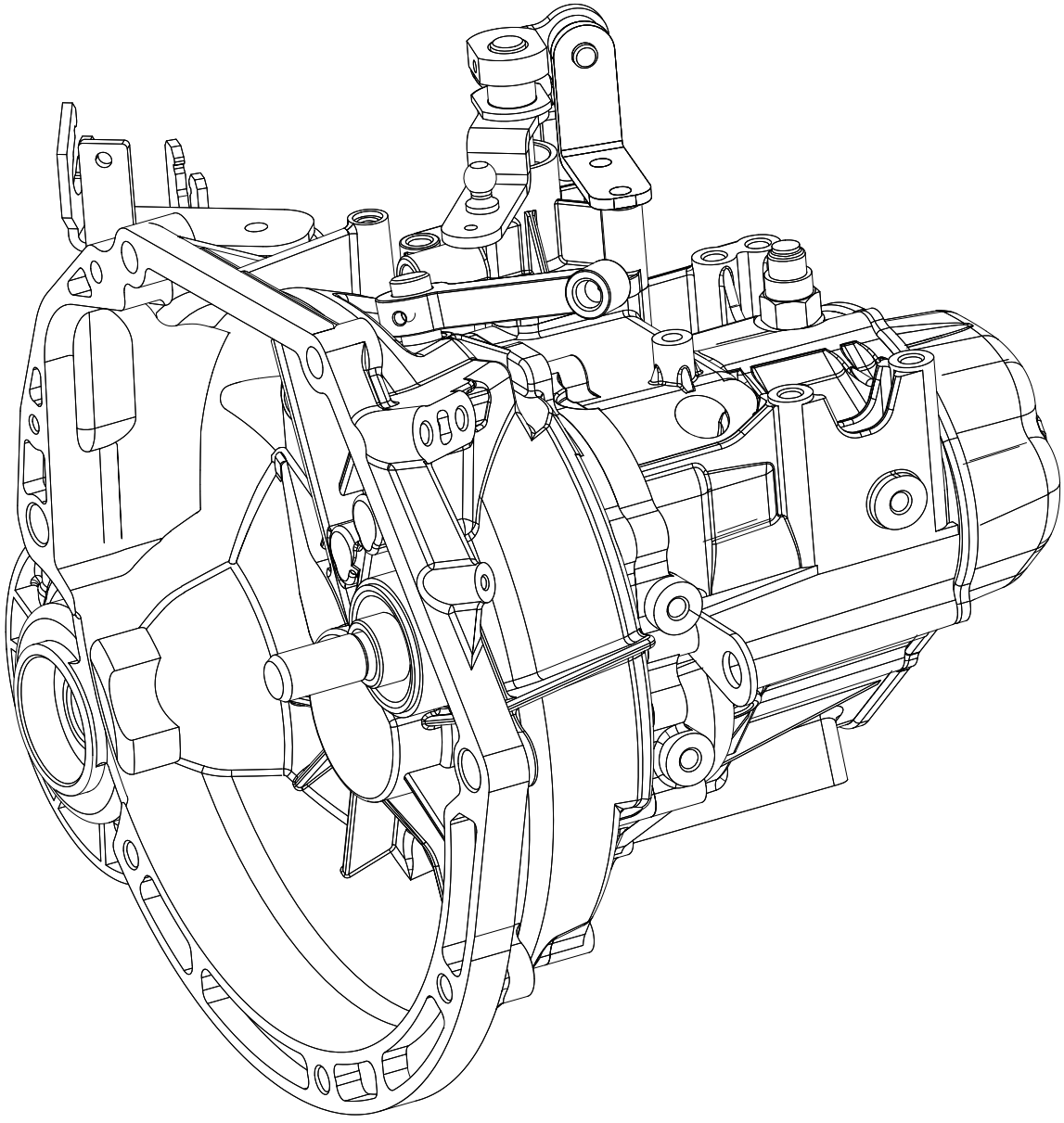
Model	MT (1.3L) MT (1.5L)
Gear Position	Five forward gears (meshed by synchronizer), and one reverse gear
Speed Ratio-MT (1.3L):	
· 1st Gear	3.462
· 2nd Gear	1.862
· 3rd Gear	1.242
· 4th Gear	0.973
· 5th Gear	0.756
· Reverse Gear	3.455
· Main Speed Reduction	3.737
Speed Ratio-MT (1.5L):	
· 1st Gear	3.462
· 2nd Gear	1.952
· 3rd Gear	1.323
· 4th Gear	0.973
· 5th Gear	0.795
· Reverse Gear	3.455
· Main Speed Reduction	4.118
Transmission Center Distance	63mm
Maximum Input Torque Permitted	
· MT (1.3L)	120Nm
· MT (1.5L)	135Nm
Maximum Input Speed	6000r/min
Weight (without oil)	30.6kg
Lubricant	MTF 94
Standard Oil Capacity of Transmission:	
· Drain and Refill	1.8L
· Dry Fill	2.0L
Maximum Overall Dimension of the Transmission:	
· Length	342mm
· Width	488mm
· Height	391mm
Grease:	
· Clutch Rocker Arm Bushing Bore	Lithium Grease

· Joint Surface Between Separation Bearing Hole and Fork	Lithium Grease
· Inner and Outer Surfaces of Gear Selection Nylon Shifting Block	Lithium Grease
Mating Face Sealant:	
· Connecting Surface of Front and Rear Housings.	Kesanxin 1596F
· Rear Cover Panel - Rear Housing	Kesanxin 1596F
·Control Cover - Rear Housing	Kesanxin 1596F
Thread Sealant:	
· Reverse Gear Idler Shaft Bolts - Rear Housing	Kesanxin 1243C
· Self-locking Bolt - Front Housing	Kesanxin 1243C
· Gear Shift Limit Bolt - Rear Housing	Kesanxin 1243C
· Four Reverse Bolts of the Front Housing	Kesanxin 1243C
Non-reusable Part:	Clutch Rocker Arm Bushing Input Shaft Oil Seal Differential Oil Seal Input Shaft Rear Bearing Adjusting Shim Retaining Ring Ø29 Shaft Retaining Ring Ø18.5 Output Shaft Rear Bearing Adjusting Shim Retaining Ring Ø32 Output Shaft Lock Nut Differential Rear Bearing Adjusting Shim Spring Pin Pin Ø5×28 Pin Ø3×22 Pin Ø5×22 Gear Selection/Shift Shaft Oil Seal Gear Selection/Shift Shaft Bearing

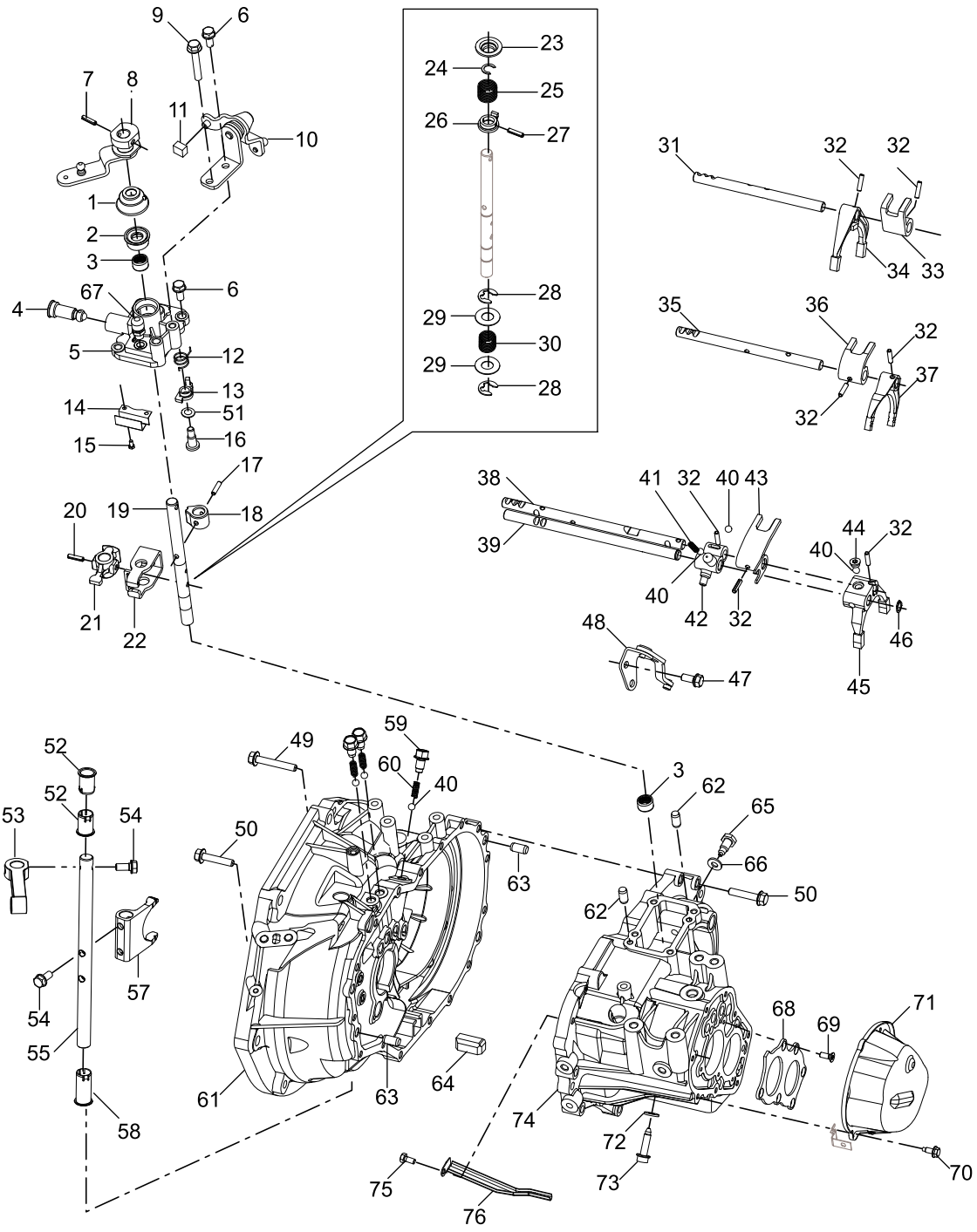
Description and Operation

System Layout Chart

Transmission Assembly Layout Chart



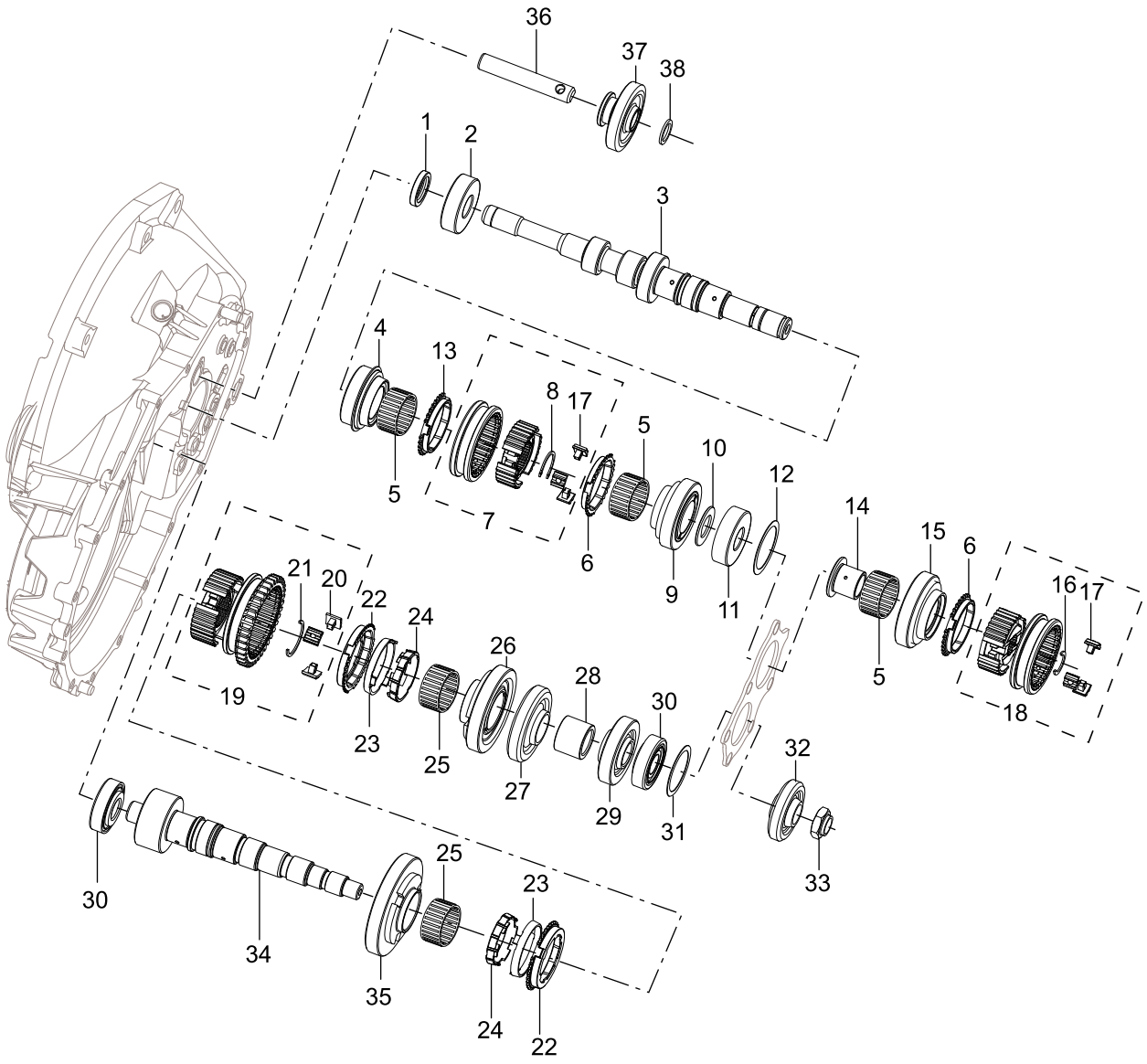
Transmission Control and Housing Decomposition Chart



1. Dust Cover - Gear Selection/Shift Shaft
2. Oil Seal - Gear Selection/Shift Shaft
3. Bearing - Gear Selection/Shift Shaft
4. Gear Selection/Shift Rocker Arm Positioning Socket
5. Control Cover
6. Bolt M8×25
7. Pin Ø5×28
8. Gear Shift Rocker Arm
9. Bolt M8×50
10. Gear Selection Rocker Arm
11. Nylon Block
12. Reverse Gear Limit Torsion Spring
13. Reverse Gear Lock
14. Oil-baffling Plate
15. Bolt - Oil-baffling Plate
16. Reverse Gear Lock Shaft

17. Pin Ø5×22
18. Gear Shift Positioning Cam
19. Gear Selection/Shift Shaft
20. Combination of Spring Pin
21. Shifting Block for Gear Selection/Shift
22. Shift Chain Guard
23. 5th/Reverse Gear Selection Limit Spring Pad
24. 5th/Reverse Gear Selection Limit Retainer
25. 5th/Reverse Gear Selection Return Spring
26. 5th/Reverse Gear Selection Return Spring Pad
27. Pin Ø3×22
28. Retainer
29. 1st/2nd Gear Selection Return Spring Pad
30. 1st/2nd Gear Selection Return Spring
31. 1st/2nd Gear Shift Shaft
32. Spring Pin
33. 1st/2nd Gear Shifting Block
34. 1st/2nd Gear Fork
35. 3rd/4th Gear Shift Shaft
36. 3rd/4th Gear Shifting Block
37. 3rd/4th Gear Fork
38. 5th Gear Shift Shaft
39. Reverse Gear Shift Shaft
40. Balls
41. Locking Spring - Reverse Gear Shifting Pin
42. Reverse Gear Shifting Pin
43. Reverse Gear Shifting Block
44. 5th Gear Fork Plug
45. 5th Gear Fork
46. Fixed Retainer
47. Bolt - Reverse Gear Rocker Arm Package
48. Reverse Gear Rocker Arm Package
49. Bolt - Housing Connecting Bolt
50. Bolt - Housing Connecting Bolt
51. Shim Ø10 - Reverse Gear Lock Shaft
52. Clutch Rocker Arm Bushing
53. Clutch Separating Rocker Arm
54. Bolt - Separating Fork and Rocker Arm
55. Clutch Separating Rocker Arm Shaft
56. N/A
57. Clutch Separating Fork
58. Clutch Rocker Arm Bushing
59. Self-locking Bolt
60. Self-locking Spring
61. Front Housing
62. Positioning Pin - Rear Housing
63. Positioning Pin - Front Housing
64. Magnetic Steel
65. Gear Shift Limit Bolt
66. Shim - Gear Shift Limit Bolt
67. Vent Plug Assembly
68. Rear Bearing Guard
69. Screw - Rear Bearing Guard
70. Bolt - Rear Cover Panel
71. Rear Cover Panel
72. Aluminum Washers
73. Bolt - Reverse Idler Gear Shaft
74. Rear Housing
75. Bolt - Oil Lead Tank
76. Oil Lead Tank

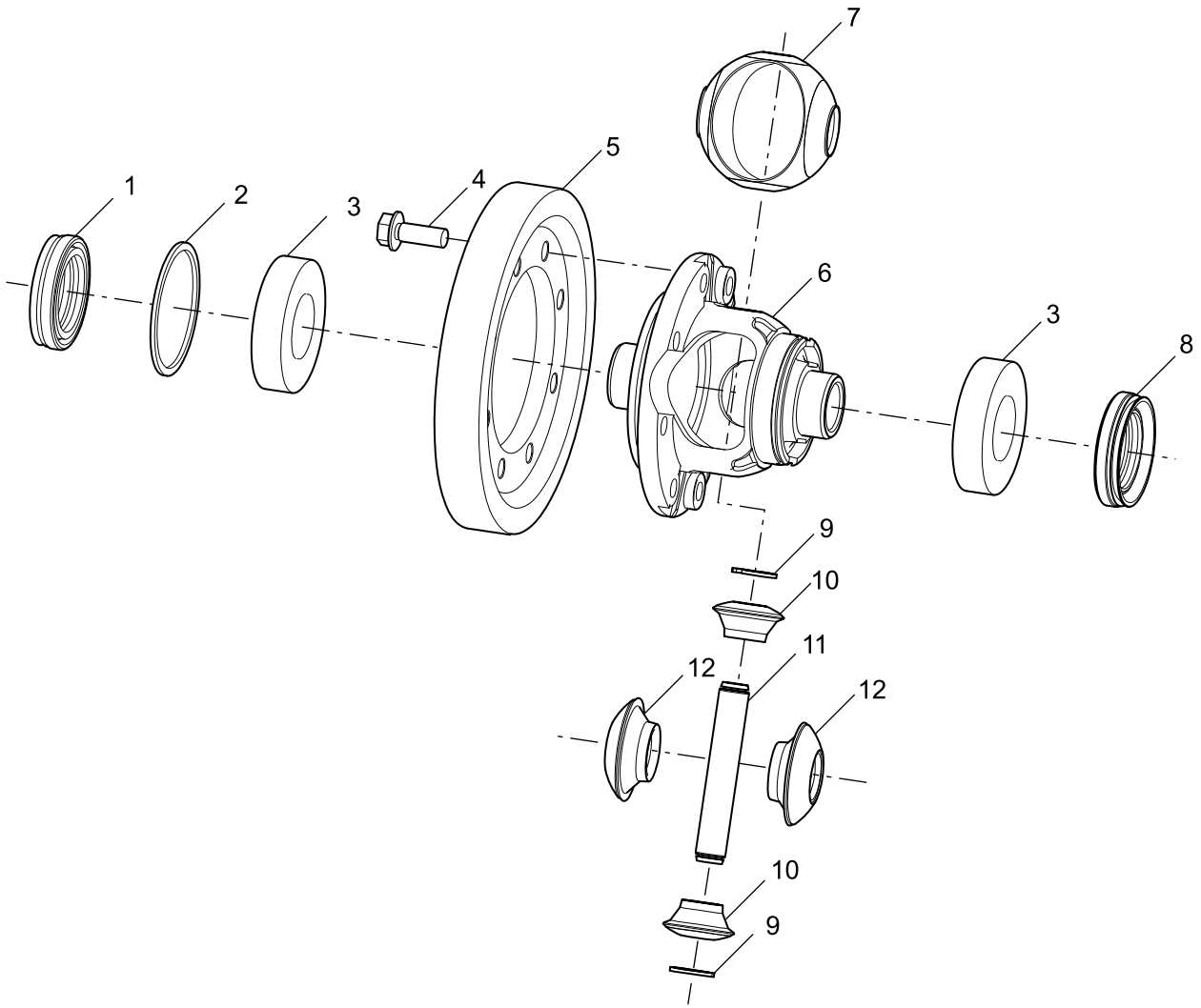
Gear Drive Mechanism Decomposition Chart



1. Drive Shaft Oil Seal
2. Drive Shaft Front Bearing
3. Drive Shaft
4. Drive 3rd Gear Assembly
5. 3rd/4th/5th Gear Needle Bearing
6. 4th/5th Gear Synchronizer Ring Gear
7. 3rd/4th Gear Synchronizer Assembly
8. Retaining Ring Ø29
9. Drive 4th Gear Assembly
10. 4th Gear Spacer
11. Drive Shaft Rear Bearing
12. Adjusting Shim - Drive Shaft Rear Bearing
13. 3rd Gear Synchronizer Ring Gear
14. 5th Gear Bushing
15. Drive 5th Gear Assembly
16. Shaft Retaining Ring Ø18.5

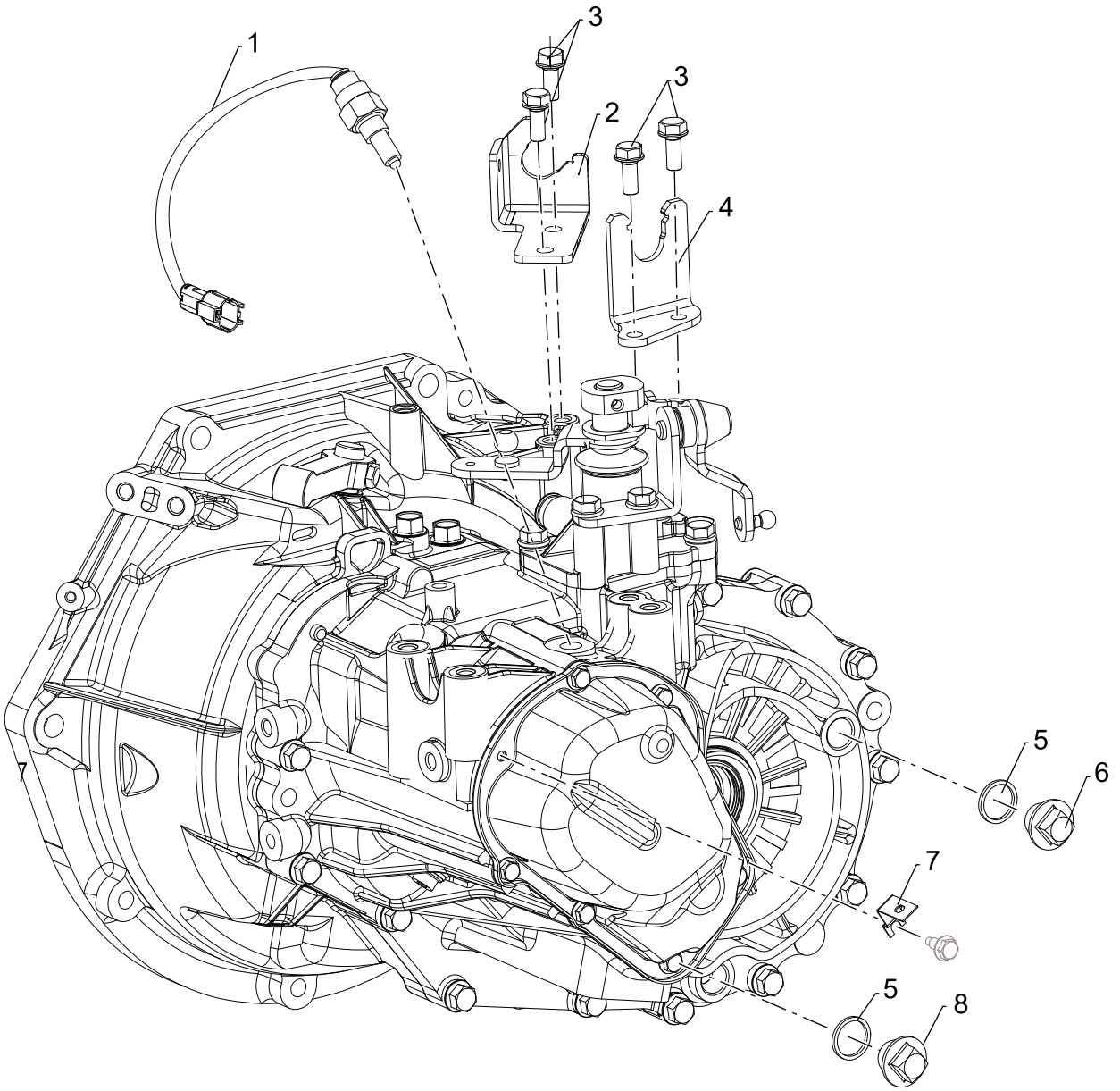
17. 4th/5th Gear Synchronizer Slider
18. 5th Gear Synchronizer Assembly
19. 1st/2nd Gear Synchronizer Assembly
20. 1st/2nd Gear Synchronizer Slider Assembly
21. Retaining Ring Ø32
22. 1st/2nd Gear Synchronizer Outer Cone Ring
23. 1st/2nd Gear Synchronizer Mid Ring
24. 1st/2nd Gear Synchronizer Inner Cone Rings
25. 1st/2nd Driven Gear Needle Bearing
26. Driven 2nd Gear
27. Driven 3rd Gear
28. 3rd/4th Gear Spacer
29. Driven 4th Gear
30. Output Shaft Bearing
31. Adjusting Shim - Output Shaft Rear Bearing
32. Driven 5th Gear
33. Nut - Driven Shaft Lock
34. Driven Shaft
35. Driven 1st Gear
36. Reverse Idler Gear Shaft
37. Reverse Idler Gear Shaft Assembly
38. Nylon Washers - Reverse Idler Gear

Differential Assembly Decomposition Chart



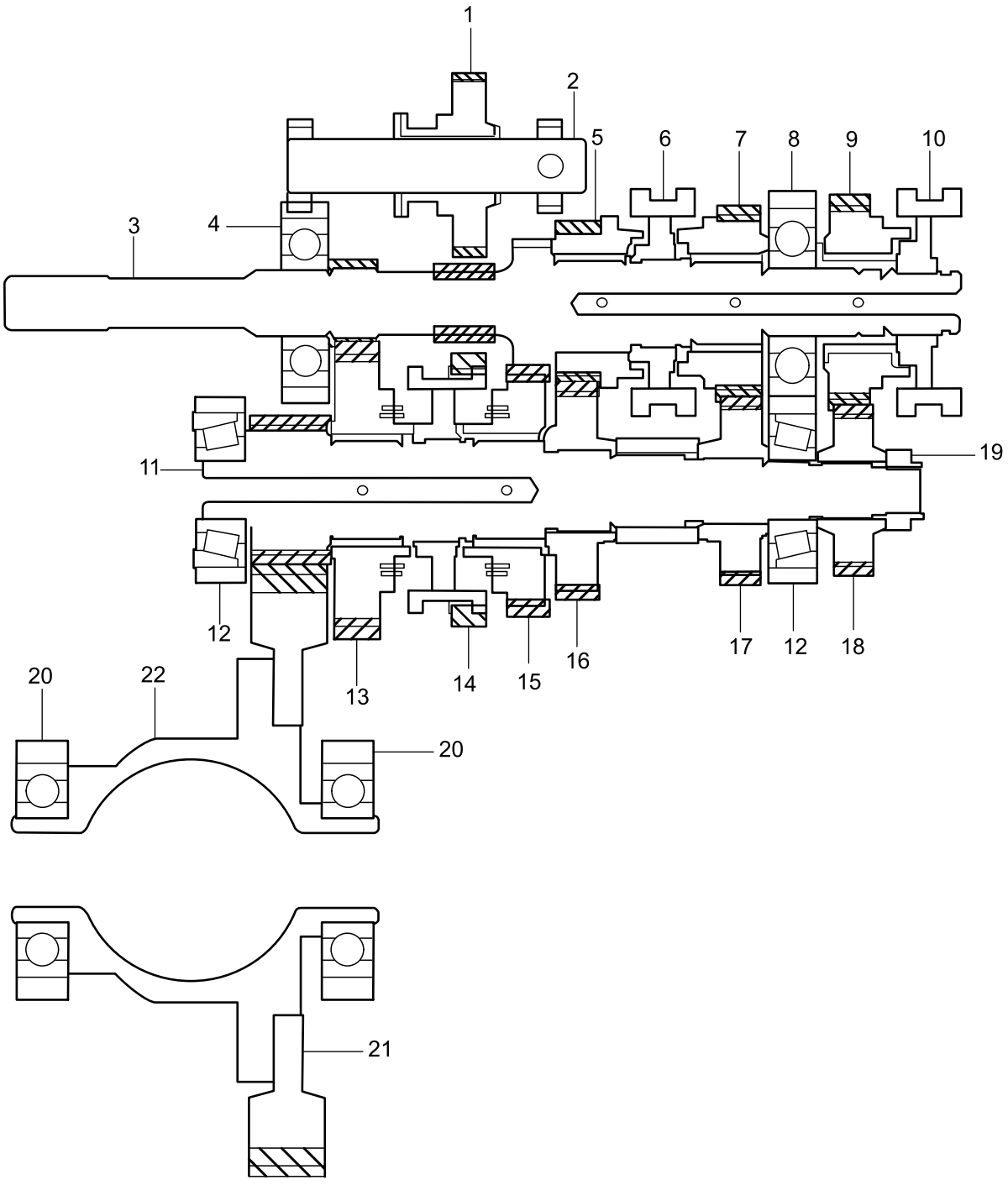
1. Oil Seal - Left Differential
2. Differential Rear Bearing Adjusting Shim
3. Differential Bearing
4. Bolt - Differential Housing to Final Drive Gear
5. Final Drive Gear
6. Differential Housing
7. Differential Washer
8. Oil Seal - Right Differential
9. Retainer
10. Planetary Gear
11. Planetary Gear Shaft
12. Side Gear

Transmission Accessory Layout Chart



1. Reverse Light Switch Assembly
2. Gear Shift Cable Bracket
3. Bolt - Gear Selection/Shift Cable Bracket
4. Gear Selection Cable Bracket
5. Shim - Oil Plug
6. Refill Plug
7. Clip - Reverse Lamp Harness
8. Drain Plug

Transmission Cutaway View



1. Reverse Idler Gear
2. Reverse Idler Gear Shaft
3. Drive Shaft
4. Drive Shaft Front Bearing
5. Drive 3rd Gear
6. 3rd/4th Gear Synchronizer Assembly
7. Drive 4th Gear
8. Drive Shaft Rear Bearing
9. Drive 5th Gear
10. 5th Gear Synchronizer Assembly
11. Driven Shaft
12. Driven Shaft Front Bearing
13. Driven 1st Gear
14. 1st/2nd Gear Synchronizer Assembly and Driven Reverse Gear
15. Driven 2nd Gear
16. Driven 3rd Gear

17. Driven 4th Gear
18. Driven Shaft Rear Bearing
19. Driven Shaft Lock Nut
20. Differential Bearing
21. Main Speed Reduction Driven Gear
22. Driven 5th Gear

Description

General Description

Where specified, a 5-speed manual transmission is fitted.

The selector lever, fitted within the passenger compartment in the centre console, gives the driver a choice of six positions, 1st, 2nd, 3rd, 4th, 5th and reverse.

The drive shafts fit into the differential assembly on the rear of the unit and transmit the drive to the road wheels.

The transmission housing is of cast aluminium construction and bolts to the LH side of the cylinder block. It features bearing supports for the input and output shafts.

The transmission housing is fitted with a filler plug located on the lower front face of the casing and a drain plug sealed with an aluminium washer located on the lower rear face of the unit.

The transmission is filled with oil which splash lubricates the internal components.

A breather plug is fitted to the rear of the selector housing.

Pressed steel closure plates seal the openings between the transmission housing and the cylinder block.

Shift and Selector

Gear selection is performed using a selector lever mounted in the centre console within the passenger compartment.

Two cables connect to the base of the selector lever, a fore-aft cable and a cross gate cable.

These pass along the transmission tunnel and connect to the gear selector and shift levers mounted externally on the transmission housing using a rose joint type fitting secured with a screw.

The selector levers are connected to the selector forks within the transmission housing.

Reverse Lock and Switch

A reverse lock mechanism is fitted to prevent inadvertent shifting directly from 5th gear to reverse gear. A plunger type reverse light switch is fitted to the rear of the selector housing.

Differential

The differential is of conventional design with a differential housing bolted to the final drive gear.

The housing supports the differential pin, planetary and sun gears.

The differential assembly is supported in the transmission housing using taper roller bearings.

Operation

Transmission Components

The drive train changes the speed and direction of rotation of the drive by engaging different gears between the input and output shafts to produce five forward ratios and one reverse gear ratio.

All gears are in constant mesh with the exception of reverse gear.

When 1st gear is selected, the synchro sleeve pressures the synchromesh female cone into contact with a corresponding male cone in the gear chosen.

This synchronizes the speeds of the synchro hub and gear. The synchro sleeve then engages the gear by means of a synchro ring and teeth extensions on the synchro sleeve.

Detents in the selector shaft ensure that precise gear selection is made and ensures that the gear is held in engagement.

Torque is transmitted from the engine via the clutch to the input shaft. Torque is then transmitted through the selected gear to the output shaft pinion and final drive gear to the drive shafts.

The 2nd, 3rd, 4th and 5th gears operate as the 1st gear.

When reverse gear is selected, reverse gear (integrated with the drive shaft) is obtained by engaging reverse idler gear with the reverse gears changing the direction of rotation of the driven shaft.

Shift and Selector

When moving the selector lever to the 1st gear position, the selector lever operates the gear selector and shift lever through the cables.

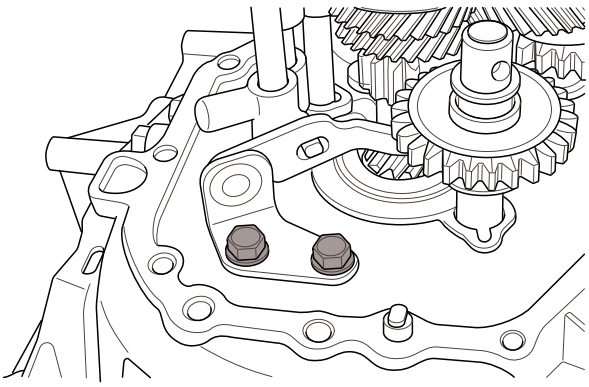
The gear selector lever engages the gear shift arm guide (attached to the gear shift and selector shaft) through the selector cable with the detent of 1st/2nd gears selector and disengages from the detent of 3rd/4th gears selector.

One end of the interlock assembly blocks the detents of the 3rd/4th and 5th/reverse gears selector, but the other end is disengaged from the detent of the 1st/2nd gears selector.

The gear shift lever rotates the gear shift arm guide (attached to the gear shift and selector shaft) through the cross gate cable.

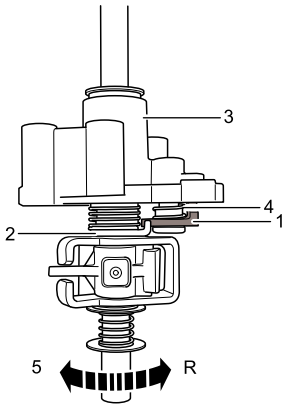
The gear shift arm guide turns the 1st/2nd gears selector engaged with the 1st/2nd gear synchronizer to realize the 1st gear's shift and selector.

The other gears are selected in the same way as 1st gear.



When the selector lever is moved to the reverse gear, one end of the shifting block of the gear selecting and shifting turns the reverse gear shifting block so as to make the reverse fork drive the reverse rocker assembly, and the sliding reverse idler gear engages with the driving shaft reverse gear and the driven shaft reverse gear respectively (the driven shaft reverse gear is integrated on the 1st/2nd gear synchronizer assembly) so as to change the rotation direction of the driven shaft.

Reverse Lock



1. Reverse lock plate
2. 5th/reverse gear gear shifting return spring gasket
3. Operating pedestal housing
4. Reverse lock plate returnning spring

When the gear is shifted to the 5th gear, the 5th/reverse gear gear shifting return spring gasket will carry the reverse lock plate on the head to move upward, then the gear selecting and shifting shaft will rotate to the left side to be locked in the groove of the gearshift and positioning cam. When the gear is shifted into the reverse gear directly from the 5th gear, as the 5th/reverse gear gear shifting return spring gasket is limited by the operating pedestal housing at the reverse lock plate limiting position, shifting the gear to the revese gear is impossible. When shifting the gear to the reverse gear from the neutral position between the 5th gear position and the reverse gear position, the 5th/reverse gear gear shifting return

spring gasket will carry the reverse lock plate on the head to move upward together,then the gear selecting and shifting shaft will rotate to the right side to be locked in the groove of the gearshift and positioning cam.

Differential

The differential allows the road wheels to turn at different speeds whilst providing an equal amount of torque.

The integral gear on the output shaft meshes with the final drive gear on the differential assembly.

When the output shaft rotates, and the wheels are in the straight ahead position, torque is applied to the complete assembly, the planetary gear does not rotate.

Torque is transmitted to the road wheels through the drive shafts.

During cornering, the inner wheel travels a shorter distance at a lower speed.

This results in the planetary gear rotating about the outer wheel gear increasing the speed of that wheel.

Service Procedures

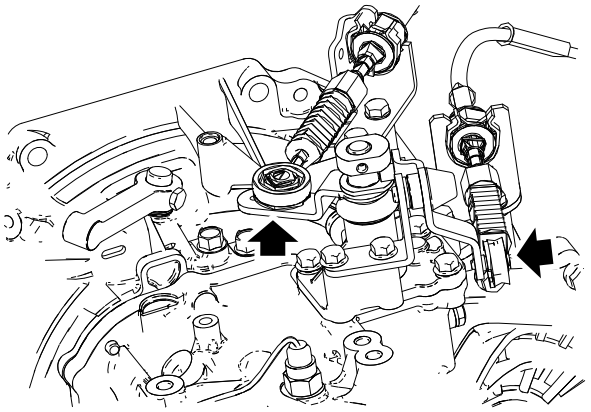
Manual Transmission Assembly

Remove

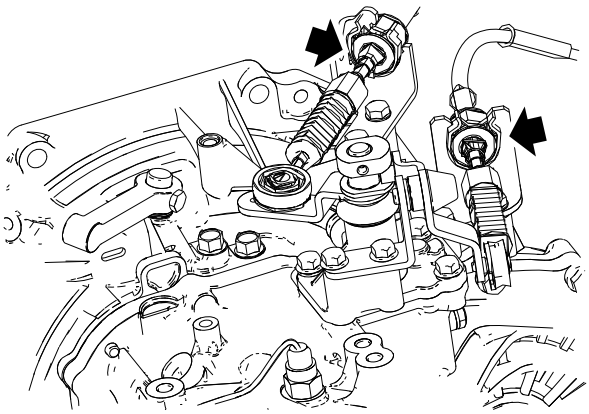
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Disconnect the reverse light switch connector.
3. Pay attention to the refit position and loosen two cable ball joints from the manual transmission gear selection/shift rocker arm.



4. Loosen the clamp fixing the gear selection/shift cable to the bracket.



5. Loosen the bolt for fixing the battery earth lead to the transmission housing.
6. Drain the transmission fluid.

☞**Transmission Fluid Draining**

7. Remove the drive shaft assembly.

☞**Left Drive Shaft Assembly Remove**

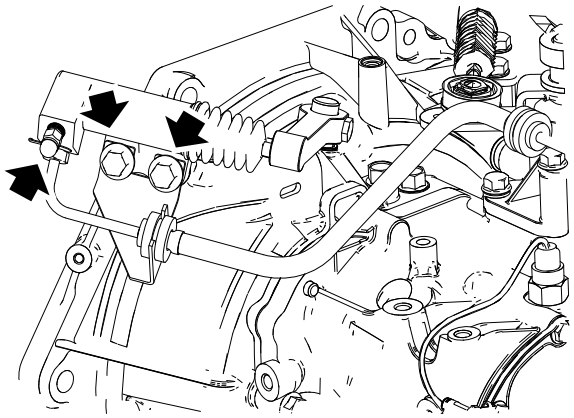
☞**Right Drive Shaft Assembly Remove**

8. Remove the starter motor.

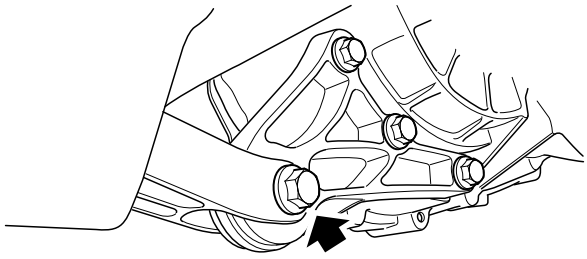
☞**Starter Motor Remove**

9. Release two bolts fixing the slave cluster cylinder to the manual transmission, then loosen and temporarily put the slave cluster cylinder well.

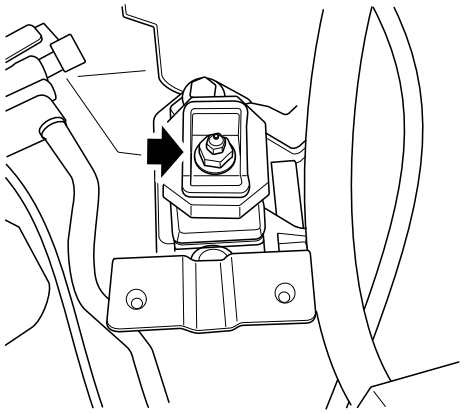
Caution: Don't hang the slave cylinder for a long time.



10. Support the engine with a spreader.
11. Support the transmission with a jack.
12. Remove the 7 connecting bolts which connect the engine and the transmission.
13. Release one bolt connecting lower tie bar and the lower tie bar refit bracket.



14. Remove the nut from transmission refit bracket to suspension.



15. Loosen the transmission from the engine, adjust the height of the jack and low the transmission slowly and carefully to the floor.
16. Loosen the three fixing bolts, and remove the transmission refit bracket.

17. Loosen the three fixing bolts, and remove the transmission lower tie bar refit bracket.

Refit

1. Clean the joint surface of the engine and the transmission.
2. Clean transmission positioning pins and holes.
3. Support the engine with a spreader.
4. Fit transmission Refit bracket to the transmission fixing bolt and tighten to **55–65Nm**.
5. The transmission remains fixed on the jack, then carefully adjust the jack and locate the transmission positioning pins.
6. Insert the transmission input shaft into the spline hole of the clutch driven plate.
7. Fit seven bolts for the connection of engine and transmission and respectively tighten to **75–90Nm**.
8. Fit the connecting nut from the suspension to the transmission refit bracket and tighten to **90–110Nm**.
9. Fit three connecting bolts from lower tie bar refit bracket to the transmission and tighten to **55–65Nm**.
10. Tighten one connecting bolt for connecting lower tie bar and the lower tie bar refit bracket to **90–110Nm**.
11. Locate slave cluster cylinder and tighten two slave cluster cylinder fixing bolts to **40–50Nm**.
12. Fix the clutch hard piping well.
13. Fit the starter motor.

☞**Starter Motor Refit.**

14. Locate the gear selection/shift cable to the cable bracket and fix it with clips.
15. Connect the gear selection/shift cable ball joint to the gear selection/shift rocker arm.
16. Check the transmission shifting operation.
17. Connect the reverse light switch connector.
18. Fit the bolt for fixing the battery earth lead to the transmission housing and tighten to **15–20Nm**.
19. Fit the drive shaft assembly.

☞**Left Drive Shaft Assembly Refit**

☞**Right Drive Shaft Assembly Refit**

20. Fill the transmission fluid.

☞**Transmission Fluid Filling**

21. Fit the battery tray.

☞**Battery Tray Refit**

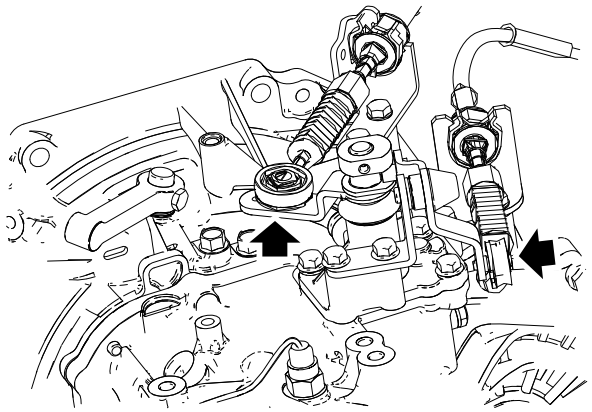
Gear selecting and shifting shaft oil seal - manual

Remove

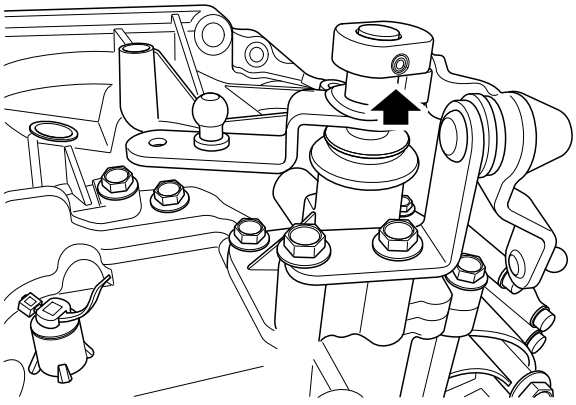
1. Remove the battery tray.

☞**Battery Tray Remove**

2. Ensure that the selector lever is in the neutral gear position.
3. Pay attention to the refit position and release the cable ball joint from the manual transmission gear selecting and shifting rocker.



4. Remove two bolts fixing the gear selecting rocker, take down the gear selecting rocker and put nylon blocks away.
5. Knock out the spring pin fixing the gear shifting rocker to the gear selecting and shifting shaft and remove the gear shifting rocker.

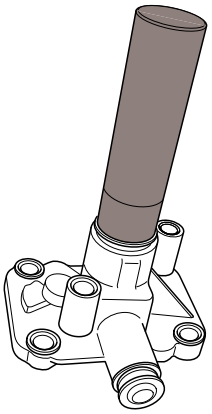


6. Release the rest three bolts fixing the selector lever cover to the rear housing and remove the selector lever cover assembly.
7. Release the reverse lock shaft, remove the reverse lock plate and the reverse limit spring.
8. Pull out the gear selecting and shifting shaft assembly.
9. Remove and abandon the gear selecting and shifting shaft oil seal.

Refit

1. Use**TPT00066** and a hammer to fit new gear selecting

and shifting shaft oil seals by knocking.



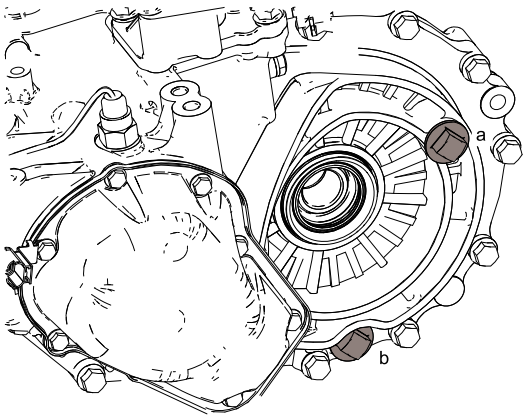
2. Insert the gear selecting and shifting shaft assembly.
3. Position the reverse limit spring and the reverse lock plate and tighten the reverse lock shaft to **15–22Nm**.
4. Change the position of the gear selecting and shifting shaft assembly to neutral gear position.
5. Clean the junction surface between the selector lever cover and the rear housing and apply evenly plane sealant.
6. Fit three bolts fixing the selector lever cover to the rear housing and tighten them to **15–25Nm**.
7. Position the gear shifting rocker to the gear selecting and shifting shaft and use**T24026** to knock in a new spring pin.
8. Apply grease on the external and internal surface of the nylon shifting block and position the nylon block to the gear selecting and shifting rocker. Fit the gear selecting rocker and tighten the fixing bolts to **15–25Nm**.
9. Connect the cable ball joint to the gear selecting and shifting rocker.
10. Inspect the quality of gear selecting and shifting.
11. Fit the battery tray.

☞**Battery Tray Refit**

Transmission oil Draining and filling

Draining and filling

1. Lift the vehicle and place an appropriate container under the transmission.
2. Clean areas surrounding the oil filler plug, remove the oil filler plug (a) and abandon sealing spacers.
3. Clean areas surrounding the oil drain plug, remove the oil drain plug (b) and abandon sealing spacers.



4. Drain the transmission oil.
5. Clean the filler and the oil drain plug.
6. Place new sealing spacers on the oil drain plug, fit and tighten the oil drain plug to **25–35Nm**.
7. Through the filler, the transmission oil can be filled to the transmission conveniently with an appropriate and clean funnel to the specified value.

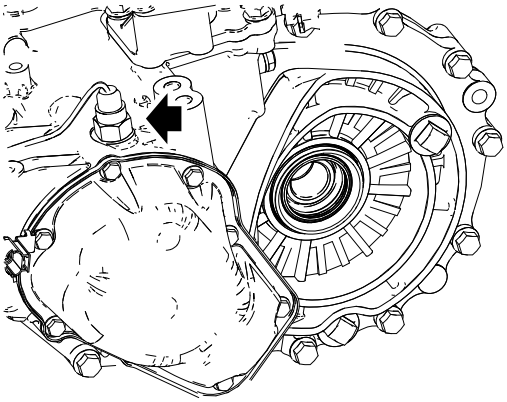
· Drain and refill	1.8 L
· Dry fill	2.0 L

8. Place new sealing spacers on the oil filler plug, fit and tighten the oil filler plug to **25–35Nm**.
9. Lower the vehicle.

Reverse Light Switch

Remove

1. Disconnect the battery earth lead.
2. Release the reverse light switch harness from the cable clamp.
3. Disconnect the reverse light switch harness connector.
4. Remove the reverse light switch assembly from the transmission.



Refit

1. Clean the joint surface of the reverse light switch and the transmission.
2. Apply sealant on the reverse lamp thread, fit reverse light switch to the transmission and tighten it to **12–18Nm**.
3. Connect the reverse light switch harness connector.
4. Fit reverse lamp harness to the cable clamp.
5. Connect the battery earth lead.

LH Differential Oil Seal

Disassembly

1. Remove the left drive shaft.

☞**Left Drive Shaft Assembly Remove**

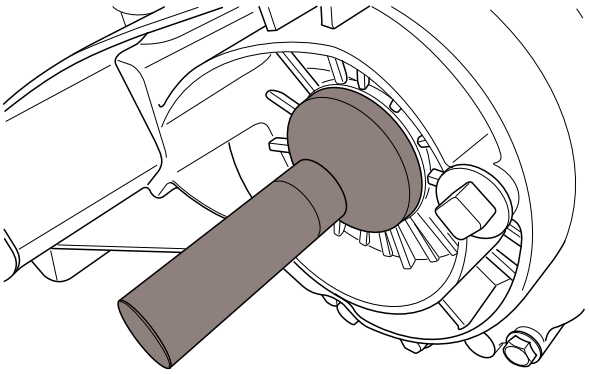
2. Carefully remove and discard the oil seal, taking care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: Oil seals are waxed and must not be lubricated prior to fitting.

2. Use**TPT00064** to fit a new oil seal.



3. Fit the left drive shaft.

☞**Left Drive Shaft Assembly Refit**

4. Fill the transmission fluid.

☞**Transmission Fluid Adding**

RH Differential Oil Seal

Remove

1. Remove the right drive shaft.

☞**Right Drive Shaft Assembly Remove**

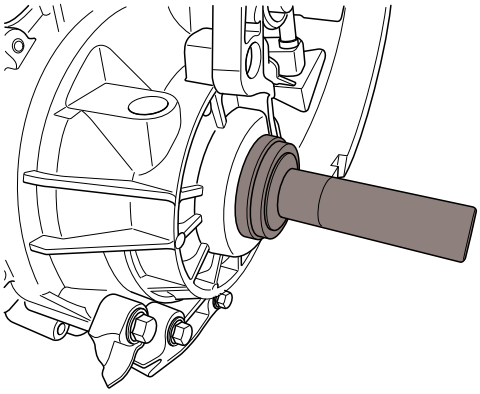
2. Carefully remove and discard the oil seal, taking care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: Oil seals are waxed and must not be lubricated prior to fitting.

2. Use**TPT00069** to fit a new oil seal.



3. Fit the right drive shaft.

☞**Right Drive Shaft Assembly Refit**

4. Fill the transmission fluid.

☞**Transmission Fluid Adding**

Manual Transmission Dismantling

Remove

1. Remove the manual transmission assembly.

☞**Manual Transmission Assembly Remove**

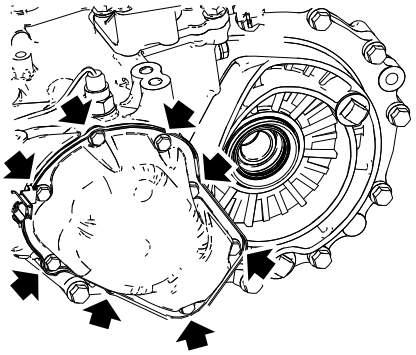
2. Remove the reverse light switch.

☞**Reverse Light Switch Remove**

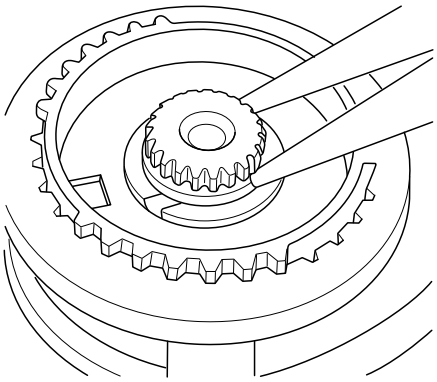
3. Remove the clutch separating bearing.

☞**Clutch Separating Bearing Remove**

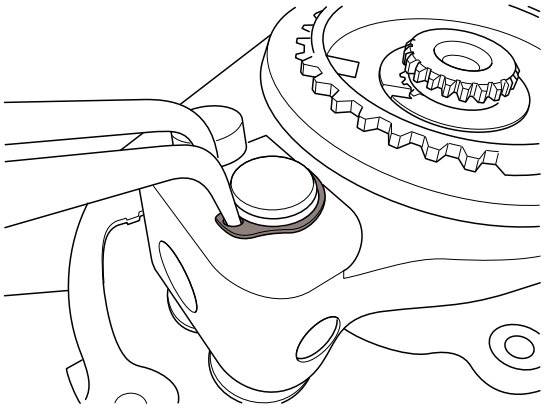
4. Remove the 8 bolts which are used to fix the rear cover panel, and remove the rear cover panel.



5. Knock out the retaining ring at the 5th gear synchronizer gear hub.

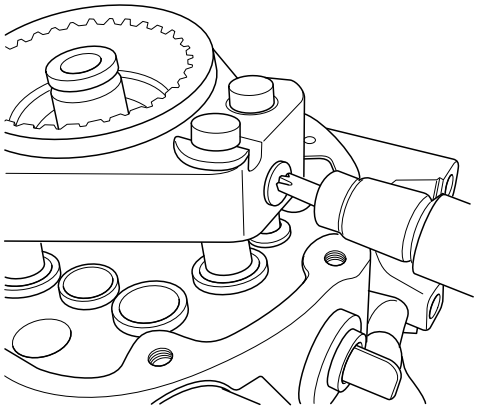


6. remove the fixed retainer with the retainer pliers on the reverse gear shift shaft.

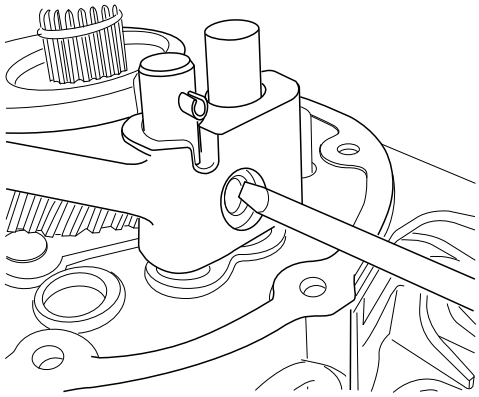


7. Link to the neutral gear, and release the 5th gear fork

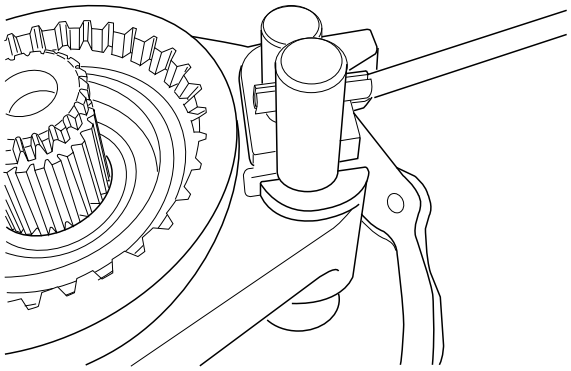
bolts.



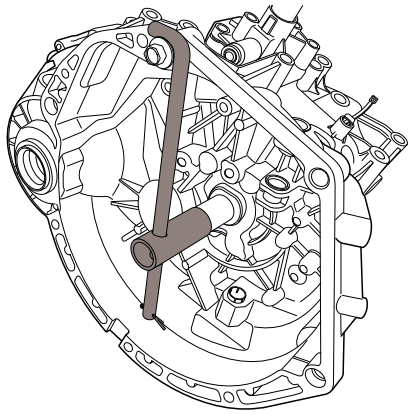
8. Take out the ball with a magnetic screwdriver.



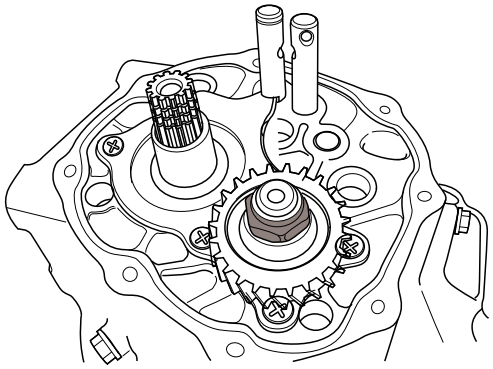
9. Link to the 5th gear, and knock out the spring pin on the 5th gear shift shaft with punch and hammer.



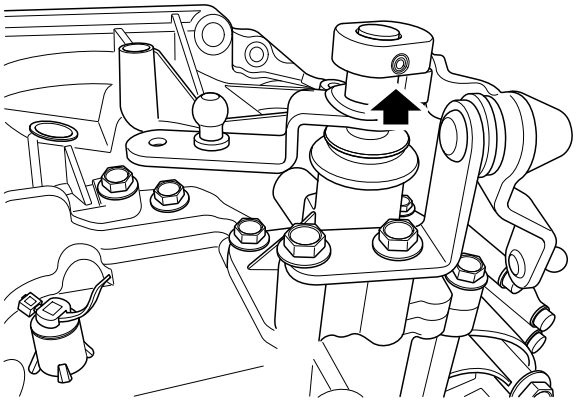
10. Get the 5th gear fork and 5th gear synchronizer assembly out together.
11. Remove the drive 5th gear and needle roller bearing.
12. Link to 4th gear and use**TPT00068** to lock the drive shaft of the transmission.



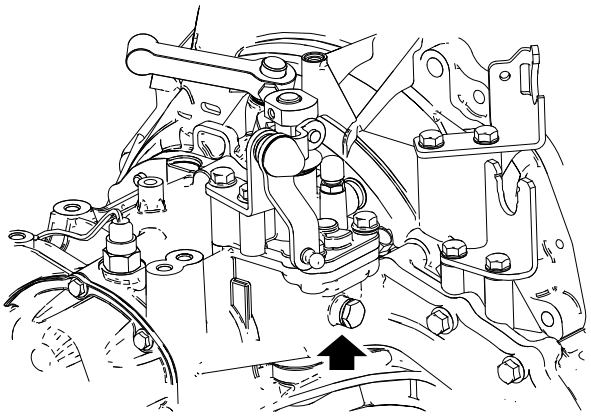
13. Remove and discard the driven shaft lock nuts.



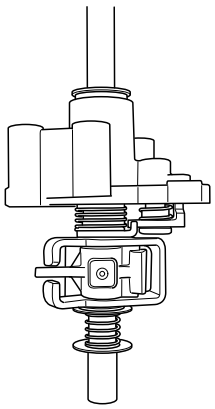
14. Remove the driven 5th gear.
15. Loosen the six screws which are used to fix the rear bearing guard.
16. Remove the rear bearing guard and the rear bearing adjusting shim.
17. Loosen the 4 bolts which are used to fix the gear selection/shift cable bracket, and remove the gear selection/shift cable bracket.
18. Loosen the bolt for fixing gear selection rocker arm, remove the arm and well collect the nylon block.
19. Punch down the spring pin for fixing the shift rocker arm to gear selection/shift shaft, remove the gear selection rocker arm.



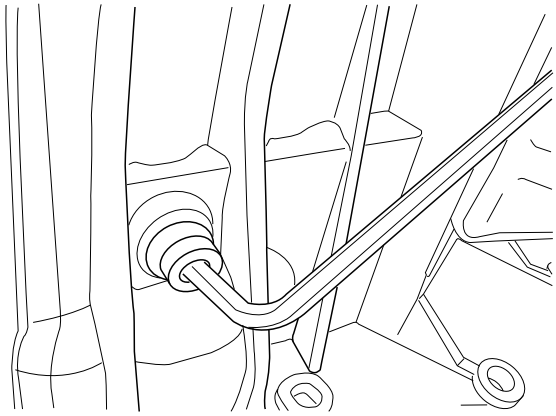
20. Remove the remaining 3 bolts which fix the control cover assembly to rear housing.
21. Remove the gear shift limit bolts and washers.



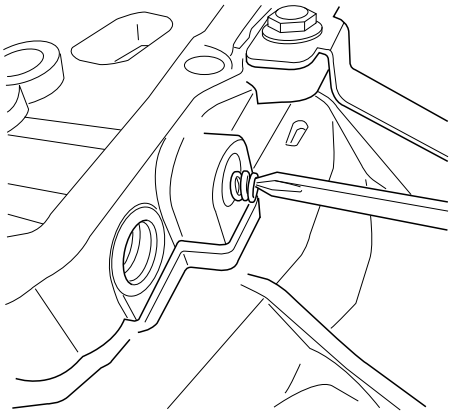
22. Change to neutral gear, and remove the control cover assembly.



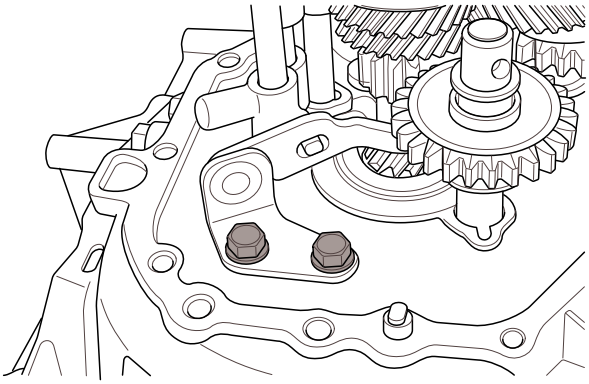
23. Remove the reverse gear idler bolts and shim.



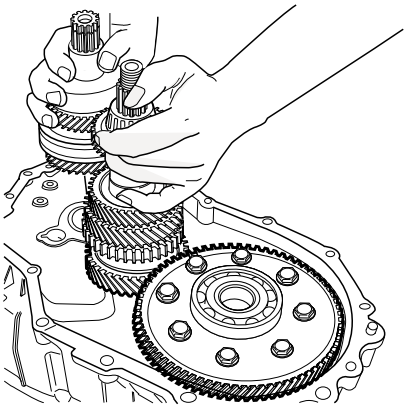
24. Remove the connecting bolts of the front and rear housings.
25. Gently tap with a nylon hammer front housing big end platform, and separate and take out the rear housing from the front housing.
26. Release 3 self-locking bolts of the front housing side
27. Remove the 3 self-locking springs and 3 balls in the hole.



28. Release the 2 bolts around the reverse gear rocker arm assembly.



29. Respectively, remove the reverse gear rocker arm assembly, reverse gear idler assembly, reverse gear idler shaft and washers.
30. Change to 4th gear, and take the 5th/reverse gear shift shaft component out upwards.
31. Lift the driven shaft assembly, drive shaft assembly , 1st/2nd gear fork shaft component and 3rd/4th gear fork shaft component out of the front housing with two hands . When separate is hard, you can use a nylon hammer to knock the rib of the front housing to detach it.

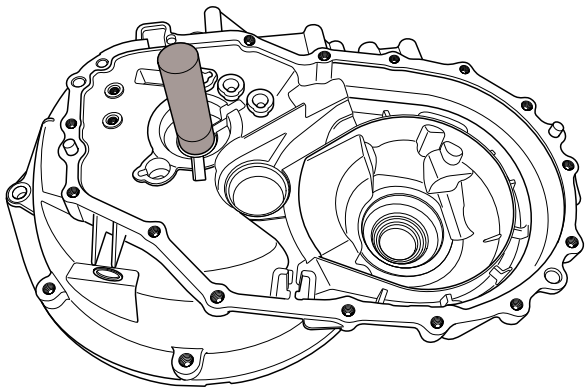


32. Remove the differential assembly from the front

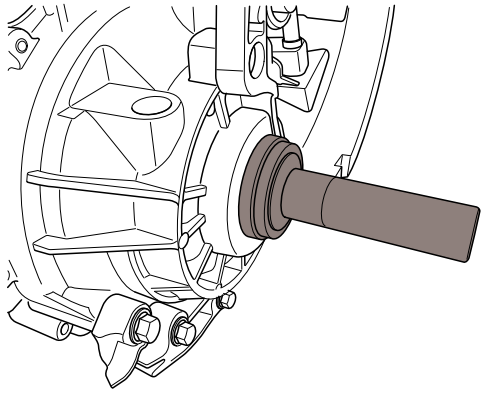
housing, if it's difficult to do that, it may be appropriate to shake the differential assembly and tap the bearing to remove it.

Refit

1. Use**TPT00066** to fit drive shaft oil seal in front housing.



2. Use**TPT00069** to fit front housing oil seal.



3. Put the driven shaft front bearing outer ring into the front housing driven shaft bearing hole and gently tap with a nylon hammer to be in correct position.
4. Fit the differential assembly into the front housing, when refit is difficult, gently tap with a nylon hammer to ensure it is in correct position.
5. Set 1st/2nd gear shift shaft components into the driven shaft assembly 1st/2nd gear synchronizer, 3rd/4th gear shift shaft components into the drive shaft assembly 3rd/4th gear synchronizer, hold the two rod assembly meshing together into the front housing with both hands, at the same time also need to note that the shift rods align with the shift rod hole around the housing, and the two rod bearings align with housing bearing holes.
6. Link the 3rd/4th gear shift shaft component up to 4th gear position, then fit the 5th/reverse shift rod component into the front housing.
7. Respectively fit the balls and self-locking springs into 3 self-locking holes at the side of the front housing. Apply thread sealant on the thread, and fit self-locking bolts and tighten to **15–20Nm**.
8. Put the reverse gear idler assembly, reverse gear idler nylon washers, reverse gear shaft into the front housing.
9. Put the reverse gear rocker arm assembly into the front housing, and fit two bolts and tighten to **22–28Nm**. After fitting the reverse gear rocker arm assembly, reverse gear idler must be rotated flexibly, bolt hole on the reverse gear idler shaft faces outside and is perpendicular to the gear.
10. Measure the slant distance from the front housing plane to differential rear bearing outer ring, and the depth of the rear housing differential rear bearing hole with differential adjusting shim measurement tools, match adjusting shim with the matching principle of pretension of 0.1 mm. The adjusting shim, coated with moderate amount grease, is put into rear housing differential rear bearing hole.
11. Clean the housing joint surface, coat the front housing plane with apply sealant and cover the rear housing. **22–28Nm**.
12. Fit gear selection/shift cable bracket, fit the fixing bolts and tighten to **22–28Nm**.
13. Align the reverse gear idler shaft hanging tight hole with the rear housing reverse gear holes, apply thread sealant on the thread of the reverse gear idler shaft hanging tight bolt, and fit the bolts and aluminum washers and tighten to **15–22Nm**.
14. Use adjusting shim measurement tools to measure the height difference between the drive shaft rear bearing cup plane and rear housing plane, also the depth of the rear bearing guard groove. and then match the corresponding adjusting shim, base on the principle that is 0-0.05mm gap. when put onto the drive shaft bearing, should apply with moderate amount grease. The refit process of driven shaft adjusting shim is the same as above, which difference is that the matching principle is pretension of 0.05-0.15mm.

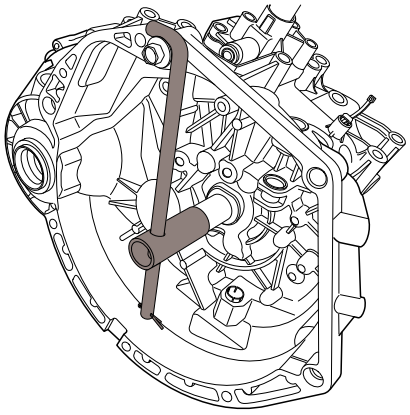
Drive Shaft Rear Bearing Adjusting Shim

Thickness: mm
0.1
0.15
0.2
0.3
0.4
0.5
0.8

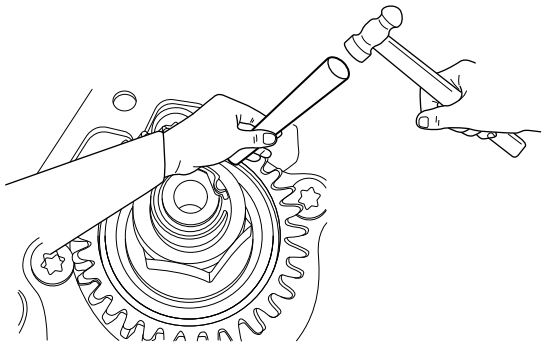
Driven Shaft Rear Bearing Adjusting Shim

Thickness: mm
0.1
0.2
0.3
0.4
0.5
0.6

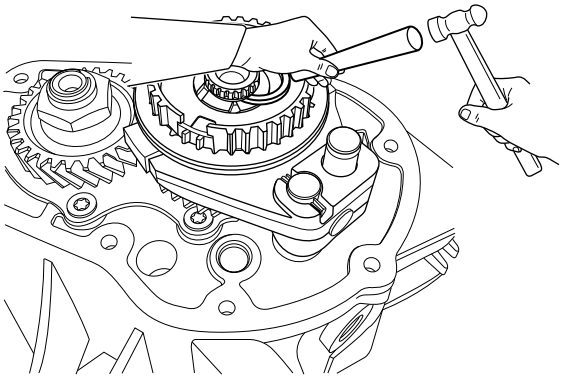
15. Press the rear bearings guard, fit six screws and tighten to **10–15Nm**.
16. Slide 3rd/4th gear shift shaft, make the transmission gear linked to 4th gear and use**TPT00068** to lock the drive shaft of the transmission.



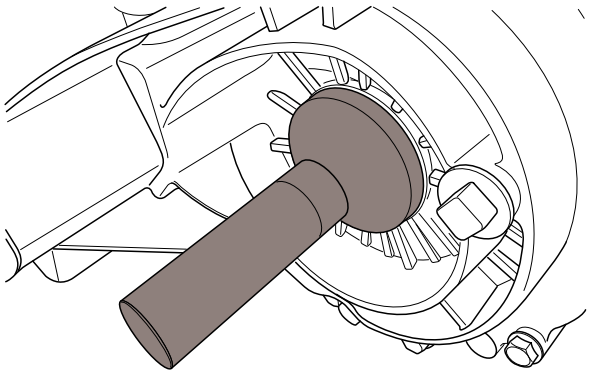
17. Put the driven 5th gear into the driven shaft, put the 3rd/4th gear needle bearing to 5th gear bushing then into the drive 5th gear, tighten the driven shaft lock nut into the driven shaft, pad the rubber pad into the 5th gear meshing parts of the drive gear and the driven gear, and tighten to **80–100Nm**.
18. Lock the nut with puncher.



19. Lubricate the inner cone of the 3rd/4th/5th gear synchronizer gear ring, and then put them into the drive gear combined gear cone of the 5th gear; set 5th gear fork into the 5th gear synchronizer assembly gear sleeve, put them all into load 5th/reverse gear shift shaft component.
20. Match the appropriate retaining ring into the 5th gear synchronizer gear hub.



21. Press the new spring pin into the 5th gear shift shaft pin hole. Then put the ball into 5th gear fork side hole, at the same time fit 5th gear fork bolt and tighten to **5–8Nm**.
22. Fit the fixed retainer with the retainer pliers.
23. Apply sealant on the control window plane of the rear housing. Put the control cover assembly into the rear housing, and meanwhile, put gear selection rocker arm assembly into it, then fit in 5 connecting bolts and tighten to **15–25Nm**.
24. Locate gear shift rocker arm to the gear selection/shift shaft and use**T24026** to punch in a new spring pin.
25. Use**TPT00069** to fit the new oil seal for the rear housing.



26. Apply plane sealant on the back plane of the rear housing. Fit the rear cover assembly, fit 8 rear cover bolts and tighten to **8–13Nm**.
27. Fit the clutch separating bearing.

☞**Clutch Separating Bearing Refit**

28. Fit the reverse light switch.

☞Reverse Lamp Switch Refit

29. Fit the manual transmission assembly.

☞Manual Transmission Assembly Refit.

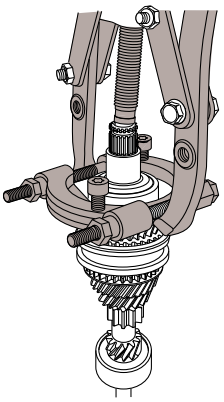
Drive Shaft Assembly

Remove

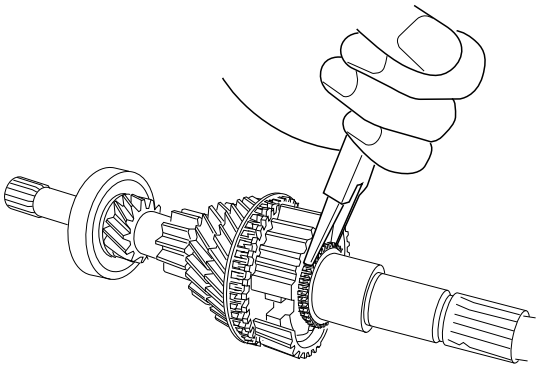
1. Remove the drive shaft assembly.

☞Transmission Remove

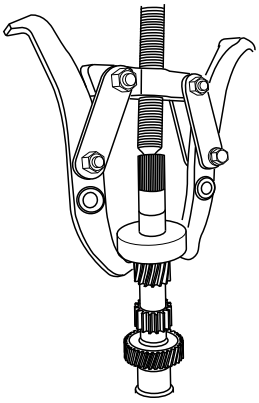
2. Use puller and**T32001** to take the drive shaft rear bearing and 5th gear bushing out together.



3. Remove the 4th gear spacer.
4. Respectively take the drive 4th gear, needle bearings, 4th gear synchronizer gear ring out.
5. Remove the 3rd/4th gear synchronizer gear sleeve and slider assembly.
6. Knock the synchronizer retainer out.

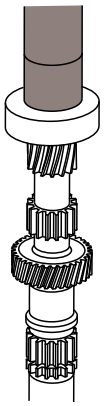


7. Remove the 3rd/4th gear synchronizer gear hub.
8. Respectively take the 3rd gear synchronizer gear ring, drive 3rd gear, needle bearings out.
9. Use puller and**T32001** to pull drive shaft front bearing out.

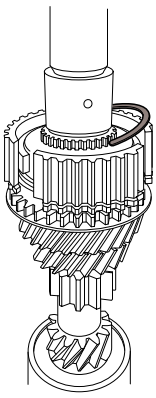


Refit

1. Use**TPT00065** to fit drive shaft front bearing into correct position.



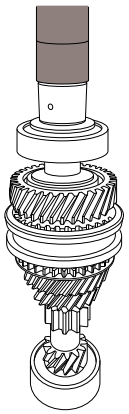
2. Lubricate needle roller bearings, fit needle bearings and drive 3rd gear.
3. Fit 3rd gear synchronizer gear ring, synchronizer gear hub.
4. Select the appropriate retainer and fit it in correct position.



5. Fit 3rd/4th gear synchronizer gear sleeve and slider assembly, to ensure that the slider assembly is right placed in the slider groove of gear sleeve and synchronizer gear hub.

Caution: Ensure parts are fitted in correct order and orientation.

6. Lubricate needle roller bearings, and then successively put into 4th gear synchronizer gear ring, needle roller bearings, drive 4th gear and 4th gear spacer.
7. Use**TPT00065** to fit the drive shaft rear bearing and 5th gear bushing into place.



8. Fit the drive shaft assembly.

☞Transmission Assembly Refit

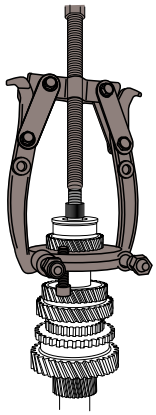
Driven Shaft Assembly

Remove

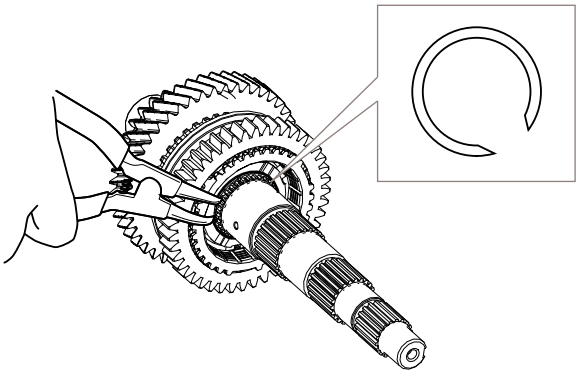
1. Remove the driven shaft assembly.

☞Transmission Remove

2. Use puller and**T32001** to pull the driven shaft rear bearing and slave 4th gear out together.



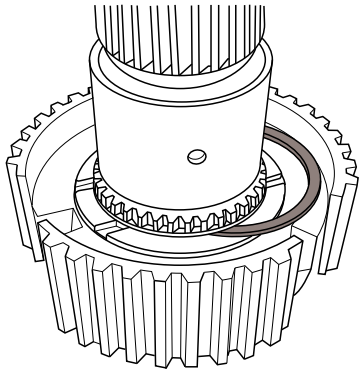
3. Take the 3rd/4th gear spacer out.
4. Use puller and**T32001** to pull the driven 3rd gear out.
5. Successively take the driven 2nd gear, 1st/2nd gear synchronizer gear ring out.
6. Remove synchronizer gear sleeve and slider.
7. Remove the synchronizer retainer, remove the synchronizer gear hub.



8. Successively take the 1st/2nd gear synchronizer gear ring, driven 1st gear, needle bearings out.
9. Use puller and**T32001** to pull the driven shaft front bearing inner ring out.

Refit

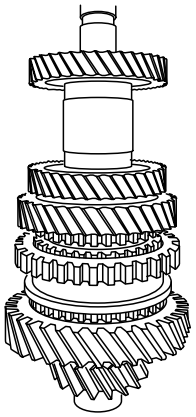
1. Use**TPT00065** to fit the drive shaft front bearing inner ring into correct position.
2. Lubricate the needle bearings, and then successively fit needle bearing, driven 1st gear, 1st/2nd gear synchronizer gear ring.
3. Fit 1st/2nd gear synchronizer gear hub and select the appropriate retainer to knock into correct position.



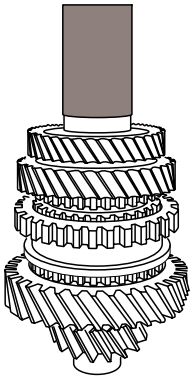
4. Fit synchronizer gear sleeve, slider and synchronizer gear ring, to ensure that the slider assembly is right placed in the slider groove of gear sleeve and synchronizer gear hub.

Caution: Ensure parts are fitted in correct order and orientation.

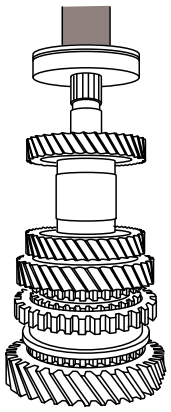
5. Lubricate the needle bearings, and then successively fit needle bearing, driven 4th gear, 3rd/4th gear spacer.



6. Use**TPT00066** to fit the driven 3rd gear into correct position.



7. Use**TPT00065** to fit input shaft rear bearing into correct position.



8. Fit the driven shaft assembly.

☞Transmission Assembly Refit

Differential Assembly

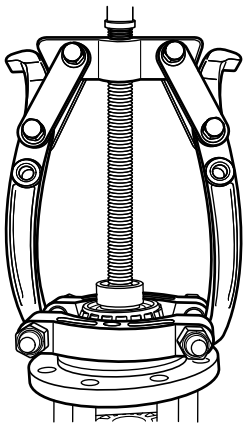
Remove

1. Remove the differential assembly.

☞Transmission Remove

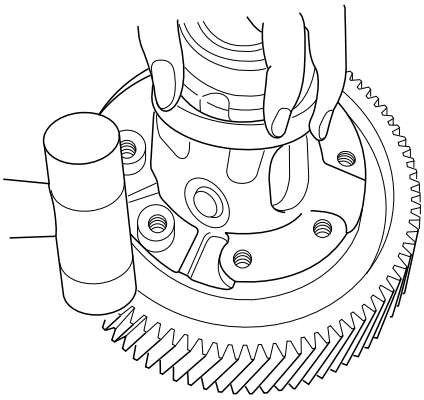
2. Use puller and**T32001** to pull the bearing of both ends out respectively.

Caution: Support bolt of the drawing die (T32001) cannot be used to support the propeller shaft hole directly, place a spacer block between them.

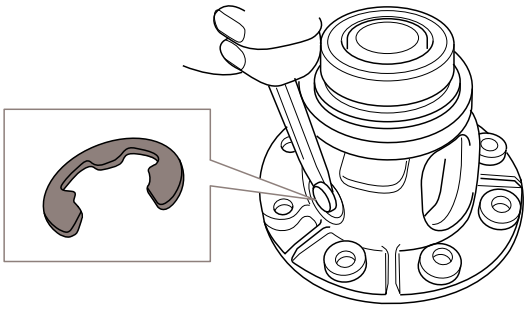


S243024

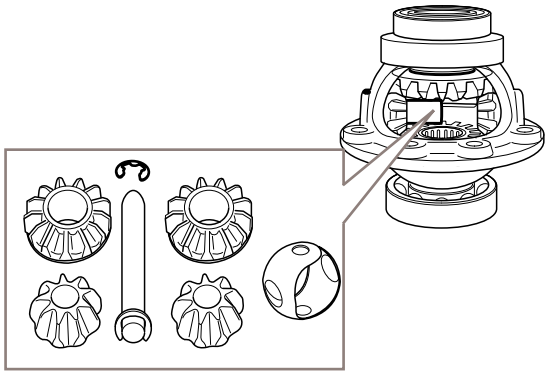
3. Remove the eight bolts which fix the final drive gear to the differential housing.
4. Use the nylon hammer to knock the final drive gear down from the differential housing.



5. Knock out the retainers at both ends of the planetary gear shaft.



6. Remove the planetary gear shaft, and take side gears, planetary gears and washer in the differential housing out in an orderly manner.



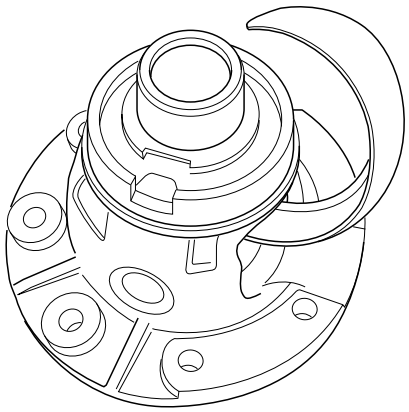
Refit

1. Check if the differential rear bearing adjusting shim indicates wear or scratch, replace the shim if necessary.

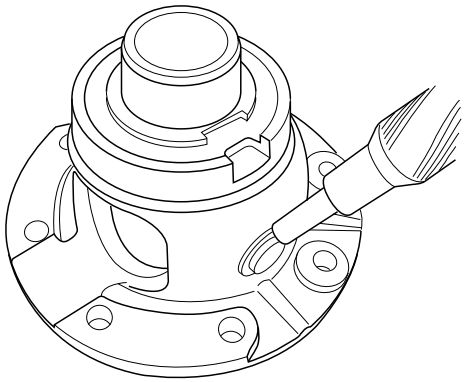
Differential Rear Bearing Adjusting Shim

Thickness (mm)
0.1
0.15
0.2
0.3
0.4

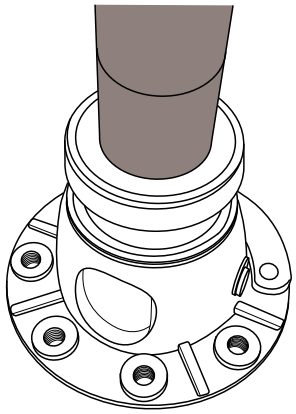
2. Put the differential washers into the differential housing cavity.



3. Successively put the planetary gear, side gear into the differential housing cavity.
4. Insert the planetary gear shaft and fix the both ends with retainers.



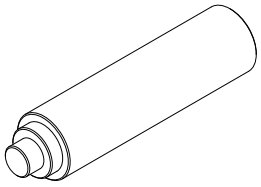
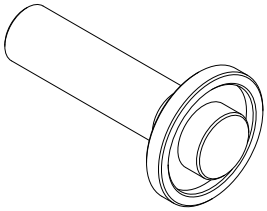
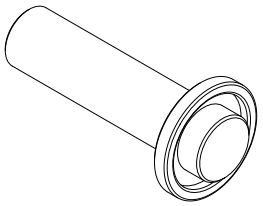
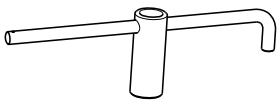
5. Use**TPT00067** to knock two differential bearings into correct position respectively.

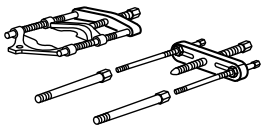
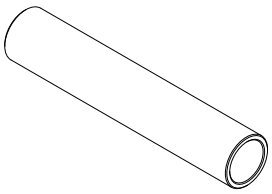
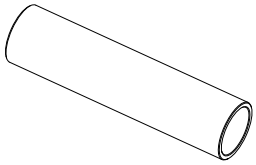


6. Fit final drive gear to the differential housing, and tighten the eight fixing bolts to **90–110Nm**.
7. Fit the differential assembly.

☞Transmission Assembly Refit

Special Tools

Tool Number	Description	Picture
TPT00066	Replacer, oil seal, input shaft and control cover	
T24026	Replacer, Ø5 spring pin	T24026
TPT00064	Replacer, LH oil seal, differential	
TPT00069	Replacer, RH oil seal, differential	
TPT00068	Locking plate, input shaft	

Tool Number	Description	Picture
T32001	Puller universal	 T32001
TPT00065	Replacer, input and output shaft bearing	
TPT00067	Replacer, differential bearing	

Clutch

Specifications

Torque

Description	Value
Bolt - clutch cover to flywheel	24–26Nm
Bolt - clutch release fork to release shaft	10–15Nm
Bolt - clutch master cylinder to pedal bracket	7–10Nm
Union - clutch master cylinder to pipe	15–19Nm
Bolt - slave cylinder bracket to rear housing	40–50Nm
Union - clutch slave cylinder to pipe	15–19Nm
Bleed plug - clutch slave cylinder	10Nm

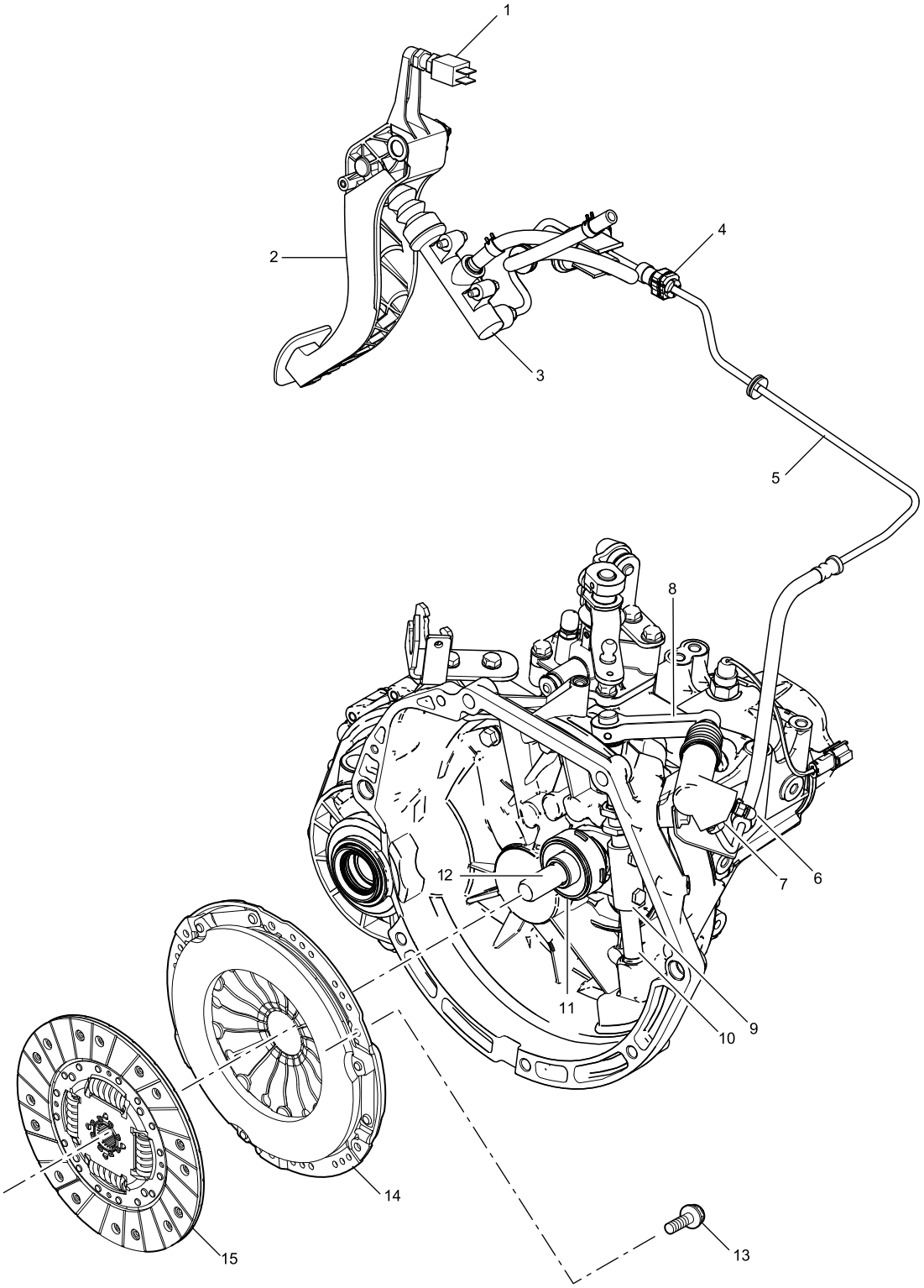
Parameter

Model	Dry Single Disc, Diaphragm Spring, Hydraulic Pressure Assistant Clutch
Driven Plate Diameter	200mm
Pressure Plate Diameter	200mm
Rivet Depth: · New · Service limit	 1.2mm above the rivet head 0.2mm above the rivet head

Description and Operation

System Layout Chart

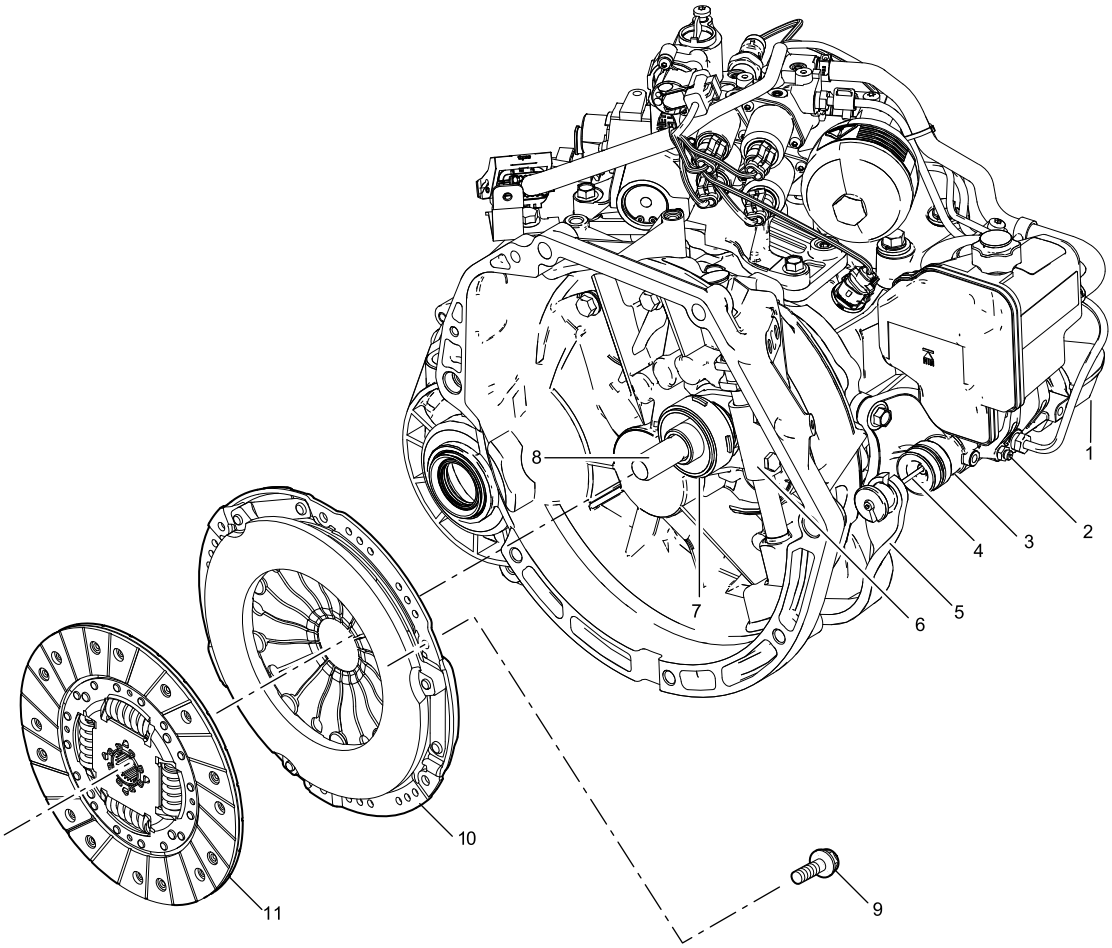
Clutch System Layout Chart – MT



1. Clutch switch
2. Clutch pedal
3. Clutch master cluster cylinder
4. Quick connector

5. Intermediate hard tube
6. Core vent
7. Clutch slave cluster cylinder
8. Separation rocker arm
9. Release shift fork
10. Release rocker arm
11. Release bearing
12. Transmission driving shaft
13. Bolt
14. Clutch cover assembly
15. Driven disk

Clutch System Layout Chart - AMT



1. Clutch Position Sensor CPS
2. Air-bleeder Plug
3. Clutch Actuator
4. Clutch Actuator Cable
5. Separating Rocker Arm Assembly
6. Separating Fork
7. Separating Bearing
8. Transmission Main Drive Shaft
9. Bolt
10. Clutch Cover Assembly
11. Driven Plate

Description

Overview

The clutch is a conventional three piece, diaphragm type fitted with a hydraulic clutch release system which comprises two main components, a master cylinder and slave cylinder. The clutch requires no adjustment to compensate for clutch wear.

Clutch Hydraulics

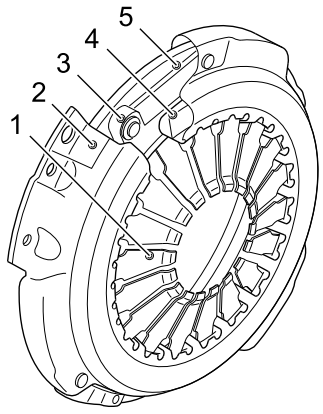
MT vehicle model : The master cylinder is located inside the vehicle, fitted directly to the pedal box. The piston pushrod is attached to a spigot on the clutch pedal and is secured with a clip and pin. Two ends of the hydraulic pipeline are connected to the master and slave cluster cylinders through screwed joints.The slave cylinder is fitted on the manual transmission housing bracket. The release arm, the release fork and release bearing form the release mechanism. The release bearing support is fitted with a guide sleeve which is fitted on the manual transmission input axis. The pipe from the slave cylinder terminates in a 'quick fit' connector next to the master cylinder. When it is released, the release fork pushes the release bearing against the clutch diaphragm spring.

AMT vehicle model: the clutch pedal is cancelled, the control of the clutch is accomplished by the electric control hydraulic unit independently. The clutch actuator is connected to the separation rocker arm through a cable with its separating mechanism similar to the manual transmission.

Clutch Mechanism

The clutch cover assembly is fit on the flywheel and secured using six bolts.

Pressure Plate



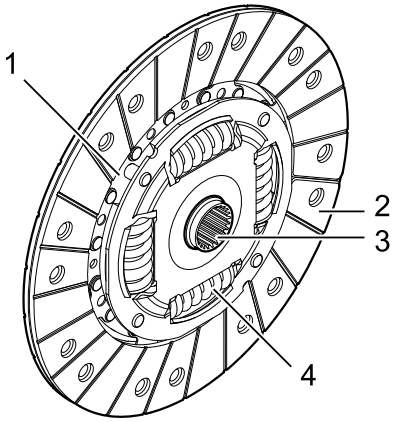
S222002

1. Diaphragm spring
2. Clutch cover
3. Pressure plate
4. Fulcrum rings
5. Leaf springs

The pressure plate assembly comprises a diaphragm spring, pressure plate and cover. The pressure plate is manufactured from cast iron and is machined to ensure a smooth surface for the drive plate to engage on. The outer diameter of the pressure plate features three lugs connecting it via leaf springs to the cover. The leaf springs have three tempered steel leaves and pull the pressure plate away from the drive plate when the clutch pedal is depressed. The cover houses the diaphragm spring and the pressure plate and is manufactured from pressed steel.

The diaphragm spring features a cast ring with eighteen fingers on its inner diameter. Two circular steel fulcrum rings are attached to the housing and allows the diaphragm to pivot between them. The diaphragm is not physically attached to the pressure plate. When pressure is applied to the diaphragm fingers from the release bearing, the diaphragm pivots between the fulcrum rings and moves away from the pressure plate. The leaf springs attaching the pressure plate to the cover move away from the drive plate.

Driven Plate

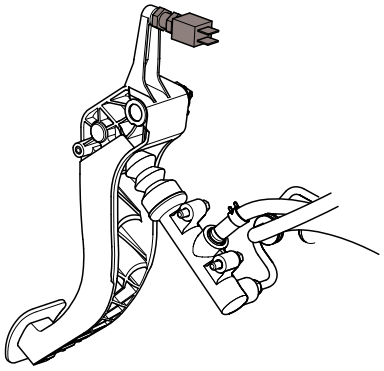


S222003

1. Driven plate
2. Friction material
3. Splined hub
4. Torsion damper

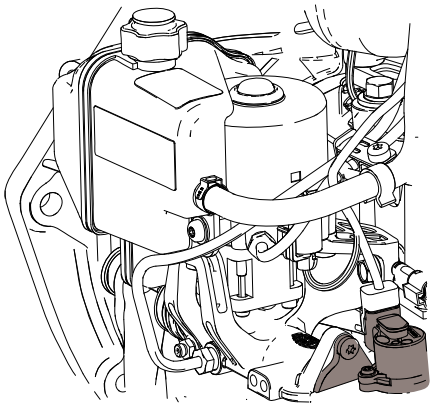
The drive plate is fitted between the flywheel and the pressure plate assembly and features a splined hub which engages with the splines on the transmission input shaft. This plate provides the attachment surface for the spring steel segments. The friction material comprises two discs which are riveted to each side of the spring steel segments. The rivets are secured through recessed holes in the friction material and emerge in clearance holes in the opposite disc to prevent damage to the pressure plate and flywheel.

Clutch switch–MT



The clutch switch is located on the clutch pedal bracket with ECM supplying power to the switch. When depress the clutch pedal, the switch push rod gets rid of the bondage of the pedal arm and is ejected under the acting force of the internal spring, driving breaking of contacts inside the switch. At this moment ECM will receive clutch release signals; when the clutch pedal returns, the pedal arm leans on the switch push rod and overcomes the spring acting force, making the contacts inside the switch close. ECM will receive clutch engaging signals.

Clutch position sensor (CPS)–AMT



TCM learns about the clutch release system state through a clutch position sensor fit on the clutch actuator.

Operation

Hydraulic operation

MT vehicle model: When the clutch pedal is pressed, the piston is pushed into the master cylinder. The piston pressurizes the fluid in the master cylinder forcing the fluid along the clutch pipe. The pressure acts on the piston of the slave cylinder which moves under the hydraulic force applied. When the clutch pedal is released, force from the compressed fingers of the diaphragm, pushes against the release bearing. The release bearing pushes the piston back into the slave cylinder which returns hydraulic fluid back up the clutch pipe and into the master cylinder.

AMT vehicle model: the electric control hydraulic unit drives the clutch actuator piston so that the clutch actuator cable pushes the release bearing through the separation rocker arm.

Mechanical operation

When the clutch pedal is pressed, the hydraulic pressure extends the piston in the slave cylinder. The extension of the piston changes the rotary movement of the release lever into linear movement pushing the release bearing on to the fingers of the diaphragm which pivots about its fulcrum on the pressure plate housing. The diaphragm fingers move away from the pressure plate. The leaf springs securing the pressure plate to the cover move away from the drive plate pulling the pressure plate away from the drive plate.

The removal of pressure from the pressure plate on the drive plate breaks the mechanical link between the flywheel and pressure plate and the drive plate preventing the transfer of drive from the drive plate to the transmission input shaft.

When the clutch pedal is released, hydraulic pressure is removed from the piston in the slave cylinder. The removal of the pressure allows the release bearing to be pushed back by the fingers of the diaphragm which pushes the piston into the slave cylinder.

The diaphragm pivots on its fulcrum on the pressure plate housing. This applies pressure to the pressure plate and overcomes the pressure applied by the leaf springs. The pressure plate moves towards the flywheel and applies force to the drive plate.

The force applied to the drive plate by the pressure plate increases the friction between the drive plate and the flywheel. As the clutch pedal is released the friction increases and rotary movement of the flywheel is transferred to the drive plate, which in turn begins to rotate the input shaft of the transmission.

When the pedal is released fully, the pressure applied to the pressure plate by the diaphragm forces the drive plate onto the flywheel transferring drive to the transmission input shaft transferring drive to wheels.

Clutch switch–MT

The clutch switch is activated when the clutch pedal is operated. The ECM uses the signal from the clutch switch for the following functions:

- Reduce impact during the gear shifting process

Surge damping stops engine speed rising dramatically during gear changes. Surge damping assists driveability in the following ways:

- Smoother gear changes
- Greater exhaust gas emission control
- Improved fuel consumption

The clutch switch receives a 12V reference voltage from the ECM. With the clutch pedal in the rest position the switch is connected to ground. When the clutch pedal is pressed the ECM receives a 12V signal.

In the event of a clutch pedal switch failure any of the following symptoms may be observed:

- Surge damping inactive

Service Procedures

Clutch assembly

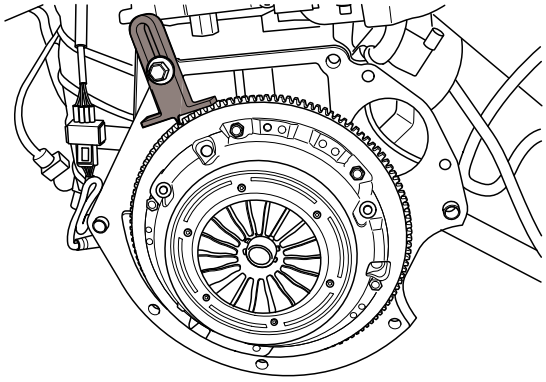
Remove

1. Remove the transmission assembly.

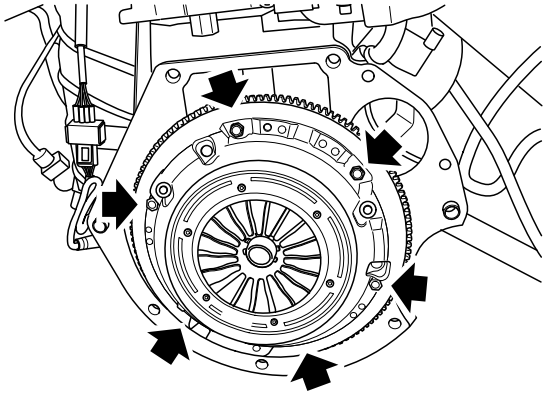
☞Manual Transmission Assembly Remove

☞Automated Mechanical Transmission Assembly Remove

2. Use**T10028** to limit the flywheel.



3. Release and remove six bolts fixing the clutch cover assembly to the flywheel.

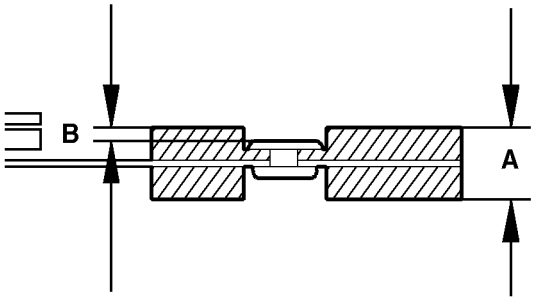


4. Remove the clutch cover assembly and take out the driven disc.
5. Remove the release bearing.

☞Clutch Release Bearing Remove

Inspection

1. Visually check diaphragm fingers for wear and irregular height.
2. Inspect clutch drive plate for signs of wear or oil contamination. Renew drive plate if necessary.
3. Measure clutch plate thickness, renew drive plate if less then service limit.



S223003

Driven disc thickness (when compressing) A

New drive plate	7.5mm
Service limit	5.9mm

4. Measure the depth of the rivet. If it is smaller than the maintenance limit, replace the driven disc.

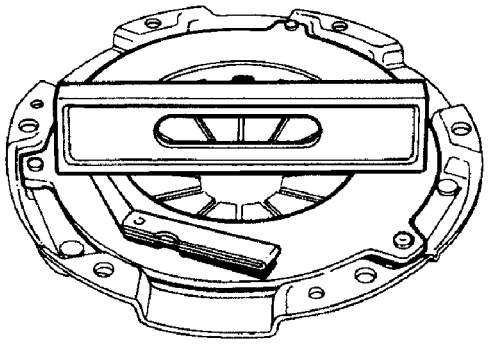
Rivet depth B

New drive plate	1.2mm
Service limit	0.2mm

5. Check pressure plate for signs of wear or damage. Check for signs of overheating on drive straps (deep yellow to blue colour), renew pressure plate if necessary.

Caution: Renew a clutch pressure plate which has been accidentally dropped.

6. Use a straight edge and feeler gauges, check the surface of the pressure plate for flatness a 4 separate points. Renew plate if more than service limit.



S223004

Deformation of the pressure plate

Maintenance limit	0.15mm

7. Examine release bearing and sleeve for signs of wear or damage. Renew release bearing if necessary.
8. Clean pressure plate and flywheel, dowels and dowel holes.

9. Inspect flywheel for signs of scoring or other damage. Renew if worn or damaged.

Refit

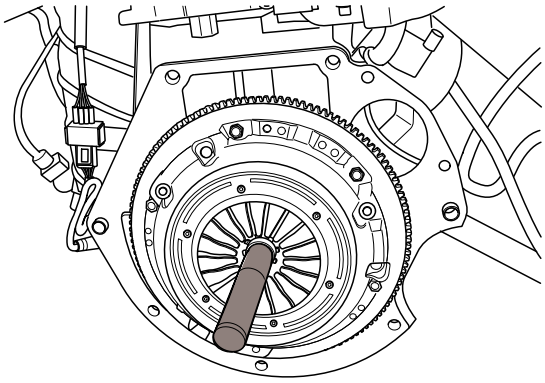
1. Fit the release bearing.

☞**Clutch Release Bearing Refit**

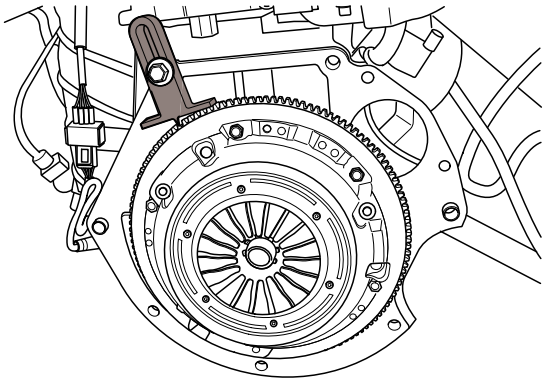
2. Apply molybdenum disulfide grease to the spline of the clutch driven disc.
3. Use**TEN00040** to insert a driven disc to ensure that the driven disc is aligned with the center of the crankshaft hole.

***Caution:** Driven disc refit direction.*

4. Position the clutch cover assembly to the flywheel.



5. Fit six bolts fixing the pressure plate to the flywheel and tighten with fingers.
6. Use**T10028** to limit the flywheel, according to the diagonal sequence, tighten bolts fixing the pressure plate to the flywheel by exerting increasing force **24–26Nm**.



7. Take away **TEN00040**.
8. Fit the transmission assembly.

☞**Manual Transmission Assembly Refit**

☞**Automated Mechanical Transmission Assembly Refit**

9. Carry out clutch kiss point self-learning with a authorized diagnostic tool (it is only applicable for vhicle models equipped with AMT).

Clutch release bearing

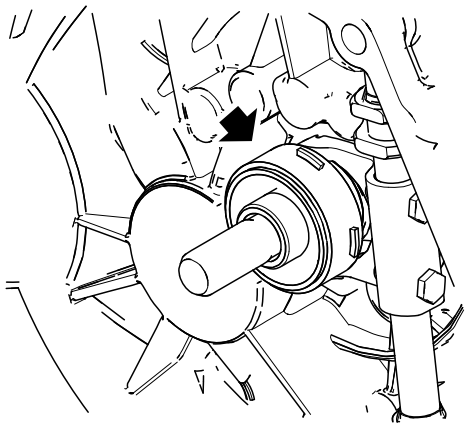
Remove

1. Remove the transmission assembly.

☞**Manual Transmission Assembly Remove**

☞**Automated Mechanical Transmission Assembly Remove**

2. Remove release fork retaining bolts and take down the release fork.
3. Release clips from the release fork and remove the release bearing from the transmission input shaft guide sleeve.



Refit

1. Clean the junction surface between the release bearing and the bearing guide sleeve.
2. Lubricate the bearing motion surface with molybdenum disulfide.
3. Fit the release bearing to the release fork and fix it to the groove of the release fork with clips.
4. Fit the clutch release rocker arm shaft of the front housing and fit in two fixing bolts of the release fork and tighten them to **10–15Nm**.
5. Fit the transmission assembly.

☞**Manual Transmission Assembly Refit**

☞**Automated Mechanical Transmission Assembly Refit**

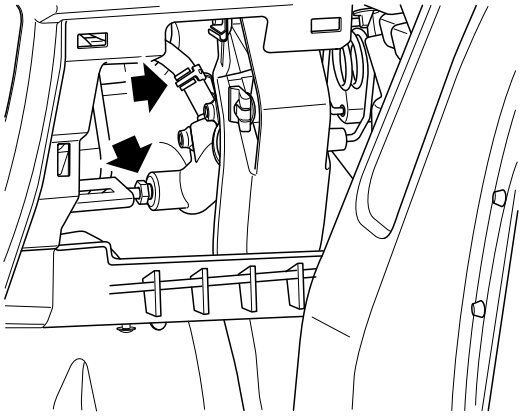
Clutch Master Cylinder

Remove

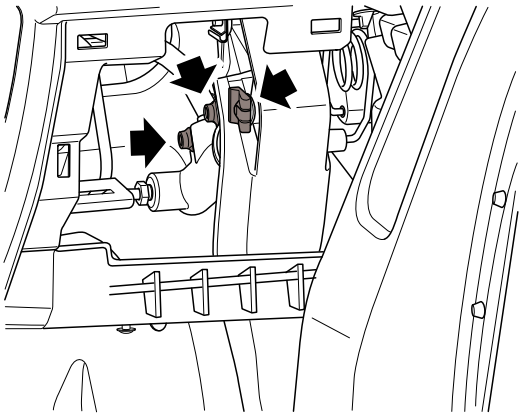
1. Discharge the brake fluid in the brake fluid reservoir.

Caution: Brake fluid will damage paint finished surfaces. If spilled, immediately remove fluid and clean area with water.

2. Remove the driver side sealing panel assembly.
3. Disconnect clips between the master cluster cylinder low pressure hose and the master cluster cylinder connection terminal.
4. Release the threaded connection between the master cluster cylinder front hard tube and the cylinder.



5. Release clips and pull out pins of the master cluster cylinder push rod.
6. Remove two bolts fixing the clutch master cluster cylinder to the pedal bracket.



7. Remove the clutch master cluster cylinder.

Refit

1. Insert pins which are used to connect the clutch pedal to the master cluster cylinder push rod and fix with clips.
2. Fit the master cluster cylinder push rod to the clutch pedal, then position the master cluster cylinder to the pedal bracket, fit bolts and tighten to **7–10Nm**.
3. Connect screwed joints between the master cluster

cylinder front hard tube and the master cluster cylinder and tighten to **15–19Nm**.

4. Connect the connections between the master cluster cylinder low pressure hose and the master cluster cylinder end and fix with clips.
5. Fit the driver side sealing panel assembly.
6. Fill the brake fluid to the reservoir, and fill the reservoir up until the fluid reaches the MAX mark line.
7. Exhaust the clutch line system.

☞Clutch Line System Bleeding

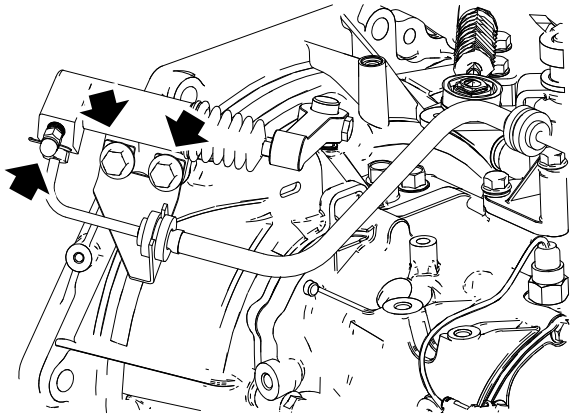
Clutch slave cluster cylinder

Remove

1. Discharge the brake fluid from the brake fluid reservoir.

Caution: Brake fluid will damage paint finished surfaces. If spilled, immediately remove fluid and clean area with water.

2. Disconnect the connection between the slave cluster cylinder and the intermediate hard tube.
3. Release two bolts fixing the slave cluster cylinder to the manual transmission.



4. Remove the clutch slave cluster cylinder.

Refit

1. Make the slave cluster cylinder push rod top prop the separation rocker arm seat hole.
2. Fix the slave cluster cylinder to the manual transmission and tighten bolts to **40–50Nm**.
3. Connect the slave cluster cylinder to the intermediate hard tube and tighten to **15–19Nm**.
4. Fill the brake fluid to the reservoir, and fill the reservoir up until the fluid reaches the MAX mark line.
5. Exhaust the clutch line system.

☞Clutch Line System Bleeding

Clutch line system bleeding

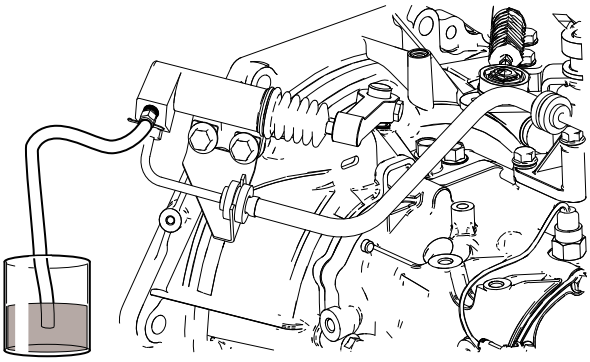
Bleed

Bleeding of the hydraulic system is only permissible if a clutch pipe or hose has been disconnected. Ensure the fluid in the reservoir is maintained between the minimum and maximum levels throughout the bleed procedure and use only new fluid.

Warning: Do not allow brake fluid to come into contact with eyes or skin.

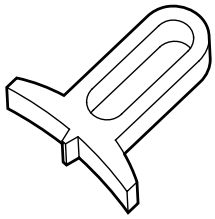
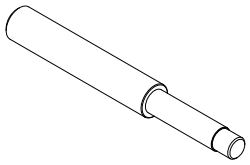
Caution: Never reuse brake fluid that has been bled from the clutch operating system.

1. Lift up the vehicle on the lifting platform.
2. Loosen the core vent dust cap on the clutch slave cluster cylinder and fit the hose to the drain plug. Immerge the free end of the hose into a glass container filled with new brake fluid which takes up half of the container.



3. Depress clutch pedal to floor and hold., maximum pressure of the system is guaranteed.
4. Loosen bleed nipple and allow air and fluid to escape.
5. Tighten the core vent firstly so as to prevent oil gas back siphon.
6. Finally release the clutch pedal smoothly to the maximum stroke; the master cluster cylinder piston returns, supplying sufficient brake fluid .
7. Repeat several times in the order of the above steps until the brake fluid containing no air flows to the container, then fix the clutch pedal to the maximum stroke and tighten the core vent to **10Nm**.
8. Take down the hose from the core vent and put on the core vent dust cap.
9. Fill the brake fluid to the reservoir, and fill the reservoir up until the fluid reaches the MAX mark line.

Special Tools

Tool Number	Description	Picture
T10028	flywheel locking tool	 T10028
TEN00040	Aligner, clutch plate	

HVAC Structure

Specifications

Torque

Description	Value
Bolt - A/C compressor assembly	20–24Nm
Bolt - A/C pipe assembly to compressor	20–24Nm
Nut - A/C pipe assembly joint	9–10Nm
Bolt - A/C hose to compressor	19–25Nm
Bolt - A/C hose to white body	7–10Nm
Bolt - condenser to radiator	5.5–7.5Nm
Bolt - A/C hose to condenser	7–10Nm
Bolt/Nut - HVAC module assembly	5–6Nm
Nut - A/C pipe assembly to TXV	20–24Nm
Bolt - TXV to evaporator core	4–6Nm

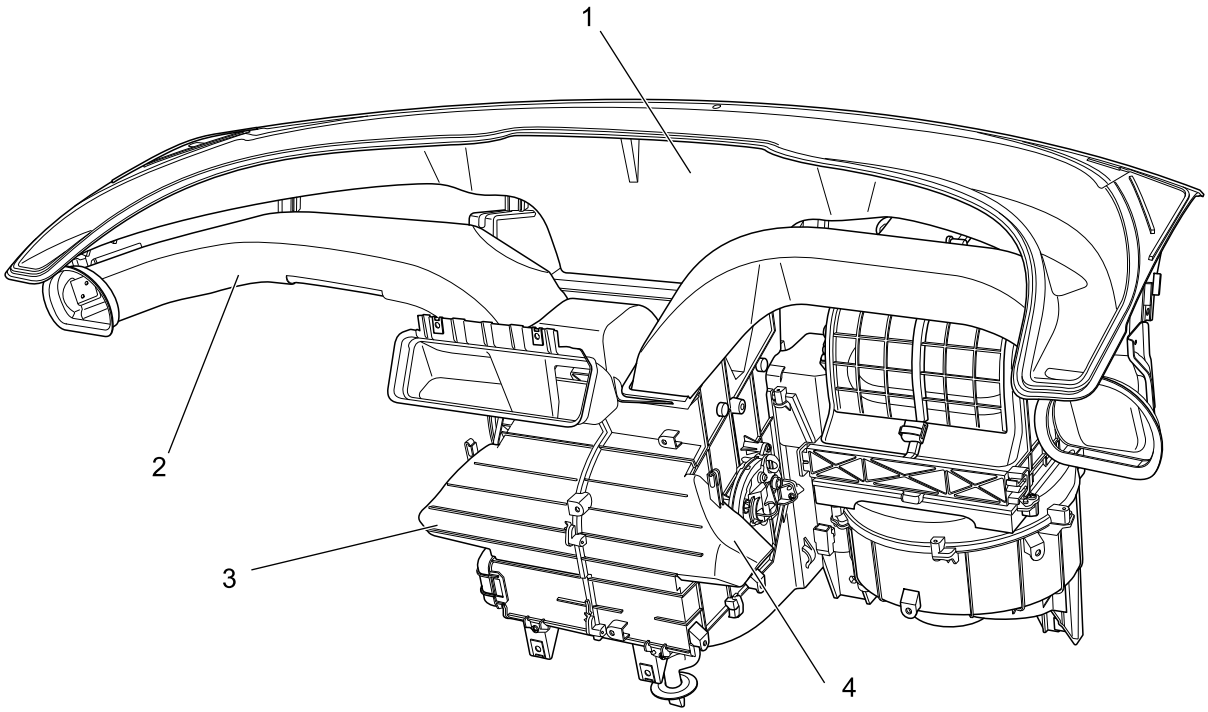
Parameter

Model	Without CFC, closed loop system, controlled by A/C ECU
Refrigerant type	HFC-R134a
Refrigerant filling quantity	420 g
Compressor: (25℃-40℃) • Pressure (high pressure side) • Pressure (low pressure side) Displacement	 1.47 MPa 0.196 MPa 167.3 ml/r
Lubricant	PAG 46
Oil filling level (new)	140 ml
Evaporator temperature sensor: • Compressor start up • Compressor shut down	 5.5 ℃ 3.5 ℃
Pressure switch Low pressure protection • Close pressure • Open pressure High pressure protection • Open pressure • Close pressure Cooling fan control High speed • Close pressure • Open pressure	 0.221 MPa 0.196 MPa 3.14 MPa 2.55 MPa 1.37 MPa 1.77 MPa

Description and Operation

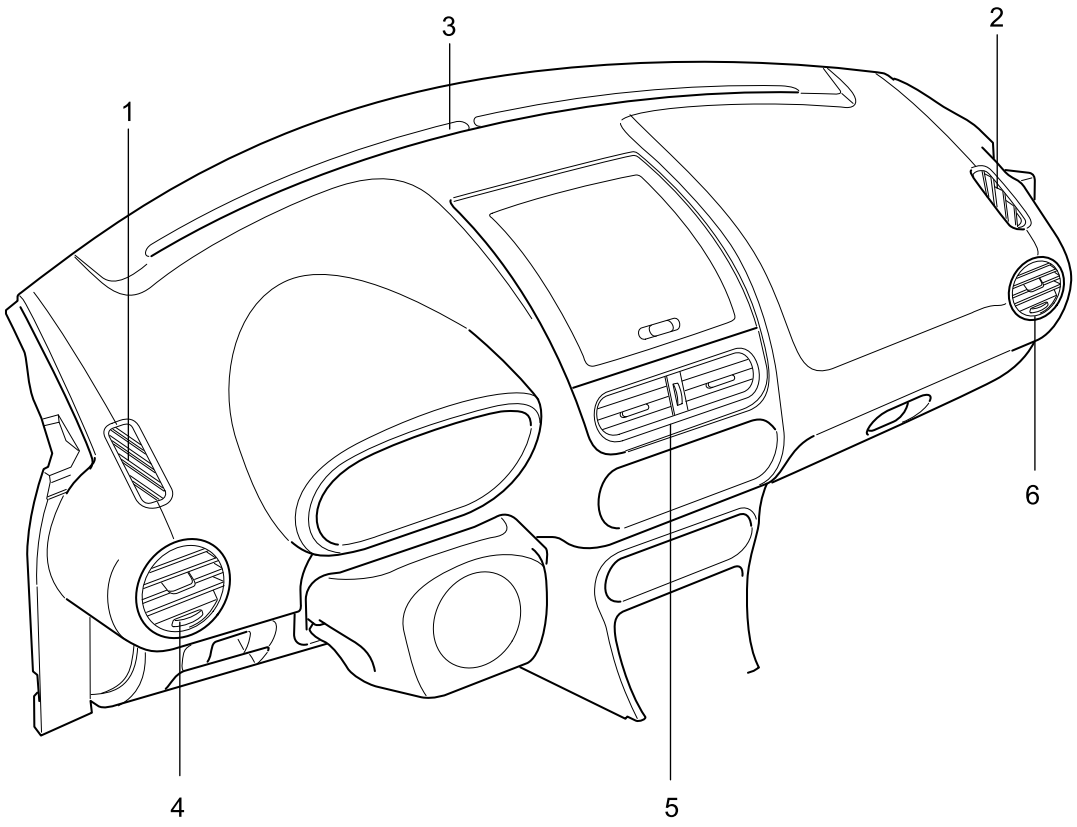
System layout

Warming and ventilation components



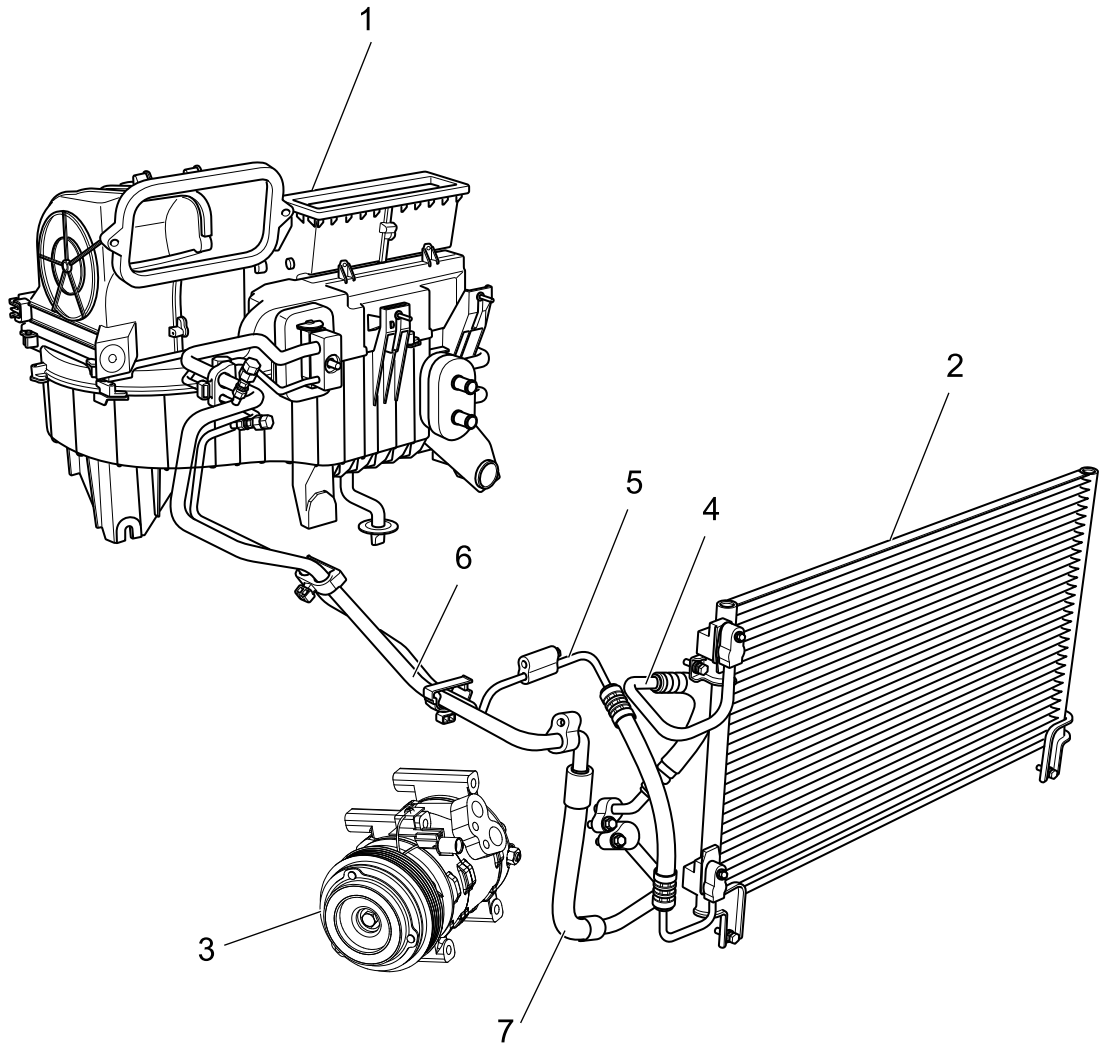
1. Defrost / Defog Duct
2. Central and Side Air Duct
3. Left Foot Part Duct
4. Right Foot Part Duct

Temperature and air volume distribution



1. Left Windshield Defrost / Defog Vent
2. Right Windshield Defrost / Defog Vent
3. Front Windshield Defrost / Defog Vent
4. Left Side Vent
5. Central / Face Vent
6. Right Side Vent

Air conditioning refrigerant system



1. Air-conditioning Box Assembly
2. Condenser
3. Compressor
4. Compressor Discharge Hose
5. Condenser Liquid Pipe
6. Air-conditioning Hard Pipe Assembly
7. Compressor Suction Pipe

Description

Overview

Air temperature and distribution inside the vehicle are controlled by heating, ventilation and air conditioning systems. This system includes the following parts: compressor, air conditioning pipeline, condenser, filter cover, heater unit assembly, distribution pipeline and controller assembly.

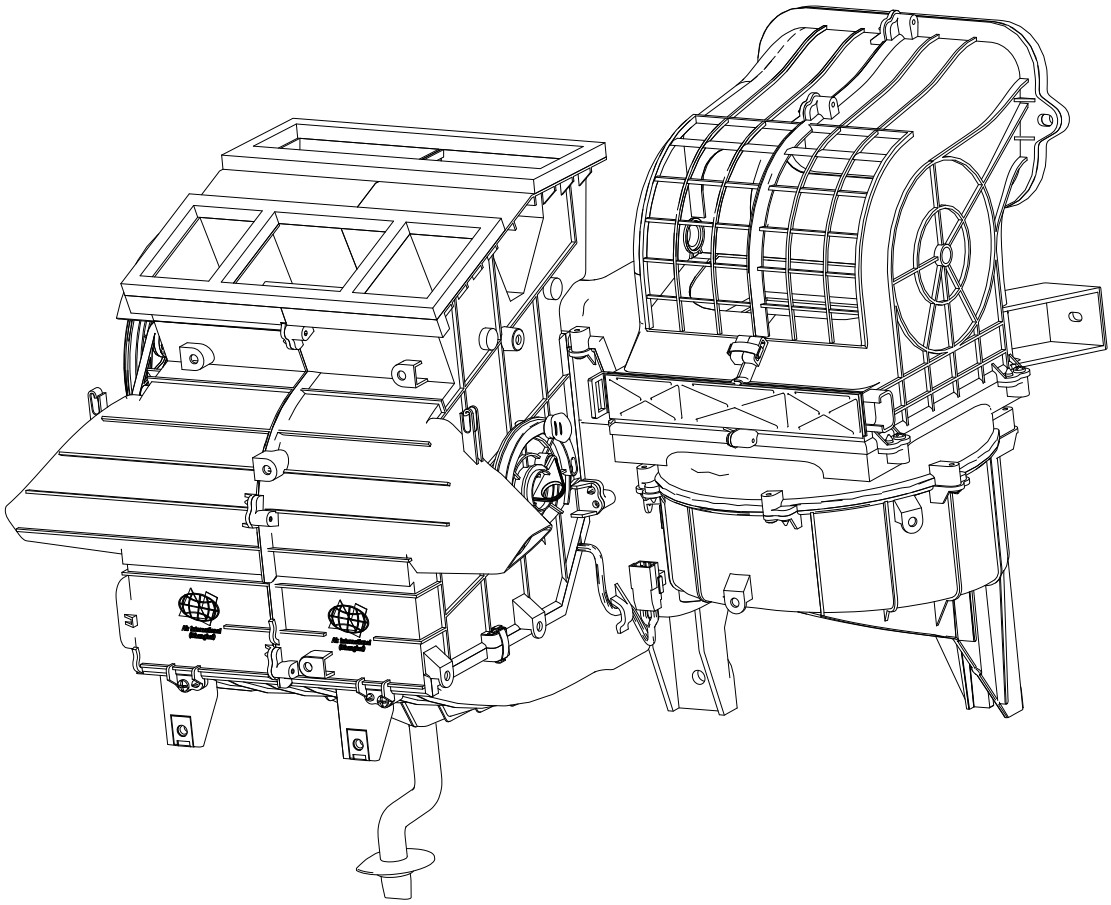
Air enters into the HVAC module assembly, the air is driven by the blower inside this assembly to pass through the entire system. According to the settings on the control panel, air is heated or cooled down and supplied to the front windshield, instrument panel and foot air outlet through the distribution pipelines. The finger wheel on the instrument panel permits that the flux at the front seat face air outlet can be adjusted independently from settings on the control panel.

According to different models, the vehicle will be fit with one of the two air conditioning systems, to be exactly, electric air conditioning system (**ETC**) or manual air conditioning system. Both two systems are composed of refrigerant system, heater unit assembly and control system. Their distinguishes are, **ETC** is a manual control air conditioning controller and realizes the purpose of controlling mode and temperature through an electronic controller which controls the throttle actuating motor; while the manual air conditioning system controls the throttle actuating motor through mechanical cables on the air conditioning controller so as to realize the purpose of controlling mode and temperature.

Passenger cabin air cleaner

The passenger cabin air cleaner above the air conditioning case blower is used to improve the quality of the fresh air supplied into the vehicle.

HVAC Module Assembly



The HVAC module assembly is heated according to the mode selected in the control panel and distributes fresh air or circulating air. The HVAC module assembly is fit on the vehicle central line between the instrument panel and the

engine cabin front panel. The case body consisted of injection plastic parts includes a blower, a heater core and a control door. The internal channel inside the HVAC module assembly guides air to flow through the case body and divides it into two part. One part enters into the left air outlet, while the other part enters into the right air outlet. The water outlet at the bottom of the case body guides the condensing water from the internal case body to the lower part of the vehicle.

Blower

The blower fit on the right side of the heater unit case body is composed of an open wheel boss and a motor driven centrifugal fan. The operation of the blower is realized by the speed adjusting knob on the control panel by controlling the speed resistance of the heater unit assembly.

Heater core

The heater core supplies heat source and distributes it to the air in each air outlet by heating. The heater core is an aluminium unilateral, flat tube heat exchanger and fit on the left side of the case body. Two aluminum pipes pass through the engine cabin front panel, connecting the heater unit assembly to the engine cooling system. When the engine is running, under the drive of the coolant pump, the coolant flows across the heater core continuously.

Recirculation Control Door

The fresh/circulating air door controls the air source by opening and closing the fresh air inlet and ciculating air inlet. The fresh/circulating air switch on the control panel controls the actuating motor driving doors.

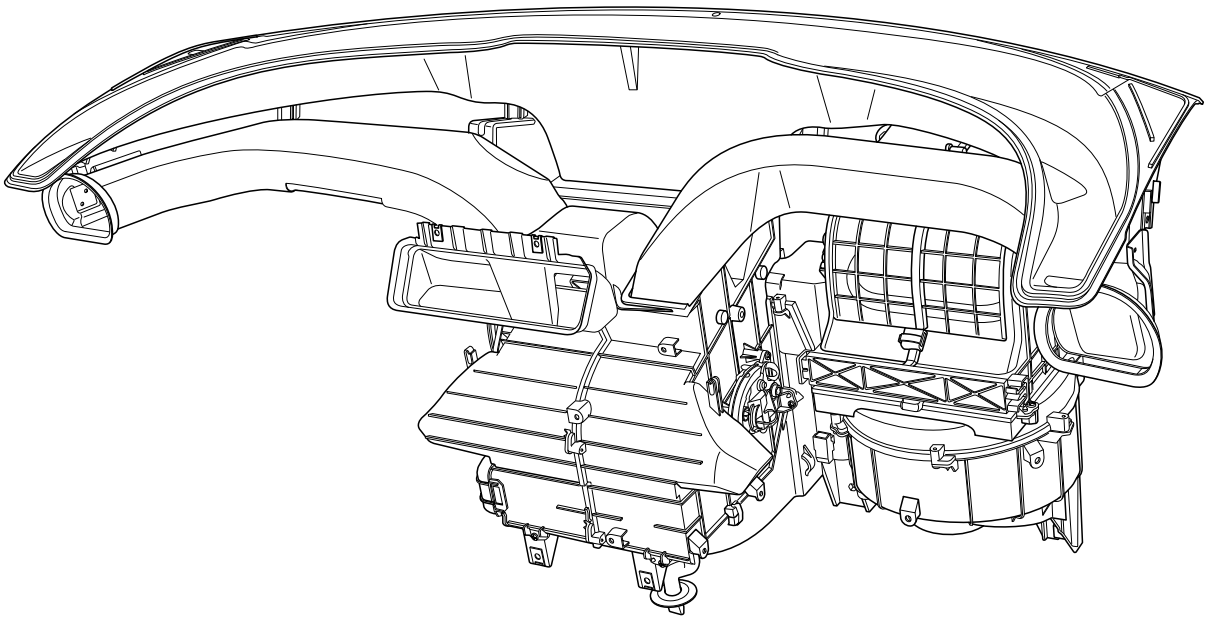
Airmixing door

The airmixing door adjusts the air flow passing through the heater core so as to control the temperature of the air inside the heater unit assembly. The airmixing door is connected to the mandril in the heater unit case body. The airmixing door is controlled by an airmixing door actuating motor or a cable.

Air distribution door

The fit two air distribution doors are used to control the air flow of air outlets at the foot position,front windshield/front window and face part. These doors control flux from the airmixing door to the air outlet and are connected to the mandril which extends to the right side of the heater unit case body. This mandril in the case body is connected to a shared operating lever mechanism. In order to operate the air distribution door, there are mode actuating motors or cables fit among the air distribution switches on the operating lever mechanism and the control panel.

Air Distribution Duct



The air outlets on the two sides and face of the instrument panel share an integral air distribution duct. The air distribution ducts of the front windshield and the front vehicle window are integrated inside the instrument panel. The air vent assembly in the instrument panel makes the passengers can control the flux and the direction of the air blowing to their faces. Each air vent assembly is integrated with finger wheels used to adjust the flux and movable vanes used to control direction. The air outlets at the front seat foot area are attached to the ports at the side surface of the heater unit assembly.

Vent

The vent causes the warm wind and the ventilating air to flow through the passenger cabin successfully. The air outlet is situated on the left side and right side of the luggage cabin, discharging air in the passenger cabin to the shadow area between the body and the rear bumper. An vent is an effective back valve. Each vent is composed of grilles covered by soft rubber doors. Doors can be automatically opened and closed according to the pressure difference between the passenger cabin and the outside.

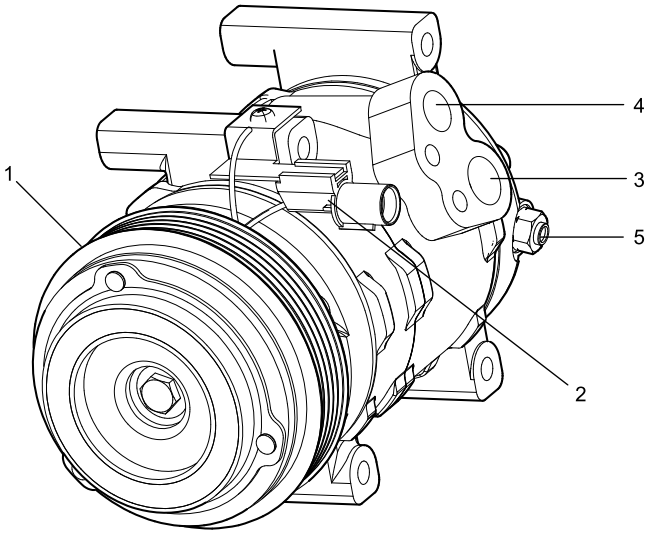
Refrigerant system

The refrigerant system transmits heat inside the vehicle to the outer atmosphere so as to provide xerantic cool air to the HVAC module assembly. This system is composed of a compressor, a condenser**TXV** , air conditioning pipelines and an evaporator. This system is a closed loop which takes R134a refrigerant filled as a kind of heat transfer medium. Air conditioning lubricating oil is added to the refrigerant so as to lubricate the internal components of the compressor.

In order to complete heat transfer, the refrigerant surrounds the system circulation and undergoes two pressure/temperature modes inside the system. In each pressure/temperature mode, the state of the refrigerant will be changed with maximum heat absorbed and released during the process of changing the state. Low pressure/low temperature mode starts from**TXV** and to the compressor through the evaporator, in**TXV** the pressure and temperature of the refrigerant is reduced and the state of the refrierant inside the evaporator is changed from moderate temperature liquid state to low temperature steam so as to absorb the heat passing through the air surrounding the evaporator. High pressure/high temperature mode starts from the compressor

and passes through the condenser to**TXV** , when the refrigerant is passing through the compressor, its pressure and temperature are increased. And then when it is in the condenser, heat will be released to the atmosphere with its state changed from high-temperature steam to intermediate high temperature liquid state.

Compressor

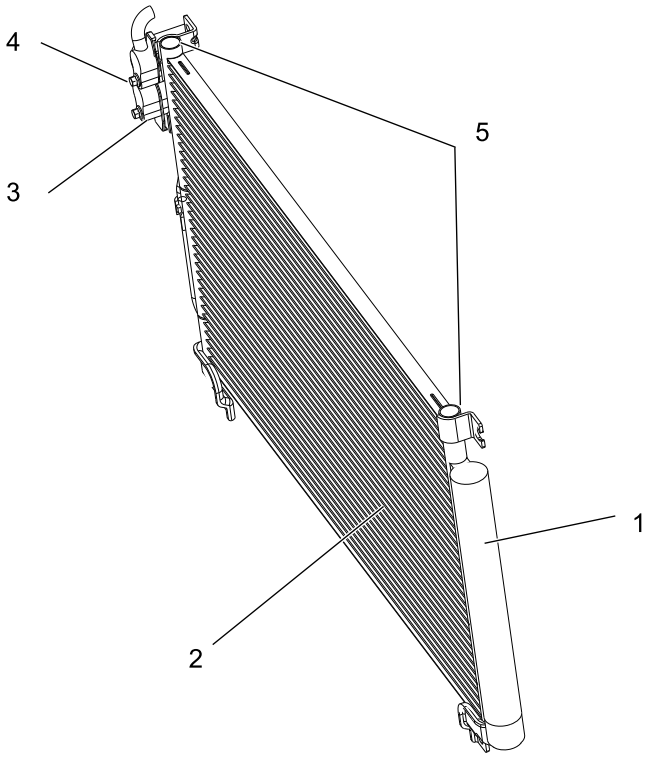


1. Belt wheel
2. Electromagnetic clutch connector
3. Gas inlet interface
4. Gas outlet interface
5. Control discharge hole

The compressor makes the refrigerant surround the system circulation in the manner of compressing low pressure, low temperature steam from the evaporator and loading it to the high pressure, high temperature steam of the condenser.

The compressor fit on the engine mounting bracket is a fixed-displacement compressor. The compressor is driven by an electromagnetic clutch and a belt wheel.

Condenser



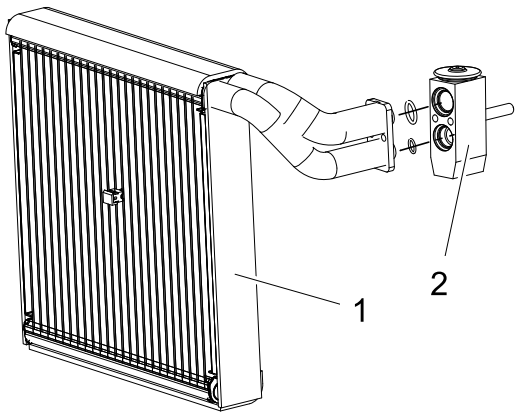
1. Regulating chamber
2. Heat exchanger
3. Liquid outlet interface
4. Gas inlet interface
5. End chamber

The condenser transmits the heat from the refrigerant to the surrounding air so as to make the refrigerant steam from the compressor convert into liquid state. Meanwhile, the condenser also eliminates the humidity and solid particles in the refrigerant through its drying modules and plays a role of liquid refrigerant container so as to adapt to the alternation of the heat load inside the evaporator.

Due to the action of impact effect and/or cooling fan, the refrigerant is converted into liquid state from steam by the air passing through the heat exchanger to absorb heat of the refrigerant. Before the refrigerant enters into the regulating chamber, the condenser cools down and liquefies the refrigerant. Most residual gases within the refrigerant are separated from the regulating chamber. The refrigerant eliminates the humidity and particles within the gases through desiccants and a filter and enter into a secondary cooler part. When the refrigerant passes through the secondary cooler part, it is further cooled down, converting almost 100% of the refrigerant from the outlet of the condenser to the evaporator into liquid state.

Thermal expansion valve (TXV)

TXV and evaporator



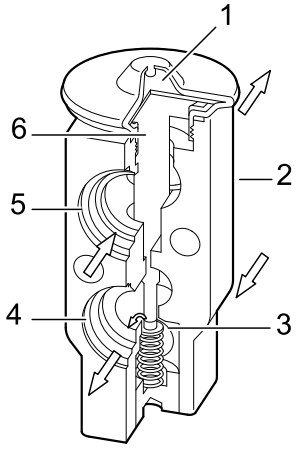
1. Evaporator

2. **TXV**

6. Thermo-sensitive tube

The expansion valve can adjust the refrigerant volume, making the refrigerant volume become matchable with the air thermal load of the evaporator core. The thermal expansion valve is fit at the inlet interface and outlet interface of the evaporator. This valve is designed with an aluminium housing which contains inlet and outlet channels. A metering valve fit inside the inlet channel is controlled by a thermo-sensitive tube connected to the diaphragm. Refrigent is filled to the top of the diaphragm so as sense the outlet pressure of the evaporator, while the thermo-sensitive tube can sense the outlet temperature of the evaporator. Through adjusting the heat expansion valve opening,the load can be balanced, ensuring appropriate degree of superheat at the evaporator outlet and reaching a balance between the cooling capacity and the air thermal load.

Thermal expansion valve



S462011

1. Diaphragm
2. Housing
3. Metering valve
4. Inlet channels extending to the evaporator
5. Outlet channels extending to the evaporator

Liquid refrigerant flows through the metering valve to enter into the evaporator. Through the limitation imposed to the metering valve, the pressure and temperature of the refrigerant are reduced, meanwhile, the refrigerant is liquified into fine spray flow from solid particles so as to improve evaporation effect. When the refrigerant passes through the evaporator, it will absorb heat of the surrounding air flowing through the evaporator core. The increase of the temperature makes the refrigerant vaporize and strengthens the refrigerant's pressure.

The action of the temperature and pressure of the refrigerant which leaves the evaporator is made to the diaphragm and the thermo-sensitive tube, which causes the diaphragm and the thermo-sensitive to move, adjusting the metering valve opening so as to control the volume of the refrigerant passing through the evaporator. The hotter of the air flowing through the evaporator core, the more the quantity of heat that can be used to evaporate the refrigerant so that more refrigerant is allowed to pass through the metering valve.

Evaporator

The evaporator fit at the air inlet of the heater unit assembly is used to absorb the heat of the external admission or the circulation admission. The low temperature and low pressure refrigerant is converted into steam from liquid in the evaporator with large quantities of heat absorbed during the convert process.

Air conditioning pipeline

All components of the system are connected together by aluminium air conditioning pipelines. In order to ensure reliable sealing, O-rings are fit in each interface. In order to maintain similar velocity of flow of the system, diameters of the air conditioning pipelines will be different so as to adapt

to two kinds of pressure/temperature conditions. Fit pipelines with larger diameters under low pressure/low temperature conditions, while fit pipelines of smaller diameters under high pressure/high temperature conditions and integrate the refrigerant filling interfaces to the air conditioning pipeline so as to facilitate system maintenance.

Operation

Compressor

When the engine is running with the air conditioning shut down, and the clutch is switched off, the belt wheel and the drive belt will move forward inertially.

When the air conditioning is requested to be used, the clutch is switched on and an adhesive disk drives the belt wheel to move together with the shaft. The drag harrow and the rotary sloping cam plate rotate together with the shaft, the angled rotary sloping cam plate makes the piston carry out reciprocatory motion. The steam in the admission pressure chamber is discharged into the discharge pressure chamber after being inhaled into the cylinder and compressed, generating air flow in the area surrounding the refrigeration circuit.

Air conditioning compressor clutch relay

12V power supplies power to the air conditioning compressor clutch by passing through No.1 relay in the engine cabin fuse box. When the main relay is energized, the air conditioning compressor clutch relay coil can be activated. The grounding of this relay coil is controlled by**ECM** and it will accomplish grounding upon receiving the request of turning on the air conditioning.

Failure

If the air conditioning compressor clutch relay fails, the following conditions will be found:

- the clutch doesn't engage with the compressor belt wheel (visual inspection)
- Intake air temperature doesn't reduce

The following faults may occur in the air conditioning compressor clutch relay:

- Short circuited relay coil
- Open relay coil
- High relay coil resistance
- The relay contact keeps open
- The relay contact keeps close
- High relay contact resistance
- Open relay lead
- High relay lead resistance
- Short circuited connections between the relay lead and 12V
- power supply
- Relay lead-to-ground short circuit
- No grounding is provided by **ECM**

If the air conditioning compressor clutch has not been engaged with the air conditioning switch at "turning on" position, remove the compressor clutch relay to carry out a test.

Air conditioning pressure switch

Warning: Servicing must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

The pressure switch is used to carry out the following operations:

1. if the refrigerant pressure reaches the designated value, engage the air conditioning compressor clutch.
2. If the refrigerant pressure is lower than or exceed the designated value, release the air conditioning compressor clutch.
3. If the refrigerant pressure exceeds the designated value, switch on or switch off the cooling fan and adjust the rotation speed of the cooling fan according to the pressure value.

Compressor state	Open pressure MPa	Close pressure MPa
Low pressure	0.196	0.221
High pressure	2.55	3.14

Therefore, if the air conditioning pressure is lower than or exceeds one of threshold values of the close pressure,**ECM** the grounding path will be disconnected. In this way, it will cause**ECM** strategy separation of the air conditioning compressor clutch.

As the compressor is lubricated by the lubricant suspending in the refrigerant, if the refrigerant pressure in the system is minimum so as to ensure minimum refrigerant and lubricant, the compressor should be prevented from running.

When the refrigerant pressure is increased to a degree that additional condensation is required,**ECM** ground the cooling fan relay unit so as to request for the corresponding cooling fan rotation speed.

Failure

If the sensor fails, the driver may find that the air conditioning system does not run at all or stops after a period of time.

Following faults may occur to the sensor:

- the refrigerant pressure is caused to become too low due to the leakage of the refrigerant or incorrect filling of the refrigerant
- The refrigerant pressure is caused to become too high due to incorrect filling of the refrigerant

- Internal short circuit
- Open external lines
- The external lines are shorted when connecting with 12V power supply
- The sensor body has not been grounded

Compressor control

When it detects that the request has been changed into turning on the compressor, **ECM** will energize the compressor clutch relay so as to provide the compressor clutch with battery power, however, the precondition is that following conditions exist:

- the pressure switch is turned to **ECM** ground.
- The evaporator temperature exceeds 3.5℃.
- It is not difficult for the engine to accelerate.
- The temperature of the engine coolant is not too high.
- There is no problem with the operation of the engine.

If one of the approval conditions is not satisfied, the power of **ECM** for compressor clutch relay will be cut off and the compressor clutch will be released until this approval condition is recovered. If the acceleration difficulty causes the release of the compressor clutch, after this condition occurs for three times in a single ignition cycle, the acceleration difficulty of **ECM** which occurs again will be ignored and the compressor clutch will be maintained at engagement state.

When receiving compressor requests, **ECM** output the compressor clutch state message to **ECU** , so as to put forward suggestions to the decision of whether or not approve this request. To approve the compressor request, **ECU** maintains the air conditioning icon at the state of being illuminated. To reject the compressor request, **ECU** repeats the compressor request until the request is approved or cancelled through the following ways:

- push the air conditioning switch again to make the request return to a request of turning off the compressor.
- Select closedown of the blower to make the request return to a request of turning off the compressor.
- Take down the ignition key.

Once the compressor request is approved, the compressor will keep running until the request is cancelled or the engine stops even if one of the approval conditions no longer exists.

Engine Cooling Fan Control

ECM operates the cooling fan relay unit so as to control the speed of the engine cooling fan: high speed and low speed. When turning on the ignition switch, **ECM** energizes the main relay in the engine cabin fuse box so as to provide battery power to the cooling fan relay unit through fuse 13. After the cooling fan relay coil energized contacts close, the battery power will be supplied to the cooling fan motor through fuse 13. **ECM** turns on or off two relays in the cooling fan modules so as to control power supply.

Except for refrigerating system, the cooling fan is also used to cool down the engine coolant and the automatic transmission liquid (if applicable). When there are conflicts among fan speeds required by different systems, select the higher one.

When the compressor request is approved, **ECM** controls the cooling fan relay unit according to pressure signals returned by the air conditioning pressure switch, making the cooling fan run at a low speed or a high speed so as to ensure appropriate cooling of the condenser.

Service Procedures

Recovery and Refilling of Refrigerant

Life and work efficiency for the air conditioning (**A/C**) system depend on the chemical stability of the refrigeration system. When the refrigeration system is contaminated by foreign matters (such as dust, air or moisture), the stability of the refrigerant and polyether type (PAG) air conditioning lubricant will be changed by contaminant. Contaminant could also affect the relations between pressure and temperature, reduce work efficiency, and result in internal corrosion and abnormal wear of moving parts.

Ensure the chemical stability of the system in the following manners:

- Wipe the dust and oil on or around the fitting before opening it. This may reduce the possibility that dust enters the system.
- After disconnecting the fitting, cover both sides with the cover cap, plug or tape, to prevent the dust, foreign matter and moisture from entering.
- Keep all the tools clean and dry, including the intake manifold gauge set and all replacement parts.
- Add polyether type (PAG) air conditioning lubricant with the clean and dry delivery device and container, to make sure that the air conditioning lubricant is not affected by moisture.
- When turning the air conditioning system on, make some preparations in advance to complete all the operations rapidly. Leave the time of the air conditioning system being on as short as possible.
- Drain and refill the air conditioning system that has been turned on.

All service parts have been dried and sealed at factory. These sealed parts should be opened only when they are to be connected. All parts must reach the room temperature before stripping. This prevents the moisture in the air from condensing on the parts and being brought to the system. Reseal all the parts as soon as possible.

Discharging, Adding, Draining and Filling Procedures for Air Conditioning System

Warning: Avoid breathing in refrigerant 134a(R-134a) and lubrications' vapor because it will hurt eyes, nose and throat. All the procedure must be carried out in a well ventilated area. Recover R-134a from A/C system should be done by service equipment certified by SAE J 2210 (R-134a recycling equipment). If system leaks accidentally, ventilate the area before any service processed. Refer to health and safety information provided by refrigerant and lubrication manufacturer. Service station can complete A/C system recycling, evacuating and recharging with one time. Service station can filter the refrigerant in recycling and evacuating process to ensure the clean, dry refrigerant to be recharged into system.

Filling station could complete the recovery, draining and refilling procedures for the air conditioning system with just one connection. Refrigerant is filtered during recovering and draining, to make sure that the clean and dry refrigerant is added to the air conditioning system.

- Adding R-12 to the system that has filled with R-134a is prohibited. Refrigerant and refrigerant oil in both systems are incompatible, so never mix them even in small amount. Mixing the remaining refrigerant may damage the device.
- Do not use adapters with different diameters. Using these adapters may cause contamination, resulting in system malfunction.

Recovery of Refrigerant

1. Connect the high pressure side hose with quick disconnect port to the high pressure side service joint of the vehicle air conditioning system.

Tip: Use refrigerant tank designed only for service station. Overcharging restraint system is designed based on this kind of refrigerant tank. The tank valve is also designed for the restraint system.

2. Turn the interface valve on.
3. Connect the low pressure side hose with quick disconnect port to the low pressure side service joint of the vehicle air conditioning system.
4. Turn the interface valve on.

Warning: If there is no refrigerant in A/C system, stop recycling process immediately to avoid air sucked into the tank.

5. Check the gauges on high and low pressure sides on the control panel in the filling station, and, make sure there is pressure in the air conditioning system. If there is no pressure, there is recoverable refrigerant in the system.
6. Turn the valves on high and low pressure sides on.

7. Turn the gas valve and liquid valve on refrigerant tank on.
8. Release the refrigerant oil from the oil separator.
9. Turn the drain valve off.
10. Connect the filling station to the appropriate power outlet socket.
11. Turn the main power switch on.

Caution: Reuse the recycled lubrication is prohibited. The recycled lubrication will damage the equipment.

Caution: Part of A/C lubrication (PAG) could be recycled together with refrigerant but service station can separate lubrication from refrigerant to calculate the quantity of lubrication.

Caution: The same quantity of lubrication must be refilled during recharging process.

12. Start recovering. For the information about the filling station, refer to the manufacturer's instruction for use.
13. Wait for 5 minutes, and then check the pressure gauge on the low pressure side of the control panel. If vacuum can be maintained in the air conditioning system, the recovery is completed.

Warning: If warning indicator illuminates, it means the tank is overfull and service station will stop, install a new empty tank to continue this process. The different type of tank is prohibited using.

14. If the pressure on the low pressure side increases from zero, there is some refrigerant in the system. Recover the remaining refrigerant. Repeat this procedure, until the vacuum can be maintained in the system for 2 minutes.

Draining

1. Check whether the hoses on the high and low pressure sides are connected to the air conditioning system. Turn the valves on the high and low pressure sides in the filling station control panel on.
2. Turn the gas valve and liquid valve on the refrigerant tank on.

Caution: The evacuating procedure must be carried out before recharging process.

3. Start the vacuum pump and begin to drain. During recirculation, non-concrete gas (mostly air) be drained from the tank automatically. Sound of pressure being released may be heard.
4. Check the system for leaks. For the information about the filling station, refer to the manufacturer's instruction for use.

Filling and Supplement of Air Conditioning System Lubricant

At this time, supplementing the lubricant drained from the air conditioning system during recovery is necessary.

Important:

- Screw the bottle cap on at any time, to prevent moisture and contamination entering.
- This operation requires air conditioning to be in vacuum. Never turn the lubricant filling valve on when the air conditioning system is under positive pressure. This may cause lubricant to return through the oil bottle ventage.
- When filling or supplementing lubricant, it is prohibited that the oil level stays below the suction tube, or the air will enter the air conditioning system.

1. Use the bottled polyether lubricant with the scale that is specified for R-134a system.
2. For the information about the filling station, refer to the manufacturer's instruction for use. Fill the system with correct amount of air conditioning lubricant.
3. When the amount of the oil that is filled meets the required amount, turn the valve off.

Refill

Caution: The evacuating procedure must be carried out before recharging process.

1. Turn the low pressure side valve on the control panel off.
2. Turn the high pressure side valve on the control panel on.
3. For the information about the filling station, refer to the manufacturer's instruction for use.
4. Refill the air conditioner with the necessary amount of refrigerant, and make sure the unit of measurement is correct.
5. Start filling.

Refrigerant Filling Completes Successfully

1. Turn off the high pressure side valve on the filling station control panel. Both the valves should be off.
2. Start the vehicle and air conditioning system.
3. Keep the engine operating, until the readings on the high pressure gauge and low pressure gauge are stable.
4. Compare the readings with the system specifications.
5. Check the evaporator outlet temperature, make sure the operation of the air conditioning system corresponds with the system specifications.
6. Keep the air conditioner operating.
7. Turn off the interface valve on the high pressure side.
8. Disconnect the high pressure side hose from the

vehicle.

9. Turn on the valves on high and low pressure sides. Refrigerant from both the hoses will be sucked by the system rapidly through the hose on low pressure side.
10. Turn off the interface valve on low pressure side.
11. Disconnect the low pressure side hose from the vehicle.

Refrigerant Filling Failed

Sometimes, the added refrigerant is not input to the air conditioning system completely. There are two reasons for this:

1. The refrigerant tank pressure in the filling station is almost the same with that in the air conditioning system.
   - Resulting in the low process of delivery.
   - For the information about the filling station, refer to the manufacturer's instruction for use.
2. Insufficient refrigerant in the refrigerant tank of the filling station for filling.
   - For this reason, it is necessary to recover some added refrigerant from the vehicle, and then drain the air conditioning system and refill again.
   - For the information about the filling station, refer to the manufacturer's instruction for use.

Compressor

Remove

1. Disconnect battery earth lead.
2. Reclaim the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Reclaiming**

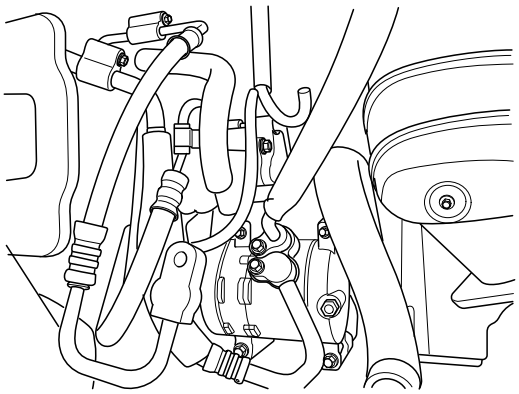
3. Lift up and support the vehicle.

☞**Vehicle Lifting**

4. Remove engine drive belts.

☞**Auxiliary Belt Remove**

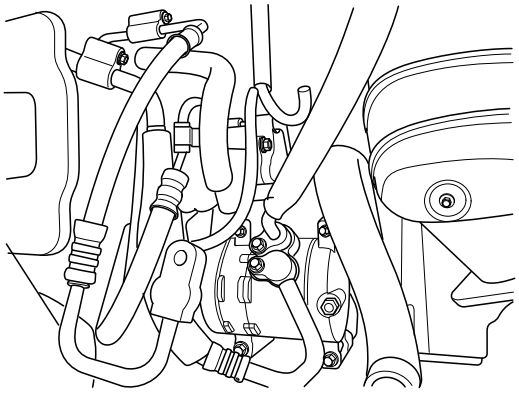
5. Disconnect the compressor clutch coil electrical connector.
6. Remove compressor inhalation hose follower bolts.



7. Disconnect the compressor inhalation hoses from the compressor.

Caution: Always fit plugs to open connections to prevent contamination.

8. Remove and discard O-ring.
9. Remove compressor exhaust hose follower bolts.

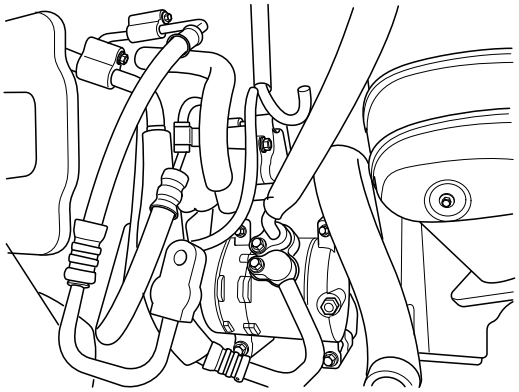


10. Disconnect the compressor exhaust hoses from the compressor.

Caution: Always fit plugs to open connections to prevent contamination.

11. Remove and discard O-ring.

12. Remove fixing bolts within the range that is from the compressor to the engine.



13. Remove the compressor from the engine.

Refit

1. Fit the compressor to the engine.
2. Fit the compressor fixing bolts to the engine and tighten bolts to **20–24Nm**.
3. Replace new O-rings and fit them to the compressor exhaust hoses.
4. Fit the compressor exhaust hose to the compressor.
5. Fit compressor exhaust hose follower bolts and tighten the bolts to **20–24Nm**.
6. Replace new O-rings and fit them to the compressor inhalation hoses.
7. Fit the compressor inhalation hoses to the compressor.
8. Fit compressor inhalation hose follower bolts and tighten the bolts to **20–24Nm**.
9. Connect the compressor clutch coil electrical connector.
10. Fit engine drive belts.

☞Auxiliary Tightener Belt Refit

11. Lower the vehicle.
12. Refill the air conditioning refrigerant.

☞Air Conditioning Refrigerant Refilling

13. Carry out a leakage test.
14. Connect battery earth lead.

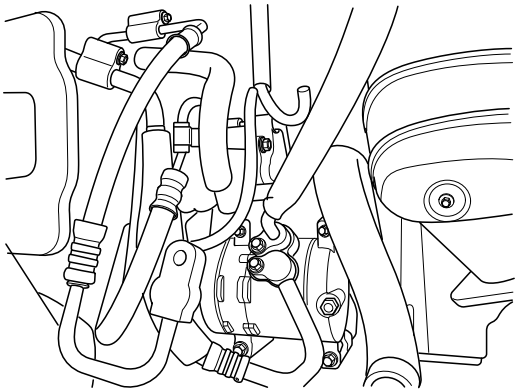
Compressor Suction hose

Remove

1. Reclaim the air conditioning refrigerant.

☞Air Conditioning Refrigerant Reclaiming

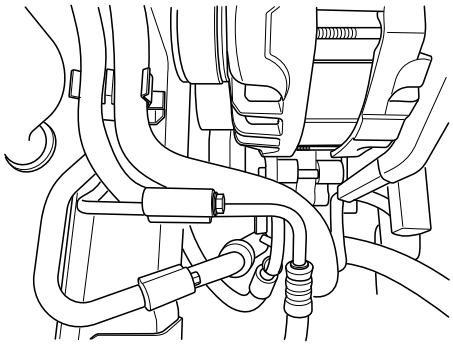
2. Remove follower bolts within the range that is from the compressor suction hose to the compressor.



3. Disconnect the compressor suction hose from the compressor.

Caution: Always fit plugs to open connections to prevent contamination.

4. Remove and discard O-ring.
5. Remove follower bolts within the range that is from the compressor suction hose to the air conditioning hard tube assembly.



6. Disconnect the compressor suction hose from the air conditioning hard tube assembly.

Caution: Always fit plugs to open connections to prevent contamination.

7. Remove and discard O-ring.
8. Remove the compressor suction hose from the vehicle.

Refit

1. Fit compressor suction hoses to the vehicle.

2. Replace with new O-rings and fit them to the compressor suction hose.
3. Fit the compressor suction hose to the compressor.
4. Fit follower bolts within the range from the suction hose to the compressor and tighten the bolts to **20–24Nm**.
5. Replace new O-rings and fit them to the compressor suction hose.
6. Fit the compressor suction hose to the air conditioning hard tube assembly.
7. Fit follower bolts within the range that is from the suction hose to the air conditioning hard tube assembly and tighten the bolts to **9–10Nm**.
8. Refill the air conditioning refrigerant.

☞Air Conditioning Refrigerant Refilling

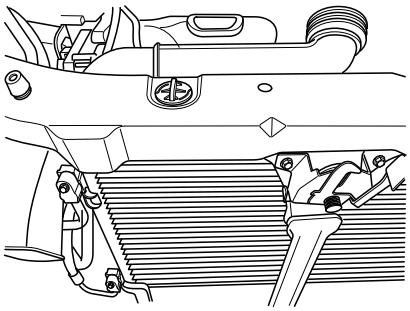
Compressor discharge hose

Remove

1. Reclaim the air conditioning refrigerant.

☞Air Conditioning Refrigerant Reclaiming

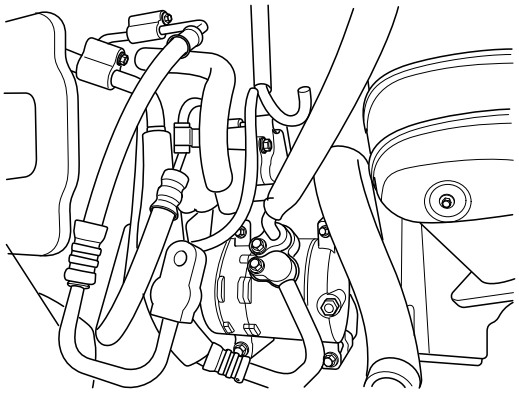
2. Remove the upper retainer of the radiator.
3. Lift the cooling module upward and move towards the engine.
4. Remove follower bolts within the range that is from the compressor discharge hose to the condenser



5. Disconnect the compressor discharge hoses from the condenser.

Caution: Always fit plugs to open connections to prevent contamination.

6. Remove and discard O-ring.
7. Remove follower bolts within the range that is from the compressor discharge hoses to the compressor.



8. Disconnect the compressor discharge hoses from the compressor.

Caution: Always fit plugs to open connections to prevent contamination.

9. Remove and discard O-ring.
10. Remove the compressor discharge hoses from the vehicle.

Refit

1. Refit compressor discharge hoses to the vehicle.
2. Replace new O-ring and refit it to compressor discharge hose.
3. Fit the compressor discharge hose to the compressor.
4. Fit follower bolts within the range that is from the discharge hose to compressor and tighten the bolts to **19–25Nm**.
5. Replace new O-ring and refit it to compressor discharge hose.
6. Fit compressor discharge hoses to the condenser.
7. Fit follower bolts within the range that is from the discharge hose to the condenser and tighten the bolts **7–10Nm**.
8. Fit the cooling module to the radiator bracket.
9. Fit the upper retainer of the radiator.
10. Refill the air conditioning refrigerant.

☞Air Conditioning Refrigerant Refilling

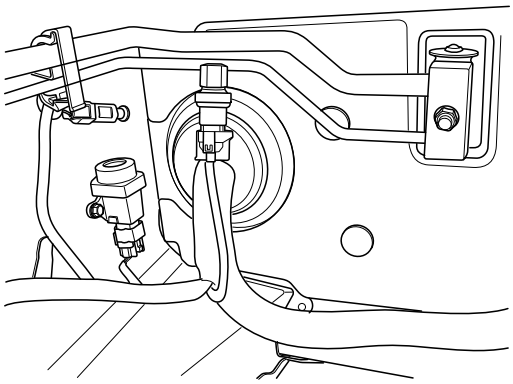
Air conditioning hard tube assembly

Remove

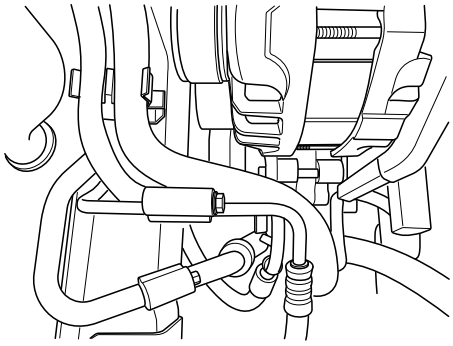
1. Reclaim the air conditioning refrigerant.

☞Air Conditioning Refrigerant Reclaiming

2. Disconnect the air conditioning pressure switch apparatus connector.



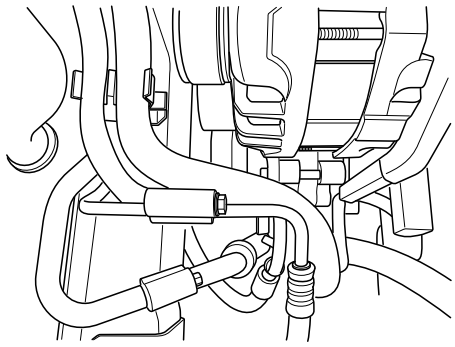
3. Remove the follower bolts within the range that is from the air conditioning hard tube assembly to the condenser pipe.



4. Disconnect the air conditioning hard tube assembly from the condenser pipe.

Caution: Always fit plugs to open connections to prevent contamination.

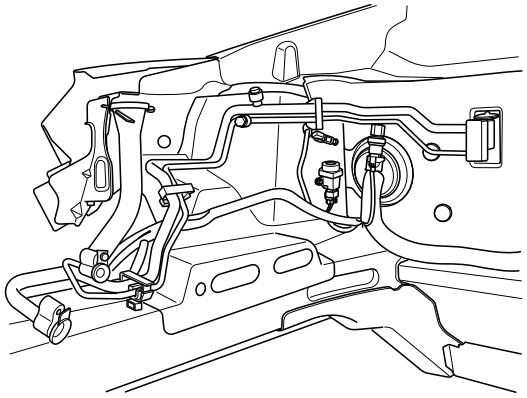
5. Remove and discard O-Ring.
6. Remove follower bolts within the range that is from the compressor inhalation hose to the air conditioning hard tube assembly.



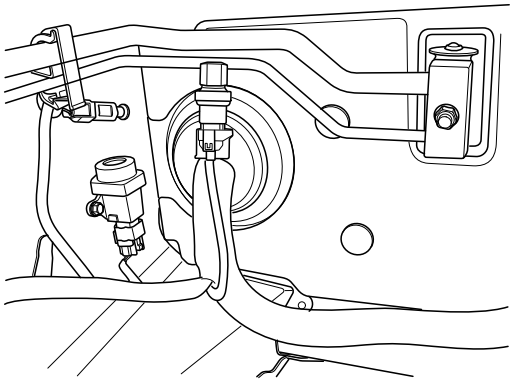
7. Disconnect the compressor inhalation hose from the air conditioning hard tube assembly.

Caution: Always fit plugs to open connections to prevent contamination.

8. Remove and discard O-ring.
9. Remove the air conditioning hard tube assembly mounting clips.



10. Remove follower nuts within the range that is from the air conditioning hard tube assembly to the thermal expansion valve.



11. Disconnect the air conditioning hard tube assembly from the thermal expansion valve.
12. Remove and discard O-ring.
13. Remove the air conditioning hard tube assembly from the vehicle.

Refit

1. Fit the air conditioning hard tube assembly to the vehicle.
2. Replace with new O-rings and fit them to the air conditioning hard tube assembly.
3. Fit the air conditioning hard tube assembly to the thermal expansion valve.
4. Fit follower nuts within the range that is from the air conditioning hard tube assembly to the thermal expansion valve and tighten the nuts to **19–25Nm**.
5. Fit the air conditioning hard tube assembly mounting bracket and retaining nuts, and tighten the nuts to **7–10Nm**.
6. Replace with new O-rings and fit them to the compressor inhalation hoses.
7. Fit the compressor inhalation hose to the air conditioning hard tube assembly.
8. Fit follower bolts within the range that is from the inhalation hose to air conditioning hard tube assembly and tighten the bolts to **7–10Nm**.
9. Replace new O-rings and fit them to the air conditioning hard tube assembly.
10. Fit the air conditioning hard tube assembly to the condenser pipes.
11. Fit follower bolts within the range that is from the air conditioning hard tube assembly to the condenser and tighten the bolts to **7–10Nm**.
12. Fit the air conditioning pressure switch apparatus connector.
13. Refill the air conditioning refrigerant.

☞Air Conditioning Refrigerant Refilling

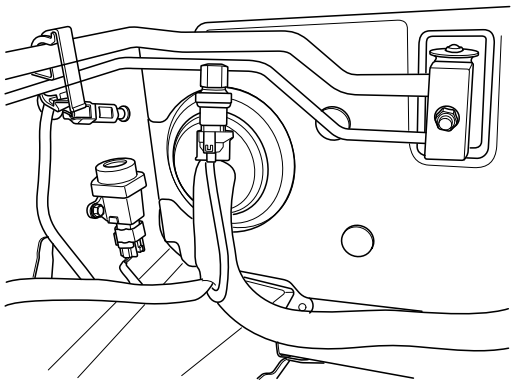
Pressure switch

Remove

1. Reclaim the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Reclaiming**

2. Disconnect the air conditioning pressure switch apparatus connector.
3. Remove the air conditioning pressure switch.



Refit

1. Replace new air conditioning pressure switches.
2. Fit the air conditioning pressure switch to the air conditioning pipeline and tighten it.
3. Refill the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Refilling**

Condenser

Remove

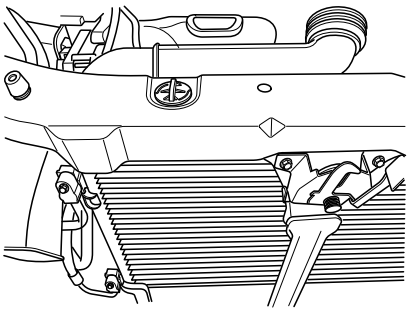
1. Reclaim the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Reclaiming**

2. Remove the cooling fan.

☞**Cooling Fan Remove**

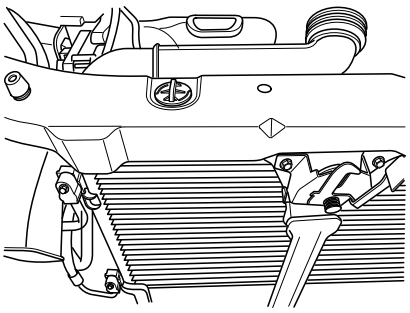
3. Remove the upper retainer of the radiator.
4. Lift the cooling module upward and move towards the engine.
5. Remove the follower bolts within the range that is from the condenser pipes to the condenser.



6. Disconnect the condenser pipes from the condenser.

Caution: Always fit plugs to open connections to prevent contamination.

7. Remove and discard O-Ring.
8. Remove follower bolts within the range that is from the compressor exhaust hoses to the condenser.

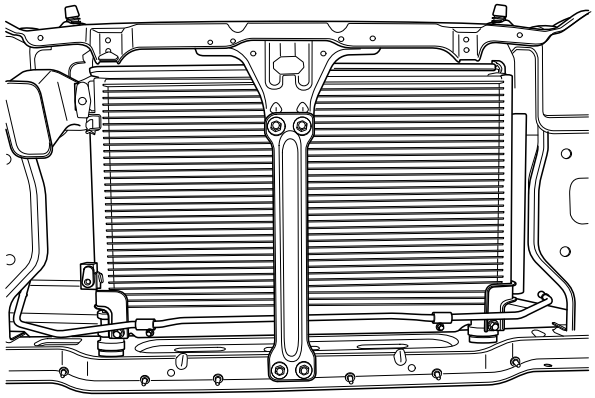


9. Disconnect the compressor exhaust hoses from the condenser.

Caution: Always fit plugs to open connections to prevent contamination.

10. Remove and discard O-Ring.
11. Remove fastening blots fit within the range that is from

the condenser to the radiator.



12. Remove the condenser from the vehicle with care so as to prevent the radiating fins from being damaged.

Refit

1. Fit the condenser with care to the vehicle so as to prevent the radiating fins from being damaged.
2. Fit fastening blots within the range that is from the condenser to the radiator and tighten them to **5.5–7.5Nm**.
3. Replace with new O-Ring and fit it to the compressor exhaust hose.
4. Fit the compressor exhaust hoses to the condenser.
5. Fit follower bolts within the range that is from the exhaust hoses to condenser and tighten the bolts to **7–10Nm**.
6. Replace new O-Ring and fit it to the condenser pipe.
7. Fit condenser pipes to the condenser.
8. Fit follower bolts within the range that is from condenser pipes to the condenser and tighten the bolts to **7–10Nm**.
9. Fit the cooling module to the radiator bracket.
10. Fit the upper retainer of the radiator.
11. Fit the cooling fan.

☞**Cooling Fan Refit**

12. Refill the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Refilling**

Air conditioning case assembly

Remove

1. Disconnect battery earth lead.
2. Recover the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Recovery**

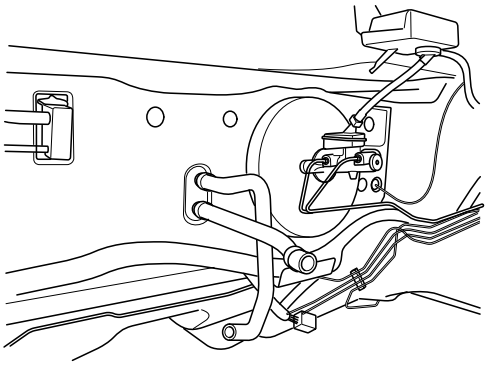
3. Drain the coolant.

☞**Coolant Draining**

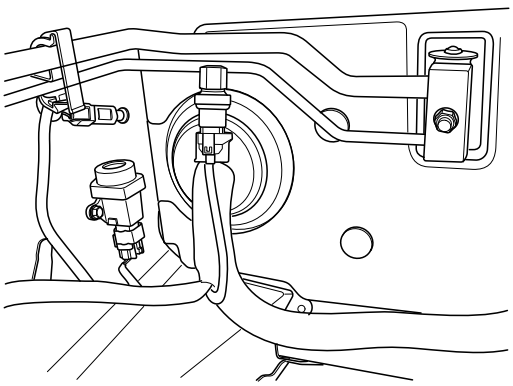
4. Remove the instrument panel assembly.

☞**Instrument Panel Assembly Remove**

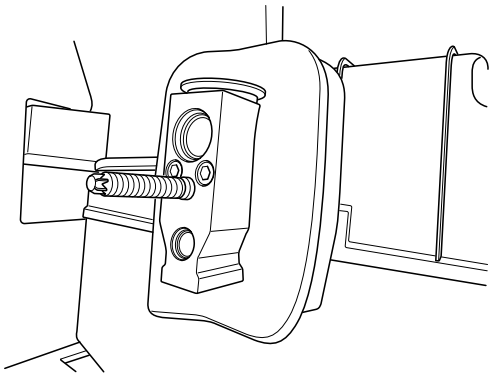
5. Loosen the clamps of the heater end on the heater water inlet pipeand disconnect the heater water inlet pipe from the heater.
6. Loosen the clamps of the heater end on the heater water outlet pipe, and disconnect the heater water outlet pipe from the heater.



7. Remove the air conditioning hard tube assembly to the thermal expansion valve pressure plate nut.



8. Disconnect the air conditioning hard tube assembly from the thermal expansion valve.



Caution: Always fit plugs to open connections to prevent contamination.

9. Remove and discard O rings.
10. Have an assistant support air-conditioning box assembly inside the vehicle, and remove the air-conditioning box assembly refit bolts.
11. Remove the air-conditioning box assembly from the vehicle.

Refit

1. Fit the air-conditioning box assembly to the vehicle.
2. Have an assistant support the air-conditioning box assembly inside the vehicle, then fit the air-conditioning box assembly refit bolts and tighten to**5–6Nm**.
3. Replace with new O rings and fit them to the air conditioning hard tube assembly.
4. Fit the air conditioning hard tube assembly to the thermal expansion valve.
5. Fit the air conditioning hard tube assembly to the thermal expansion valve pressure plate nut, and tighten the nut to **20–24Nm**.
6. Fit the heater water outlet pipe to the heater, and secure it with the clamp.
7. Fit the heater water inlet pipe to the heater, and secure it with the clamp.
8. Fit the instrument panel assembly.

☞**Instrument Panel Assembly Refit**

9. Refill the coolant.

☞**Coolant Filling**

10. Refill the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Refilling**

11. Connect battery earth lead.

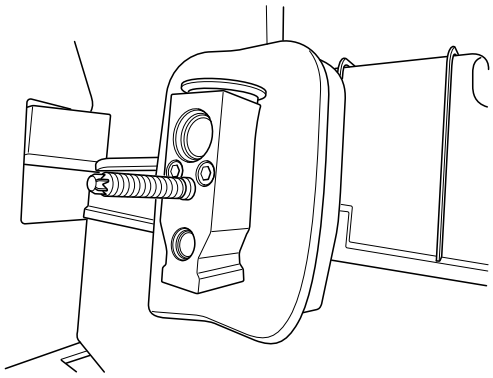
Evaporator Core

Remove

1. Remove the air conditioning case assembly.

☞**Air Conditioning Case Assembly Remove**

2. Remove the fastening blots within the range that is from the thermal expansion valve to the evaporator core.



3. Remove the thermal expansion valve from the evaporator core.

Caution: Always fit plugs to open connections to prevent contamination.

4. Discard O-Ring.
5. Remove evaporator core housing fastening screws.
6. Remove the evaporator core cover board.
7. Remove the evaporator core from the air conditioning case assembly.

Refit

1. Fit the evaporator core to the air conditioning case assembly.
2. Fit the evaporator core cover board.
3. Fit the evaporator core housing fastening screws and tighten them.
4. Replace new O-Ring and fit it to the evaporator core tube.
5. Fit the thermal expansion valve to the evaporator core.
6. Fit the fastening blots within the range that is from the thermal expansion valve to the evaporator core and tighten them to **4–6Nm**.
7. Fit the air conditioning case assembly.

☞**Air Conditioning Case Assembly Refit**

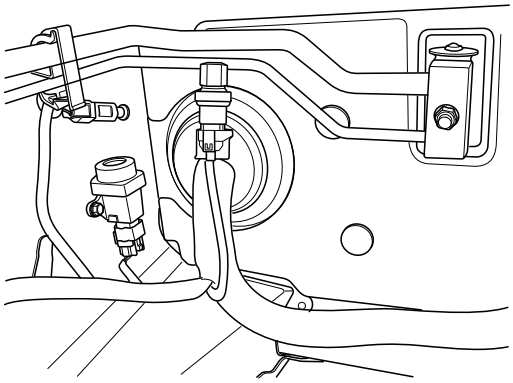
Expansion valve

Remove

1. Reclaim the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Reclaiming**

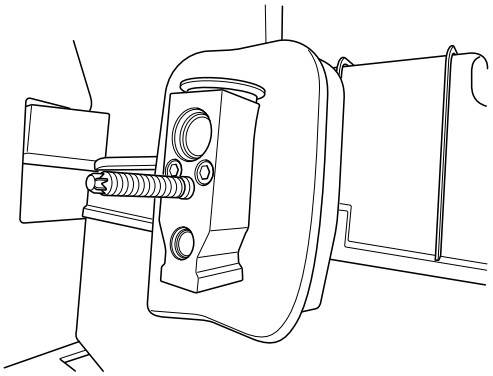
2. Remove the air conditioning hard tube assembly mounting bracket retaining nuts.
3. Remove follower nuts within the range that is from the air conditioning hard tube assembly to the thermal expansion valve.



4. Disconnect the air conditioning hard tube assembly from the thermal expansion valve.

Caution: Always fit plugs to open connections to prevent contamination.

5. Remove and discard O-Ring.
6. Remove the fastening blots from the thermal expansion valve to the evaporator core.



7. Remove the thermal expansion valve from the evaporator core.
8. Discard O-Ring.

Refit

1. Replace with new O-Ring and fit them to the evaporator core tube.
2. Fit the thermal expansion valve to the evaporator core.
3. Fit the fastening blots within the range that is from the thermal expansion valve to the evaporator core and tighten them to **4–6Nm**.
4. Replace with new O-Ring and fit it to the air conditioning hard tube assembly.
5. Fit the air conditioning hard tube assembly to the thermal expansion valve.
6. Fit follower nuts within the range that is from the air conditioning hard tube assembly to the thermal expansion valve and tighten the nuts to **20–24Nm**.
7. Fit the air conditioning hard tube assembly mounting bracket and fit it to the body.
8. Refill the air conditioning refrigerant.

☞**Air Conditioning Refrigerant Refilling**

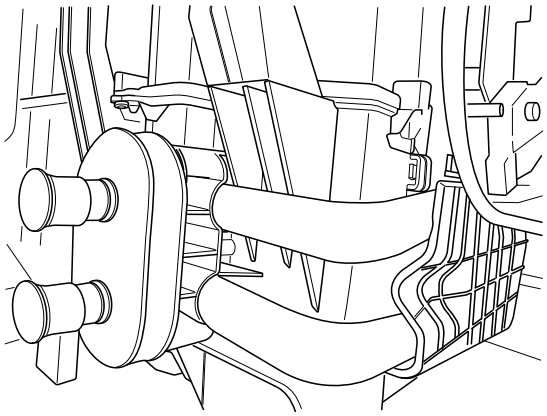
Heater core

Remove

1. Remove the air conditioning case assembly.

☞**Air Conditioning Case Assembly Remove**

2. Remove the air conditioning case assembly mounting sealing gaskets.
3. Remove the heater core inlet/outlet pipe pressure pad fastening screws.
4. Remove the heater core inlet/outlet pipe pressure pad.
5. Remove heater core baffle fastening screws.
6. Remove the heater core baffle.



7. Draw out the heater core from the air conditioning case assembly.

Refit

1. Fit the heater core into the air-conditioning box assembly.
2. Fit the heater core guard.
3. Fit the heater core guard tightening screws, and tighten them.
4. Fit the heater core inlet and outlet pipe pressure plates.
5. Fit the heater core inlet and outlet pipe pressure plates tightening screws, and tighten them.
6. Fit the air-conditioning box assembly refit gasket.
7. Fit the air-conditioning box assembly.

☞**Air-conditioning Box Assembly Refit**

Blower Motor Assembly

Remove

1. Disconnect battery earth lead.
2. Remove the glove box.

☞**Glove Box Remove**

3. Disconnect the blower motor assembly electrical connector.
4. Remove the blower motor assembly fixing screws.
5. Remove the blower motor assembly.

Refit

1. Fit the blower motor assembly to the blower case.
2. Fit the blower motor assembly fixing screws and tighten them.
3. Connect the blower motor assembly electrical connector.
4. Fit the glove box.

☞**Glove Box Refit**

5. Connect battery earth lead.

Blower Resistor

Remove

1. Disconnect battery earth lead.
2. Remove the glove box.

☞Glove Box Remove

3. Disconnect the blower speed adjustment resistor electrical connector.
4. Remove the blower speed adjustment resistor fixing screws.
5. Remove blower speed adjustment resistor.

Refit

1. Fit the blower speed adjustment resistor to the blower case.
2. Fit blower speed adjustment resistor fixing screws and tighten them.
3. Connect the blower speed adjustment resistor electrical connector.
4. Fit the glove box.

☞Glove Box Refit

5. Connect battery earth lead.

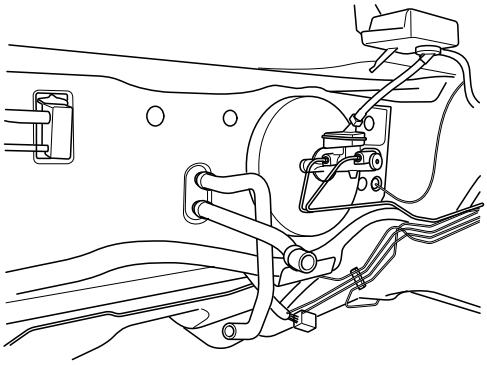
Heater Water Inlet Pipe

Remove

1. Drain the coolant.

☞Coolant Draining

2. Loosen the clamps of the heater end on the heater water inlet pipe, and disconnect the heater water inlet pipe from the heater.
3. Loosen the clamps of the engine end on the heater water inlet pipe, and disconnect the heater water inlet pipe from the engine.



4. Remove the heater water inlet pipe from the vehicle.

Refit

1. Fit the heater water inlet pipe to the vehicle.
2. Fit the heater water inlet pipe to the engine, and secure it with the clamp.
3. Fit the heater water inlet pipe to the heater, and secure it with the clamp.
4. Refill the coolant.

☞Coolant Filling

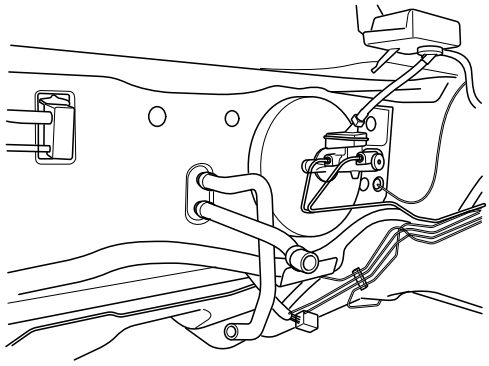
Heater Water Outlet Pipe

Remove

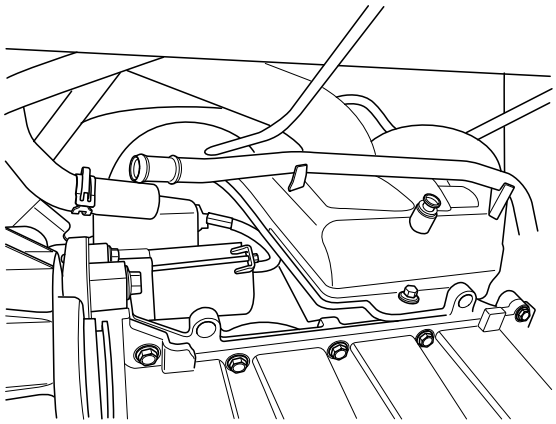
1. Drain the coolant.

☞Coolant Draining

2. Loosen the clamp of the heater end on the heater water outlet pipe, and disconnect the heater water outlet pipe from the heater.



3. Loosen the clamp from the heater water outlet pipe to the engine oil cooling pipe, and disconnect the heater water outlet pipe from the engine oil cooling pipe.



4. Remove the heater water outlet pipe from the vehicle.

Refit

1. Fit the heater water outlet pipe to the vehicle.
2. Fit the heater water outlet pipe to the engine, and secure it with the clamp.
3. Fit the heater water outlet pipe to the heater, and secure it with the clamp.
4. Refill the coolant.

☞Coolant Filling

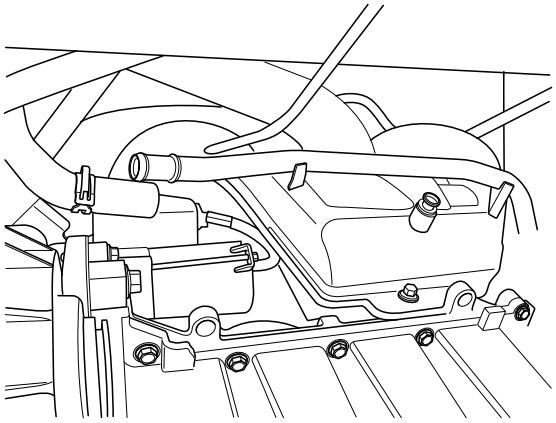
Oil Cooler Hose

Remove

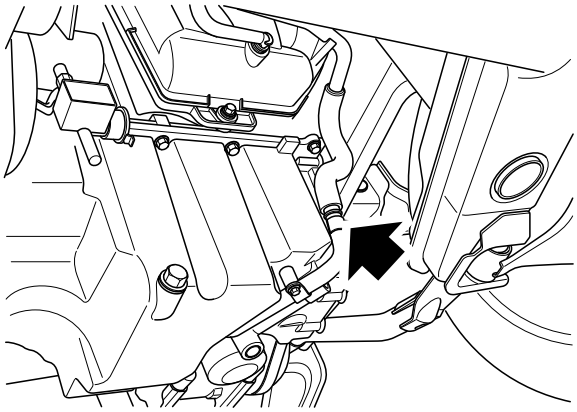
1. Drain the coolant.

☞Coolant Draining

2. Loosen the clamp on connection ends of the oil cooler hose and heater water outlet hose, and disconnect the oil cooler hose from the heater water outlet hose.



3. Raise and support the vehicle.
4. Loosen the clamp on connection ends of the oil cooler hose and oil cooler, and disconnect the oil cooler hose from the oil cooler.



5. Remove the oil cooler hose from the vehicle.

Refit

1. Fit the oil cooler hose to the vehicle.
2. Fit the oil cooler hose to the oil cooler, and secure it with the clamp.
3. Lower the vehicle.
4. Fit the oil cooler hose to the heater water outlet hose connection end, and secure it with the clamp.
5. Refill the coolant.

☞Coolant Filling

Instrument Panel Left and Right Air Outlet Ducts

Remove

1. Remove the instrument panel assembly.

☞**Instrument Panel Assembly Remove**

2. Remove the instrument panel air outlet duct.

Refit

1. Fit the instrument panel air outlet duct.
2. Fit the instrument panel assembly.

☞**Instrument Panel Assembly Refit**

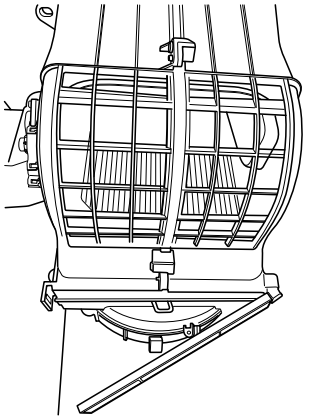
Passenger Compartment Air Cleaner

Remove

1. Remove the glove box assembly.

☞**Glove Box Assembly Remove**

2. Remove the passenger compartment air cleaner cap.



3. Remove the passenger compartment air cleaner.

Refit

1. Fit the passenger compartment air cleaner.
2. Fit the passenger compartment air cleaner cap.
3. Fit the glove box assembly.

☞**Glove Box Assembly Refit**

HVAC-ETC

Specifications

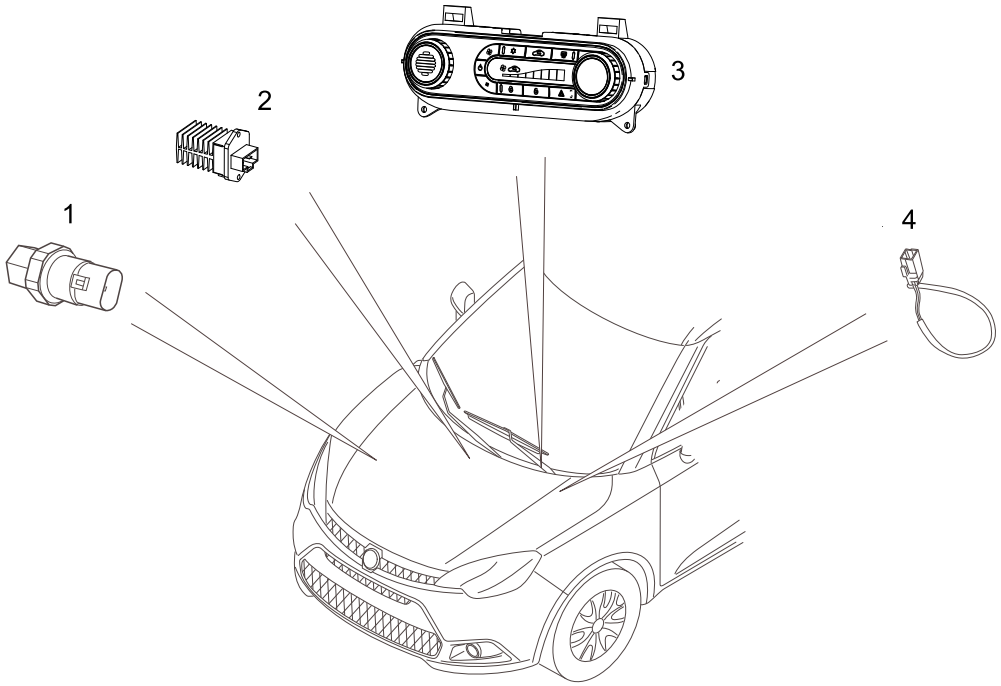
Torque

Description	Value
Screw - A/C controller assembly	1.6Nm
Screw - air temperature servo motor	1–2Nm
Screw - air distribution mode servo motor	1–2Nm
Screw - recirculated air servo motor	1–2Nm

Description and Operation

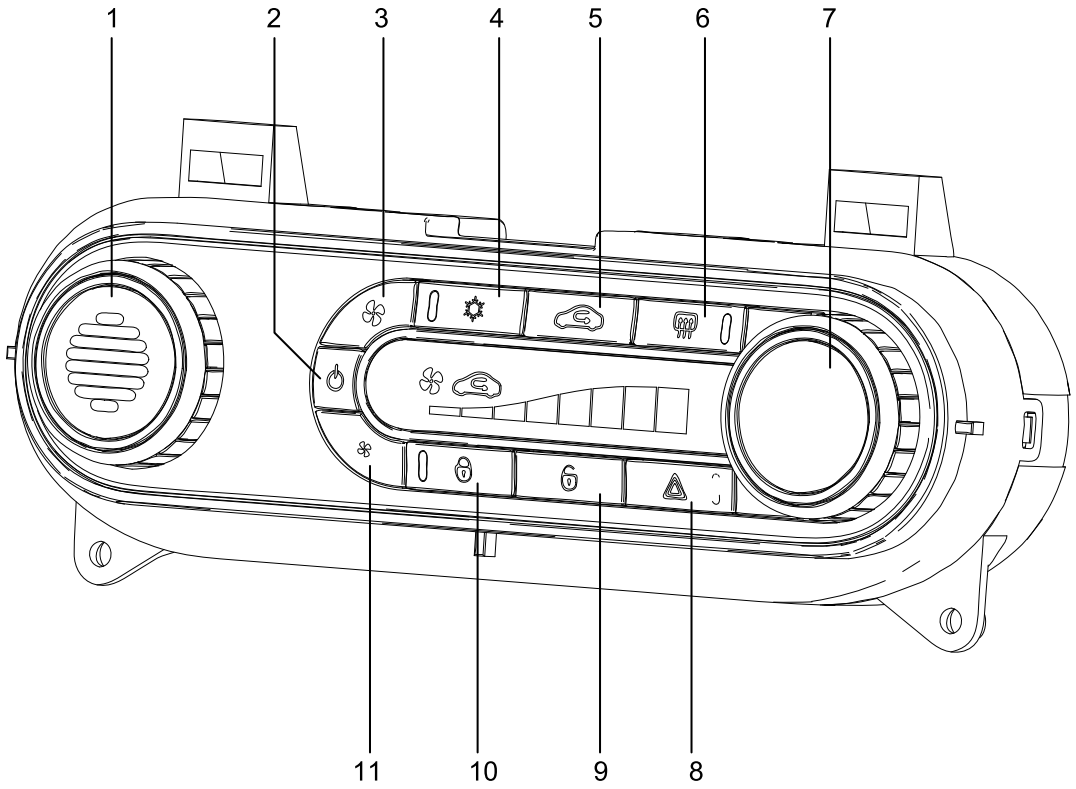
System Layout Chart

Electronic Air-conditioning ETC



1. Air Conditioning Pressure Switch
2. Blower Speed Adjustment Resistor
3. Controller Assembly
4. Evaporator Temperature Sensor

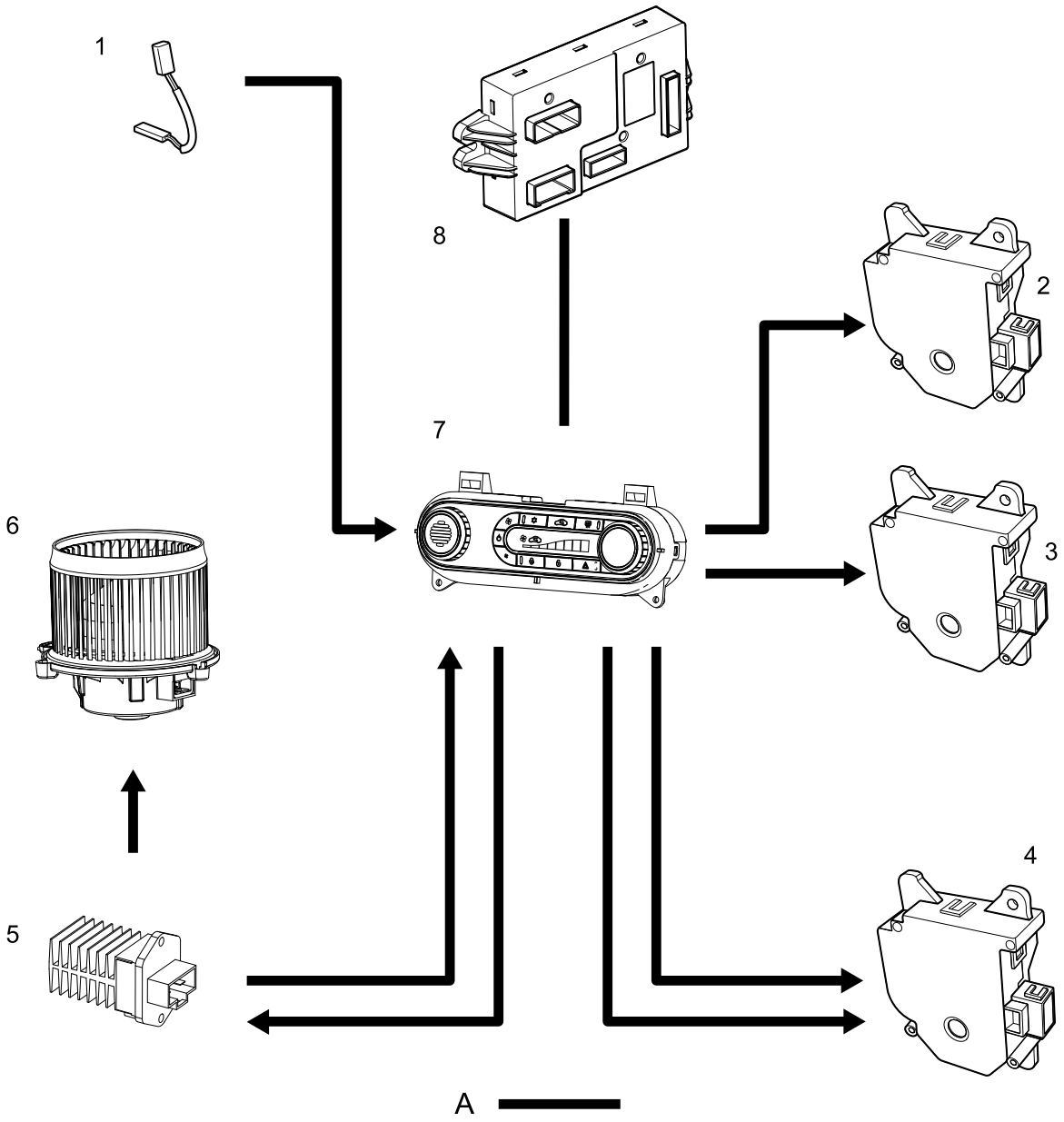
Control Panel



1. Temperature Control Knob
2. Air-conditioning Off Switch
3. Air Volume Up Button
4. Air-conditioning On Button
5. Inner / Outer Circulation Shift Switch
6. Heating of Rear Windshield HRW Button
7. Mode Control Knob
8. Warming Lamp Switch
9. Main Control Door Lock Open
10. Main Control Door Lock Closed
11. Air Volume Down Button

System Control Chart

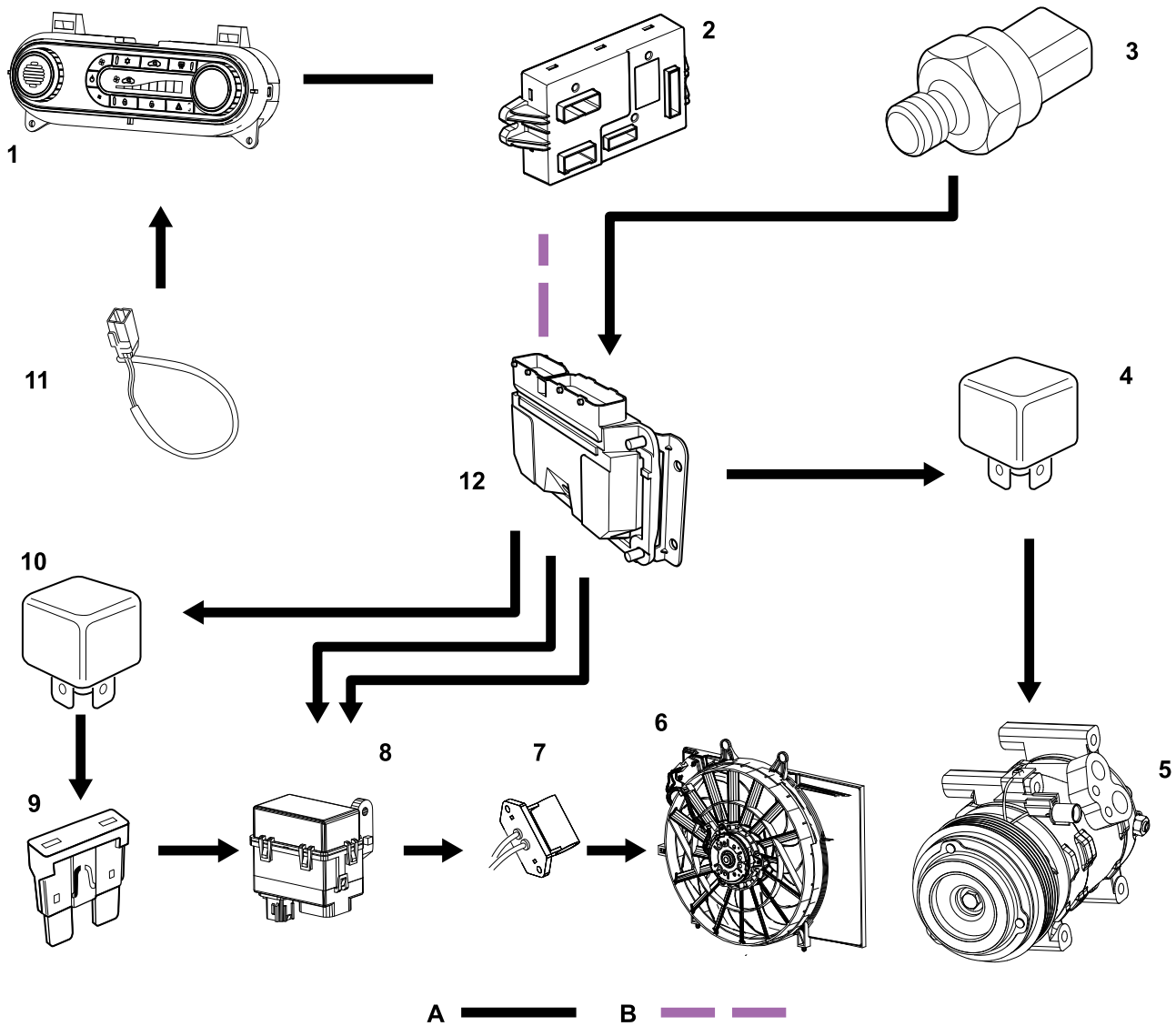
Air-conditioning Box Control



A = Hardwire;

1. Evaporator Temperature Sensor
2. Temperature Air Door Servo Motor
3. Mode Air Door Servo Motor
4. Inner/Outer Circulation Air Door Servo Motor
5. Blower Speed Adjustment Resistor
6. Blower Motor Assembly
7. Air Conditioning Controller
8. **BCM**

Compressor and Cooling Fan Control



A = Hardwire; B =**CAN** BUS

1. Air Conditioning Controller
2. **BCM**
3. Pressure Switch
4. Relay
5. Compressor
6. Cooling Fan
7. Cooling Fan Low Speed Resistor
8. Fan Relay Box
9. Main Fuse
10. Main Relay
11. Evaporator Temperature Sensor
12. **ECM**

Description

General Description

In the electronic control air conditioning system, certain functions are selected manually, such as the air inlet source, air temperature, air distribution and blower speed.

Control System - Electronic Air Conditioning System (ETC)

ETC Control system consists of the following parts:

- **ETC ECU**
- Air Conditioning Pressure Switch
- Evaporator Temperature Sensor
- Power Tube

ETC ECU

ETCECU and**BCM** are connected by hard wires to control the rear windshield heater, central control door lock, warning light and other functions.

Control Panel

Heater and ventilation system control the air temperature and air distribution in the vehicle. The system contains the following parts: filter cover, heater assembly, distribution pipe and controller assembly. The air outlet is integrated in the trunk.

The fresh air or circulation air from the filter cover enters into the heater assembly, and passes through the entire system by the impact effect of the variable speed blower in the assembly. According to the settings on the control panel, the air is heated or cooled, and supplied to the front windshield through the distribution pipe.

Icons on the panel and control switches indicate the respective operating positions and functions.

Operation

General Description

To operate the cooling system,**ETCECU** and**ECM** communications,**ECM** control the compressor clutch engagement and engine cooling fan speed.**ETCECU** also to control the operations of servo motor on the heater, blower speed, air temperature and air distribution.

Blower Control

ETC The air volume up/down button on the blower control controls the blower speed, and the air speed level is from 0 to 8.

When the IGN is turned on, the air volume button can be used to control the operation state of **ETC**. If the LCD display shows at 0 level, it indicates that**ETC** is turned off, if it shows the levels other than level 0, it means that**ETC** is turned on.

The blower speed is divided into 9 levels, level 0 and level 1 to 8 respectively. The air speed may be increased step by step. The level of the air speed is indicated by LCD display.

If the air volume is at level 0, it means that no air is blown from the blower, and**ETC** is turned off. At this time,**A/C** can not send request, however, the mode knob, temperature knob, REC button and**HRW** button can be operated independently. If the air volume is not at level 0, it means that air is blown from the blower, and**ETC** is turned on.

In the normal operation mode, when the blower knob is turned from level 1 to level 8 or from level 8 to level 1, the air blowing mode,**A/C** state,**HRW** state, REC state and outlet air temperature are not affected, and only the air volume of the blower is changed.

In the front defrost mode, if the blower air volume is turned to level 0, the front defroster operation stops, and the front defroster indicator will go off,**A/C** is turned off forcibly, and**ETC** is turned off; if the blower knob is turned from level 1 to level 8 or from level 8 to level 1, without affecting the mode,**HRW A/C** , REC and temperature state, the air volume of the front defrost changes according to the air volume selected.

When the blower knob is turned from level 1 to level 0, it is forced to close**A/C** and**A/C** indicator will be turned off, the front defrost will be closed and the front defrost indicator will be turned off. However, the control of mode knob, temperature knob, inner/outer recirculation button,**HRW** button and the state of respective indicators are not affected (If it was inner recirculation, the motor is in inner recirculation mode, it is still in the operation of 16 minutes of inner recirculation and 0.5 minute of outer recirculation. If it was outer recirculation, the motor is in outer recirculation mode.)it can also respond to the signal of backup or spraying washer fluid.

Air Temperature

The air mix door servo motor on the heater assembly is operated by turning the temperature knob switch on the control panel. The air mix door changes the rate of air that flows through the heater bypass and heater core. The ratio varies between all bypasses with no warm air and no bypasses with all warm air to match the positions of the knob switch.

Air Distribution

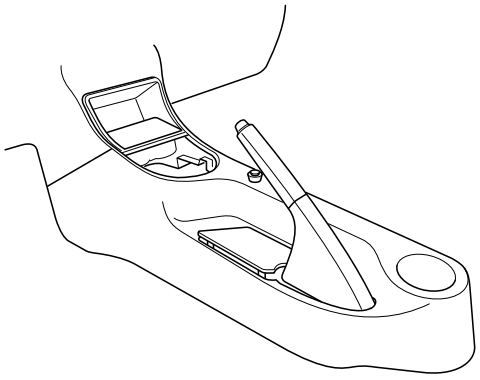
The mode air door servo motor is operated by using the five air distribution knobs on the control panel to turn the air distribution door in the heater assembly and lead the air to the respective air outlet around the passenger compartment.

Service Procedures

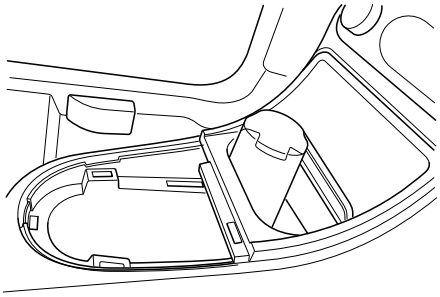
Air Conditioning Controller Assembly - ETC

Remove

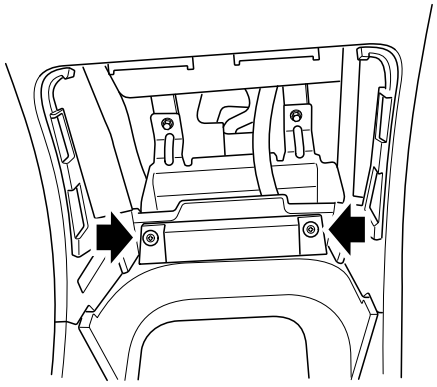
1. Disconnect battery earth lead.
2. Remove the gear shift panel.



3. Remove the handbrake panel.



4. Remove the central console storage compartment assembly.



5. Remove the air conditioning controller assembly and the trim panel.
6. Disconnect the air conditioning controller electrical connector.
7. Remove the two refit screws for fitting the air conditioning controller assembly to the trim panel.
8. Remove the air conditioning controller assembly.

Refit

1. Fit the air conditioning controller assembly to the trim panel.
2. Fit the two screws tightening the air-conditioning controller assembly to the trim panel, and tighten them to **1.6Nm**.
3. Connect the air conditioning controller assembly electrical connector.
4. Fit the air conditioning controller assembly and the trim panel to the instrument panel.
5. Fit the central console storage compartment.
6. Fit the handbrake panel.
7. Fit the gear shift panel.
8. Connect battery earth lead.

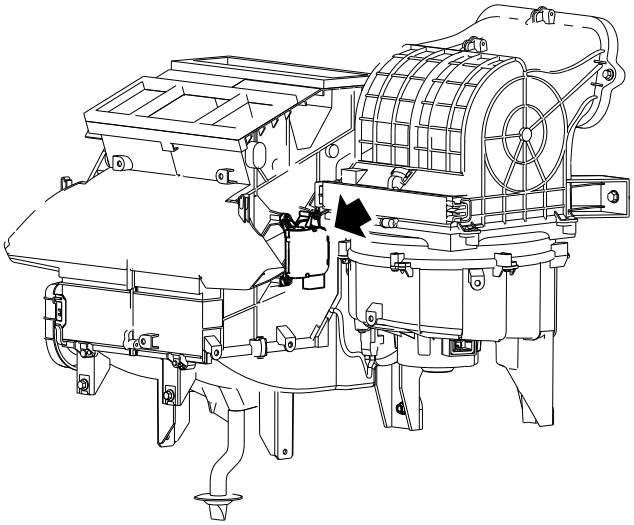
Temperature Air Door Actuator

Remove

1. Disconnect battery earth lead.
2. Remove the glove box assembly.

☞Glove Box Assembly Remove

3. Remove the air duct at the bottom rear right side of the air-conditioning box.
4. Disconnect the temperature air door actuator electrical connector.
5. Remove the temperature air door actuator tightening screws.



6. Remove the temperature air door actuator.

Refit

1. Fit the temperature air door actuator.
2. Fit the temperature air door actuator tightening screws, and tighten them to **1–2Nm**.
3. Connect the temperature air door actuator electrical connector.
4. Fit the air duct at the bottom rear right side of the air-conditioning box.
5. Fit the glove box assembly.

☞Glove Box Assembly Refit

6. Connect battery earth lead.

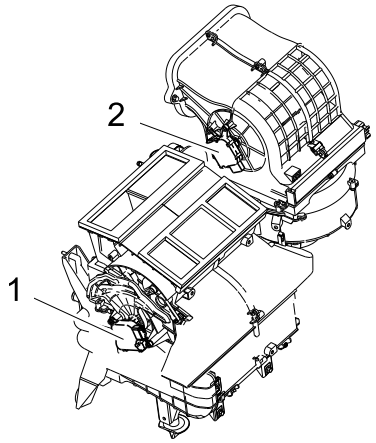
Mode Air Door Actuator

Remove

1. Disconnect battery earth lead.
2. Remove the glove box assembly.

☞Glove Box Assembly Remove

3. Remove the air duct at the bottom rear right side of the air-conditioning box.
4. Disconnect the mode air door actuator electrical connector.
5. Remove the mode air door actuator tightening screw1.



6. Remove the mode air door actuator.

Refit

1. Fit the mode air door actuator.
2. Fit the mode air door actuator tightening screws, and tighten them to **1–2Nm**.
3. Connect the mode air door actuator electrical connector.
4. Fit the air duct at the bottom rear right side of the air-conditioning box.
5. Fit the glove box assembly.

☞Glove Box Assembly Refit

6. Connect battery earth lead.

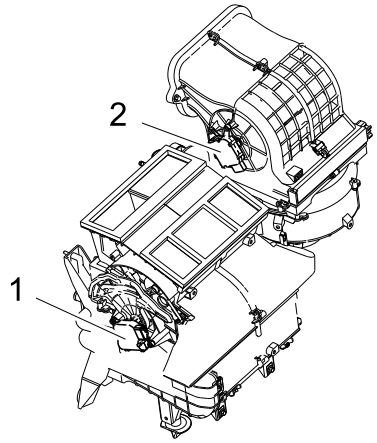
Recirculation Door Actuator

Remove

1. Disconnect battery earth lead.
2. Remove the glove box assembly.

☞**Glove Box Assembly Remove**

3. Disconnect the circulation control air door actuator electrical connector.
4. Remove the circulation control air door actuator tightening screws (2).



5. Remove the circulation control air door actuator.

Refit

1. Fit the circulation control air door actuator.
2. Fit the circulation control air door actuator tightening screws, and tighten them to **1–2Nm**.
3. Connect the circulation control air door actuator electrical connector.
4. The glove box assembly refit.

☞**Glove Box Assembly Refit**

5. Connect battery earth lead.

Evaporator Core Temperature Sensor

Remove

1. Disconnect battery earth lead.
2. Remove the air-conditioning box assembly.

☞**Air-conditioning Box Assembly Remove**

3. Remove the air-conditioning box upper evaporator case tightening screws.
4. Remove the air conditioning box upper evaporator case.
5. Remove the evaporator core temperature sensor from the evaporator.

Refit

1. Fit the evaporator core temperature sensor to the evaporator, and the refit position must be the same as the original.
2. Fit the air conditioning box upper evaporator case.
3. Fit the air-conditioning box upper evaporator case tightening screws.
4. Fit the air-conditioning box assembly.

☞**Air-conditioning Box Assembly Refit**

5. Connect battery earth lead.

HVAC-ATC

Specifications

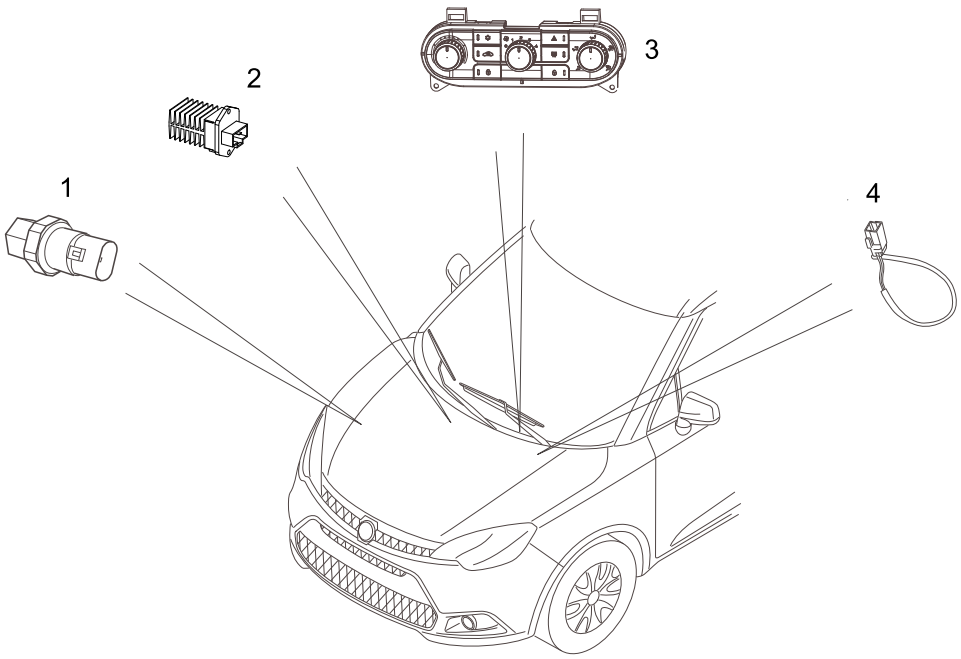
Torque

Description	Value
Screw - A/C controller assembly	1.6Nm

Description and Operation

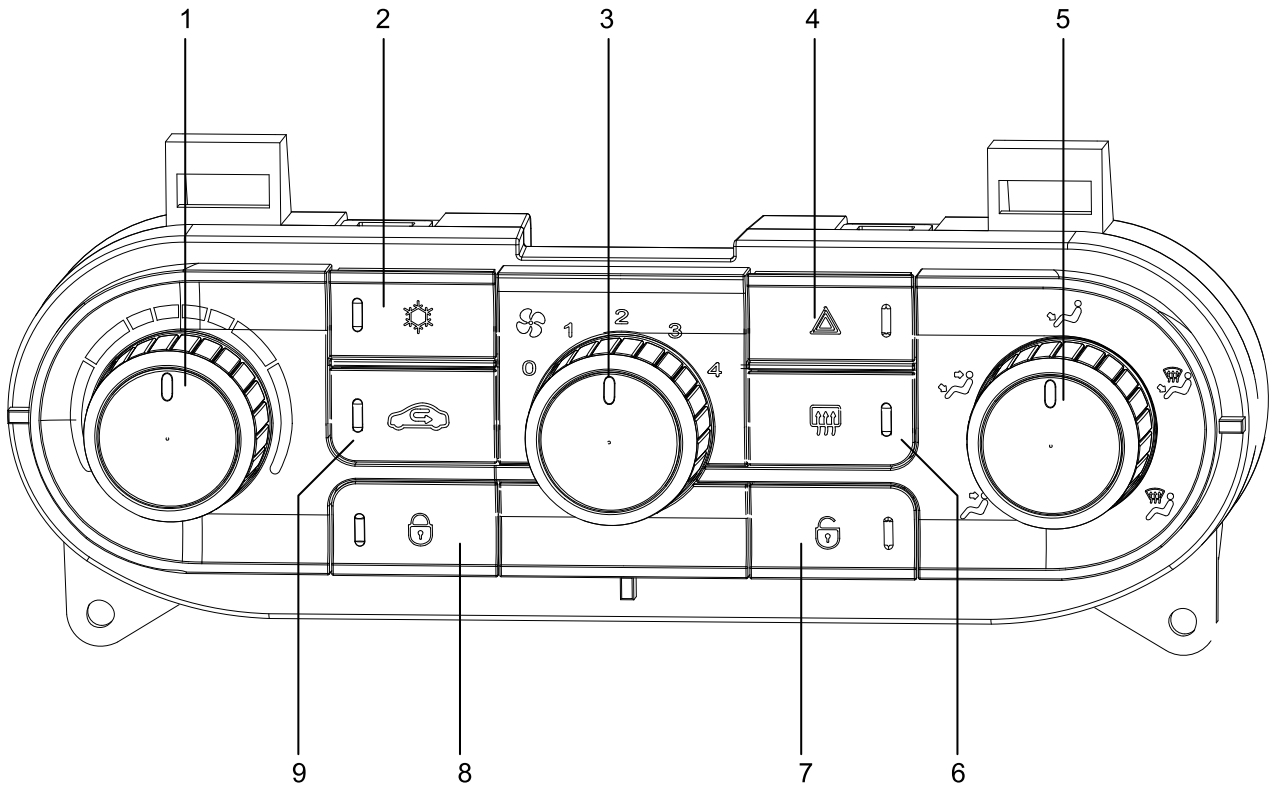
System Layout Chart

Manual Air-conditioning



1. Pressure Switch
2. Blower Speed Adjustment Resistor
3. Air Conditioning Controller
4. Evaporator Temperature Sensor

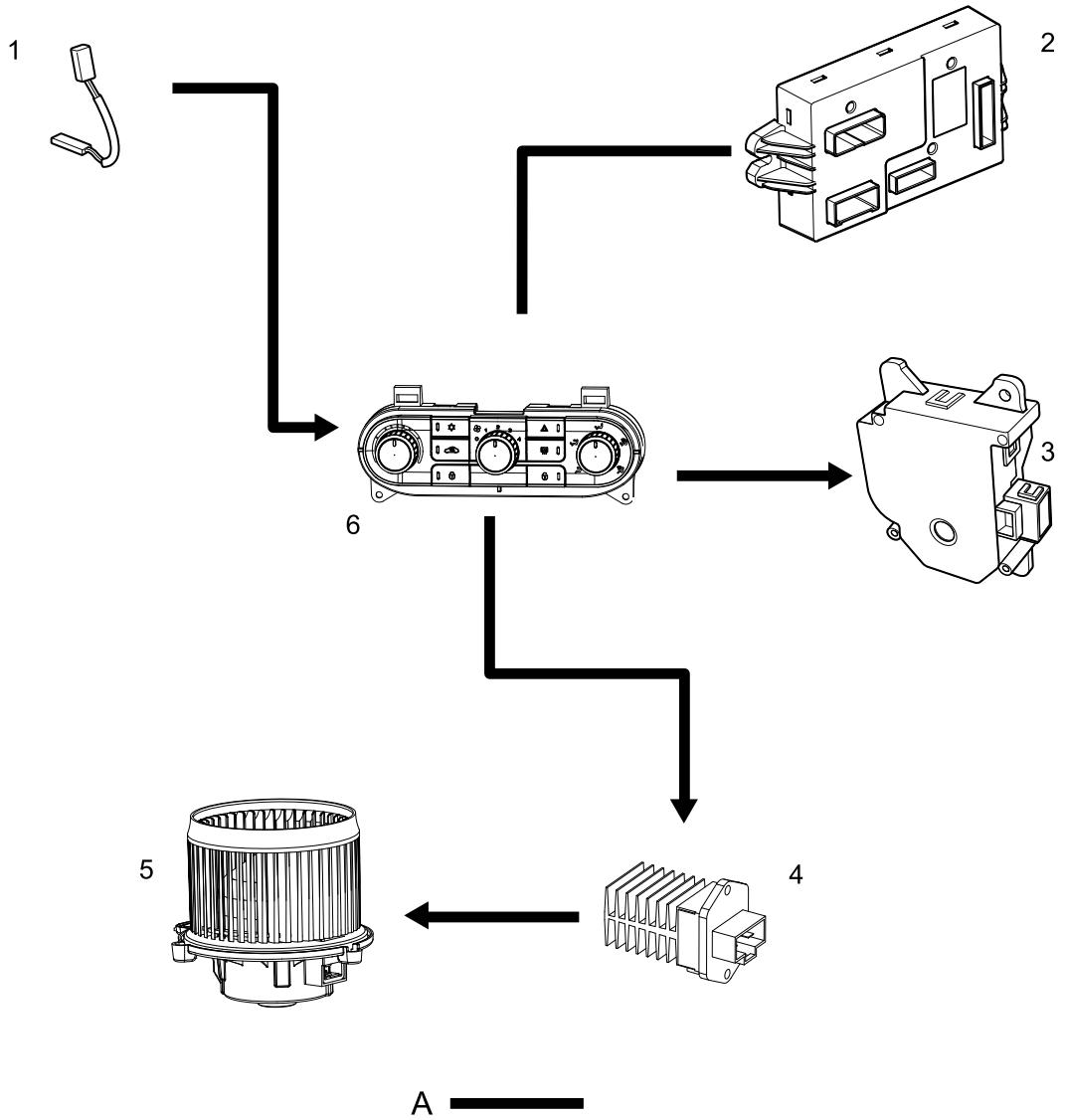
Control Panel



1. Temperature Control Knob
2. Air-conditioning Switch
3. Wind Speed Adjustment Knob
4. Warming Lamp Switch
5. Mode Control Knob
6. Rear Windshield Heating
7. Central Lock Open
8. Central Lock Closed
9. Inner / Outer Circulation Switch

System Control Diagram

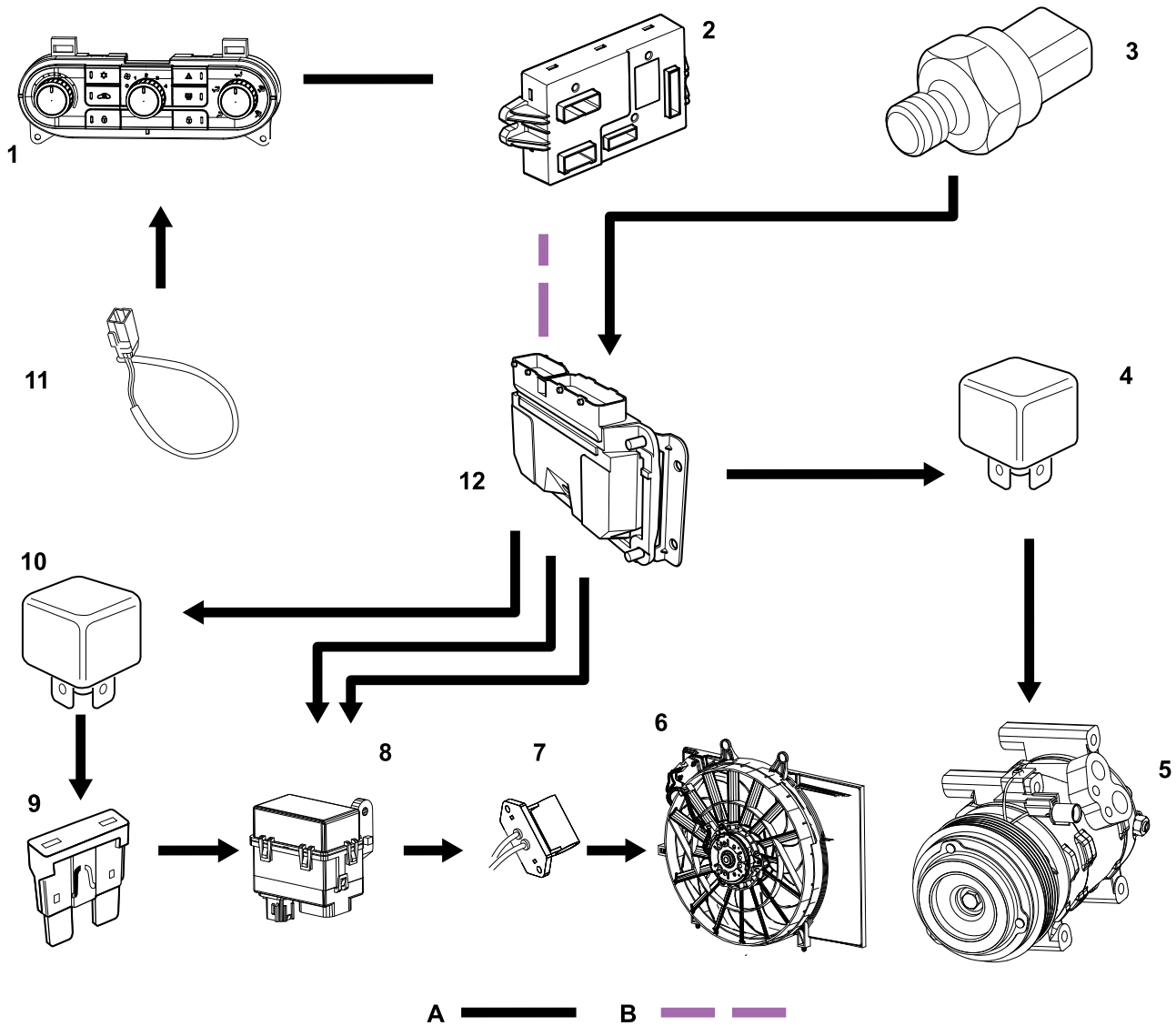
Air Conditioner Case Control



A = Hardwire;

1. Evaporator Temperature Sensor
2. **BCM**
3. Inner/Outer Circulation Air Door Servo Motor
4. Blower Speed Adjustment Resistor
5. Blower Motor Assembly
6. Air Conditioning Controller

Compressor and Cooling Fan Control



A = Hardwire; B =**CAN** BUS

1. Air Conditioning Controller
2. **BCM**
3. Pressure Switch
4. Relay
5. Compressor
6. Cooling Fan
7. Cooling Fan Low Speed Resistor
8. Fan Relay Box
9. Main Fuse
10. Main Relay
11. Evaporator Temperature Sensor
12. **ECM**

Description

Overview

In the manual control air conditioning system, functions including air source, air temperature, air distribution as well as blower speed are all selected manually.

Manual air conditioning system (MTC)

The control system is composed of the following parts:

- Manual controller
- Air conditioning pressure switch
- Evaporator temperature sensor
- Blower speed resistance

Manual controller

Manual controller and**BCM** are connected with hardwires so as to control functions including rear windshield electric heater, central door lock as well as warning light.

Control panel

Air temperature and distribution inside the vehicle are controlled by the warming and ventilating system. This system includes the following parts: filter cover, heater assembly, distribution pipeline and controller assembly. The air outlet is integrated inside the trunk.

When fresh air or circulating air coming from the filter cover enter into the heater assembly, the air is forced to pass through the entire system by the impact of the variable speed blower inside the assembly. According to the settings on the control panel, air is heated or cooled down and supplied to the front windshield through distribution pipelines.

Icons on the panel and the control switch indicate respective operation positions and functions.

Operation

Defrost/Defog

When frost/fog is formed on the front windshield, turn the mode control knob to the defrost/defog position, then the mode control knob will drive the mode door cable, the cable will drive the mode door to rotate to the position where the defrost/defog duct opens, and the air going out of the air conditioner will eliminate the frost/fog, so as to defrost/defog.

When frost/fog is formed on the rear windshield, press the rear windshield defrost/defog button, then the rear windshield heating signals will be transferred to**BCM** by the air conditioner controller,**BCM** will connect the heating circuit of the rear windshield, so as to defrost/defog. The defrost/defog function can operate only when the engine is running, and when the engine does not start, this function will not respond.

Temperature Control

The purpose of adjusting the air conditioner temperature can be achieved by means of adjusting the temperature control knob on the air conditioner controller. Turn the temperature control knob, the knob will drive the door cable, and the cable will drive the mixed air door to rotate, so as to change the open degree of the door to adjust the temperature.

When the knob is at the bottom of the red area, the open degree of the door for the hot air heated by the heater core will reach its maximum value, and at this time the temperature of the air outlet of the air conditioner will reach its maximum value; when the knob is at the bottom of the blue area, if the air conditioner is opened at this time, then the open degree of the door for the cold air cooled by the evaporator will reach its maximum value, and at this time the temperature of the air outlet of the air conditioner will reach its lowest value, if the air conditioner is not opened at this time, the temperature of the air outlet of the air conditioner will be the ambient temperature.

Blower Control

The blower speed will be controlled by the air volume knob on the control panel, and the air speed level on the knob are from level 0 to level 4. The speed of the blower will be fixed by the position of the knob, and the air speed of the blower can be divided into five classes: level 0, level 1, level 2, level 3, and level 4, and the air speed will increase level by level. The level of the air speed is indicated by the air volume knob. If the air volume knob indicator is at level 0, it means that no air is blown from the blower, and at this time it cannot send a request, however, the mode knob, temperature knob, REC button and HRW button can be operated independently. If the air volume knob indicator does not indicate at level 0, which means that air is blown from the blower,**A/C** can send a request for turn on the air conditioner. In the normal operation mode, when the blower knob is turned from level 1 to level 4 or from level 4 to level 1, the delivery mode,**A/C** state, HRW state, REC state and outlet air temperature are not affected, and only the air volume of the blower is changed. In the present front defrost mode, if the blower air volume is turned to level 0, then the front defroster operation will stop, the front defroster indicator will go off, and**A/C** will turn off forcibly; if the blower knob is turned from level 1 to level 4 or from level 4 to level 1, then the mode, HRW, **A/C**, REC and temperature state will not be affected, and the air volume of the front defrost will change with the change of the indicating position of the air volume knob. When the blower knob is turned from level 1 to level 0, the**A/C** will turn off forcibly, and**A/C** indicator will turn off, and the front defrost and front defog indicators will also turn off, but the mode knob, temperature knob, inner/outer recirculation button, HRW button control and the states of the corresponding indicators will not be affected.

Mode Control

The mode control drives the mode door cable by the mode control knob, so as to drive the mode door to different positions and therefore achieve purposes of different mode controls, and this manual air conditioner can be divided into the following modes:

- blowing to face
- blowing to face + blowing to feet
- blowing to feet
- blowing to feet + front windshield
- front windshield defrost/defog

Inner/Outer Recirculation

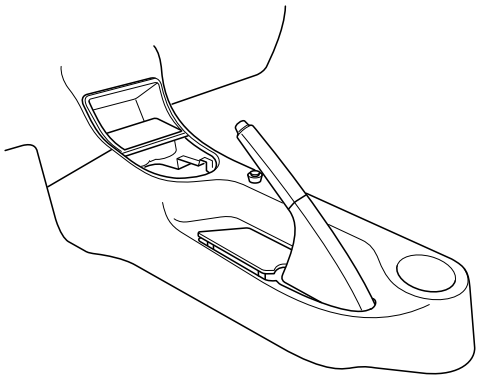
Control the inner/outer recirculation state of the air conditioner system with the inner/outer recirculation button, and when the engine is stopped, the inner/outer recirculation door will stay at the existing state when the engine is stopped.

Service Procedures

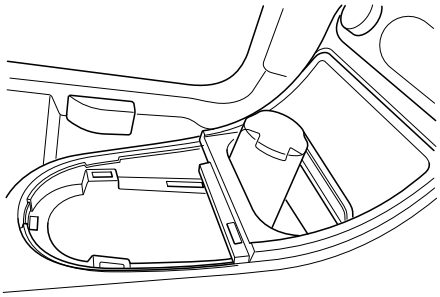
Air conditioning controller assembly - MTC

Remove

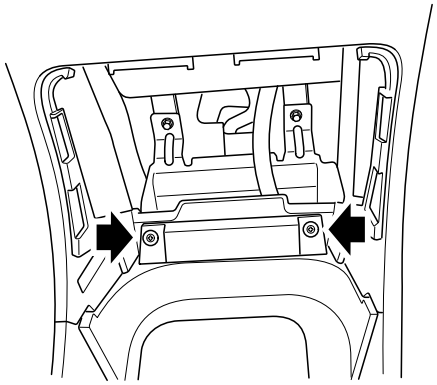
1. Disconnect battery earth lead.
2. Remove the gearshift panel.



3. Remove the manual brake panel.



4. Remove the console storing case assembly.



5. Take down the air conditioning controller assembly and the trim panel
6. Disconnect the air conditioning controller apparatus connector.
7. Remove the air door cable joint from the air conditioning controller
8. Remove two mounting screws fitting the air conditioning controller assembly to the trim panel.
9. Remove the air conditioning controller assembly.

Refit

1. Fit the air conditioning controller assembly to the trim panel
2. Fit two bolts fixing the air conditioning controller assembly to the trim panel and tighten them to **1.6Nm**
3. Connect the air conditioning controller assembly electrical connector.
4. Connect the air door cable to the air conditioning controller.
5. Fit the air conditioning controller assembly and the trim panel to the instrument panel.
6. Fit the console storing case.
7. Fit the manual brake panel
8. Fit the gearshift panel.
9. Connect battery earth lead.

Temperature Door Cable

Remove

1. Remove air conditioner control head assembly.

☞Air Conditioner Control Head Remove

2. Remove the glove box assembly.

☞Glove Box Assembly Remove

3. Remove temperature door cable from the left side of HVAC module.
4. Remove temperature door cable.

Refit

1. Fit the temperature door cable to the vehicle.
2. Fit one end of the temperature door cable to the HVAC module.
3. Fit the other end of the temperature door cable to air conditioner control head.
4. Fit the glove box assembly.

☞Glove Box Assembly Refit

5. Fit air conditioner control head.

☞Air Conditioner Control Head Refit

Mode Door Cable

Remove

1. Remove air conditioner control head assembly.

☞Air Conditioner Control Head Remove

2. Remove the driver side lower protector.

☞Driver Side Lower Protector Remove

3. Remove mode door cable from the left side of HVAC module.
4. Remove mode door cable.

Refit

1. Fit the mode door cable to the vehicle.
2. Fit one end of the mode door cable to the HVAC module.
3. Fit the other end of the mode door cable to air conditioner control head.
4. Fit the driver side lower protector.

☞Driver Side Lower Protector Refit

5. Fit air conditioner control head.

☞Air Conditioner Control Head Refit

Front Wheel Steering

Specifications

Torque

Description	Value
Bolt - PAS steering feed pipe to PAS pump	35–40Nm
Nut - track rod bar ball joint	28–32Nm
Bolt - steel road wheel bolt	115–130Nm
Nut - steering rack to front subframe	90–110Nm
Bolt - power steering oil intake pipe to power steering pump	25–28Nm
Bolt - power steering oil intake pipe to power steering rack	25–28Nm
Bolt - subframe to body	90–110Nm
Nut - exhaust manifold to exhaust front pipe	45–55Nm
Nuts - anti-roll bar to links	45–55Nm
Bolt - power steering column to power steering rack input shaft	19–24Nm

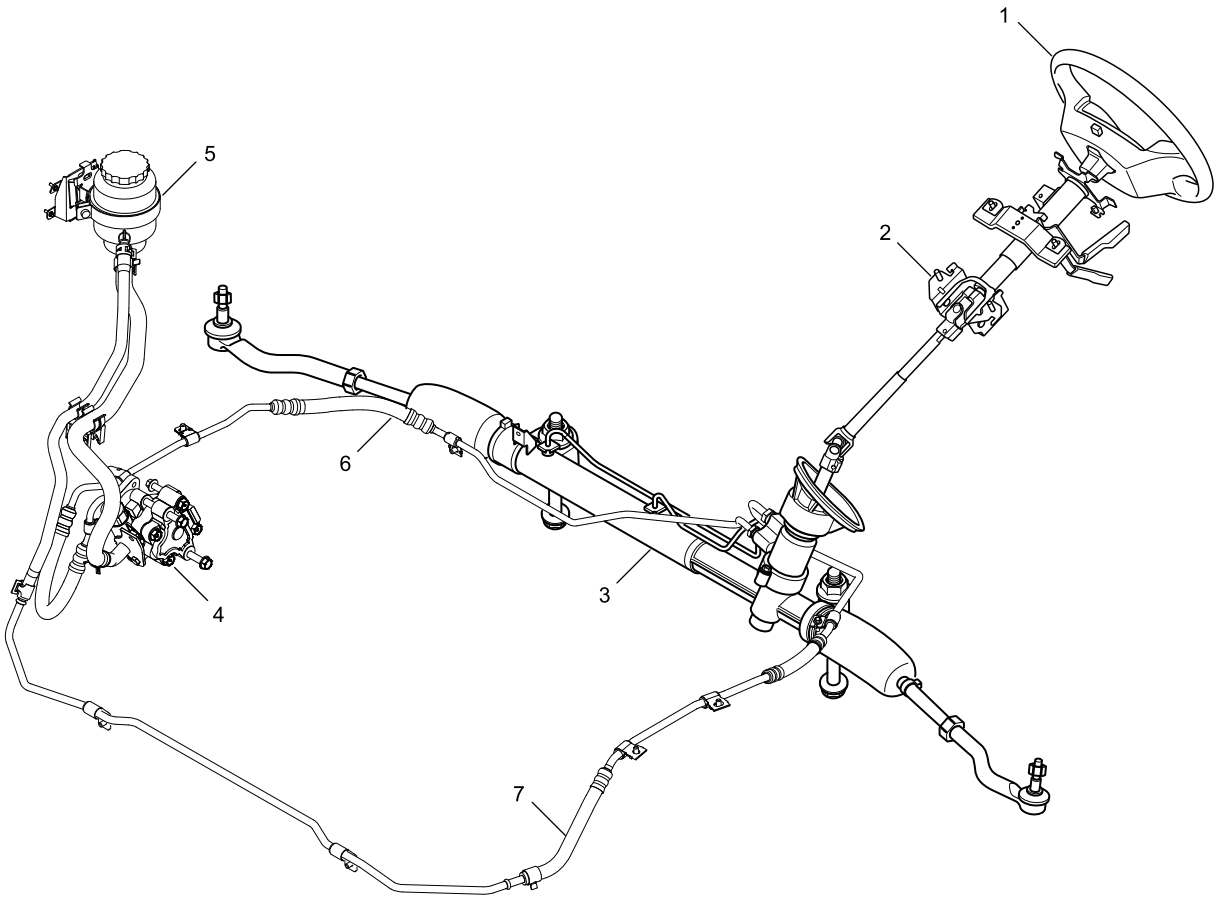
Specifications

Type	Servo-assisted rack and pinion, linear ratio system
Steering column Type	Tilt and reach adjustable steering column with collapse mechanism. Integral electronic steering column lock.
Steering wheel diameter	370 mm
Turns - lock to lock	2.85
Turning circle Smallest turning radius	10.4m
Power assisted steering Operating pressure Flow rate Nominal	102bar 6-7.5 L/min 7.50L

Description and Operation

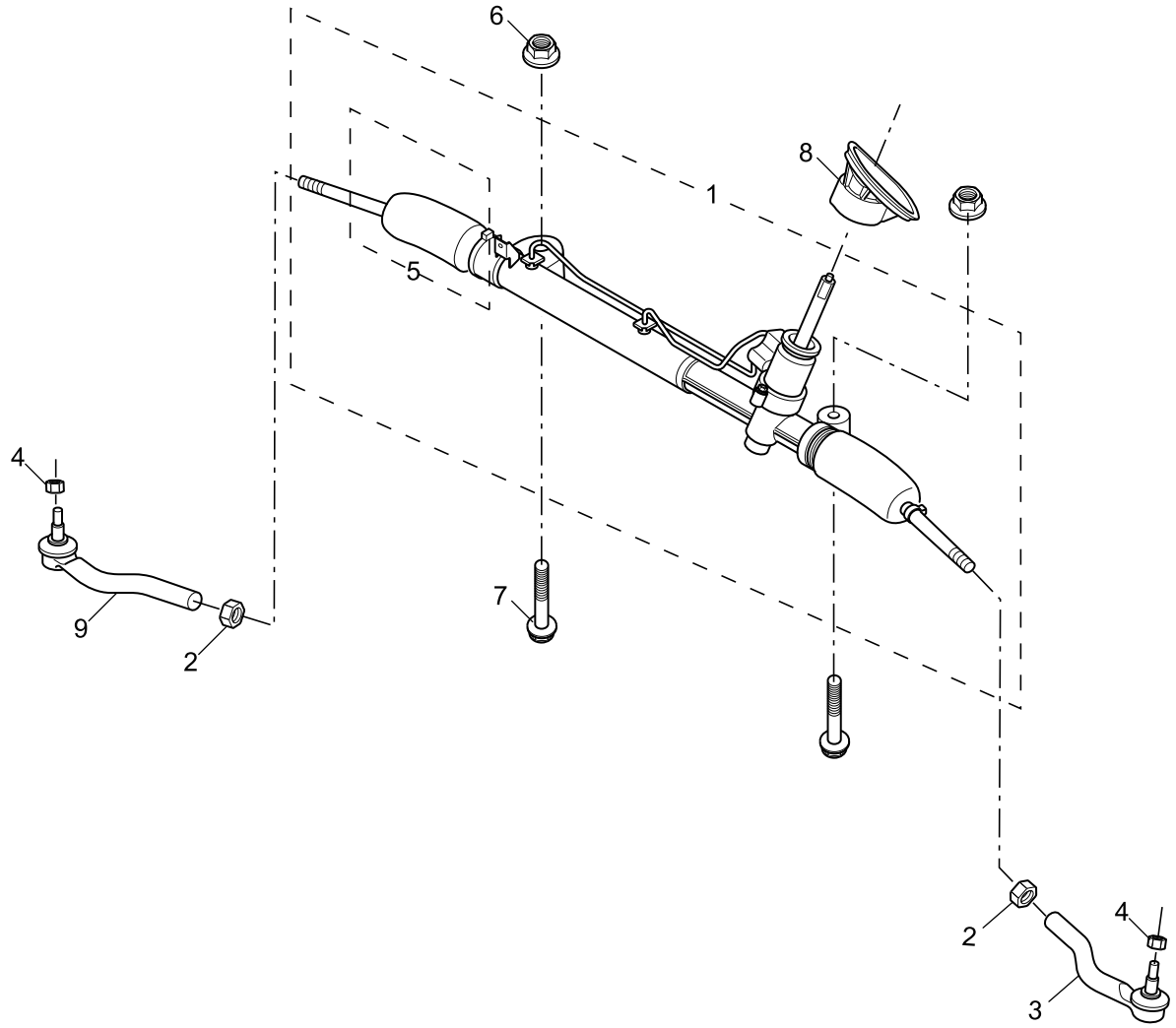
System Component layout

Steering system component layout



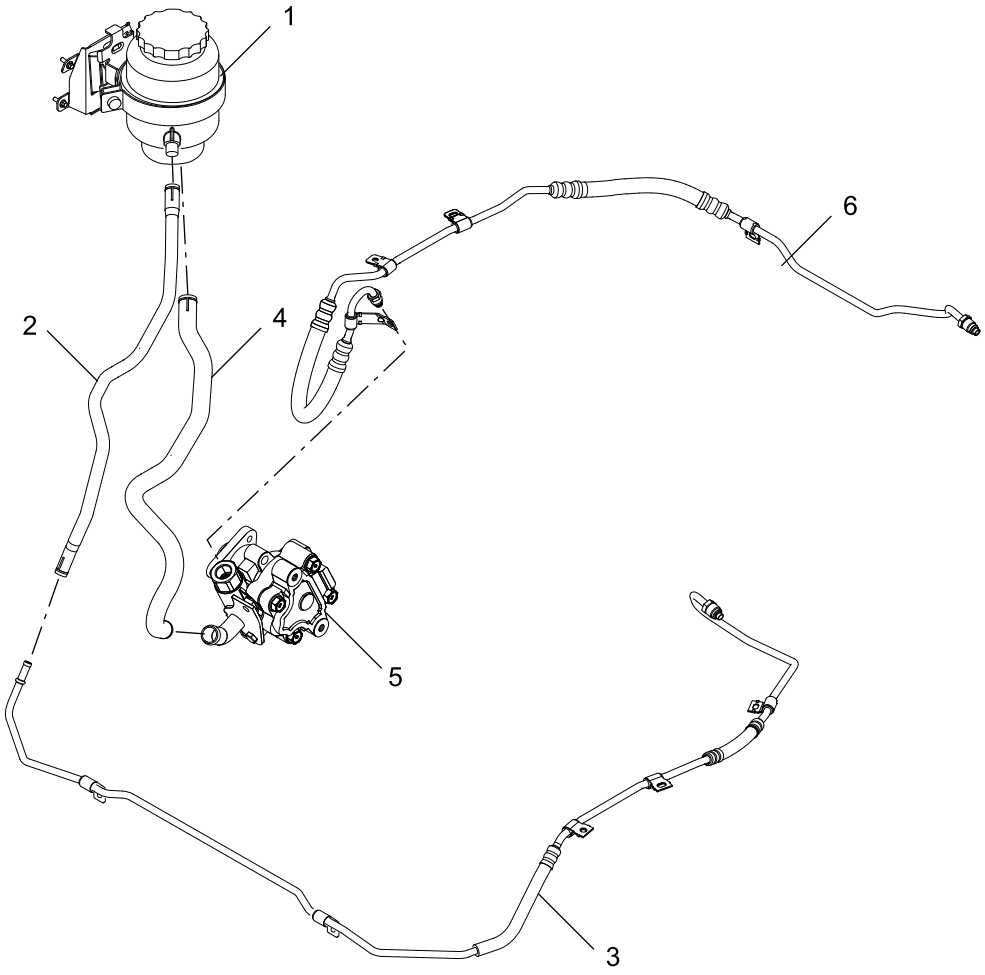
1. Steering Wheel
2. Steering Column
3. Steering Gear
4. PAS pump
5. Fluid reservoir
6. PAS high pressure hose
7. PAS return hose

Steering Gear Component Location



1. Steering Gear Sub-assembly
2. Track rod end lock nut (Two)
3. Track rod ball joint
4. Lock nut (Two)
5. Gaiters (Two)
6. Nuts (Two)
7. Bolts (Two)
8. Pinion Seal
9. Track rod ball joint

PAS Hydraulic Component Location



1. Fluid reservoir
2. PAS return hose (to reservoir)
3. PAS return hose (from Steering Gear)
4. PAS Pump suction hose
5. PAS Pump
6. PAS high pressure hose

Description

General

The major steering components comprise a two stage collapsible steering column, a power assisted steering rack, a pump, a pressure sensor, a fluid reservoir, a fluid cooler and fluid pipes and hoses.

Steering Rack

The steering rack is mounted in the optimum position, low on the rear cross member of the front subframe. As the rack mounting points and suspension pivot points are all defined by the accurate rigid subframe, the designed geometric relationships are maintained at all times. The rack is retained with two bolts through cast lugs near the valve unit and two bolts which secure a clamp fixed to the opposite end of the rack. A 'Double D' arrangement together with a nut and cam bolt secures the steering column to the steering rack pinion. The rack requires 2.81 turns from lock to lock and the rack and pinion has an overall ratio of 16:1. Rubber gaiters protect the movement area of the rack. Track rod ends, fitted to threaded tie rods and secured with locknuts provide for the adjustment of front wheel steering alignment. Each track rod end is secured by a lock nut to the steering arm, which extends from the front hub.

Power Assisted Steering (PAS) Pump

Hydraulic pressure to operate the PAS system is generated by a vane-type pump which is driven from the crankshaft of the engine by a polyvee ribbed belt. Whilst the engine is running, hydraulic fluid is drawn from the reservoir by the suction action of the pump. The amount of fluid delivered to the control valves, and its pressure, is regulated by the flow control valve built into the pump. Excess fluid is returned to the intake side of the pump via internal fluid ways.

Warning: Care is required when working on the hydraulic systems, since the high pressure fluid can be hot and, when the pump is operating, reach pressures in excess of 10000 KPa(1450 lbf/in2) causing a risk of personal injury.

Power steering fluid

The pressure of the fluid coming from the power assisted steering pump is transported to the crossover valve through pinions with a control valve controlling the fluid pressure and changing the fluid flow direction. The fluid is guided to the pressure cylinder which is fit at the corresponding side of the power steering, generating the drive of the steering gear rack accordingly. The pressure fluids reflow from the power steering gear pressure cylinder. Before the power fluids return to the steering oil reservoir, an annular passage of the return pipe through which the pressure fluids flow plays a role of cooling down the power steering fluids. The steering oil reservoir is the place where the power fluid is stored.

Fluid Reservoir

The reservoir comprises a body, a cap and a filter assembly. The cap features an integral fluid level dipstick and an O-ring seal fitted to the cap prevents leakage. A breather hole is incorporated in the cap to allow changes in fluid level during operation. A non-serviceable filter assembly is fitted into the bottom of the reservoir. The filter mesh is moulded into the frame of the filter and removes particulate matter from the fluid before it is drawn into the supply connection.

Operation

Rotary movement of the steering wheel is transferred via the steering column to the valve unit which is mounted on the steering rack. The rotary movement of the steering is converted into linear movement of the steering rack through the rack and pinion.

Neutral Position

With no movement of the steering wheel being applied, fluid flows from the pump to the valve unit. The slots in the outer sleeve and the rotor are aligned so that the fluid pressure flows across the valve unit. Some pressure is applied to the feed and return ports which in turn is felt at either side of the piston in the hydraulic cylinder. With the forces equal on each side of the cylinder, the steering remains in the neutral position. The majority of the fluid delivered from the pump is returned from the valve unit, and via the fluid cooler, back to the reservoir. With the majority of the fluid being returned to the reservoir, the pressure available at each side of the piston is very low.

Steering to the Left

Counter-clockwise rotation of the steering wheel in turn rotates the rotor and the torsion bar in the same direction. The slots in the rotor move out of their neutral alignment and block the return flow of fluid to the reservoir. Fluid pressure from the pump now flows into the newly aligned slots in the rotor and outer sleeve. The pressure is directed by the alignment of the slots into the left hand side of the hydraulic cylinder where the pressure increases. The right hand side of the hydraulic cylinder is opened to return and allows fluid displaced from the right hand side of the piston to flow to the reservoir. The pressure difference on the left and right hand sides of the piston in the cylinder gives the power assistance to turn the steering.

Steering to the Right

Clockwise rotation of the steering wheel in turn rotates the rotor and the torsion bar in the same direction. The slots in the rotor move out of their neutral alignment and block the return flow of fluid to the reservoir. Fluid pressure from the pump now flows into the newly aligned slots in the rotor and outer sleeve. The pressure is directed by the alignment of the slots into the right hand side of the hydraulic cylinder where the pressure increases. The left hand side of the hydraulic cylinder is opened to return and allows fluid displaced from the left hand side of the piston to flow to the reservoir. The pressure difference on the left and right hand sides of the piston in the cylinder gives the power assistance to turn the steering.

Progressive Assistance

Progressive power assistance is dependant on the amount of road wheel resistance opposing the turning of the front wheels. When the steering wheel is turned to the left or right, the rotary movement is transferred through the steering column to the rotor shaft which rotates the same amount as the steering wheel. The rotary movement is also transferred from the rotor to the torsion bar. If the road wheel resistance is high, (when parking), the torsion bar will twist. The twisting of the torsion bar means that the rotary movement of the pinion and the outer sleeve is slightly less than that of the rotor. The twisting of the torsion bar moves the slots in the rotor and the torsion bar out of alignment, resulting in the gaps between both sets of slots becoming larger. The greater the resistance of the road wheels to the steering rotary movement, the greater the misalignment of the slots in the rotor and torsion bar. As the misalignment becomes greater, the fluid pressure passing to the applicable side of the hydraulic cylinder increases. When the road wheel resistance reduces or less effort is applied to the turning of the steering wheel, the reduced torque applied to the rotor allows the torsion bar to unwind. This reduces the in the rotor and the torsion bar, reducing the fluid pressure applied to the applicable side of the hydraulic cylinder.

Hydraulic Circuit

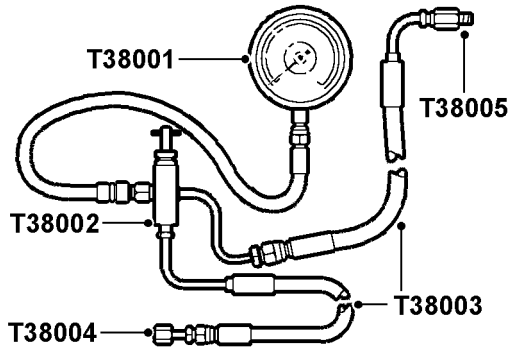
When the engine is started, the pump draws fluid from the reservoir down the low pressure suction line. The fluid passes through the pump and emerges as pressurised fluid at the discharge port where it passes through a hose to a valve unit. If no steering effort is applied, the pressure is applied equally to each side of the piston in the hydraulic cylinder. The remainder of the flow is returned from the valve unit to the reservoir via the fluid cooler. If steering effort is applied in either direction, the fluid pressure is directed to the applicable side of the piston in the hydraulic cylinder, providing power assistance to reduce the steering effort required. The fluid displaced by the movement of the piston in the cylinder is returned through the valve unit to the reservoir via the fluid cooler. The fluid cooler reduces the fluid temperature which prolongs the life of the hoses and seals in the system.

Service Procedures

Power Assisted Steering System - Pressure Test

Check

1. Test equipment - assembly.



S383003

   a. Fit gauge and hoseT38001to valve assemblyT38002and tighten union.

   b. Fit the 2 hosesT38003to the valve assemblyT38002and tighten unions.

2. Disconnect battery earth lead.

Caution: Care must be taken to ensure that oil or fluid does not enter or contaminate the alternator.

3. Position container to collect **PAS**fluid spillage.
4. Clean PAS pump, PAS pipes and unions.
5. Remove banjo bolt securing steering rack feed pipe to PAS pump, remove and discard sealing washers.
6. Fit adaptorT38005and seal washer to the power assisted steering pump.
7. Fit adaptorT38004to the power steering rack feed pipe, using banjo bolt and seal washer.
8. Connect hoseT38003toT38004andT38005adaptors.
9. Ensure all pipes and fittings are clear of rotating parts.
10. Hang pressure gauge in a safe position under bonnet.
11. Connect battery earth lead.
12. Start engine and allow air to bleed from PAS system, by turning steering from lock to lock.

☞**Power Assisted Steering (PAS) System Bleeding**

13. Check and top up steering fluid reservoir.

☞**Capacity**

14. Test procedures:

   a. Ensure steering system is free from leaks and maintain maximum fluid level during test.

   b. With the test rig valve open, start the engine.

   c. With the engine at idle and normal running temperature, slowly turn the steering wheel and hold on lock.

   d. Repeat pressure test on opposite lock.

   e. The test pressure should progressively rise from 5 bar to 100bar, dependant on road surface. Pressure will rise to 100bar when the steering is held on full lock.

   f. With the engine at idle, release the steering wheel. Pressure should read 5 bar or below.

   g. Pressure outside the above tolerance indicates a fault.

Adjust

1. To determine if a fault is in the steering pump or steering rack, close the test valve for a maximum of five seconds. Pump damage may occur if test valve is closed for longer periods.
2. If the gauge does not register between 85 and 95 bar (maximum pump pressure), the pump is faulty.
3. If maximum pump pressure is correct, suspect the steering rack.
4. On completion, stop the engine.
5. Disconnect battery earth lead.
6. Remove test equipment from adaptors.
7. Remove test equipment adaptor.
8. Remove adaptors from PAS pump and steering rack feed pipe.
9. Fit new sealing washers, connect feed pipe to PAS pump, fit and tighten banjo bolt to **35–40Nm**.
10. Clean chassis and surrounding area.
11. Fit power steering oil reservoir.
12. Check PAS fluid level.

☞**Capacity**
☞**Fluid**

13. Connect battery earth lead.

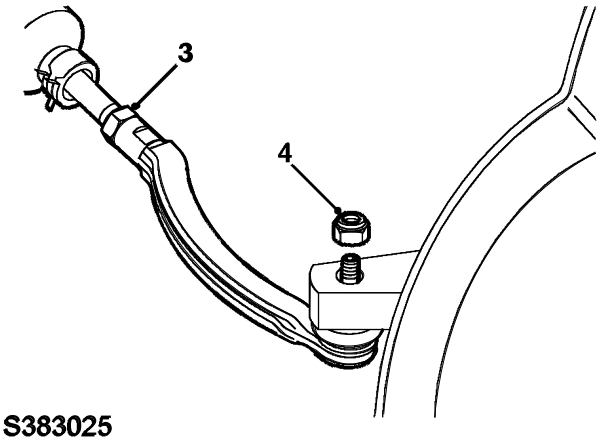
Track Rod Ball Joint

Remove

1. Raise vehicle with a lift.

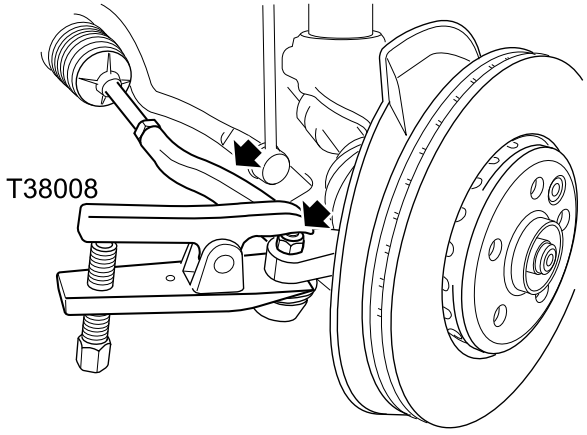
Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove front wheels.
3. Loosen track rod end locknut.



S383025

4. Remove nut from ball pin and discard.
5. Fit an M10 nut to ball pin, flush with end of pin. aligning with the pin end.
6. Use tool T38008separate the ball joint from the steering arm. Remove the M10 nut from the ball joint.



7. Remove track rod from steering rack. Retain the track rod locknut in position as fitting reference.

Refit

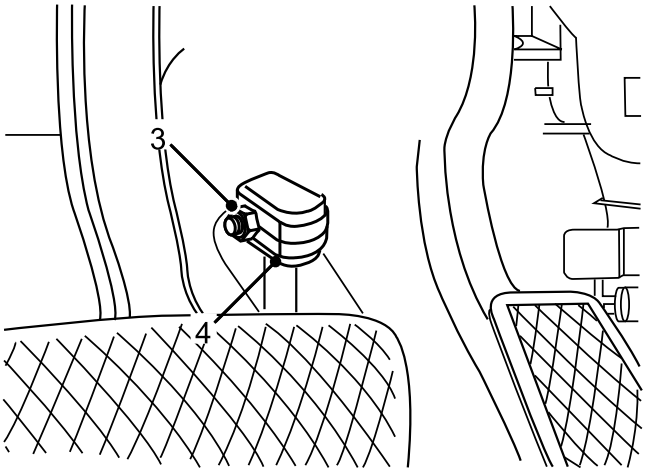
1. Fit track rod end up to locknut with ball pin facing upwards.
2. Connect ball pin to steering arm, fit new nut and tighten to **28–32Nm**.
3. Fit road wheel and tighten bolts to **115–130Nm**.
4. Lower the vehicle.
5. Check steering geometry.

Four-wheel alignment

Power Assisted Steering Rack

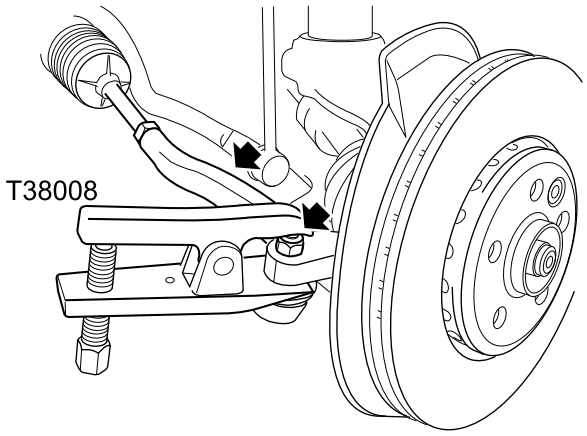
Remove

1. Raise vehicle on lift.
2. Peel back carpet and peel back seal to reveal bolt securing steering joint to steering rack.

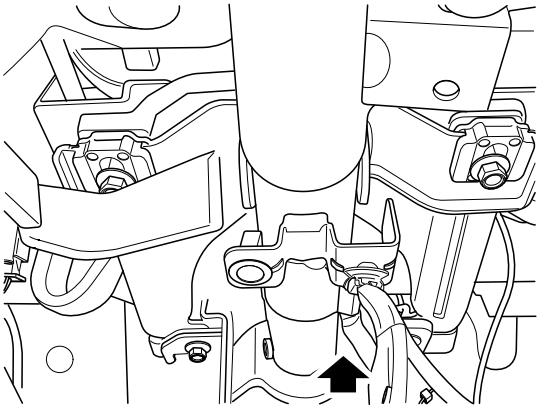


Caution: Before disconnecting any part of the steering linkage, ensure the road wheels are positioned straight ahead and the steering wheel is prevented from turning. Unrestricted turning of the steering wheel will damage the SRS rotary coupler.

3. Remove nut and bolt securing steering joint to steering rack and discard nut.
4. Release universal joint from steering rack.
5. Remove front wheels.
6. Remove nuts securing track rods to steering arms. Fit an M10 nut to ball pin, flush with end of pin.



7. Use tools T38008 release track rod ends from steering arms. Remove M10 nuts from ball pins.
8. Remove nuts securing anti roll bar links to anti roll bar and release links.
9. Position anti roll bar aside.
10. Remove 3 bolts securing exhaust intermediate pipe to downpipe release intermediate pipe and collect gasket.



11. Support the middle exhaust pipe and release two front exhaust pipe mountings.
12. Support rear of subframe using a transmission jack.
13. Remove two bolts fixing the subframe assist rod to the body and discard.
14. Remove two centre bolts and rear bolts fixing the subframe and the subframe assist rod to the body and discard, and collect washers.
15. Lower the rear end of the subframe.
16. Place a container to collect the overflowing fluid.
17. Remove pipe fittings fixing the power steering rack return pipe to the power steering rack and discard O-Ring.
18. Remove pipe adaptor securing power steering rack feed pipe to the power steering rack and discard O-Ring.
19. Remove two bolts securing power steering rack to the subframe.
20. Remove the front anti roll bar.

☞**Front Anti Roll Bar Remove**

21. Lower subframe to the right height with assistance.
22. Withdraw and remove steering rack from driver's side of vehicle, position anti roll bar as necessary.
23. Remove pinion seal.
24. Note number of threads exposed from each track road end locknut for refitting reference.
25. Remove track rod ends and lock nuts from steering rack.

Refit

1. Centre steering rack and position each locknut on track rod with same amount of thread exposed as noted during removal.
2. Fit rod ball joint to the lock nut, making the rod ball joint face upward.
3. Fit pinion seal ensuring that the recess on the seal is located on the raised 'sign' on the gear
4. Position the power steering rack to the subframe. Be careful not to lose power steering rack input shaft seals.
5. Fit two upper bolts and tighten to **90–110Nm**.
6. Clean pipe adaptor and matching faces.
7. Fit new O-Ring to the power steering rack return pipe, connect pipes and tighten to **25–28Nm**.
8. Fit new seal washers to the power steering rack feed pipe, connect feed pipe and tighten to **25–28Nm**.
9. Lift subframe, fit safe washer and new bolts securing subframe and tighten to **90–110Nm**.
10. Fit two mountings of the front exhaust pipe and remove assistance.
11. Clean the exhaust pipe matching face and fit new washers.
12. Connect nuts securing front exhaust pipe to middle exhaust pipe and tighten nuts to **45–55Nm**.
13. Fit anti roll bar link to anti roll bar and fit nuts and tighten to **45–55Nm**.
14. Connect the rod ball joint to steering arm, and fit new nuts and tighten to **28–32Nm**.
15. Fit wheel and tighten bolts to **115–130Nm**.
16. Fit new bolts securing universal joint to the power steering rack input shaft and tighten to **19–24Nm**.
17. Fixt the universal joint seals and put the carpet back in position.
18. Bleed the power steering system.

☞**Power Assisted Steering (PAS) System Bleeding**

19. Check steering geometry.

☞**geometry Alignment**

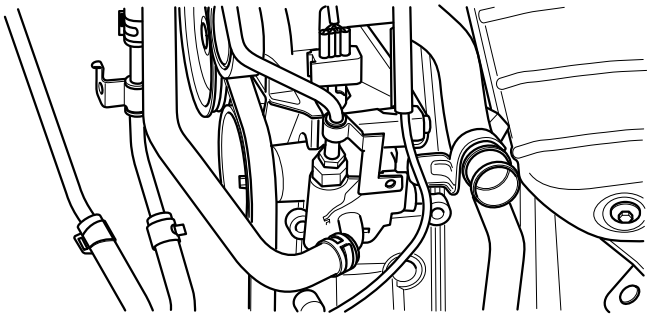
Power Assisted Steering Pump

Remove

1. Disconnect battery earth lead.
2. Raise vehicle with a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

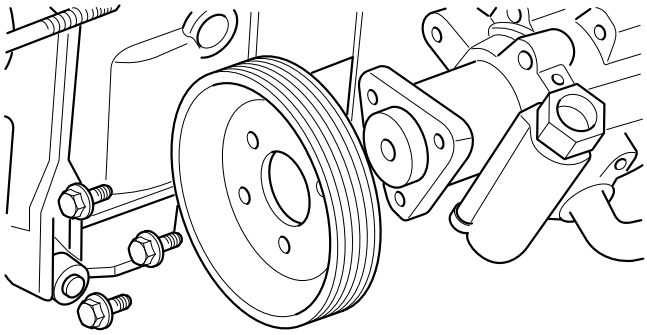
3. Place a container so as to collect the overflowing fluid.
4. Remove the oil inlet/outlet interfaces of the power assisted steering pump.



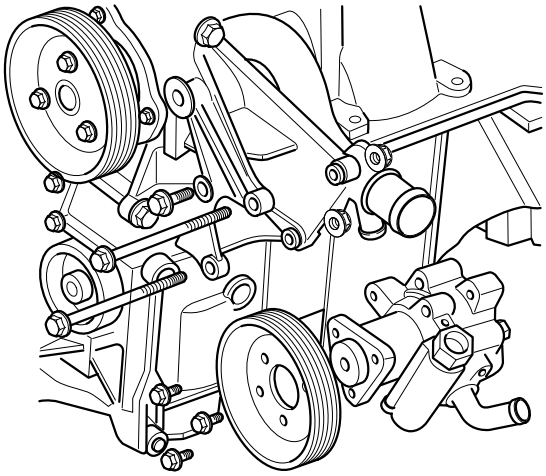
5. Remove auxiliary driving belts.

☞Auxiliary Driving Belt Remove

6. Remove three connecting bolts within the range that is from the power assisted steering pump pulley to the power assisted steering pump.



7. Remove three connecting bolts securing power assisted steering pump to bracket.

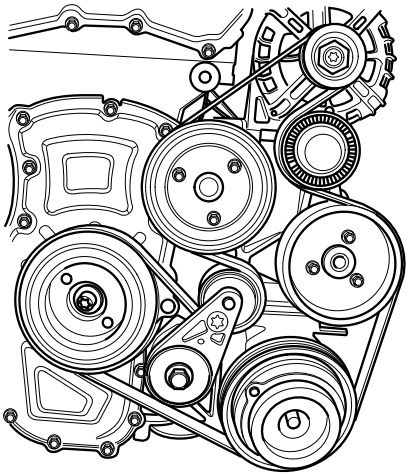


8. Remove power assisted steering pump.

Refit

1. Clean the power assisted steering pump and the matching face.
2. Fit three bolts securing power assisted steering pump to bracket.
3. Fit three bolts securing power assisted steering pump pulley to pump.
4. Fit auxiliary driving belts.

☞Auxiliary Driving Belt Refit



5. Clean and fit oil inlet/outlet interfaces of the power assisted steering pump.
6. Lower the vehicle.
7. Connect battery earth lead.
8. Bleed the power steering system.

☞Power Steering System Exhaust

Pipe - PAS Pump to Steering Rack

Remove

1. Disconnect battery earth lead.
2. Raise vehicle on lift.
3. Place a container so as to collect the overflowing fluid.
4. Remove power steering rack feed pipe adaptor, remove seal washers and discard.

Caution: To prevent damage to components, use two spanners when loosening or tightening unions.

Caution: Always fit plugs to open connections to prevent contamination.

5. Remove pipe adaptor securing power steering rack feed pipe to the steering pump, remove seal washers and discard.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

Caution: Always fit plugs to open connections to prevent contamination.

6. Remove power steering rack feed pipe assembly from the engine cabin.

Refit

1. Clean power steering rack feed pipe end and the matching surface.
2. Position feed pipe to the engine cabin.
3. Make use of new seal washers, place the power steering inlet pipe to the pump, fit pipe fittings and tighten.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

4. Make use of new seal washers, place the power steering rack feed pipe to the power steering rack, and fit adaptor and tighten.

Caution: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

5. Take away the container.
6. Fit pressure sensor.
7. Connect the battery earth lead.
8. Bleed power steering system.

☞Power Steering System Exhaust

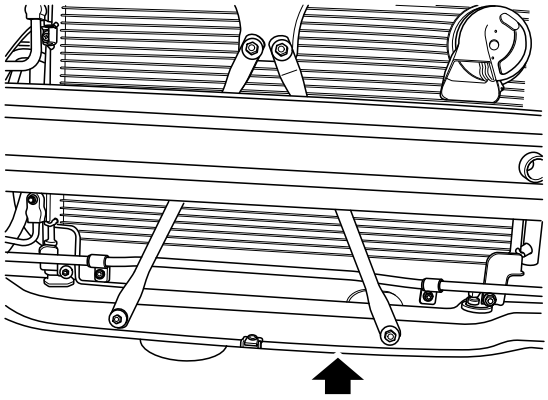
Return Pipe - Steering Rack

Remove

1. Remove the front bumper.

☞Front Bumper Assembly Remove

2. Raise vehicle on lift.
3. Place a container so as to collect the overflowing fluid.
4. Remove 4 bolts and remove reinforcements in front of the bumper.



5. Release clamps between the fuel return pipe assembly and**PAS** the pump.
6. Remove pipe fittings fixing the steering gear fuel return pipe to the power steering gear, take down washers and discard.

Caution: Always fit plugs to open connections to prevent contamination.

7. Remove two bolts fixing the fuel return pipe assembly to the body, and then remove the fuel return pipe assembly.
8. Take away the power steering rack return pipe.

Refit

1. Clean the power steering fuel return pipe end and the matching surface.
2. Position the steering rack fuel return pipe to the engine cabin.
3. Remove plugs from the power steering rack.
4. Position the steering rack fuel return pipe to the power steering rack, fit new washers and tighten the pipe fittings.

Caution: To prevent damage to components, use two spanners when loosening or tightening unions.

5. Fit bolts and tighten, and fit nuts and tighten.
6. Remove plugs and connect the steering rack return pipe to **PAS**the pump.
7. Take away the container.
8. Fit the front bumper assembly.

☞Front Bumper Assembly Refit

9. Connect the battery earth lead.
10. Bleed the power steering system.

☞Power Steering System Bleeding

Power Steering (PAS) system Bleeding

Adjust

1. Clean reservoir around filler cap.
2. Remove filler cap from reservoir and fill reservoir with power steering fluid from a clean container until fluid reaches between upper and lower mark on level.

Caution: Care must be taken to ensure that oil or fluid does not enter or contaminate the alternator.

3. Start engine and allow to run at idle for 10 seconds. Stop engine.
4. Check and top-up steering fluid reservoir.
5. Start engine and turn steering fully to LH and RH locks. Stop engine.
6. Check and top-up steering fluid reservoir.
7. Start and run engine for 2 minutes, turn steering fully to RH and LH locks.

Caution: Do not hold steering at full lock for longer than 10 seconds.

8. Switch off engine.
9. Check power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to upper level mark.
10. Fit reservoir filler cap.

Steering Wheel and Column

Specifications

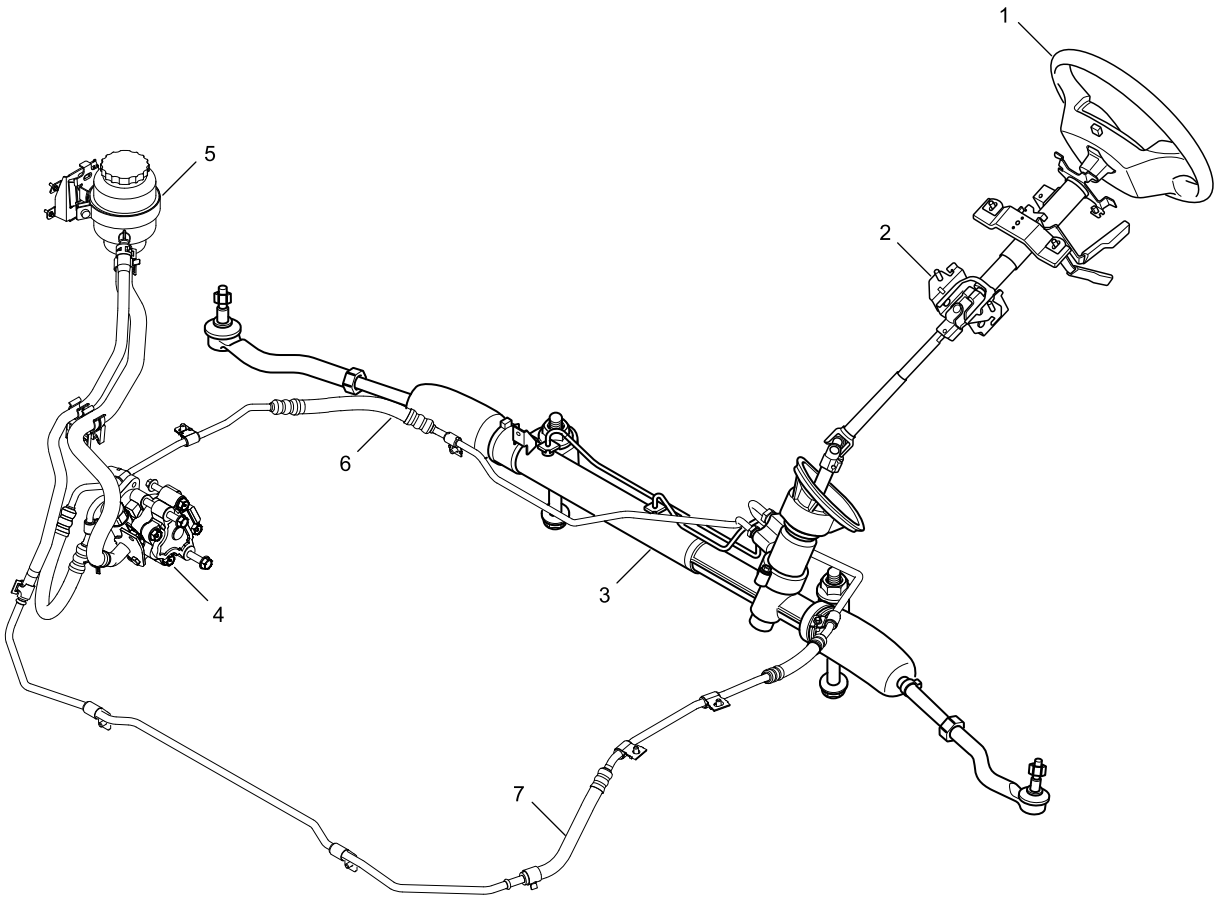
Torque

Description	Value
Nut - steering wheel to steering column	40–60Nm
Bolt - power steering column to power steering rack input shaft	19–24Nm
Bolt - power steering column to instrument panel frame	19–24Nm
Bolt - steering column cover	1.6±0.3Nm

Description and Operation

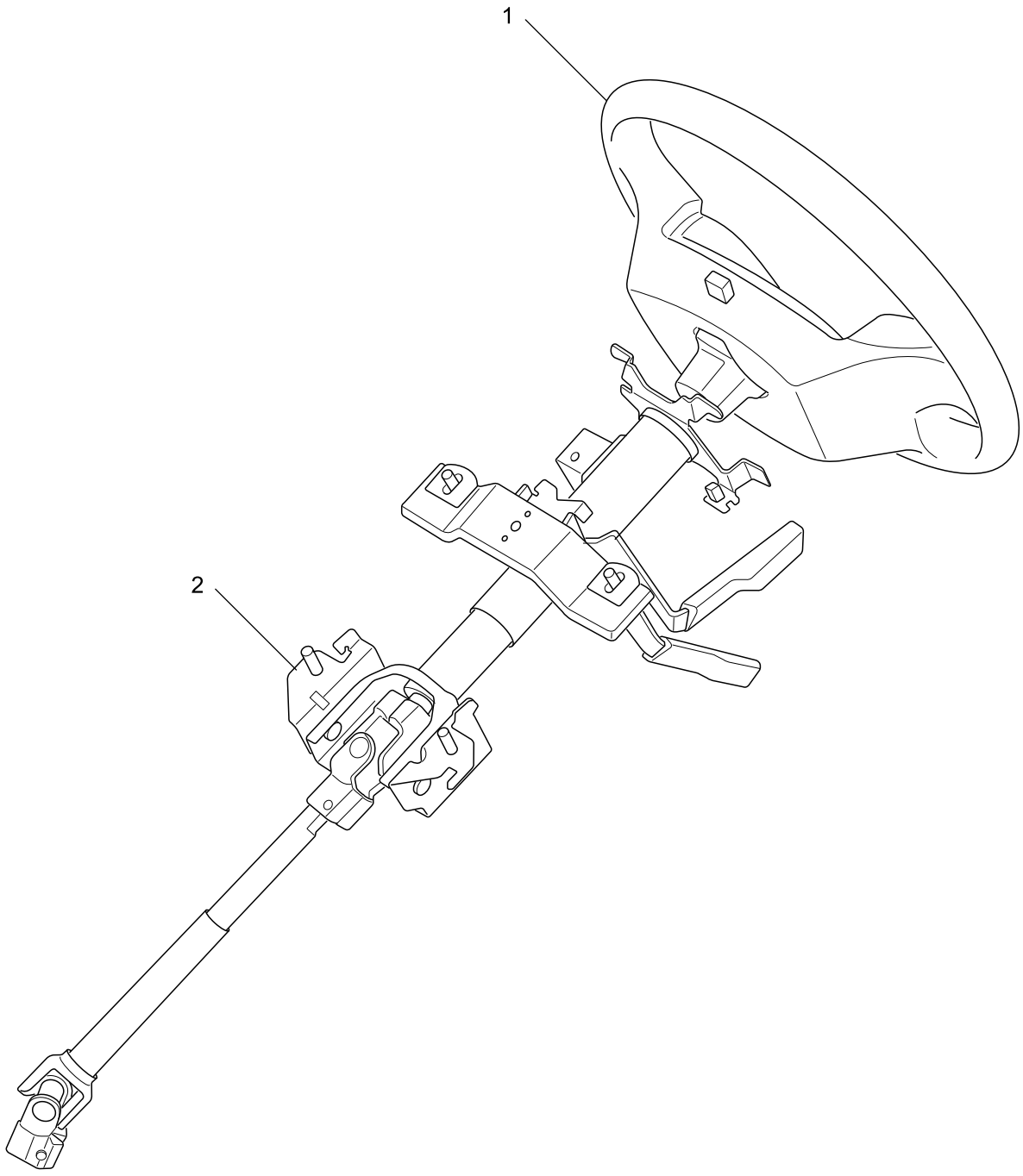
System layout

System Component Layout



1. Steering Wheel
2. Steering Column
3. Power Steering rack
4. Power Assisted Steering Pump
5. Power Steering Oil Reservoir
6. Power Steering feed pipe
7. Power Steering return Pipe

Steering Column Component Location



1. Steering Wheel
2. Steering Column

Description

General

The major steering components comprise a two stage collapsible steering column, a power assisted steering rack, a pump, a pressure sensor, a fluid reservoir, a fluid cooler and fluid pipes and hoses.

Steering Column

The steering column features two collapse mechanisms, the upper part sliding away from the driver and the lower part telescoping to allow for the movement of the engine and steering components in severe impacts. The column is mounted to the cross car beam. It is possible to adjust the steering wheel for both reach and rake. To aid with rake adjustment there is a counterbalance spring, as well as cushion stops, at each end of the adjustment. A twin-walled grommet provides the seal between the steering column and the bulkhead. The 370 mm steering wheel comprises a cast, four spoke frame onto which model specific covering materials are moulded. The hub is splined to locate with the splines on the steering column. The horn switch is mounted in the centre pad of the steering wheel. The trip computer remote switches and, where fitted, the cruise control, remote radio (volume, mode and scroll) and tiptronic paddle switches, are also mounted on the steering wheel. All the switches are connected by wires to the rotary coupler connector. Protection for the driver's face and upper torso is provided by an airbag located in the centre of the steering wheel under a plastic cover and brand badge.

Electronic Steering Column Lock (ESCL

The ESCL is located on the steering column housing. The lock is considered to be not serviceable. The ESCL ECU is located on the lower front of the fascia. The ECU receives a handset status and confirms the validity of the handset. If the validity of the handset is confirmed the ECU will send a ‘lock’ or ‘unlock’ signal to the ESCL depending on the users requirements.

Service Procedures

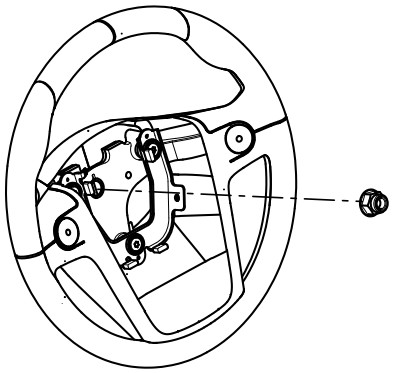
Steering Wheel

Remove

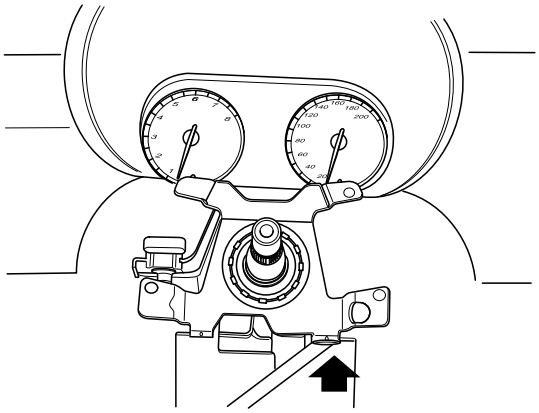
1. Remove airbag.

☞**Airbag - Steering Wheel - Driver Remove**

2. Disconnect steering wheel switch multiplugs.
3. Centralise steering wheel with road wheels in straight ahead position.
4. Restrain steering wheel and loosen bolt securing steering wheel to column - do not fully remove bolt.
5. Release steering wheel from column.
6. Remove bolt and steering wheel.



7. Attach tape across edge of rotary coupler to retain correct setting.
8. Remove 2 screws securing horn switch to steering wheel and remove horn switch.
9. Remove 2 screws securing LH and RH switch finishers to steering wheel and remove both finishers.
10. Disconnect horn switch multiplug from steering wheel switch harness and release harness from cable tie.



11. Disconnect ground lead.
12. Carefully release ribbon cable from steering wheel.

Refit

1. Fit horn switch assembly to steering wheel and secure with screws.
2. Position ribbon cable and secure to steering wheel.
3. Position harness to steering wheel.
4. Fit LH and RH switch finishers and secure with screws.
5. Connect horn switch multiplug and secure to steering wheel harness.
6. Remove tape from rotary coupler.
7. Remove the adhesive tape on the steering pipe column selector lever combination switch.
8. Ensure road wheels are in straight ahead position and fit steering wheel to column.
9. Fit and tighten bolt securing steering wheel to column to **40–60Nm**.
10. Connect horn switch multiplug.
11. Fit airbag.

☞**Airbag - Steering Wheel - Driver Refit.**

Steering Wheel Alignment - Adjustment

Steering wheel alignment should be carried out by adjustment of track rod ends and NOT by removal and refitting of the steering wheel.

Check

1. Ensure tyre pressures are correct and vehicle is at kerbside weight.
2. Roll vehicle backwards and forwards to relieve stresses in steering and suspension.
3. Ensure that wheel alignment equipment is properly calibrated and position equipment as per manufacturers instructions.
4. Take an average of 3 readings.
5. Check front wheel alignment is within tolerance.

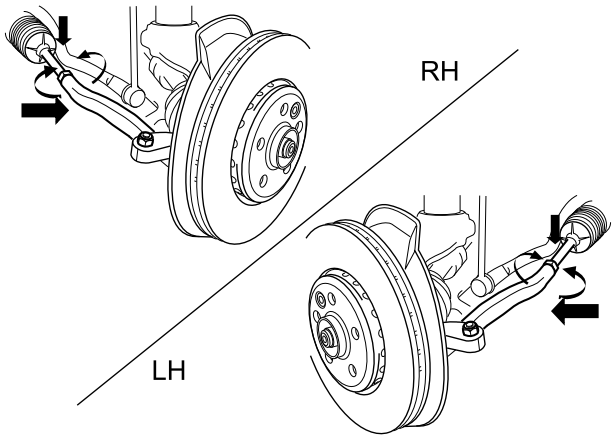
☞**Four-Wheel Alignment**

Adjust

1. Mark position of track rods for reference.
2. Loosen RH and LH track rod end lock nuts.

Caution: To avoid possible joint damage always use a spanner to hold track rod end when loosening or tightening track rod end lock nut.

3. Rotate track rod to obtain correct alignment.



Tip: When rotating one side of the steering rod lock nut outward or inward, the other side should be rotated in the same amount of threads outward or inward.

4. Recheck front wheel alignment.

☞**Four-Wheel Alignment**

5. Tighten RH and LH track rod lock nuts.
6. Ensure steering rack gaiters are not strained or twisted then secure gaiter clips.

Switch Assembly - Steering Column

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

SRS Prevention

Warning: Always remove the ignition key from the ignition switch, disconnect the vehicle battery and wait 10 minutes before commencing work on the SRS system.

Caution: Before disconnecting or removing components, ensure the immediate area around joint faces and connections are clean. Plug open connections to prevent contamination.

Remove

1. Disconnect battery earth lead.
2. Remove the steering wheel assembly.

☞**Steering Wheel Assembly Remove**

3. Remove the steering pipe column panel.

☞**Steering Column Panel Remove**

4. Disconnect three connectors of the clock spring, windscreen washing and wiper switches.
5. Be careful not to damage three locking corners in removing the clock spring.
6. Remove respectively the windscreen washing/window wiper switch and the indicator switch with care so as to prevent damage.

Refit

1. Ensure that the front wheels are dead ahead. Position the clock spring and fix it to the steering pipe column and connect the connector.
2. Position respectively the windscreen washing/window wiper switch and the indicator switch and fix them to the steering pipe column and connect the connector.
3. Fit the steering pipe column shield.

☞**Steering Pipe Column Shield Refit**

4. Fit the steering wheel assembly

☞**Steering Wheel Assembly Refit**

5. Connect the negative pole of the battery.
6. Carry out system inspection, rotate the combination switch to inspect.**SRS** Whether the warning light illuminates firstly for 4 seconds and then goes out.
7. Inspect whether the steering long-range light lever switch, wiper/washer switch and the steering wheel control switch can work normally.

Steering Column

Remove

1. Remove handset from docking station, disconnect battery earth lead, and wait for 10 seconds for the**SRS** back-up power circuit to discharge before commencing work.
2. Remove the steering wheel assembly.

☞**Steering Wheel Remove**

3. Remove the steering column panel.

☞**Steering Column panel Remove**

4. Remove the steering column switch.

☞**Switch Assembly - Steering Column Remove**

5. Move the floor carpet and slide the seal rearward, expose the bolt securing the steering column to the power steering rack.
6. Remove the nut and bolt securing the steering column cardan joint to the power steering gear input shaft and dispose the nut.
7. Loosen the cardan joint from the power steering rack.
8. Remove the 4 bolts securing the steering column to the instrument panel frame.
9. Disconnect the 2 ties securing the wiring harness to the steering column, and place the steering column wiring harness aside.
10. Remove the steering column assembly.

Refit

1. Position the universal joint onto the power steering gear input shaft to ensure the correct position.
2. Tighten the universal joint by fitting a new lock nut and bolt, tighten the bolt slightly.
3. Check if a 4 mm gap exists between the universal joint and the power steering gear seal retainer, such as the 12 clock position.
4. If the gap is less than 4 mm, release the steering column to power steering gear input shaft bolt, and move upward, until the gap is proper.
5. Tighten the universal joint nut and bolt to**19–24Nm**.
6. Fit the bolt securing the steering column to the instrument panel frame and tighten it to**19–24Nm**.
7. Position the steering knuckle seal and put the floor carpet to the original place.
8. Secure the wiring harness to the steering column with ties.
9. Connect the electronic steering column lock connector.
10. Fit the steering column trim panel.

☞**Steering Column Trim Panel Refit**

11. Fit the steering column combination switch.

☞**Combination Switch Refit**

12. Fit the steering wheel assembly.

☞**Steering Wheel Assembly Refit**

13. Connect battery earth lead.

Steering Column Panel

Remove

1. Remove the driver-side instrument panel side panel.

☞Instrument Side Panel Remove

2. Loosen the steering column to the lowermost position.
3. Separate the upper trim panel and lower trim panel slightly with a screwdriver, remove them with the steering column gap tape together.
4. Remove the 3 screws securing the steering column lower trim panel to the steering column.
5. Release the steering column adjusting handle and remove the steering column lower protector cover plate.
6. Remove the steering column upper protector from the steering column.

Refit

1. Position and secure the steering column lower protector panel with 3 screws to the steering column, tighten the screws to **1.6±0.3Nm**.
2. Release the steering column lever and move the steering column to the upper position.
3. Place the top steering column protector cover onto the steering column and engage it to the lower protector carefully.
4. Fit the driver-side instrument panel side panel.

☞Instrument Panel Side Panel Refit

Wheel Alignment

Specifications

Torque

Description	Value
Nuts - steering rod	63–73Nm

Specifications

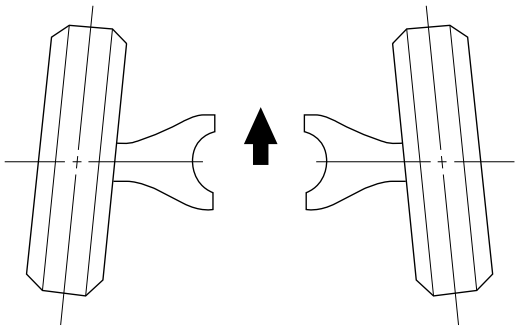
Type	
Wheel Alignment	
Front Wheel	
Camber	–29¢±30¢
Caster	3°26¢±30¢
Kingpin Inclination (unadjustable)	12°6¢±30¢
Toe-in (single-edge)	4¢±6¢
Rear Wheel	
Camber - Unladen Condition	-1°15¢±30¢
Toe-in (single-edge)	15¢±9¢

Description and Operation

Description

The primary target of machine design is to ensure the safe and reliable steering system and suspension system. Each component must be strong enough to bear and absorb extreme impact. The steering system, front suspension system and rear suspension system must keep a certain geometric shape with the body. The steering system and suspension system require the front wheels to return automatically, which can keep the rolling force of the front wheels and the friction force of the road at a minimum level, allow the consumer to control the directions more easily and comfortably. The thorough inspection of the wheel alignment includes the measurement of the toe and camber of the rear wheel. The four-wheel alignment can ensure that all four wheels rotate in the same direction. After geometric alignment, the vehicle can achieve the optimum fuel economy and tire life, and improve the steering and performance.

Toe in



S323001

The toe-in observes the inward (or outward) wheel rotations from the top. Usually, the actual value of the toe angle is less than one degree, just several minutes. The purpose to specify the toe for static wheels is to ensure the wheels can roll in parallel while the vehicle is in dynamic condition. Excessive toe or toe-out may increase the wear of the wheels. For the vehicle driven by rear wheels, a smaller wheel toe angle (the value being measured when the vehicle is stationary) must be used to compensate the minute disturbance that generated because of the roll resistance and braking operation, and this disturbance makes the wheel have a tendency of expanding outward.

Service Procedures

Four-wheel Alignment

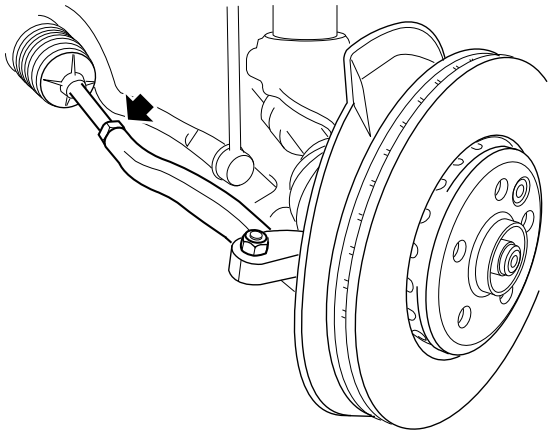
Check

1. Wheel alignment must only be carried out using approved equipment.
2. The equipment must be calibrated, set up and operated accordance with the manufacturer's instructions.
3. Ensure correct vehicle data is entered into the approved equipment.
4. Check steering joints, suspension joints and wheel bearings for wear or free play. Adjust or repair as required.
5. Check and adjust tyre pressures.
6. Raise the vehicle on a lift.
7. Ensure vehicle is at unladen weight.
8. Ensure wheel mounting clamps are adjusted to correct size and fitted securely to vehicle.
9. Ensure cameras are fitted and aligned correctly.
10. Carry out run-out compensation in accordance with equipment manufacturer's instructions. Lower vehicle, and allow vehicle suspension to return to level.
11. Ensure steering wheel is in the central position.

Adjust

1. Observe readings from test equipment and adjust geometry as required.
2. Front wheel alignment adjust:

- Loosen lock nut on front track rod.
- Adjust track rod to specification.
- Tighten lock nut to**63–73Nm**.



- Repeat above for other side.

Front Suspension

Specifications

Torque

Description	Value
Nuts - rear spindle	320–350Nm
Bolts - front damper to knuckle	90–110Nm
Bolt - lower arm outer ball joint to swivel hub	50–65Nm
Nuts - steering rod outer ball joint	28–32Nm
Screws - front brake disc to knuckle	30–36Nm
Bolts - front brake caliper to knuckle	90–110Nm
Screws - front speed wheel sensor	7–10Nm
Front brake hose to caliper housing	16–18Nm
Nut - lower arm rear bush to subframe lock	90–110Nm
Nut - lower arm front bush to subframe lock	90–110Nm
Nut - lower arm outer ball joint to swivel hub	50–65Nm
Nut - anti-roll bar links to damper	50–65Nm
Bolts - subframe brace to body	60–80Nm
Bolts - anti-roll bar bush and clamp to subframe	22–28Nm
Nuts - anti-roll bar to links	45–55Nm
Bolt - subframe to body	90–110Nm
Bolt - subframe to body	90–110Nm

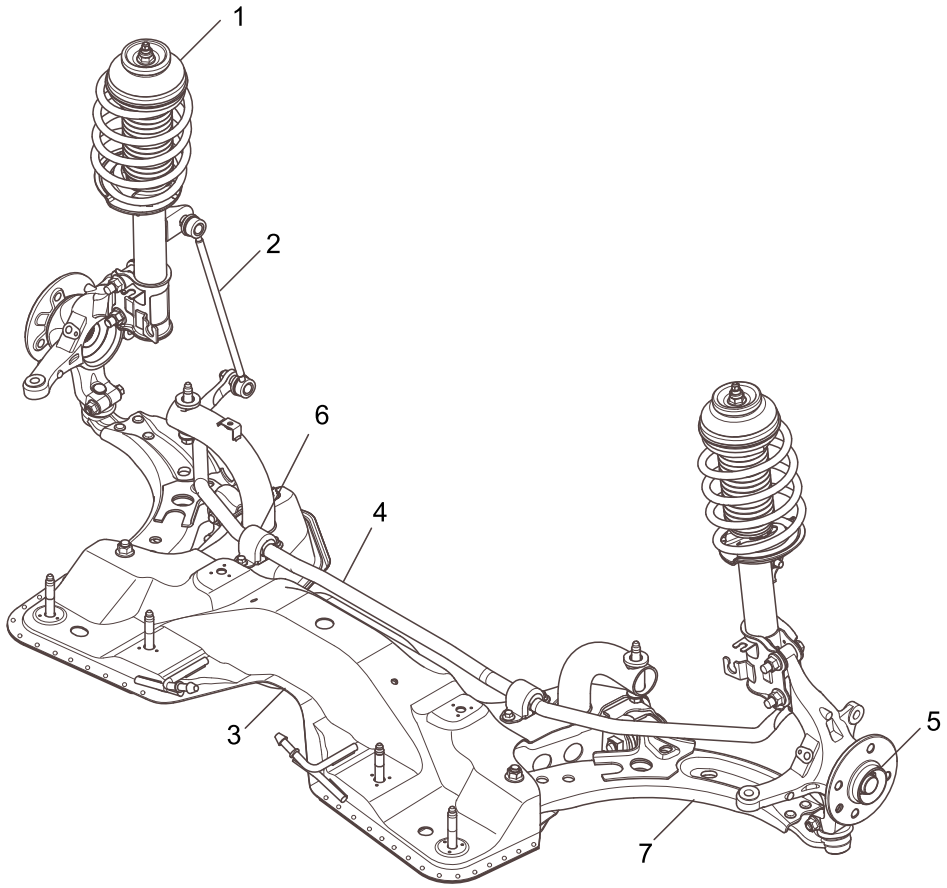
Specifications

Type	
Front Lower Arm	L shaped, steel forged with lightening holes. Ball joints at forward inner and outer joints
Anti Roll Bar Diameter	20.5 mm
Front Spiral Spring Data:	
Total Turns	4.8
Active coils	3.8
Wire diameter	11.6 mm

Description and Operation

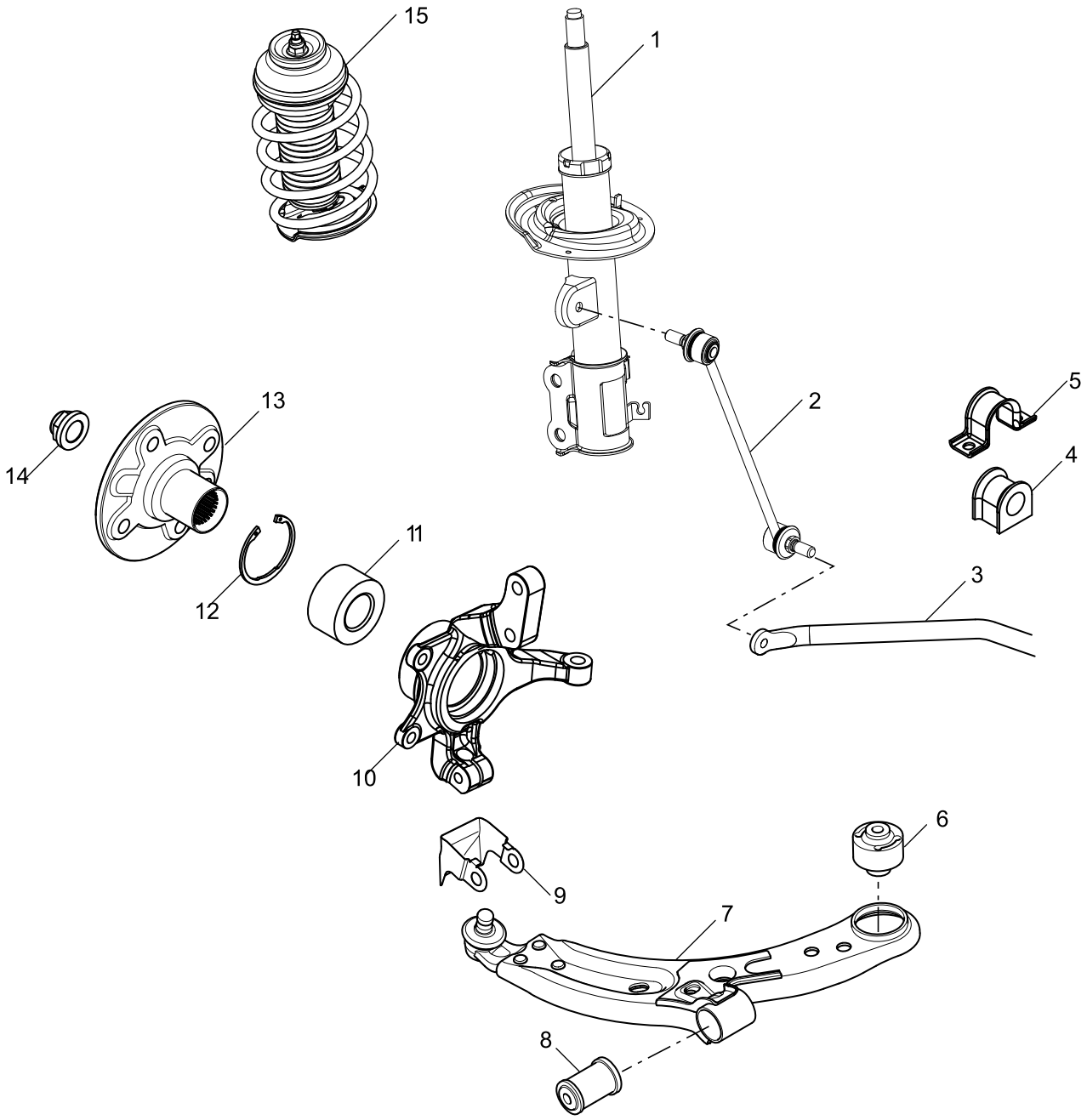
System Component Layout

Front Suspension Component Location



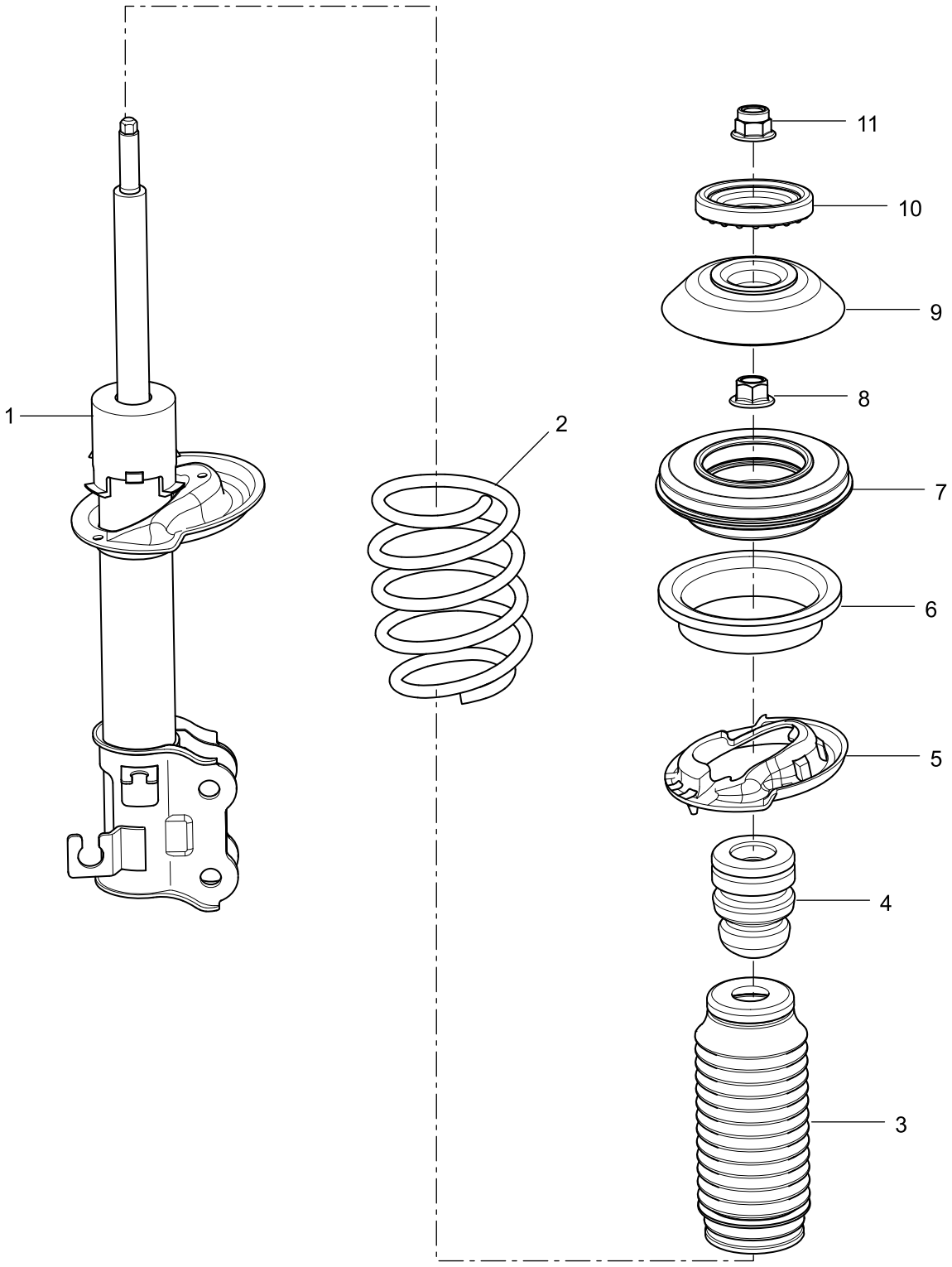
1. Shock Absorber Assembly
2. Anti-roll Bar Link
3. Front Sub Frame Assembly
4. Anti-roll Bar
5. Front Hub Assembly
6. Anti-roll Bar Bush And Clamp
7. Front Lower Arm Assembly

Front Suspension Components



1. Damper Unit
2. Anti-roll Bar Link
3. Anti-roll Bar
4. Anti-roll Bar Bush
5. Anti-roll Bar Clamp
6. Front Lower Arm Front Bushing
7. Front Lower Arm Assembly
8. Front Lower Arm Rear Bushing
9. Front Suspension Knuckle Dust Cover
10. Front Wheel Hub
11. Bearing
12. Circlip
13. Drive Flange
14. Hub nut
15. Front Shock Absorber Coil Spring

Strut Components



1. Damper
2. Coil spring
3. Dust cover
4. Bump stop
5. Damping Strut Insulating Pads
6. Lower Spring Pad
7. Bearing
8. Nut
9. Upper Spring Pad
10. Spring Washer
11. Piston rod top nut

Description

The front suspension frame consists of:

- 2 shock absorbers
- 2 front lower arms
- Anti roll bar
- 2 anti roll bar links
- Front suspension frame
- Front wheel hub, bearing and drive flange

Allow the design of front suspension frame to be with pitching characteristics through the anti roll bar and the shock absorber drive ratio of 1:1. The layout and design of the struts minimizes camber loss due to side forces, improving handling and steering response.

Front Sub Frame Assembly

The front suspension frame is formed by punching and welding, whose quality is light, and structure strength is high. The geometric dimensions of all key positions are machined after the manufacture of front suspension frame has been finished, to ensure the front suspension frame and steering system components are precisely located. The front suspension frame assist rod fitted between the front suspension frame bearing point and the body can enhance the rigidity of front suspension frame. The layout of bearing point can avoid the movement due to the front suspension frame lateral force, which will generate unnecessary steering effect.

Front Shock Absorber Assembly

The front shock absorber adopts an aerated dual-cylinder structure, which can aerate and refuel. This dual-cylinder structure allows the shock absorber piston to move within the inner cylinder. On the inner cylinder, a oil discharge hole is provided between the inner and outer cylinders. This structure minimizes the cavitation, and eliminates the result of that the piston movement is effected due to outer cylinder damage. The lower end of front shock absorber is connected to the front hub, and secured with a locking bolt. The bottom fixture of front shock absorber is located on the front wheel hub, to ensure proper guidance of the front shock absorber. The front shock absorber pillar is located within the rubber bushing of inner-mounted steel plate, The rubber bushing is integrated together with the upper erection support. The front shock absorber pillar is secured with a nut and spacer. An outer hexagonal end face is provided on the front shock absorber pillar end. When securing the front shock absorber pillar nut, the hexagonal end face can used to restrict the front shock absorber pillar, to prevent rotating. The front shock absorber pillar uses a material whose friction is low for sealing within the shock absorber. The spring seat with a certain angle are integrated with the shock absorber. Meanwhile, it can also used as the connection refit point of the anti roll bar and connection bar.

Front Lower Arm Assembly

The front lower arm connects the front hub and the front suspension frame. An outer ball joint, on which a straight pin exists, is provided on the front lower arm. This pin can be fit at the open position of the front wheel hub bottom, and clamped in place with a bolt and locking nut.

Anti Roll Bar and Connection Bar

The anti roll bar made of solid spring steel functions through the anti roll bar link—the upper end of the anti roll bar link is connected to the spring retainer of front shock absorber pillar, and the lower end to the anti roll bar end. The bushing is secured to the suspension frame with bolts and U-shaped supports. The bushing made by vulcanizing pure natural gum has a low friction, allowing the anti roll bar to rotate freely under static state. Thus, the input reaction of anti roll bar to vehicle side inclination is fast. The external wave circlip of each bushing on the anti roll bar can prevent the anti roll bar from moving aside. The anti roll bar tail is connected to the spring retainer of front shock absorber through the anti roll bar link. This arrangement allows the anti roll bar to function with the rate of 1:1 to the wheel travel, to provide the maximum anti-roll effect. A ball joint is fit at the end of each anti roll bar link, for which large moving space is provided, so as to allow the anti roll bar and shock absorber pillar to move relatively within the normal suspension travel. Besides, the ball joint can improve the reaction speed and efficiency. The upper ball joint is located on the axis line of anti roll bar link, directly connected to the spring retainer of front shock absorber, and secured with locking nuts. The link must be connected to the rear ball joint of anti roll bar. The ball joint on the anti roll bar link is a component unable to be repaired. If any of the ball joints is required to be replaced, it is necessary to replace the new anti roll bar link assembly.

Service Procedures

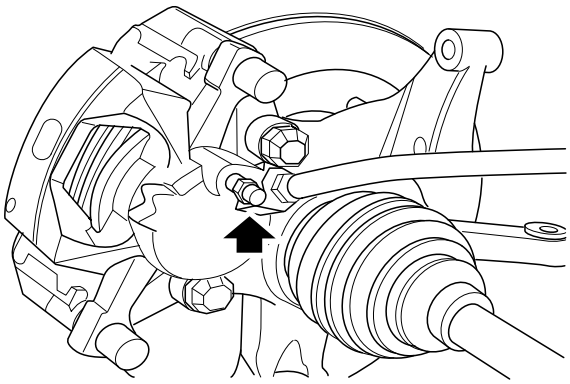
Front Hub Assembly

Remove

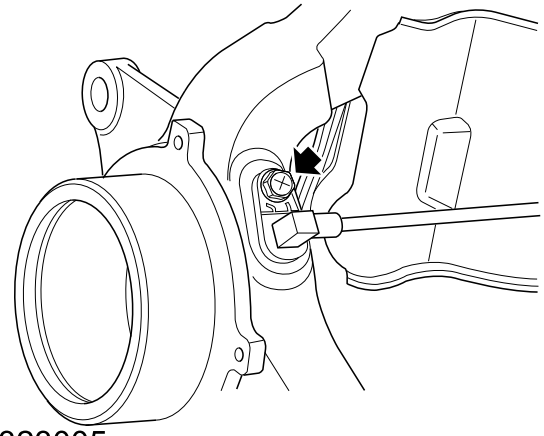
1. Raise the vehicle on a lift.
2. Remove the front wheel.

☞ **Wheel Remove**

3. Loosen the connection between the brake hose and the brake caliper.

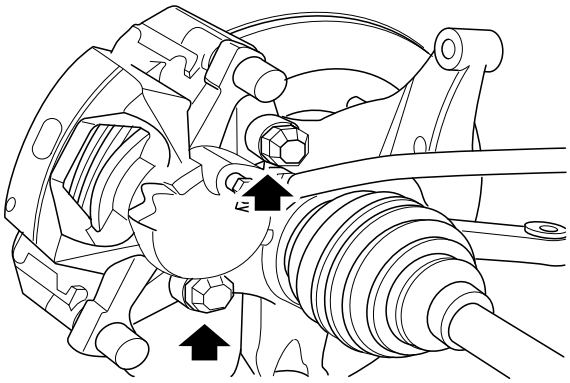


4. Loosen speed sensor wiring harness.

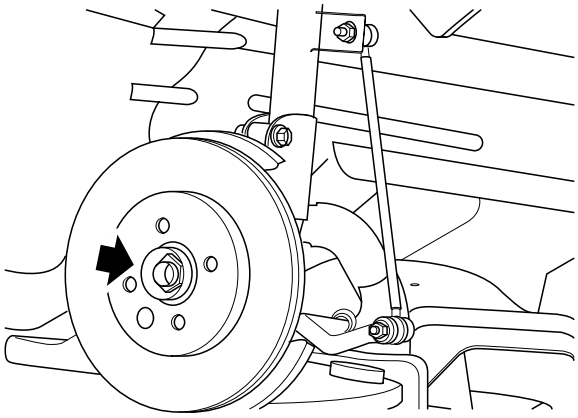


S323005

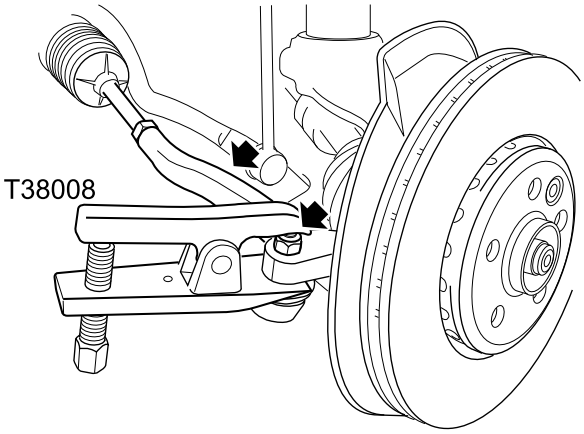
5. Remove 2 bolts securing brake caliper to hub.



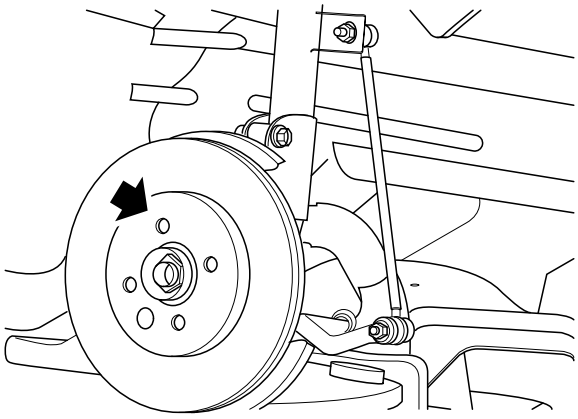
6. Remove countersunk screw securing brake disc to drive flange.



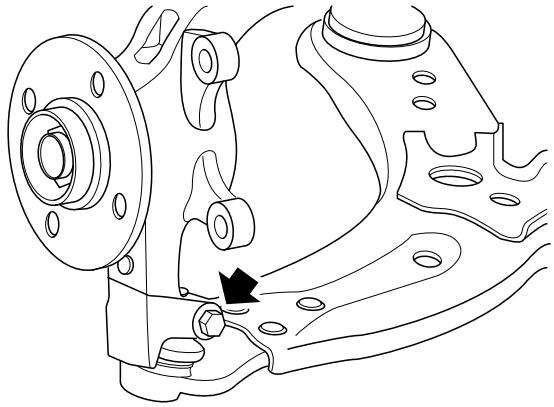
7. Remove nut securing track rod to steering arm and discard nut.
8. Loosen the tie rod ball joint from the steering knuckle with **T38008** tool.



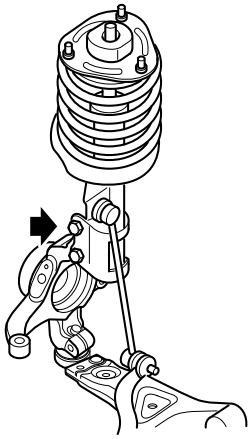
9. Remove the sunk screw securing the brake rotor to the drive flange.



10. Remove the front brake rotor.
11. Remove the dust cap, nut and bolt securing the front lower arm outer ball to the front hub.



12. Fit the front lower arm ball joint protector.
13. Remove the bolt securing the front shock absorber assembly to the front hub.



S323012

14. Loosen the bolt connecting the wheel steering knuckle to the pillar & spring assembly.
15. Remove the front wheel hub.

Caution: Do not store hub bearings near magnetic fields or iron filings as damage may occur.

Caution: Do not remove protective cover from bearing until hub is about to be fitted.

Refit

1. Clean the junction between the front hub and the front shock absorber.
2. Clean the drive shaft assembly and flange spline.
3. Clean the junction from the front hub to the front lower arm ball joint.
4. Fit the front hub onto the front shock absorber assembly.
5. Connect the front hub onto the front lower arm assembly.
6. Connect the front hub onto the drive shaft, and tighten the large nut to **320–350Nm**.
7. Fit the bolt securing the front shock absorber assembly to the front hub to **90–110Nm**.
8. Secure the front lower arm assembly to the front hub, fix the dust cover and tighten the nut and bolt to **50–65Nm**.
9. Ensure the front lower arm outer ball and front hub are completely engaged, and the bolt is also fitted into the valley of front lower arm outer ball joint.
10. Clean the junction between the tie rod and the steering knuckle.
11. Connect tie rod to the steering knuckle, fit the nut and tighten to **28–32Nm**.
12. Clean the junction surface between the front ABS sensor and the front hub.
13. Lubricant the junction between the front wheel ABS sensor and the front hub with appropriate lubrication grease.
14. Fit brake disc to drive flange, fit countersunk screw and tighten to**30–36Nm**.
15. Fit bolts securing caliper to hub and tighten to**90–110Nm**.
16. Secure the front brake hose to the jumper frame of front shock absorber with a hose clip.
17. Secure the front speed sensor wiring harness to the steering knuckle, and tighten the screw to **7–10Nm**.
18. Tighten the 2 bolts securing the brake hose to the brake caliper to **16–18Nm**.
19. Fit the wheels.

☞Wheel Refit

20. Lower the vehicle.
21. Check the wheel alignment.

☞Four-wheel Alignment

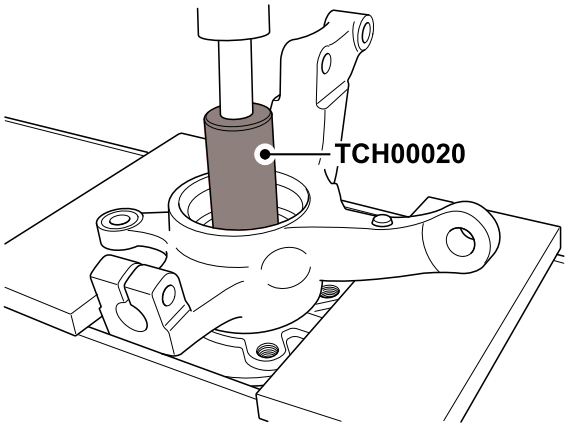
Front Hub Bearing

Remove

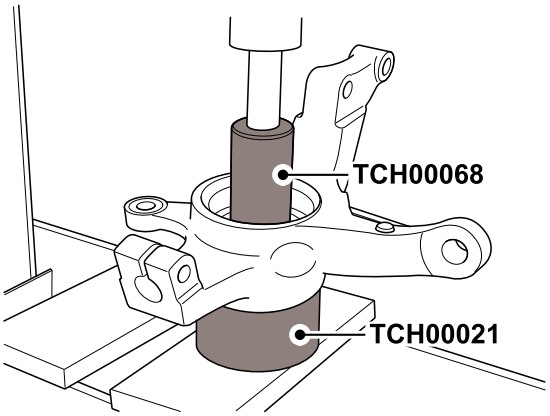
1. Remove the front hub.

☞**Front Hub Remove**

2. Remove the 3 bolts securing the front brake disc.
3. Position the front hub in place.
4. Fit**TCH00020** tool onto the front drive flange, press down from the front hub bearing, and separate the drive flange.

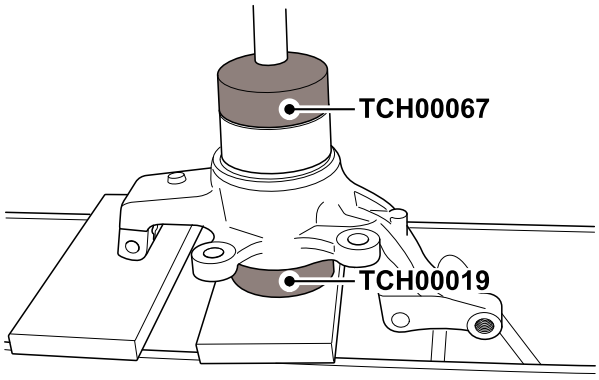


5. Remove the front hub bearing retainer ring from the front hub.
6. Fit**TCH00021** tool onto the front hub bearing, and press down the bearing from the front hub with the**TCH00068** tool.

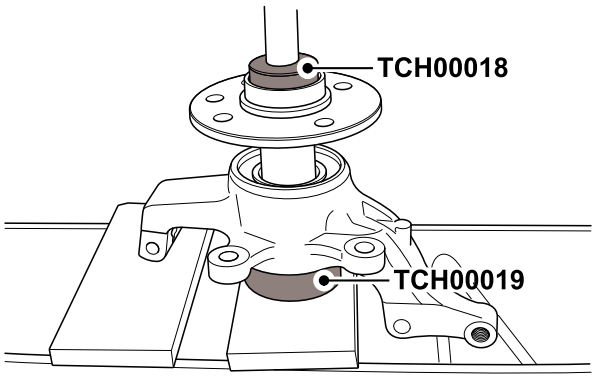


Refit

1. Clean the junction between the front hub and the bearing.
2. Support the front hub on**TCH00019** tool, and press a new bearing into the hub with**TCH00067** tool.



3. Fit the front hub bearing retainer ring onto the front hub.
4. Support the front hub bearing on**TCH00019** tool, and press the drive flange into the front hub bearing with**TCH00018** tool.



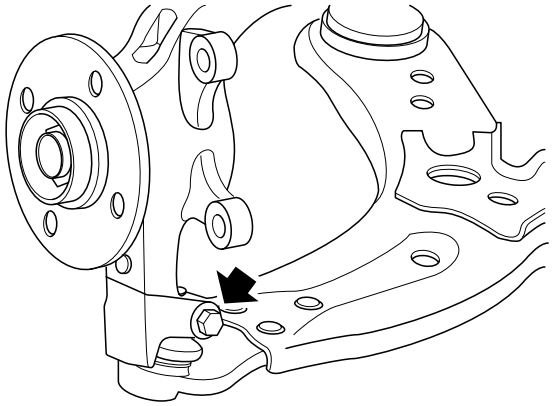
Front Lower Arm Assembly

Remove

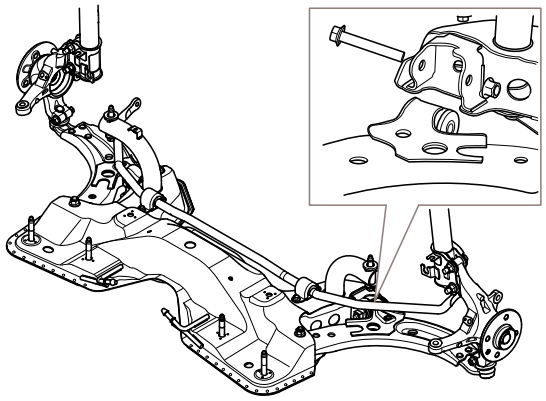
1. Raise the vehicle on a lift.
2. Remove the front wheel.

☞Wheels Remove

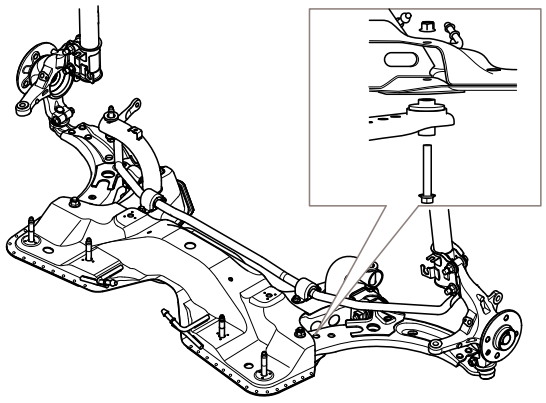
3. Loosen the front steering knuckle dust cover, remove the steering knuckle dust cover, bolt and nut.



4. Fit the front lower arm outer ball joint protector.
5. Remove the bolt of the welding nut from the lower arm rear bushing to the suspension frame.



6. Remove the nuts and bolts of the lower arm front bushing and suspension frame.



7. Remove the front lower arm assembly.

Refit

1. Connect the front arm rear bushing and the corresponding hole position of the suspension frame with the bolts, tighten the nuts and bolts of the lower arm rear bushing and the suspension frame to **90–110Nm**.
2. Place the lower arm on the corresponding hole position of the suspension frame, tighten the bolts of the welding nuts from the lower arm front bushing to the suspension frame to **90–110Nm**.
3. Remove the front lower arm ball joint protector, and check the ball joint protector for damage.
4. Connect the front lower arm outer ball joint to the front wheel hub. Fit the dust cap, and tighten the nut and bolt to **50–65Nm**.
5. Fit the wheels.

☞Wheel Refit

6. Lower the vehicle.
7. Check the wheel alignment.

☞Four-wheel Alignment

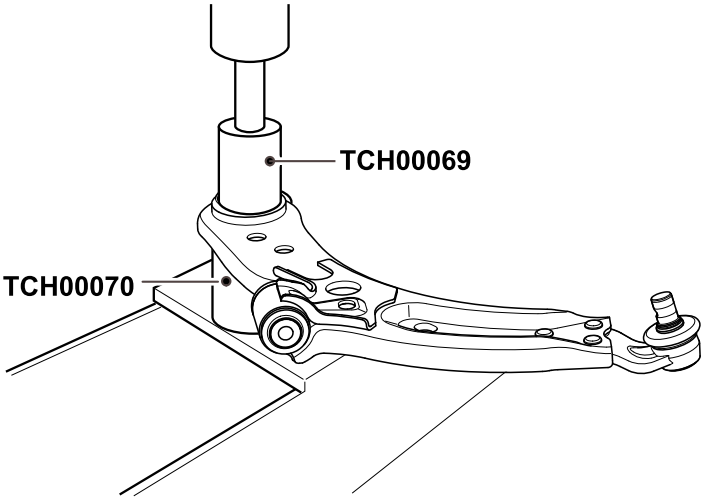
Front Lower Arm Rear Bush

Remove

1. Remove of Front Lower Arm

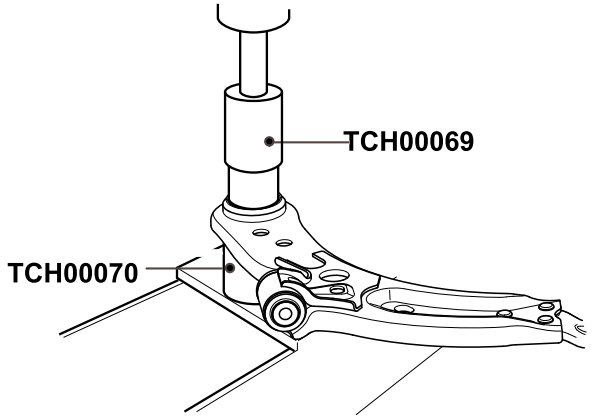
☞Front Lower Arm Assembly Remove

2. Use**TCH00069** and**TCH00070** tools to remove the front lower arm bushing.



Refit

1. Clean front lower arm to bush.
2. Locate the front lower arm bush on the front lower arm, and ensure the marks of the bushing and front lower arm are aligned.
3. Use **TCH00069**and**TCH00070** tools to press the front lower arm bush to the front lower arm, until aligning to the mark on the front lower arm.



4. Fit the front lower arm assembly.

☞Front Lower Arm Refit

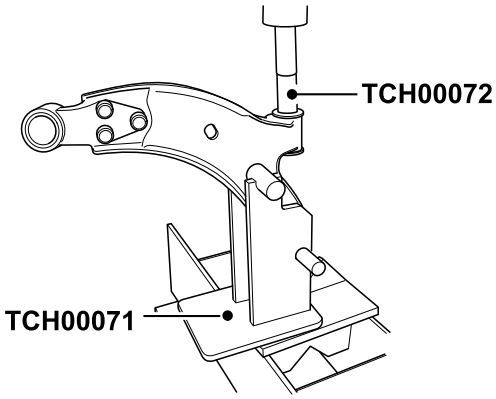
Front Lower Arm Front Bush

Remove

1. Remove of Front Lower Arm.

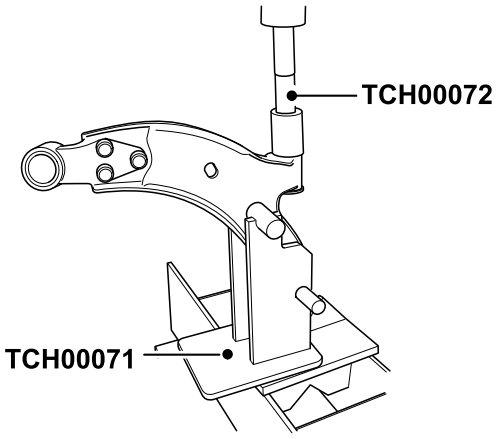
☞Front Lower Arm Remove

2. Use**TCH00071** and**TCH00072** tools to remove the front lower arm bush.



Refit

1. Clean front lower arm to bush.
2. Locate the front lower arm bush on the front lower arm, to ensure the marks of the bush and front lower arm are aligned.
3. Use**TCH00071** and**TCH00072** tools to press the front lower arm bush to the front lower arm, until aligning to the mark on the front lower arm.



4. Fit the front lower arm.

☞Front Lower Arm Refit

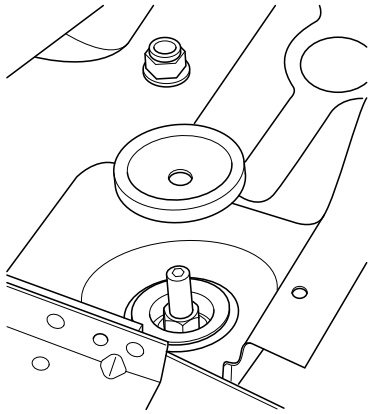
Front Damper

Remove

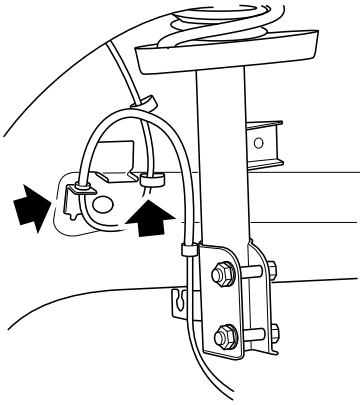
1. Raise the vehicle on a lift.
2. Remove the front wheel.

☞ **Wheels Remove**

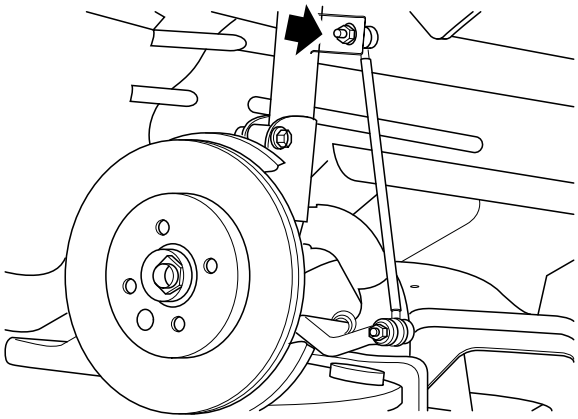
3. Release the upper cover and nuts on the engine compartment shock absorber strut.



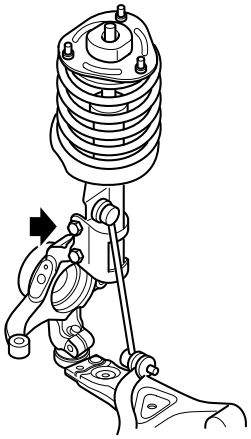
4. Release the speed sensor harness and the brake hose from the front shock absorber. Release the wire harness and the brake hose from the retaining clip.



5. Remove nuts between the anti-roll bar link and the shock absorber strut assembly, and disconnect the anti-roll bar link.

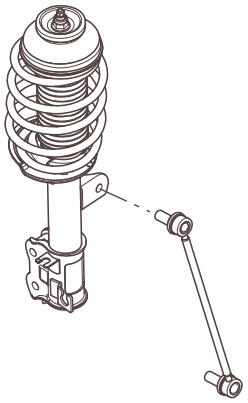


6. Remove nuts and bolts within the range that is from the knuckle to the shock absorber strut assembly so as to disconnect the knuckle.

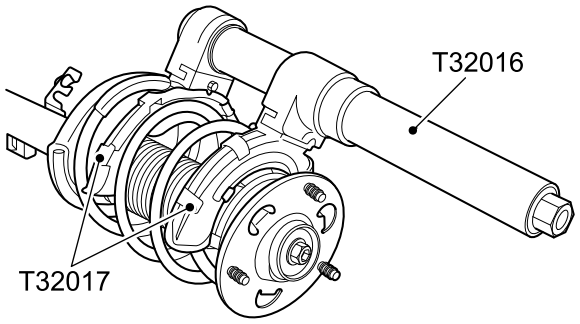


S323012

7. Remove the shock absorber strut assembly.



8. Fix the spring compressor tool**T32016** and **T32017**to the front shock absorber spring.



S323021

9. Make sure the spring compressor clip is positioned correctly, and compress the spring.
10. Stick the top of the front shock absorber strut with a tool, and remove and discard the nuts on the top of the strut.
11. Remove the front shock absorber rebound gasket and the front shock absorber upper mounting support

assembly.

12. Remove the spring insulator.
13. Remove the spiral spring.
14. Remove the shock absorber compression travel bumper block gasket, the front shock absorber compression travel bumper block and the front shock absorber dust cover.
15. Release the pressure of the spiral spring, loosen the clip on the spring compressor and remove the spiral spring.

Refit

1. Check if cracks and damages exist on the front shock absorber pillar, upper and lower spring insulators, and front shock absorber bearing.
2. Check if aging or damaging signs occur to the front shock absorber dust cover and compression travel bumper.
3. Wipe damper shaft and bump stop cup.
4. Fit the compression travel bumper and its spacer as well as the pillar dust cover of front shock absorber to the assembly.
5. Ensure the compression travel bumper and its spacer of front shock absorber are properly located on the pillar dust cover.
6. Fit the coil spring to the pillar.
7. Locate the spring compressor to the front shock absorber, and use**T32016** and**T32017** tools to compress the spring.
8. Ensure the relative refit position is proper. When fitting the front shock absorber, fit the support and spring insulator onto the shaft.
9. Fit the rebound spacer and a new nut.
10. Release the elastic force of the spring, loosen the spring compressor pin and remove the spring compressor.
11. Connect the front shock absorber assembly to the steering knuckle, and tighten the nut and bolt securing the steering knuckle to the front shock absorber pillar assembly to **90–110Nm**.
12. Connect the stabilizer shaft link to the shock absorber assembly, tighten the nut for connecting to **50–65Nm**.
13. Fit the front brake hose and front wheel speed sensor wiring harness onto the front shock absorber pillar support.
14. Fit the wheels.

☞Wheel Refit

15. Lower the vehicle.
16. Fit the engine compartment shock absorber pillar upper cover and nut to **60–80Nm**.
17. Check the wheel alignment parameter.

☞Four-wheel Alignment

Anti Roll Bar

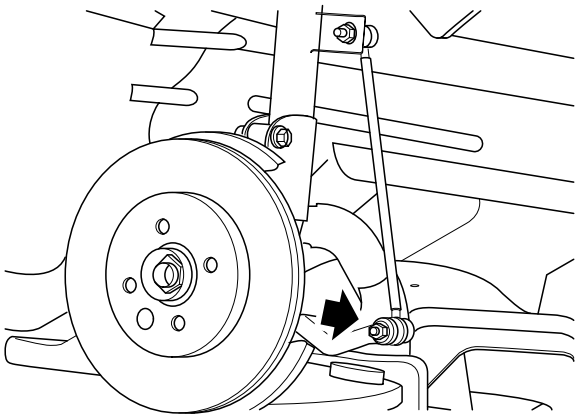
Remove

1. Raise the vehicle on a lift.
2. Remove the front wheel.

☞Wheels Remove

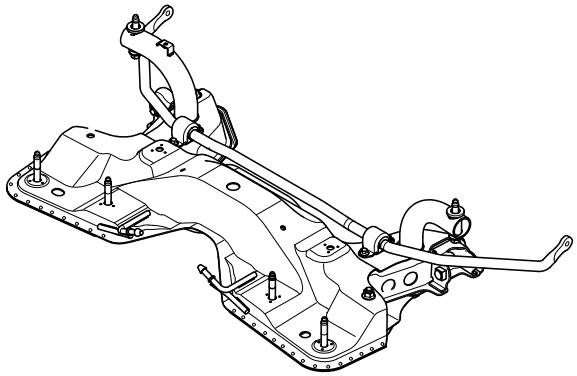
Caution: Nuts and bolts must be tightened with weight of vehicle on suspension.

3. Remove the nuts securing the anti roll bar link to the anti roll bar.

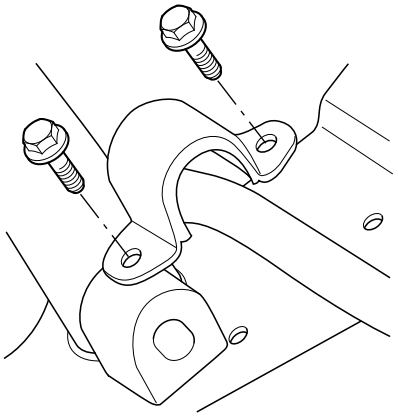


4. Disconnect the anti-roll bar link.
5. Remove the front sub frame assembly.

☞Front Sub Frame Remove



6. Remove the 4 bolts securing the anti-roll bar bushing support to the front sub frame assembly.



Refit

1. Secure the anti roll bar bushing support to the front frame, and tighten the bolts to**22–28Nm**.
2. Fit the front sub frame assembly.

☞Front Sub Frame Assembly Refit

3. Tighten the nuts from the anti roll bar to anti roll bar link to **45–55Nm**.
4. Fit the wheels.

Caution: Nuts and bolts must be tightened with weight of vehicle on suspension.

☞Wheel Refit

5. Lower the vehicle.
6. Check the wheel alignment.

☞Four-Wheel Alignment

Anti Roll Bar Bush

Remove

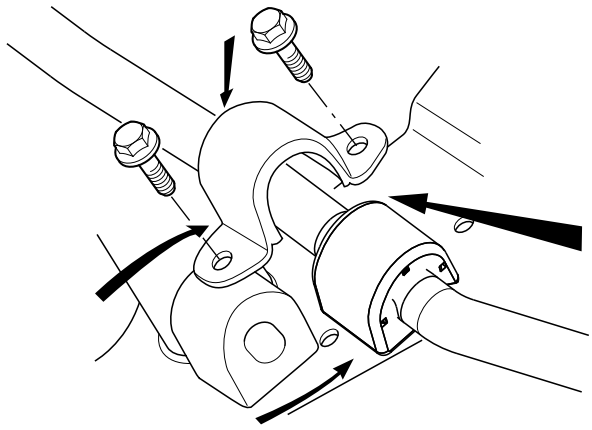
1. Raise the vehicle on a lift.
2. Remove the front wheel.

☞ **Wheels Remove**

3. Remove the anti roll bar.

☞ **Anti Roll Bar Remove**

4. Remove the anti roll bar fixed support and the bushing.



Refit

1. Fit the bushing to the anti roll bar and position it on the bracket.

Caution: Anti roll bar bushes have a special coating and must not be lubricated.

2. Fit the bushing fixed support.
3. Fit the bolts securing the fixed bushing support, and tighten each of them in order to **22–28Nm**.
4. Fit the front sub frame assembly.

☞ **Front Suspension Frame Refit**

5. Fit the wheels.

☞ **Wheel Refit**

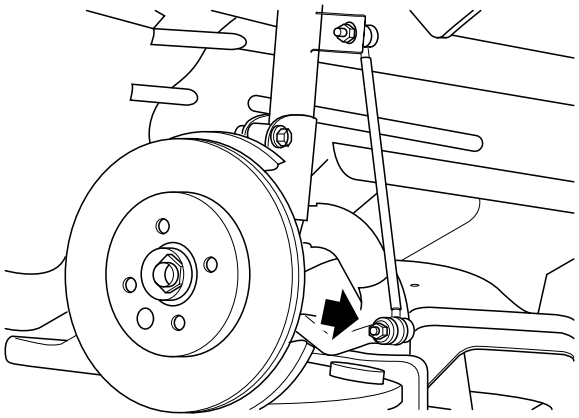
Anti Roll Bar Link

Remove

1. Raise the vehicle on a lift.
2. Remove the front wheel.

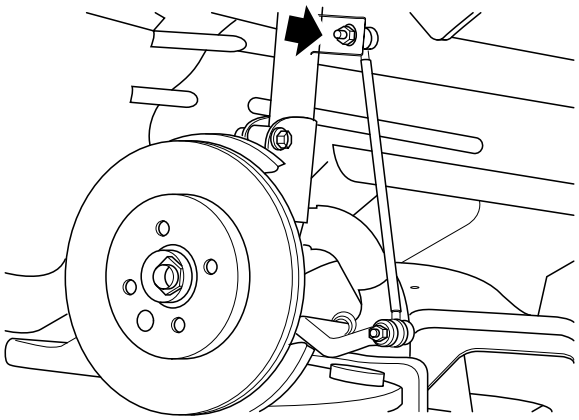
☞ **Wheels Remove**

3. Remove the nuts securing the anti roll bar link to the anti roll bar.

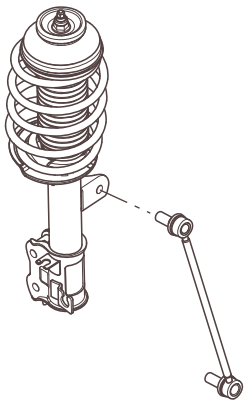


4. Disconnect the anti roll bar link.
5. Turn the front shock absorber pillar to touch the retaining nuts on the anti roll bar link.
6. Remove the nuts securing the anti roll bar link to the front shock absorber.

Caution: To prevent damage to components, use two spanners when loosening or tightening unions.



7. Remove the anti roll bar link from the front shock absorber.



Refit

1. Fit the front anti roll bar link to the front shock absorber, and tighten the nuts to**50–65Nm**.

Caution: To prevent damage to components, use two spanners when loosening or tightening unions.

2. Connect the anti roll bar link to the anti roll bar, and tighten the nuts to **45–55Nm**.
3. Fit wheels.

☞**Wheels Refit**

4. Lower the vehicle.
5. Inspect the wheel alignment.

☞**Four-wheel Alignment**

Front Sub Frame Assembly

Remove

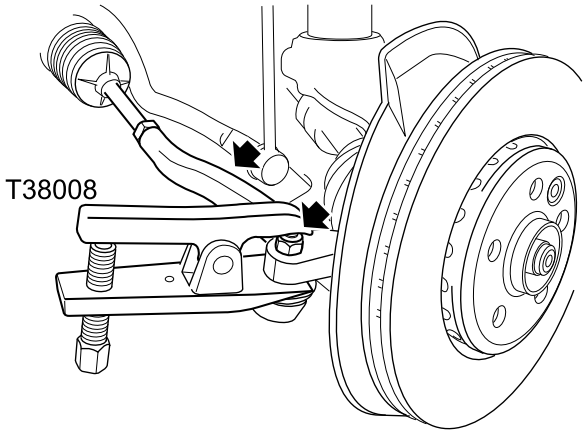
1. Raise the vehicle on a lift.
2. Remove the front wheels.

☞**Wheels Remove**

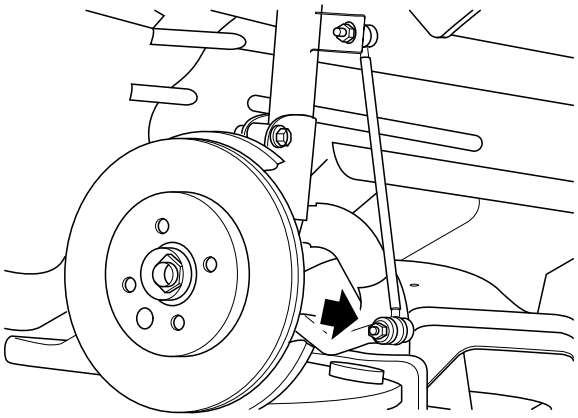
3. Remove intermediate pipe and silencer.

☞**Intermediate Pipe Remove**

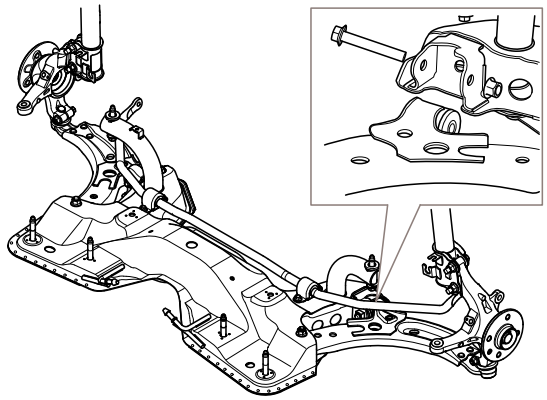
4. Remove the engine rear lower tie bar.
5. Use the tool**T38008** to disconnect the tie rod from the knuckle assembly.

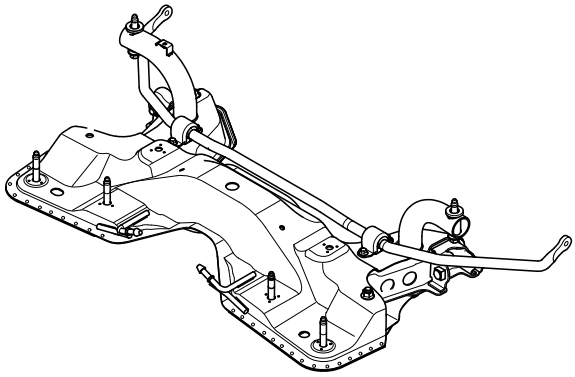


6. Disconnect the anti roll bar link from the anti roll bar.

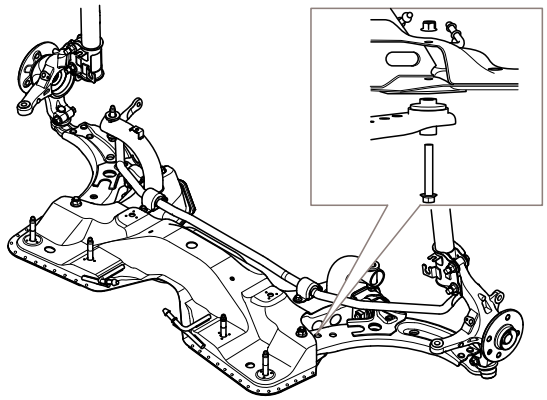


7. Release parts within the range that is from the front lower swing arm rear bush to the front subframe.

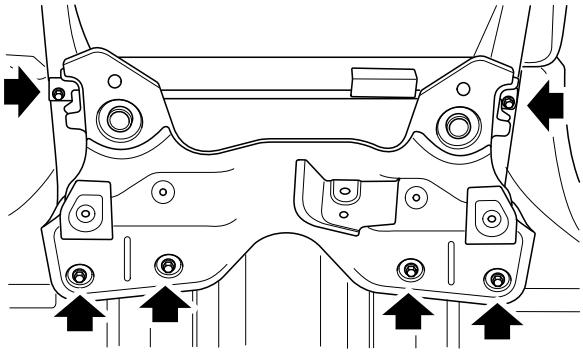




8. Release parts within the range that is from the front lower swing arm front bush to the front subframe.



9. Remove 6 screws securing the subframe to the body-in-white.



10. Remove the front subframe assembly from the vehicle.

Refit

1. Place 2 bolts at the corresponding holes of the body without tightening.
2. Place 4 bolts at the corresponding holes of the body without tightening.
3. Tighten 2 bolts to**90–110Nm**.
4. Tighten 4 bolts to**90–110Nm**.
5. Connect the front lower arm rear bush to the front subframe, and tighten bolts to**90–110Nm**.
6. Connect the front lower arm front bush to the front subframe, and tighten bolts to**90–110Nm**.
7. Connect the anti roll bar link to the anti roll bar, and tighten nuts to **45–55Nm**.
8. Fit intermediate pipe and silencer.

☞**Intermediate Pipe Refit**

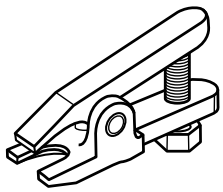
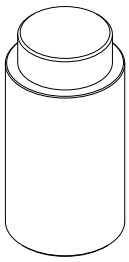
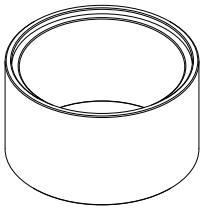
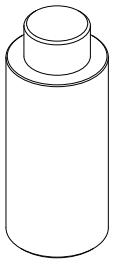
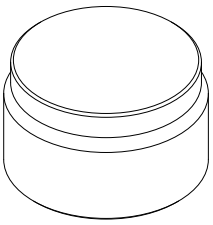
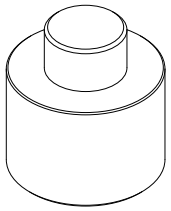
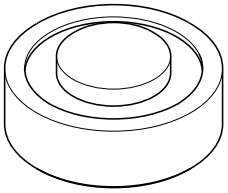
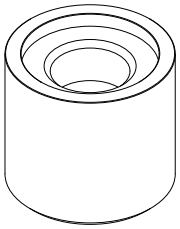
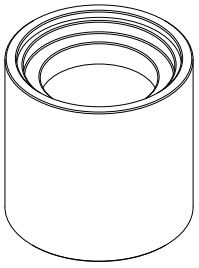
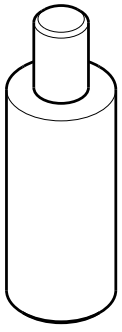
9. Fit the wheels.

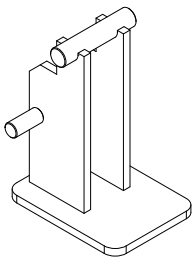
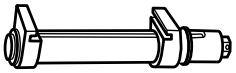
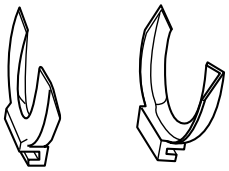
☞**Wheels Refit**

10. Lower the vehicle.
11. Check the wheel alignment.

☞**Four-wheel Alignment**

Special Tools

Tool Number	Description	Picture
T38008	Remover ball joint	 T38008
TCH00020	Remover front hub bearing	
TCH00021	Support front hub	
TCH00068	Support front hub bearing and drive flange	
TCH00019	Support front hub	
TCH00067	Support front hub bearing and drive flange	
TCH00018	Replacer front hub bearing	
TCH00069	Remover and replacer front lower arm bush (big)	
TCH00070	Support front lower arm bush (big)	
TCH00071	Remover and replacer front lower arm bush (small)	

Tool Number	Description	Picture
TCH00072	Support front lower arm bush (small)	
T32016	Coil spring compressor	 T32016
T32017	Adaptor coil spring compressor	 T32017

Rear Suspension

Specifications

Torque

Description	Value
Nut - rear damper to body	50–65Nm
Bolts - rear damper to trailing arm	140–170Nm
Nuts - rear spindle	320–350Nm
Screw - cap-drum brake	6–8Nm
Bolts - rear subframe to bod	90–110Nm
Bolts - rear subframe to bracket	90–110Nm
Screw - hand brake clip bracket	7–10Nm

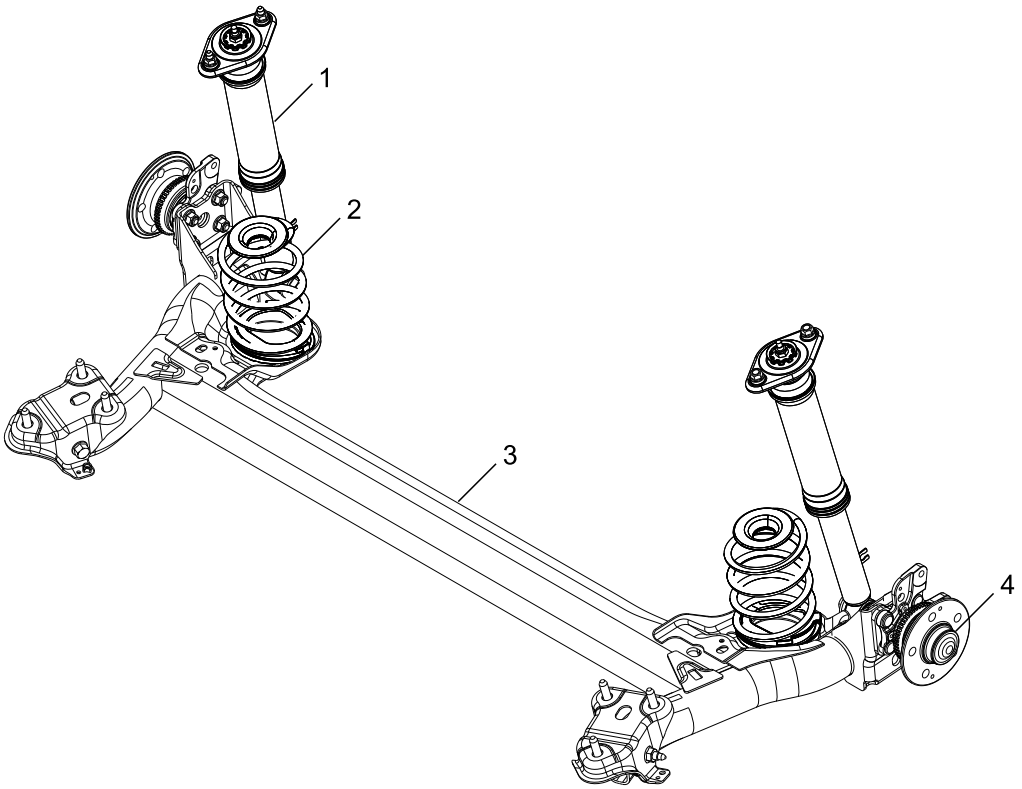
Specifications

Type	
Rear coil spring data:	
Total coils	6.48
Active coils	5.28
Wire diameter	11.3mm
Free Length	302mm

Description and Operation

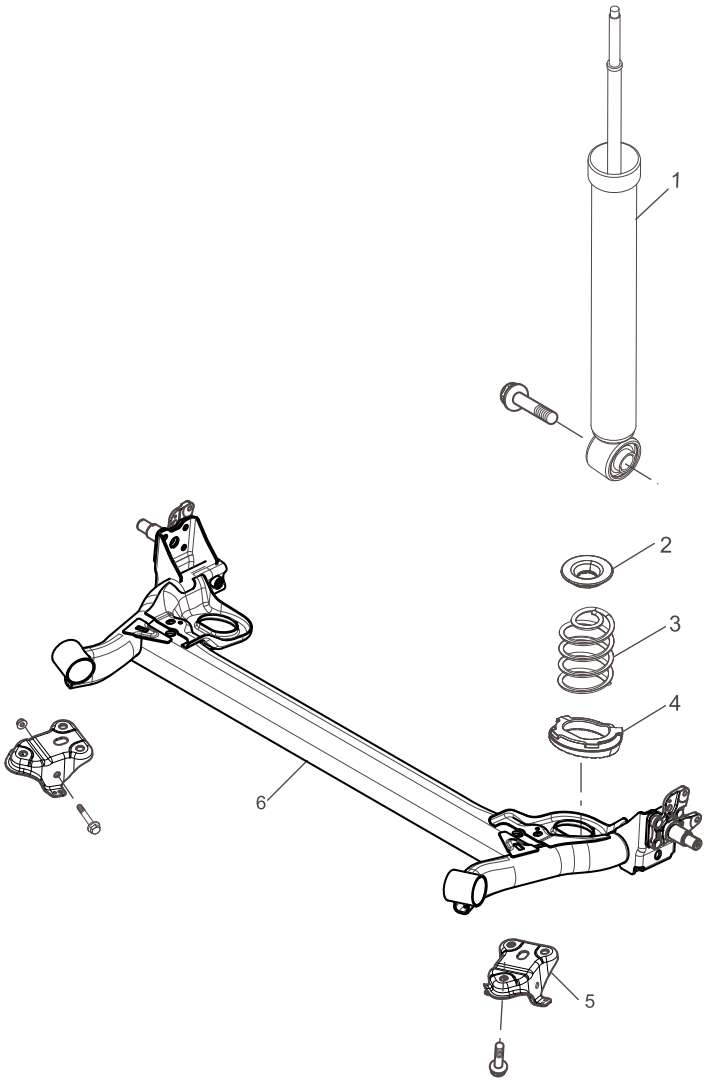
System Component Layout

Rear Suspension Component Location



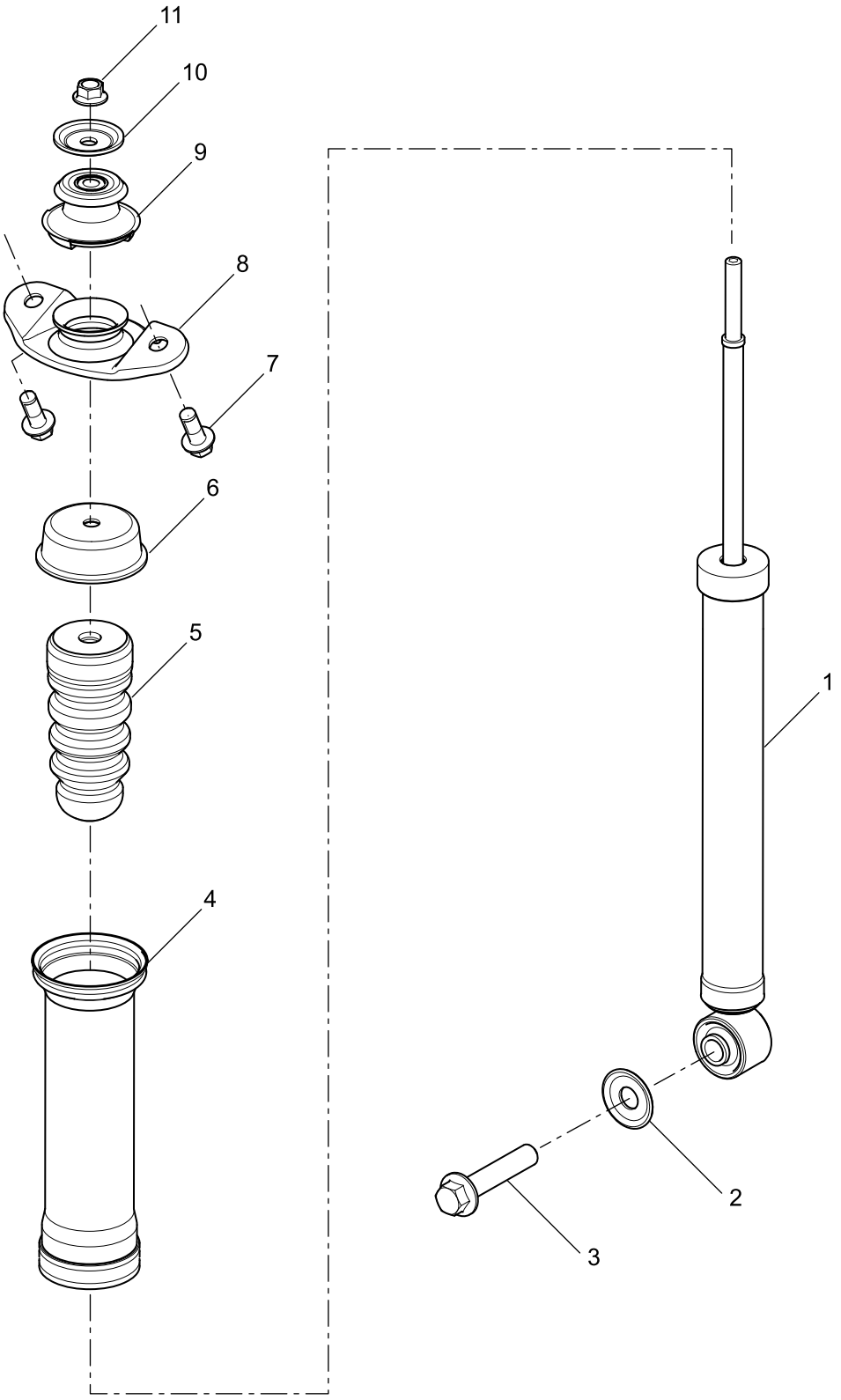
1. Rear Damper assembly
2. Coil Spring
3. H Frame Assembly
4. Rear Hub Assembly

Rear Suspension Components



1. Rear Damper assembly
2. Upper Spring Shock Isolator
3. Coil Spring
4. Rear Suspension Lower Spring Shock Isolator
5. H Frame Bracket
6. H Frame Assembly

Rear Damper Assembly Components



1. Rear Damper assembly
2. Rear Shock Absorber Washer
3. Bolt
4. Dust cover
5. Bump stop
6. Bump stop plate

7. Bolt
8. Top mounting
9. Rod Bush
10. Spring Washer
11. Nut

Description

The rear suspension includes:

- Coil springs
- Rear damper
- H frame

H Frame

There is a pair of suspension trailing arms on the left and right side, extending to the front-rear direction of the vehicle, and they may be supported on the body by shaking their front ends, and the rear wheels are supported freely by rear end rotation; The torsion beam extends along the transverse direction of the vehicle, with each end in the longitudinal direction connecting to the middle part in the front and rear direction of each suspension trailing arm mentioned above respectively, and a corner section is formed by each end of the spiral spring set in the longitudinal direction of the above torsion beam and the rear side of the the above suspension trailing arms and fixed on the said torsion beams and the suspension trailing arms, and a spiral spring mounting seat is set at the rear of the spiral spring; The shock absorber mounting seat used for fitting the shock absorber is set on the rear end of the spiral spring mounting seat above; The spring seat mentioned above has a bottom wall which is used for supporting the spiral spring and connected to the said suspension trailing arm and is not connected to the torsion beam, and the seat also has a flange part bending upwards from this bottom wall and connected to the said torsion beam and the suspension trailing arm. The above flange part is reinforced within a range that is extending from the surrounding area of the above shock absorber mounting seat to the backside.

Coil Spring

Coil springs, manufactured from chromium steel, are fitted between the body and the lower arm. Each spring is located in upper and lower spring isolators which reduce noise transmitted to the body from the suspension. Both isolators are positively retained to the spring. The lower isolator is positively retained by a location pip on the lower arm. A hole in the lower isolator is provided for water drainage and must be aligned with corresponding hole in the lower arm when fitted.

Rear Damper

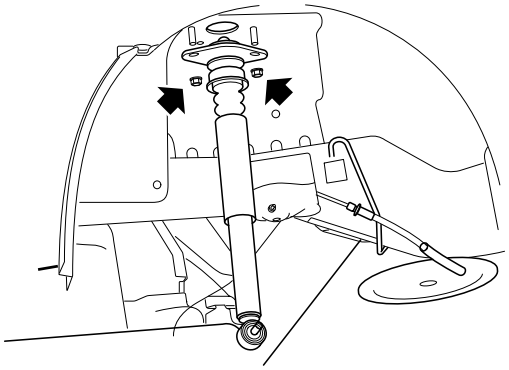
Each damper features 125 mm bump and 75 mm rebound damping. The dampers are gas charged and oil filled and are of twin tube construction. The twin tube construction allows the damper piston to operate on an inner tube with an oil/gas cavity between the inner and outer tubes. This minimises oil cavitation and eliminates the effect of damage to the outer tube affecting piston operation. The lower damper mounting is fitted with a nonserviceable bush that is attached to the trailing arm with a bolt and washer. This mounting position gives the damper an approximate ratio of 1:1, which is beneficial for damping control. The damper rod is located in a bush in a top mounting and is secured with a rebound plate and a locknut. The top mounting is attached to the body with two captive studs on the mount and two lock nuts. The rebound plate fitted between the damper rod locknut and the top mounting cushions forces as the damper rod reaches full extension. A spring aid plate and a spring aid are fitted over the rod and cushion the damper operation if maximum bump travel is reached. A bump cup is fitted to the top of the damper body and protects the low friction damper rod seal from damage from the spring aid when maximum travel is reached. A dust cover is fitted to protect the damper rod from dirt and damage

Service Procedures

Rear Damper Assembly

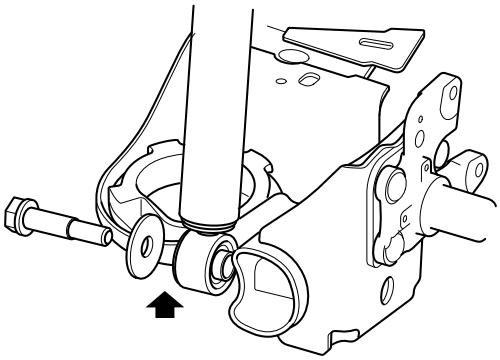
Remove

1. Remove the bolts within the range that is from the damper to the upper body.



S323021

2. Raise the vehicle and support frame.
3. Remove the bolts within the range that is from the damper to frame.



S323022

4. Remove the damper.

Refit

1. Place the rear damper below the damper shield.
2. Align the 2 holes on the damper with the mounting hole on the body damper, and pre-tighten with screws.
3. Tighten the bolts to **50–65Nm**, to make sure the connection panel on the top of the damper is completely applied to the body lip plate.
4. Let bolts within the range that is from the damper to the torsion beam go through the damper joint carrier and insert it into the frame, and tighten them to **140–170Nm**.

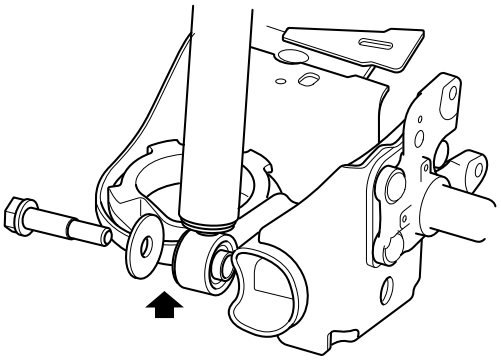
Rear Spring

Remove

1. Remove the rear wheels.

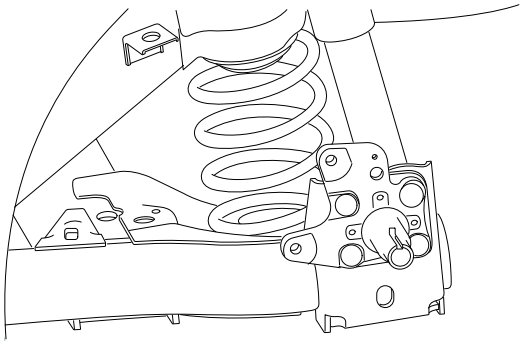
☞**Wheels Remove**

2. Lift up and support the vehicle properly. Support the rear arm using the jack bracket.
3. Remove the left and right damper lower bolts.



S323022

4. Lower the H frame and remove the spring and upper isolators from spring.



S323023

Refit

1. Fit the upper isolators and fix the lower bumper.
2. Fit the spring and lift up the frame.
3. Fit the damper.

☞**Rear Damper Refit**

4. Fit the wheels.

☞**Wheels Refit**

5. Remove the jack bracket and lower the vehicle.

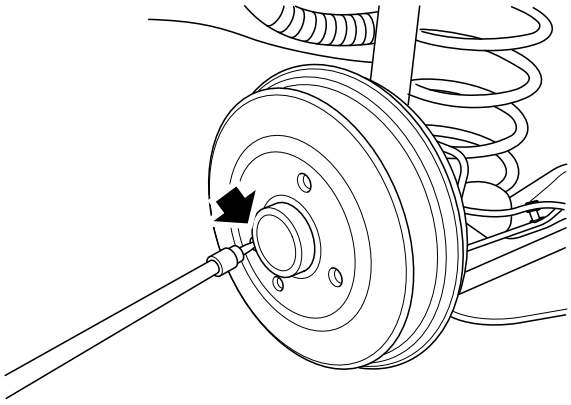
Rear Hub Bearing

Remove

1. Raise the vehicle on a lift.
2. Remove the rear wheel.

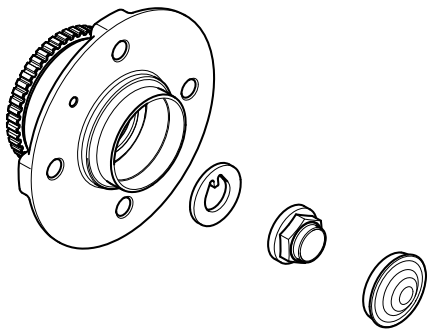
☞ Wheels Remove

3. Remove the screws on the rear brake drum.



4. Remove and discard cap from hub.
5. Knock back staking locking hub nut to stub axle shaft.
6. Remove and discard the rear brake drum nuts.
7. Remove the rear wheel hub washer from the stub axle.
8. Remove the rear hub bearing.

Caution: Do not store hub bearings near magnetic fields or iron filings as damage may occur.



Refit

1. Align the bearing hole to the spindle, and fit the bearing.
2. Align the locking washer hole to the spindle with the washer having a chamfer end face fit inwardly.
3. Align the locking nut to the spindle. Fit the locking nut and tighten to **320–350Nm**.
4. Fit the rear brake drum cover, and tighten the countersunk screw to **6–8Nm**.
5. Fit wheels.

☞ Wheels Refit

6. Lower the vehicle.

H Frame Assembly

Remove

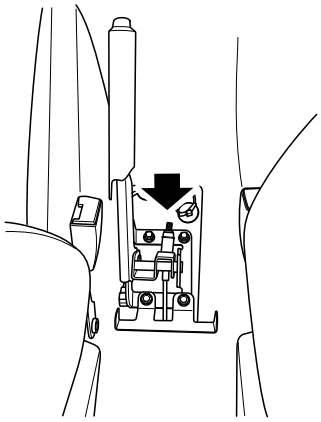
1. Raise the vehicle on a lift.
2. Remove rear wheels.

☞ **Wheels Remove**

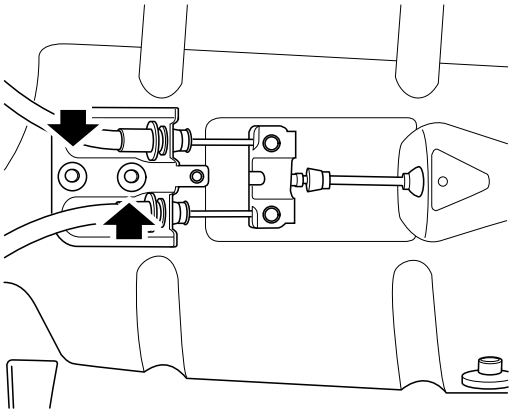
3. Remove the console assembly.

☞ **Console Assembly Remove**

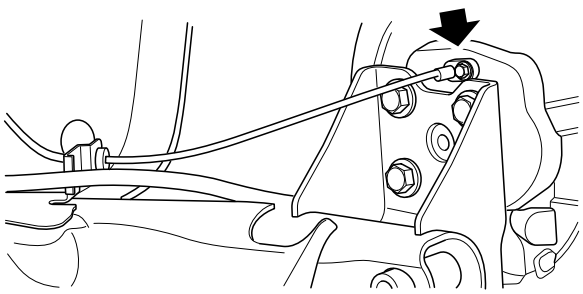
4. Release the hand brake cable adjustment nut.



5. Release the hand brake cable from the hand brake cable tensioner.

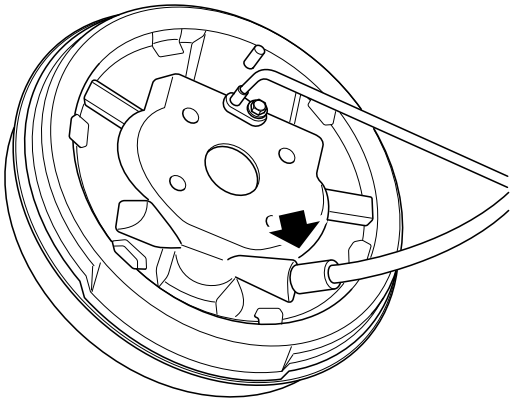


6. Disconnect**ABS** the connector.

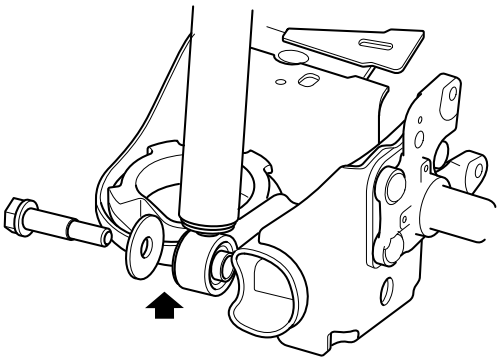


7. Disconnect the hand brake cable.

Caution: Always fit plugs to open connections to prevent contamination.

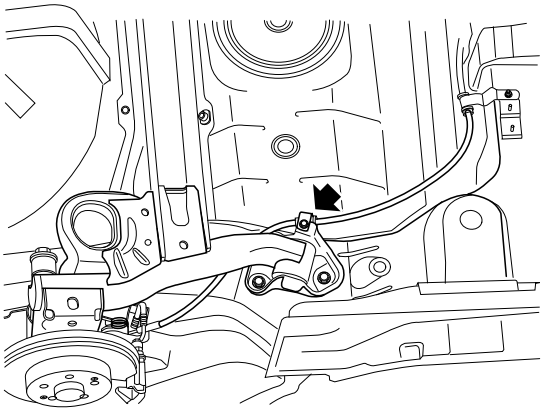


8. Remove the bolts at the bottom of two dampers.



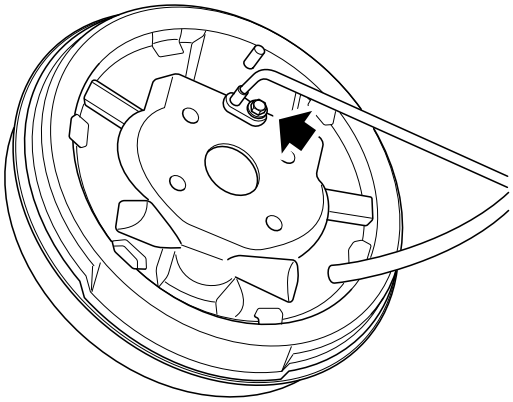
S323022

9. Remove 2 bolts securing the hand brake cable to the frame. Put the cable aside so as to remove the H frame.

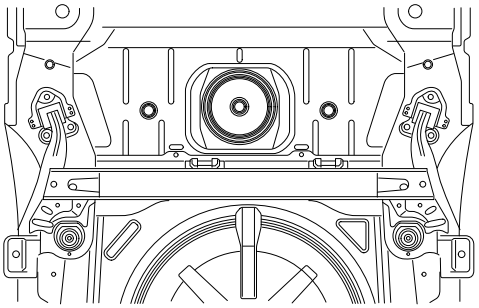


S402012

10. Release the connector securing the wheel speed sensor to the rear brake drum.



11. Repeat the above steps at the other side.
12. Compress and remove two rear springs and put away the spring insulator.
13. Support the frame.
14. Remove 8 bolts securing the frame to the body.



S323026

15. Remove the H frame.

Refit

1. Using the hydraulic lifter, position the frame onto the body.
2. Tighten the frame connection support to the body-in-white bolts to **90–110Nm**.
3. Fit 2 rear spring assemblies.
4. Tighten the bolts within the rang that is from the rear frame to the mounting support to **90–110Nm**.
5. Fit bolts fixing the hand brake cable clamp, and tighten them to **7–10Nm**.
6. Fit two dampers and tighten bolts to **140–170Nm**.
7. Connect the hand brake cable to the rear hub.
8. Fix the connector to the frame.
9. Connect the wheel speed sensor.
10. Connect the hand brake cable to the hand brake cable tensioner.
11. Bleed the brake system.

☞**Brake System Bleeding**

12. Fit 2 rear wheels.

☞**Wheels Refit**

13. Check wheel alignment.

☞**Four-wheel Alignment**

Tires and Wheels

Specifications

Torque

Description	Value
Bolt - road wheel	105–115Nm

Reference

Wheel

Wheel Size:	
Alloy	6.5J×16
	6J×15
Steel	5.5J×14
Tire Size:	
	185/65 R15
	195/55 R16
Spare Tire	185/65 R15 R15

Tire Pressure

Tire Pressure - Normal Driving Conditions	Front	2.1 bar
	Rear	2.1 bar
Tire Pressure - High Speed (over 100mph(160km/h))	Front	2.1 bar
	Rear	2.1 bar

Tip: Normal driving conditions: Carrying up to 4 passengers and luggage.

Service Procedures

Wheel

Warning: Do not use silicone lubricant on the or wheel rim or tyre edge. Clean tyre edge before removing. Use 50% non-silicone lubricant and 50% water based lubricant to these areas prior to refitting.

Remove

1. Remove the wheel trim cover assembly with a screwdriver.
2. Use a suitable wheel brace or the wrench supplied in the vehicle tool kit to loosen 4 road wheel bolts.
3. Raise the vehicle on a lift, and set to normal working height.
4. Remove wheels.
5. Remove the tire valve assembly.

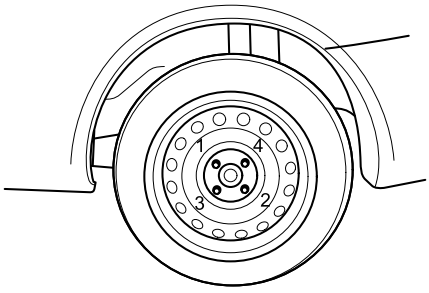
Warning: Use a tyre changer to remove the tyre. Manual tools or prybar could damage the road wheel or tyre.

Caution: Do not place the wheel face down on the ground to avoid scratching.

Refit

Caution: Please clean the corrosive on the surface of the road wheel, drum and brake disc before refitting. If wheel, disc and drum contact surfaces are not properly cleaned, the wheel bolts could become loose and may cause the wheel to fall off while the vehicle is moving. This will cause the vehicle to go out of control, and could cause injury.

1. Fit a new tire valve assembly.
2. Fit tire with tire changer and charge until the tire is in it's position. Ensure the ring of the tire is in the wheel. This way can position the tire well.
3. Carry out dynamic balancing to new pairs of wheels and assemble new matched wheel balance weights.
4. Fit the wheel, tighten 4 steel road wheel bolts**105–115Nm** . Follow the sequence shown on the illustration below, (1 to 4)..



Warning: If there is oil leakage between the wheel and the brake disc or drum, it will cause the wheel bolts to become loose and result in injury with the vehicle out of control. Never use heat to remove a seized wheel. This will shorten the life of the wheel, wheel bolts, hub and bearing. Wheel bolts must be tightened in correct sequence and to correct torque to avoid distortion of wheel, brake drum or disc.

5. Fit the wheel trim cover assembly.

Brake

Specifications

Torque

Description	Value
Nuts - master cylinder to servo	21–29Nm
Bolt - hose to panel	7–10Nm
Brake pipe unions to master cylinde	20–24Nm
Nut - master cylinder to servo	21–29Nm
Nuts - servo to body	19–25Nm
Bolts - pedal box to body	19–25Nm
Nuts - ped box to body	19–25Nm
Screw - accelerator to body	8Nm
Bolt - brake lamp switch to pedal box	8–12Nm
Bolt - brake caliper	90–110Nm
Front brake hose to caliper housing	16–18Nm
Screw - front brake bleeding	9–11Nm
Screw - front brake disk to hub	7–10Nm
Bolt - front caliper housing to hub	85–105Nm
Screw - cap drum-brake	6–8Nm
Screw - rear brake bleeding	9–11Nm
Bolt - EVP bracket to body	19–25Nm
Bolt - EVP to bracket	7–9Nm
Nut - ECM to ECM bracket	8–10Nm
Bolt - battery tray	20–28Nm
Bolt - fuse box to battery tray	6–8Nm
Bolt - battery clip	20–28Nm
Bolt - battery	20–28Nm

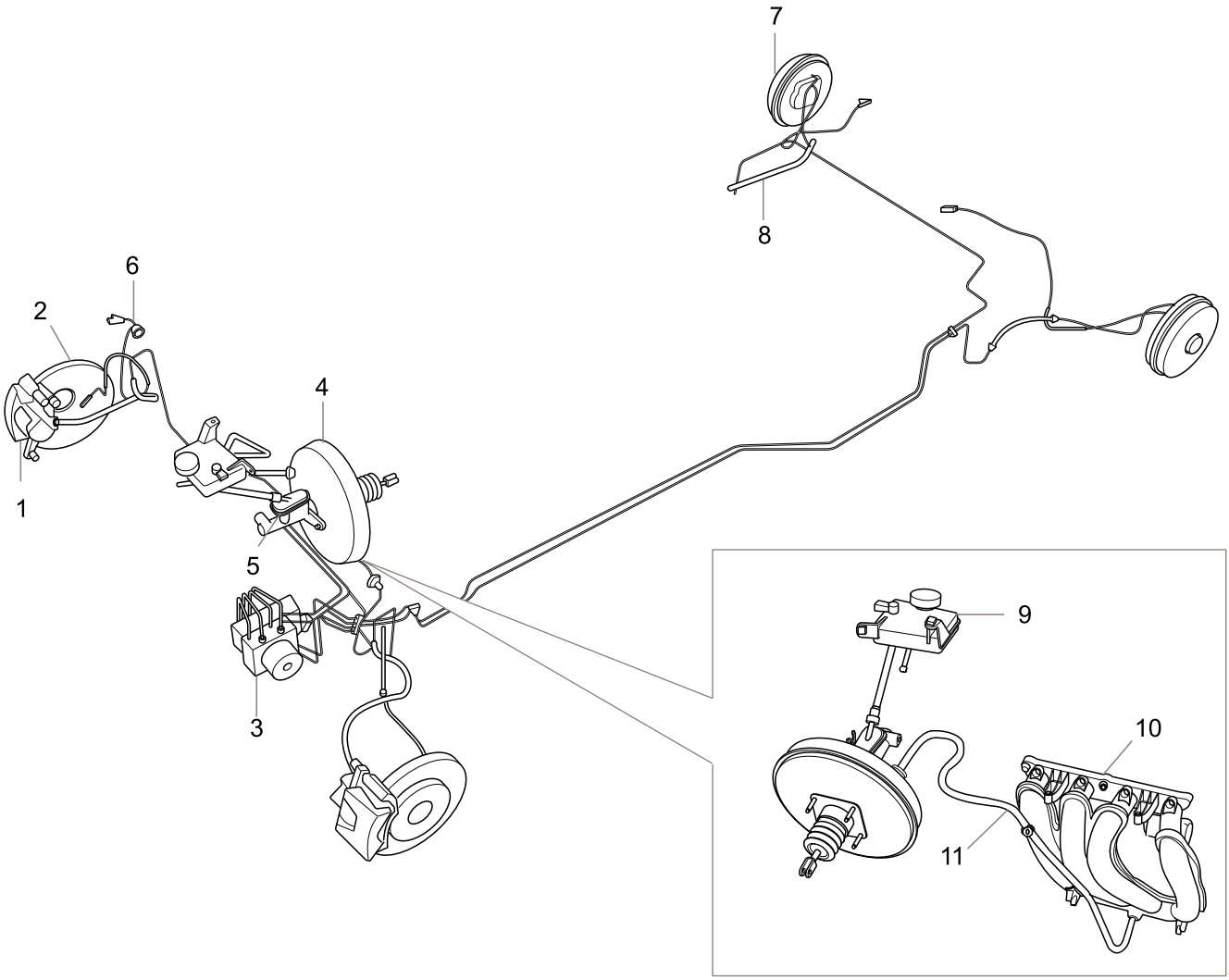
Specifications

Type	
Front	Single piston, sliding caliper assembly with ventilated disc
Rear	Drum brake system
Caliper piston diameter - front	54mm
Disc diameter - front	257mm
Front disc minimum thickness - New (nominal)	22mm
Front disc minimum thickness - Service limit	20mm
Maximum disc run out (equipped with wheels)	0.05
Circuit type	Diagonal split, dual circuit, 4 wheel speed sensor

Description and Operation

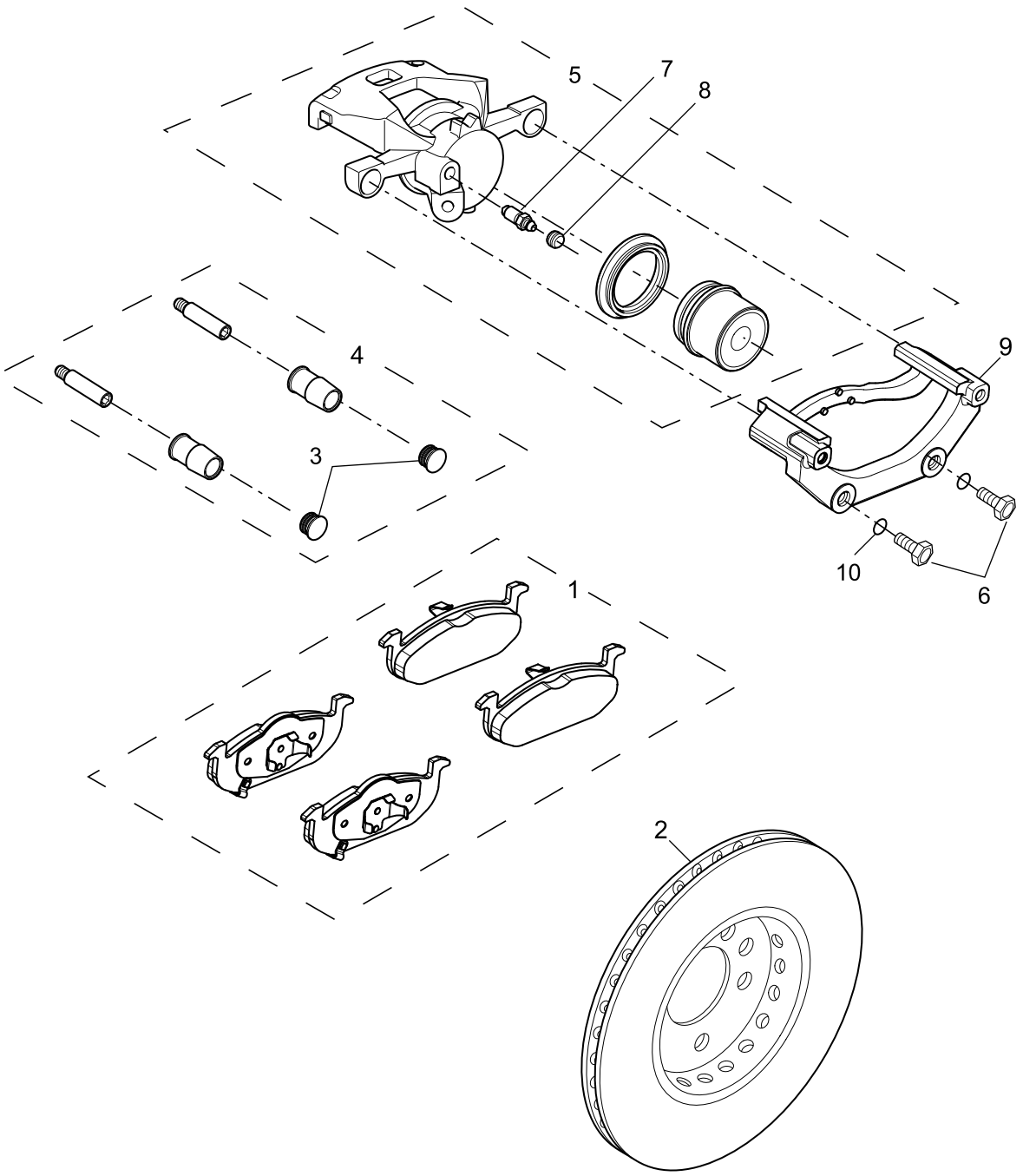
System Component Layout

Brake System Component Location



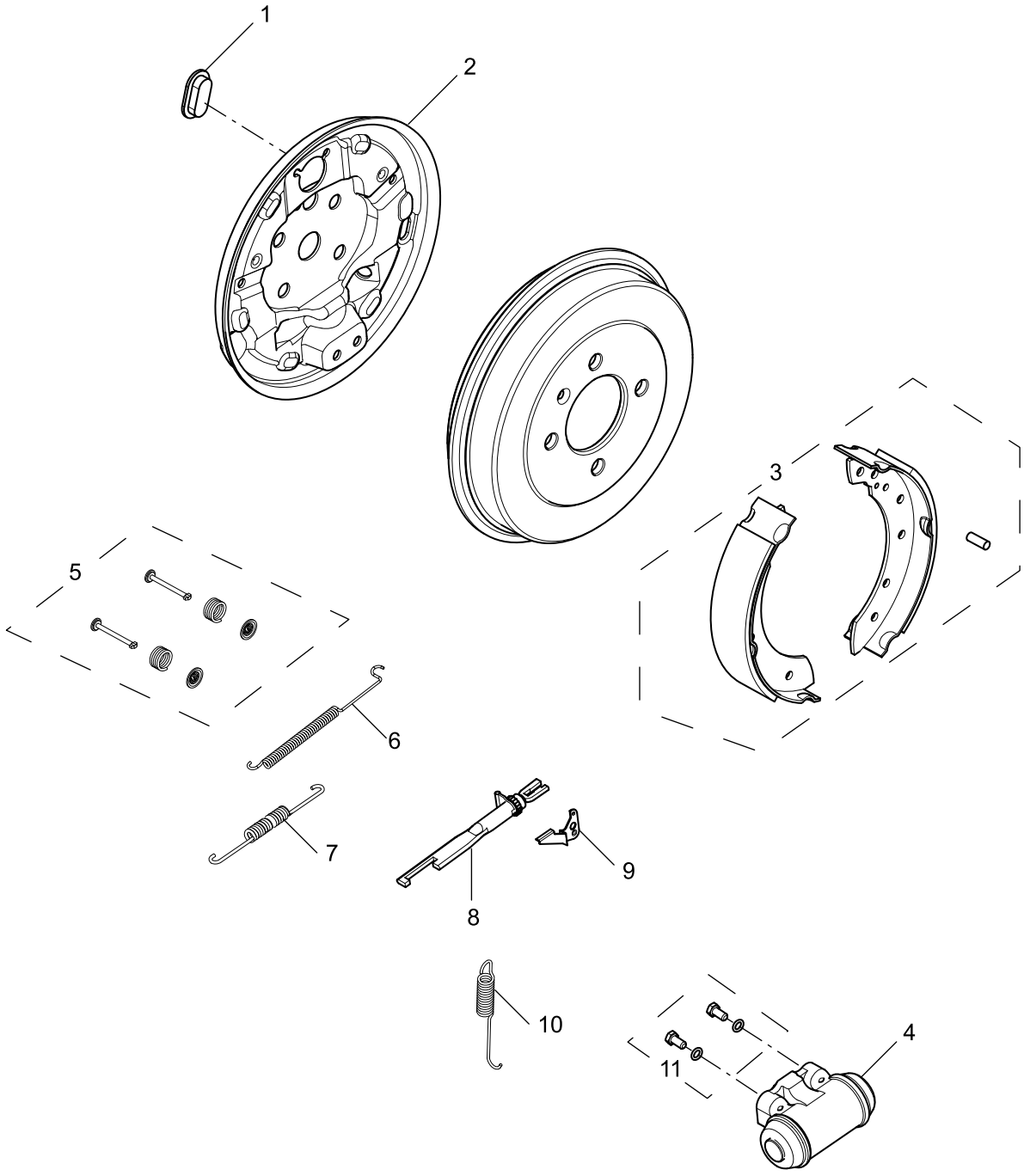
1. Front Brake Caliper Assembly
2. Front Brake Backplate
3. ABS Modulator
4. Brake Servo Assembly
5. Master Cylinder Assembly
6. Front Wheel Speed Sensor
7. Rear Brake Drum
8. Rear Wheel Speed Sensor
9. Brake Fluid Low Level Switch
10. Inlet Manifold
11. Brake Vacuum Hose Assembly

Front Brakes Components



1. Brake Pad
2. Brake Disc
3. Guide Pin Dust Cover Cap
4. Brake Guide Pin
5. Caliper Housing Assembly
6. Calliper Securing Bolt
7. Bleed Screw
8. Bleed Screw Cap
9. Calliper Carrier
10. Spring Washer

Parking Drum Brake Components



1. Observation Hole Blockage
2. Rear Backplate
3. Rear Shoe with Pulling Arm
4. Front Shoe with Spring Cylindrical Pin
5. Kit - Brake Shoe Fixed
6. Upper Shoe Return Spring
7. Lower Shoe Return Spring
8. Right Gap Tuning Mechanism Assembly
9. Right Shifting Plate for Gap Tuning
10. Shifting Plate Tension Spring for Gap Tuning
11. Kit - Wheel Cylinder and Back Panel for Fastening
12. Rear Wheel Cylinder

Description

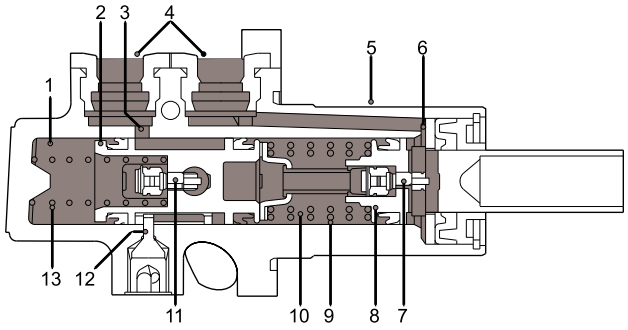
Brake Pedal and Switch

The brake pedal is installed on a pivot shaft in the pedal mounting bracket on the engine bulkhead. A clevis pin and clip connect the input rod of the brake servo to the brake pedal. A tang on the end of the brake pedal activates the Hall effect brake switch in the pedal mounting bracket. The brake switch provides two pedal status outputs: one is connected to the modulator **ECU**. The second is connected to the cruise control system (where fitted) and the TCM on automatic transmission models. The brake switch consists of an inner sensor in an outer mounting sleeve. To ensure correct orientation, the sensor is keyed to the mounting sleeve and the mounting sleeve is keyed to the pedal mounting bracket. Mating serrations hold the sensor in position in the mounting sleeve. While the brakes are off, the tang on the brake pedal rests against the end of the sensor. When the brake pedal is pressed, the tang moves away from the sensor and induces a change of sensor output voltages.

Vacuum Booster Assembly

The brake servo assembly provides power assistance to reduce the pedal effort when braking. If the brake servo assembly fails, the hydraulic system still functions but will require greater brake pedal effort due to the lack of vacuum assistance. The master cylinder assembly is attached to the forward ends of two tie bolts in the brake servo assembly. The brake servo assembly consists of a circular housing which contains two diaphragms, a central plate, a control valve assembly, input and output push rods and a filter. The input push rod is connected to the brake pedal. The output push rod locates in the primary piston of the master cylinder. A protective gaiter is installed on the control valve assembly where it extends from the rear of the housing. A port in the front face of the housing is connected to a vacuum line from the engine. A non return valve is incorporated into the vacuum line. The control valve assembly consists of a valve body containing a valve, a piston, a valve spring and an input rod spring. The valve controls a vacuum port in the valve body. The piston controls an air inlet port between the valve and the piston. A reaction disc and a ratio disc separate the piston from the output push rod. A guide tube on the front of the valve body is attached to the front diaphragm and supported in a bush in the central plate. A return spring locates in the open end of the guide tube. The two diaphragms and the central plate separate the interior of the housing into four sealed chambers. The chambers at the front of the diaphragms are connected together through fixed passages in the valve assembly. The chambers at the rear of the diaphragms are connected together through the interior of minor diaphragms on the tie bolts.

Master Cylinder Assembly



S402001

1. Secondary Pressure Chamber
2. Secondary Piston
3. Secondary Feed Hole
4. Fluid Reservoir Ports
5. Master Cylinder
6. Primary Feed Hole
7. Primary Centre Valve
8. Primary Piston
9. Primary Springs
10. Primary Pressure Chamber
11. Secondary Centre Valve
12. Valve Pin
13. Secondary Spring

The master cylinder assembly produces hydraulic pressure to operate the brakes when the brake pedal is pressed. The assembly is attached to the front of the brake servo assembly, and typically comprises a cylinder containing two pistons in tandem. The rear piston produces pressure for the primary circuit and the front piston produces pressure for the secondary circuit. A brake fluid reservoir is installed on top of the cylinder. The reservoir is internally divided to provide an independent supply of fluid to each brake circuit, and so prevent a single fluid leak from disabling both primary and secondary brake circuits. Should a failure occur in one circuit, the remaining circuit will still operate effectively, although brake pedal travel and vehicle braking distances will increase. If the fluid level in the reservoir is too low, a level switch opens and breaks a circuit between the ABS modulator and the instrument pack, which illuminates the brake warning light.

Front Brake

The front brakes each comprise of a hub mounted, single piston, sliding calliper assembly and a ventilated disc. The inboard side of the disc is protected by a shield. On the RH brake, a pad wear sensor is connected to the inboard brake pad and wired in series with the rear brake pad wear sensor.

The connector of the sensor lead is located on the inner wing in the engine compartment. When hydraulic pressure is supplied to the calliper, the piston extends and forces the inner pad against the disc. The calliper housing reacts and slides on the guide pins to bring the outer pad into contact with the disc. If the brake pads become sufficiently worn, the RH disc causes the pad wear sensor to go open circuit and illuminates the pad wear warning light in the instrument pack.

Rear Brake

The drum brake is mainly composed of the backing plate, brake drum, brake shoe, wheel cylinder (brake cylinder), return spring, locating pin and other spare parts. The backing plate is fit and secured on the vehicle shaft for bearing the rotational torque when braking, on which brake shoe, wheel cylinder, return spring and locating pin are fit. A pair of brake shoes, on which friction lining is available, are provided for each drum. The brake drum is fit on the bearing flange, which rotates with wheels. When braking, the wheel cylinder piston pushes the brake shoe to repress the brake drum. The brake drum decelerates when subjected to the friction, forcing the rotation of wheels to be stopped.

The gap between the brake shoe and the brake drum increases with the friction lining abrasion. A mechanism that can adjust the gap automatically is provided on the drum brake. After the friction lining is abraded, the gap between the brake drum and itself will be adjusted automatically. When the gap increases and the brake shoe pushing amount exceeds a certain range, the gap-adjusting mechanism will pull the adjusting rod (pawl) to the position where the adjusting rod is joined with the next adjusting tooth. Thus, the link length will be increased to allow the brake shoe position movement to restore to a normal gap.

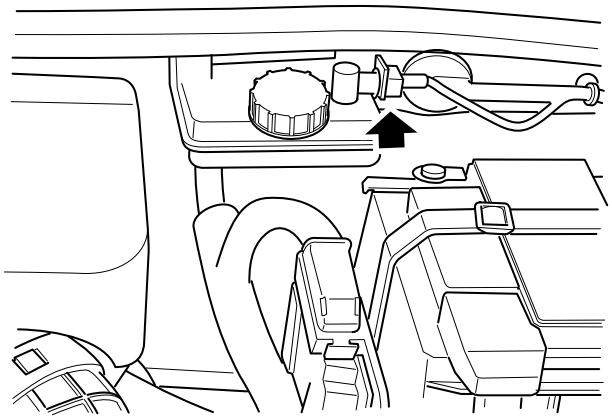
The drum brake running and park brakes are composed together. The park is a mechanical system, which is completely separated from the hydraulic system of the vehicle brake. Use a handle lever to tense the steel cable, and operate the drum brake park pulling arm extending brake shoe, exerting the parking and braking functions and preventing the vehicle from sliding. After loosening the steel cable, the return spring will allow the brake shoe to return, with the brake force eliminated.

Service Procedures

Low Level Indicator Switch-Brake Fluid

Remove

1. Disconnect multiplug from brake fluid low level indicator switch.



2. Release clip securing brake fluid low level indicator switch to brake fluid reservoir and remove switch.

Refit

1. Fit brake fluid low level indicator switch to brake fluid reservoir and secure clip.
2. Connect multiplug to brake fluid low level indicator switch.

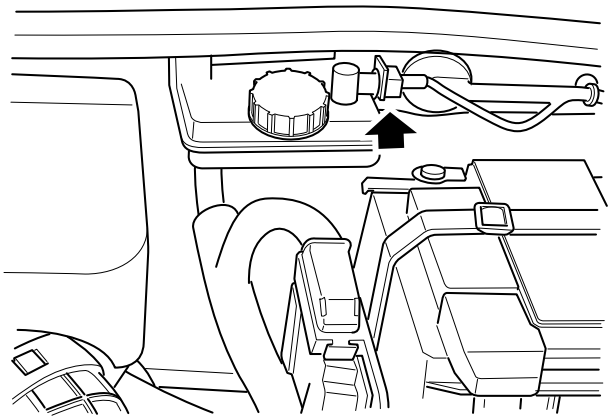
Master Cylinder and Fluid Reservoir

Remove

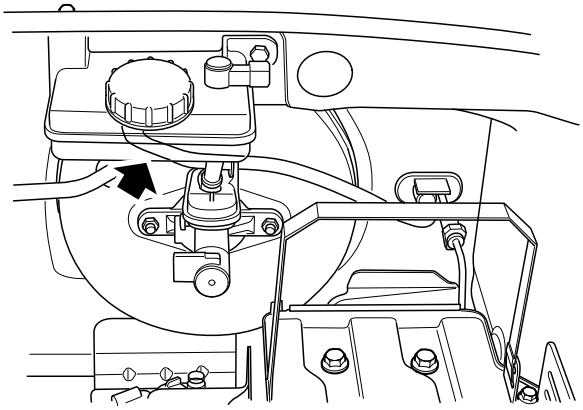
1. Position absorbent cloth under **ABS**modulator to absorb fluid spillage

Caution: Brake fluid will damage paint finished surfaces. If spilled, immediately remove fluid and clean area with water.

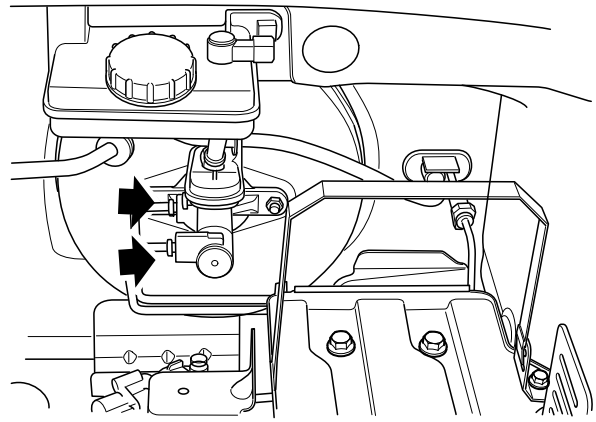
2. Disconnect multiplug from brake fluid low level indicator switch.



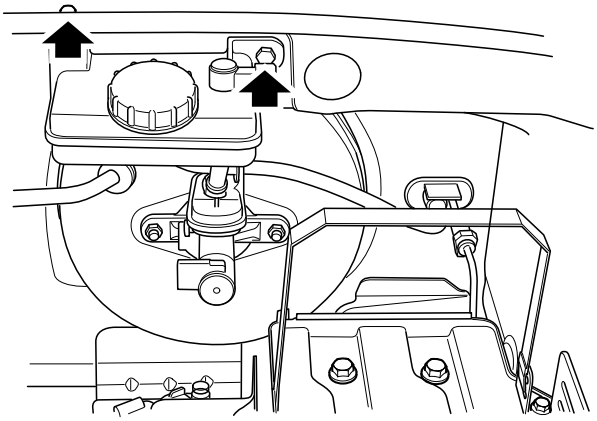
3. Disconnect master cylinder lines.



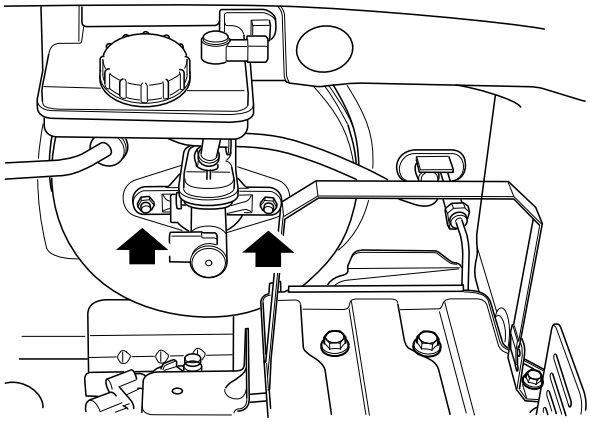
4. Release clips fixing the clutch lines to the master cylinder.
5. Disconnect 2 brake pipe unions from master cylinder.



6. Release the engine bay harness from battery carrier and disconnect main harness.
7. Release the reservoir construction bolts.



8. Remove 2 nuts and washers securing master cylinder to servo and discard nuts.



9. Remove master cylinder and fluid reservoir.

Refit

1. Fit master cylinder to servo, fit washers and nuts and tighten to **21–29Nm**.
2. Fit the reservoir to the ventilation panel and tighten bolts to **7–10Nm**
3. Clean brake pipe unions.
4. Connect brake pipes to master cylinder and tighten to **20–24Nm**.
5. Connect the clutch lines to the reservoir.
6. Fit the clutch lines to the master cylinder with clips.
7. Connect multiplug to brake fluid low level indicator switch.
8. Fit**ECM** the wiring harness and connect it to the connector.
9. Connect the connector on the brake fluid level switch.
10. Bleed brake system.

☞**Brake System Bleeding**

Vacuum Servo-Brake

Remove

1. Remove the battery box cover.

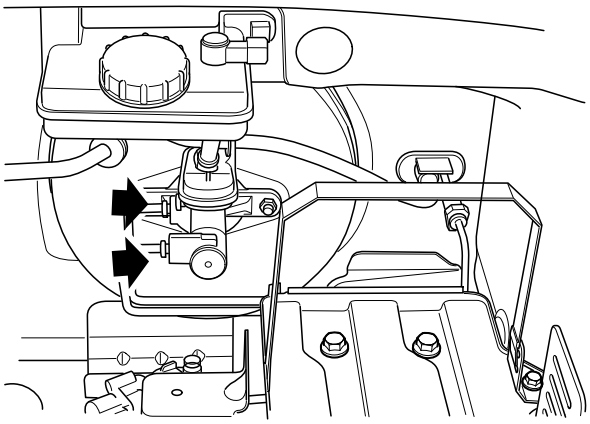
☞**Battery Box Cover Remove**

2. Disconnect multiplug from brake fluid low level indicator switch.
3. Position cloth under reservoir to absorb fluid spillage.

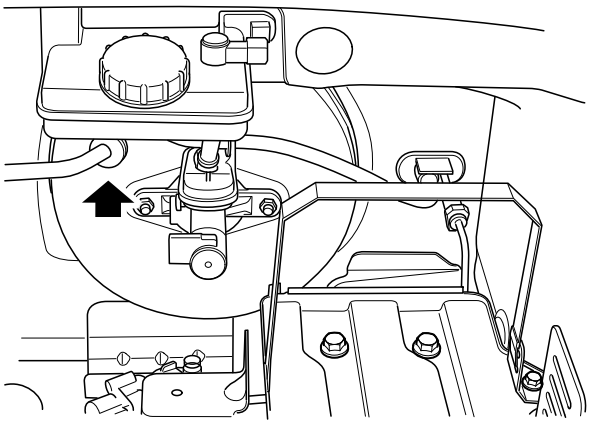
Caution: Brake fluid will damage paint finished surfaces. If spilled, immediately remove fluid and clean area with water.

4. Release 2 brake pipes from master cylinder.

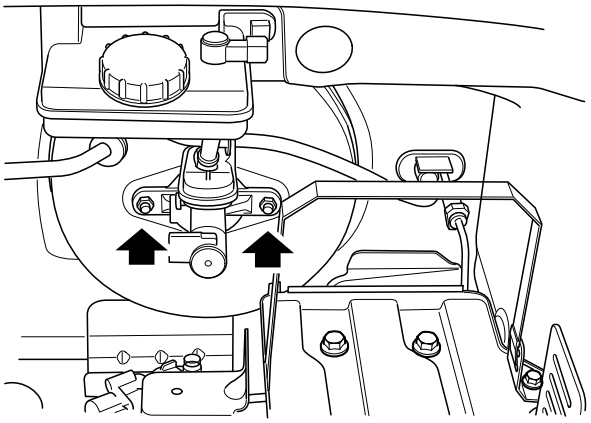
Caution: Before disconnecting or removing components, ensure the immediate area around joint faces and connections are clean. Plug open connections to prevent contamination.



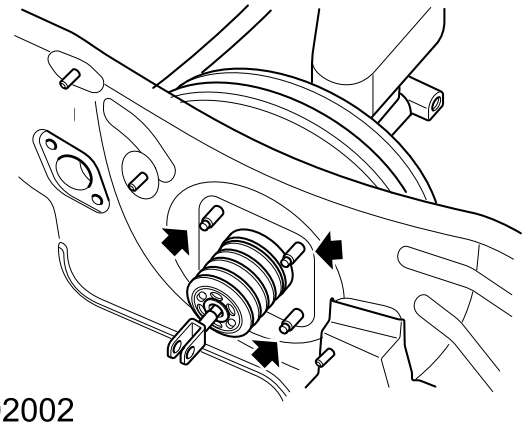
5. Disconnect vacuum hose from brake servo.



6. Remove and discard 2 nuts and washers securing master cylinder to servo.



7. Remove steering column closing panel.
8. Remove nut securing brake servo push rod to brake pedal.



S402002

9. Remove servo assembly.

Refit

1. Fit master cylinder to servo and secure, fit 2 new nuts and tighten to **21–29Nm**.
2. Clean mating faces of servo and body.
3. Fit servo assembly and secure to pedal box, fit nuts and tighten to **19–25Nm**.
4. Position servo to brake pedal with pin and nuts.
5. Refit steering column closing panel.
6. Connect vacuum hose to brake servo.
7. Clean brake pipe unions.
8. Fit brake pipes to master cylinder and tighten to **20–24Nm**.
9. Connect multiplug to brake fluid low level indicator switch.
10. Bleed the brake system.

☞**Brake System Bleeding**

11. Fit the battery box cover.

☞**Battery Box Cover Refit**

Brake pedal

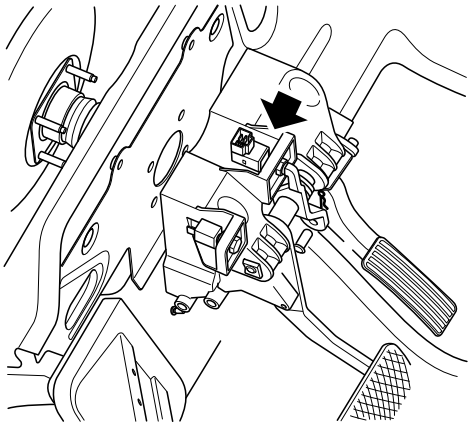
Remove

1. Disconnect battery earth lead.
2. Remove steering column closing panel.

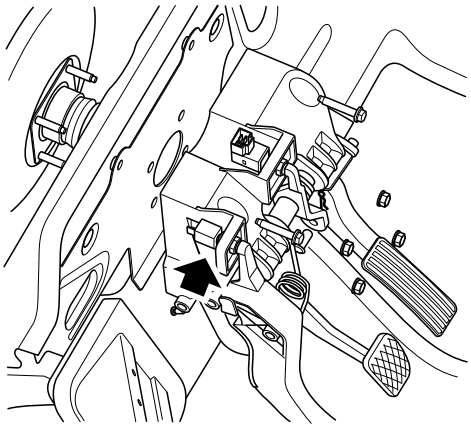
☞**Panel Assembly – Fascia Closing Panel – Driver Remove**

3. Remove the brake lamp assembly.

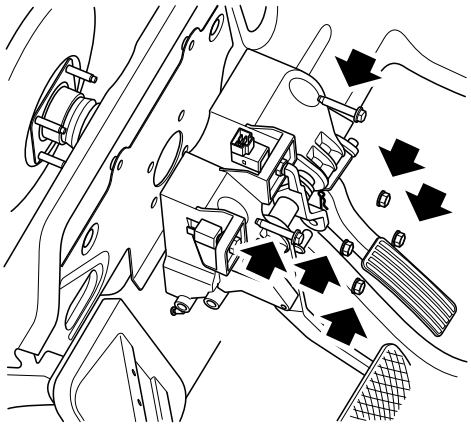
☞**Brake Lamp Switch Remove**



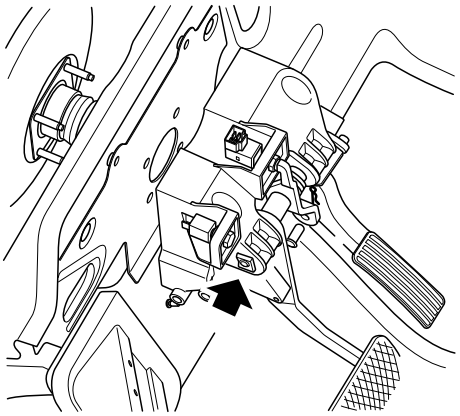
4. Remove the clutch switch.



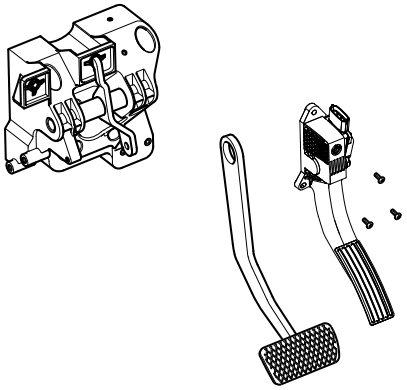
5. Release nuts securing the vacuum booster push-rod to the brake pedal.
6. Release bolts and nuts securing the pedal housing to the front panel.



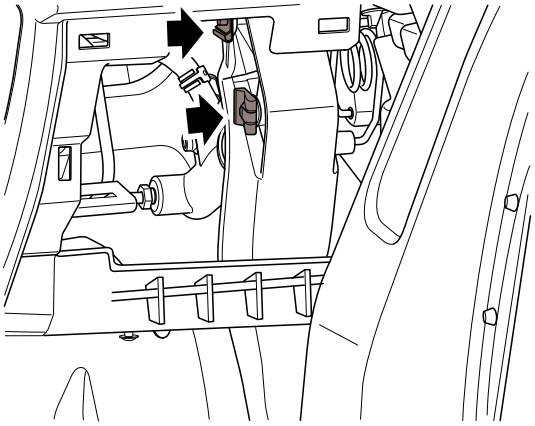
7. Release three bolts securing the accelerator pedal and take down the accelerator pedal.
8. Release clamps of the brake pedal.



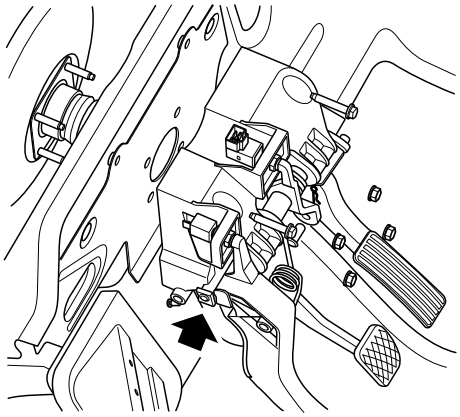
9. Take down the brake pedal.



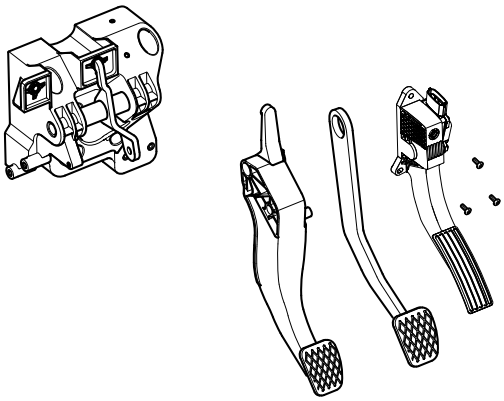
10. Remove the pins and clips which are fixed on the clutch master cylinder.



11. Remove clips securing the clutch pedal to the pedal housing.



12. Remove the clutch pedal.



Refit

1. Embed the brake pedal arm into the push-rod head, then insert pins and finally insert deadbolts.
2. Embed the clutch pedal arm into the clutch push-rod U-shaped head, insert pins and finally insert clips.
3. Adjust the clutch master cylinder push-rod U-shaped head so that the clutch pedal could be positioned at an appropriate position.
4. Thread bolts of the vacuum booster through the front panel and make them being matched with the brake

pedal holes.

5. Align two holes on the top of the pedal support with mounting holes on the body, fix the pedal on the body with two bolts and tighten them to **19–25Nm**.
6. Fit four flange nuts to four stud bolts of the vacuum booster. Fix them in order. Fix the stud bolt on the bottom right firstly , then fix the one on the diagonal, then fix the one on the bottom left and finally fix the one on the other diagonal, tighten them to**19–25Nm**
7. Fix the accelerator pedal to the front panel with two bolts and one bolt, and tighten them to **8Nm**.
8. Fit the clutch lamp switch.
9. Fit the brake lamp switch.

☞**Brake Lamp Switch Refit**

10. Fit steering column closing panel.

☞**Panel Assembly - Fascia Closing Panel - Driver Refit**

11. Connect battery earth lead.

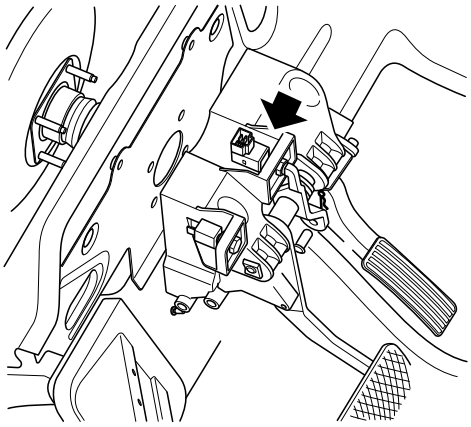
Brake lamp switch

Remove

1. Disconnect battery earth lead.
2. Remove steering column closing panel.

☞**Panel Assembly - Steering Column Lower Cover - Base Remove**

3. Remove securing nuts of the brake lamp switch and remove the switch.



Refit

1. Connect multiplug to brake switch.
2. Fit brake switch bracket to pedal box and secure with bolts and tighten to **8–12Nm**.
3. With brake pedal released, ensure brake switch is in contact with operating tang on brake pedal.
4. Fit steering column closing panel.

☞**Panel Assembly - Steering Column Lower Cover - Base Refit**

5. Connect battery earth lead.

Front brake caliper housing

Remove

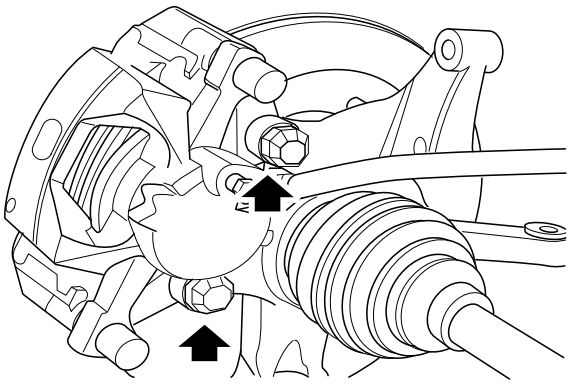
1. Raise the vehicle on a lift.
2. Remove front wheels.

☞Wheels Remove

3. Remove connecting bolts and washers within the range that is from the brake hose to the brake caliper.
4. Disconnect the brake hose, block the openings of the brake caliper and the brake hose so as to prevent loss and pollution of the brake fluid.

Caution: Before disconnecting or removing components, ensure the immediate area around joint faces and connections are clean. Plug open connections to prevent contamination.

5. Remove the brake caliper construction bolts from the knuckle, and then remove the brake caliper assembly.



Refit

1. Clean the brake parts.

Warning: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

2. Fit the brake caliper assembly with construction bolts and tighten bolts to **90–110Nm**.
3. Connect the brake hoses and tighten bolts and washers within the range that is from the brake hose inlet fittings to the brake caliper to **16–18Nm**.
4. Bleed the brake system.

☞Brake System Bleeding

5. Fit the wheels.

☞wheels Refit

6. Lower the vehicle.

Front brake pads

Remove

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

1. Raise the vehicle on a lift.
2. Remove front wheels.

☞Wheels Remove

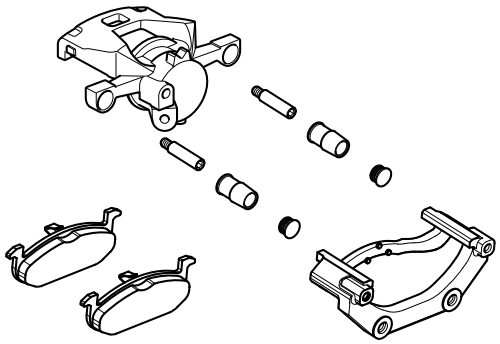
3. Remove the front brake caliper assembly.

☞Front Brake Caliper Remove

4. Remove 2 caps from guide pin dust covers.
5. Remove 2 guide pins from caliper housing.
6. Release caliper housing from caliper carrier and tie aside.

Caution: Don't tie brake caliper on brake hose.

7. Remove brake pads from caliper housing.



Refit

1. Remove any scale and loose corrosion from around edge of disc.
2. Clean caliper housing and caliper carrier using brake cleaning fluid.

Warning: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

3. Remove bleed screw cap, connect bleed hose and bottle to bleed screw. Loosen bleed screw.
4. Press piston into caliper housing then tighten bleed screw to **9–11Nm**.
5. Disconnect bleed hose and remove bottle.
6. Secure bleed screw cap.
7. Fit brake pads to caliper housing. On RH brake, ensure pad wear sensor is connected to inner pad.
8. Lubricate guide pins with anti-seize grease.

Caution: If brake pads low warning light was illuminated on the instrument pack before changing brake pads, the

sensor must be renewed, otherwise the warning light will still be illuminated.

9. Untie caliper housing and position to caliper carrier and align. Fit guide pins and tighten.
10. Fit caps to guide pin dust covers.
11. Fit anti-rattle spring clip to carrier housing.

Caution: Never reuse fluid that has been bled from the brake system.

12. Fit the wheels.

☞**Wheels Refit**

13. Lower the vehicle.
14. Press brake pedal several times to seat brake pads.

Tip: Pedal travel may be longer than normal during first brake applications.

Front brake disc

Remove

Caution: Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1500 km) from new.

1. Raise the vehicle on a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

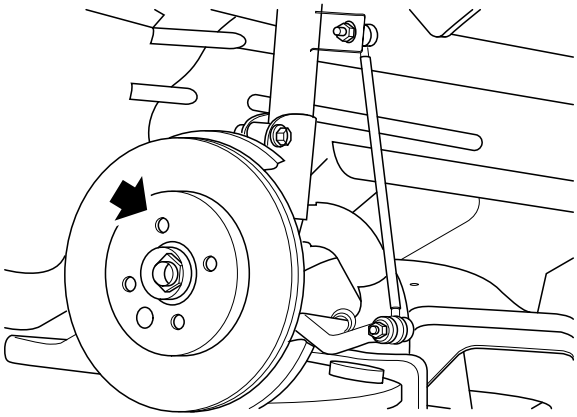
2. Remove front wheels.

☞**Wheels Remove**

3. Remove the front brake caliper assembly.

☞**Front Brake Caliper Remove**

4. Remove Torx screw securing brake disc to drive flange.



5. Remove brake disc.

Refit

1. Ensure mating surfaces of disc and drive flange are clean.
2. Fit disc to drive flange, fit countersunk screw and tighten to **7–10Nm**.
3. Check brake disc run-out.

☞**Thickness and Run-out Check - Front Brake Disc**

4. Examine brake pads and renew if necessary.
5. Fit caliper assembly to hub, fit and tighten bolts to **85–105Nm**.
6. Fit the wheels.

☞**Wheels Refit**

7. Lower the vehicle.

Thickness and Run-Out Check-Front Brake Disc

Check

1. Raise the vehicle on a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

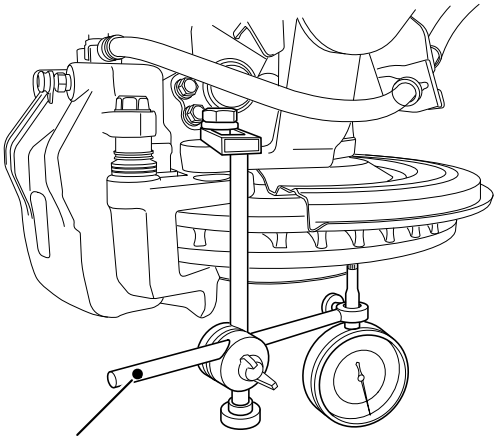
2. Remove front wheels.

☞**Wheels Remove**

3. Remove the front brake caliper.

☞**Front Brake Caliper Assembly Remove**

4. Using a micrometer, measure the thickness of disc at 4 equally spaced points around disc, 10 mm from outer edge of disc. Disc thickness must be 20.0 mm minimum; Renew disc if outside limit(s).
5. Mount a Dial Test Indicator (DTI) to**TCH00022** and secure**TCH00022** to inboard side of hub using caliper assembly bolt hole.



TCH00022

6. Position DTI probe 5 mm from outside edge of disc.
7. Zero DTI and rotate wheel one complete turn to measure disk runout. Disc runout must not exceed 0.06 mm.
8. If disc runout is outside limits:

- Remove countersunk screw securing brake disc to hub and remove disc.
- Ensure disc to hub flange mounting faces are clean.
- Fit disc to hub and tighten countersunk screw and tighten to **7–10Nm**.
- Check disc run-out again as detailed.
- If run-out is still outside limits, renew disc and/or hub.

9. Remove DTI and**ABS** from inboard side of hub.
10. Fit caliper assembly to hub, fit and tighten bolts to **85–105Nm**.
11. Fit the wheels.

☞**Wheels Refit**

12. Press brake pedal several times to seat brake pads.
13. Lower the vehicle.

Rear drum brake

Remove

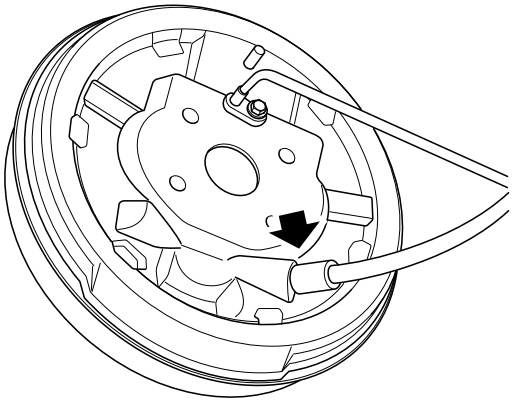
1. Raise the vehicle on a lift.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

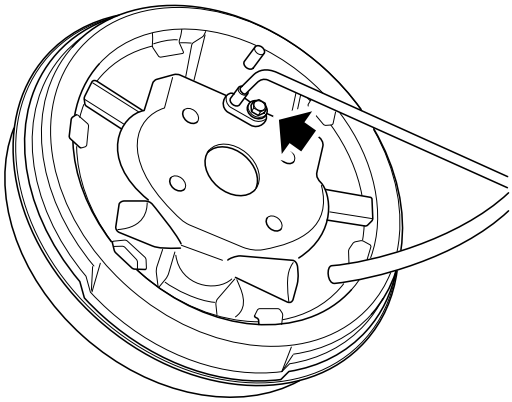
2. Remove rear wheels.

☞Wheels Remove

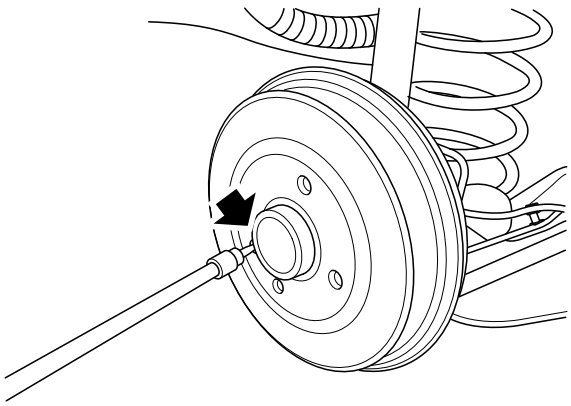
3. Disconnect the rear hand brake cable.



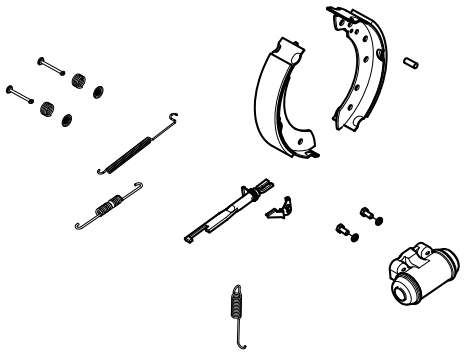
4. Disconnect the rear wheel speed sensor.



5. Release the rear brake drum screws.



6. Remove the gap adjusting mechanism and the rear wheel cylinder.



Refit

1. Clean the brake parts.

Warning: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

2. Fit the rear brake drum cover with bolts and tighten bolts to **6–8Nm**.
3. Connect the rear wheel speed sensor and the hand brake cable.
4. Bleed the brake system.

☞Brake System Bleeding

5. Fit the wheels.

☞Wheels Refit

6. Lower the vehicle.

Brake system bleeding

Bleed

Warning: Do not allow brake fluid to come into contact with eyes or skin.

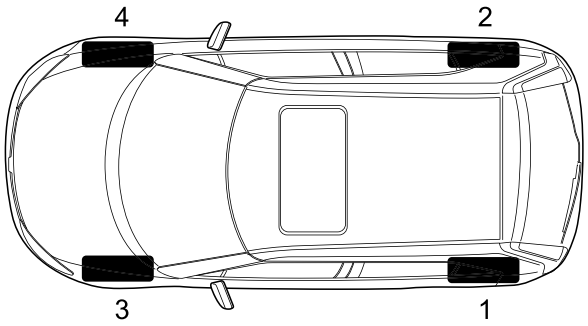
Caution: Never reuse fluid that has been bled from the brake system.

The following procedure covers bleeding the complete system, but where only the primary or secondary circuit has been disturbed in isolation it should only be necessary to bleed that circuit. Partial bleeding of the hydraulic system is only permissible if a brake pipe or hose has been disconnected with only minor loss of fluid.

1. Top-up fluid level in brake reservoir to 'MAX' mark.

Caution: Ensure the fluid in the reservoir is maintained between the minimum and maximum levels throughout the bleed procedure using new brake fluid.

2. Raise the vehicle on a lift.
3. Apply pressure to brake pedal several times, then apply steady pressure.
4. Loosen bleed screw to release brake fluid and air. Allow pedal to return unassisted.
5. Repeat procedure until a flow of clean airfree fluid is purged into the container then, while holding pedal at end of downward stroke, tighten bleed screw to **9–11Nm**.
6. Remove tube from bleed screw and fit bleed screw dust cap.



7. Repeat bleed procedure at remaining three brake calipers in the following sequence:

- LHD moderear leftfront rightfront left.
- LHD moderear rightfront leftfront right.

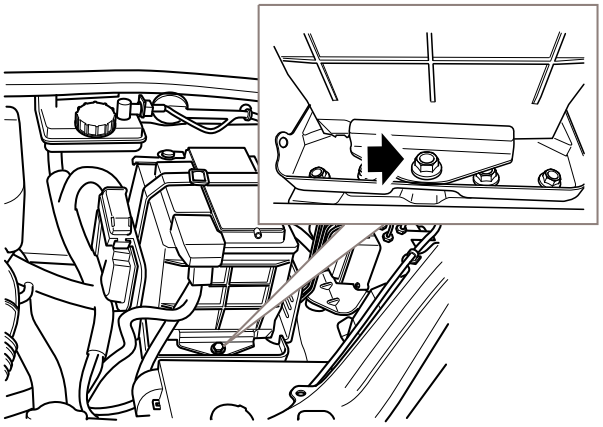
Warning: Braking operation may be seriously impaired if the incorrect bleed sequence is used.

8. Lower the vehicle.
9. Top-up fluid level in brake reservoir to 'MAX' mark.
10. Apply brakes and check for leakage.
11. Road test vehicle. Check brake pedal for firm travel when brakes are applied.

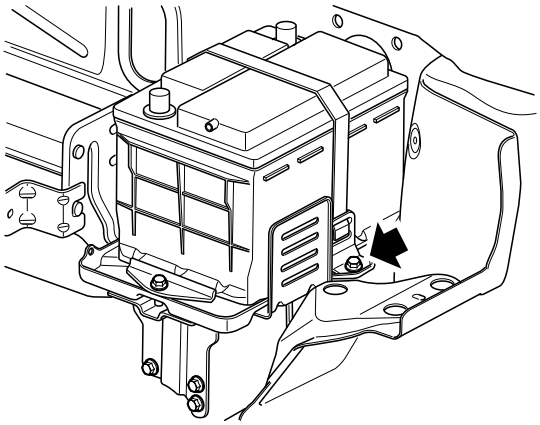
Electronic Vacuum Pump

Remove

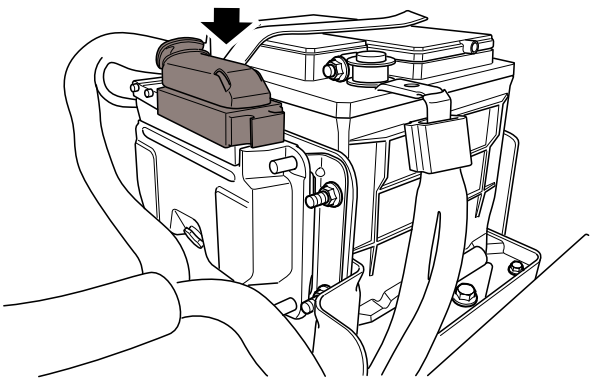
1. Disconnect the battery earth lead.
2. Remove the bolts securing the battery, remove the battery retaining clip.



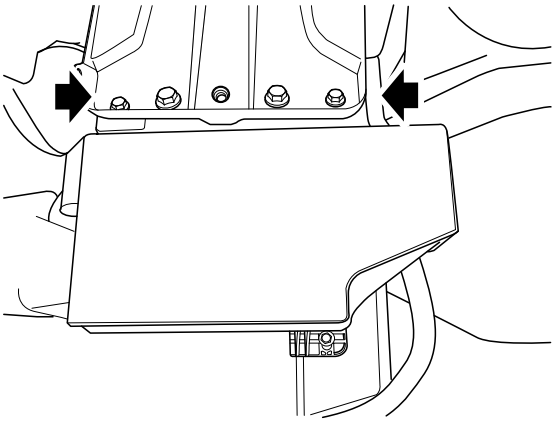
3. Remove the bolts securing the battery strap clip, to release the battery strap.



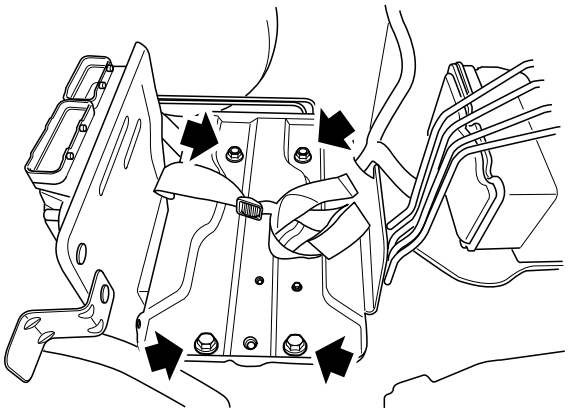
4. Remove the battery.
5. Disconnect the connector from the ECM.



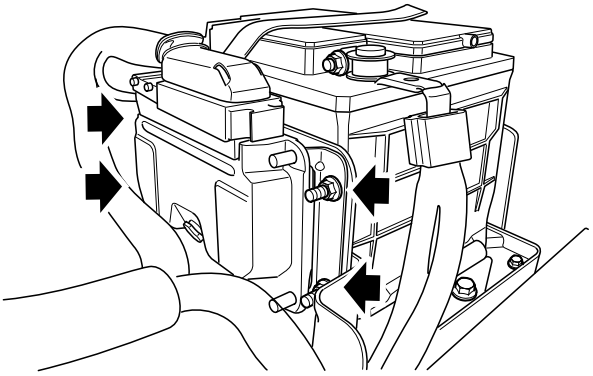
6. Remove the bolts securing the engine bay fuse box to the battery tray.



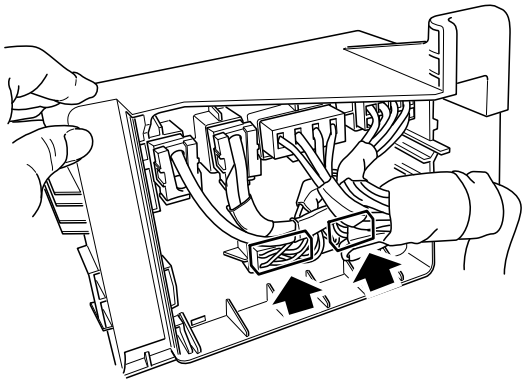
7. Remove the bolts securing the battery tray and engine control module (ECM) brackets to front and rear trays, remove the battery tray and the ECM brackets.



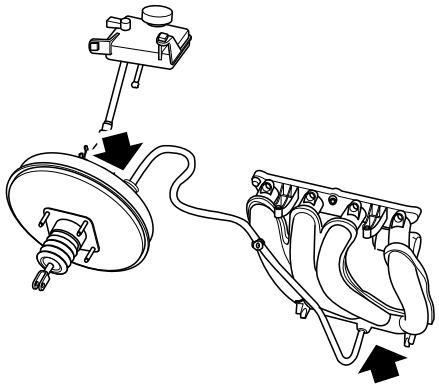
8. Remove the nuts securing the engine control module (ECM) to the battery tray.



9. Remove the battery tray.
10. Remove the fuse box body, take the white 22-hole and black 3-hole connectors apart.



11. Remove the vacuum hose assembly.

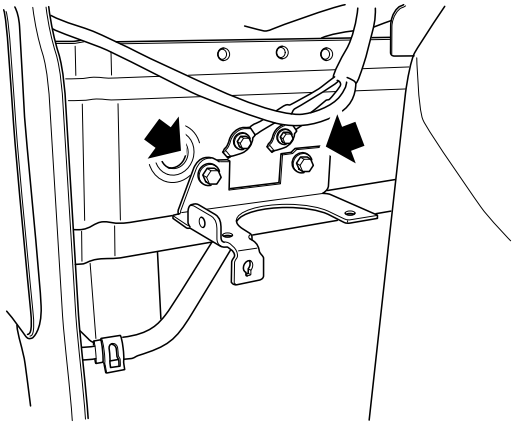


12. Remove the left side tire.

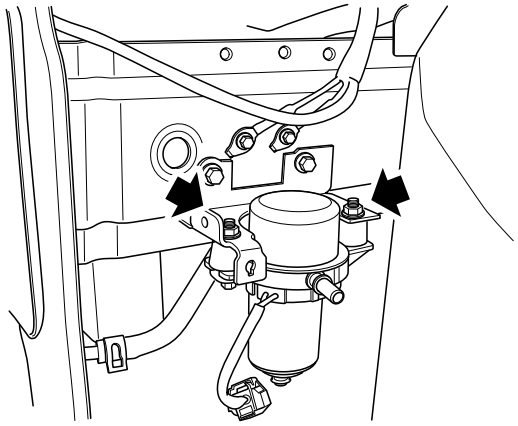
☞ **Wheels Remove**

Refit

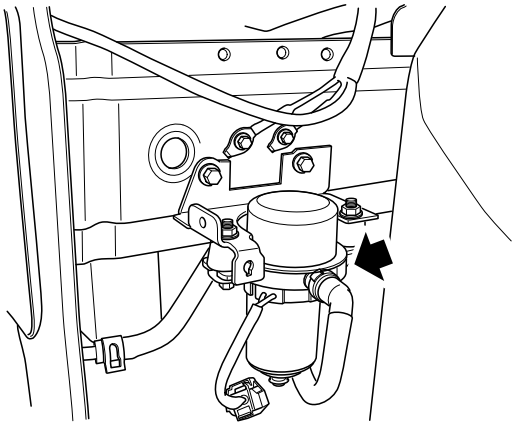
1. Secure the electronic vacuum pump bracket to rails on the left side, tighten the M8 bolts to **19–25Nm**(Another 400 cars are equipped with M6 bolts, whose part number is 91000181).



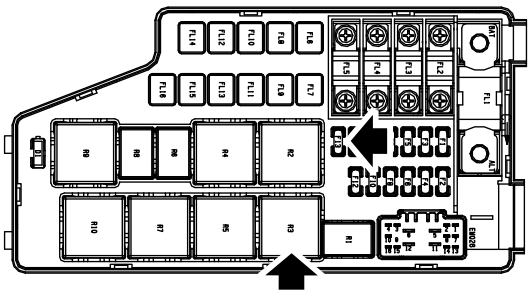
2. Tighten the 2 bolts securing the electronic vacuum pump to the bracket to **7–9Nm**.



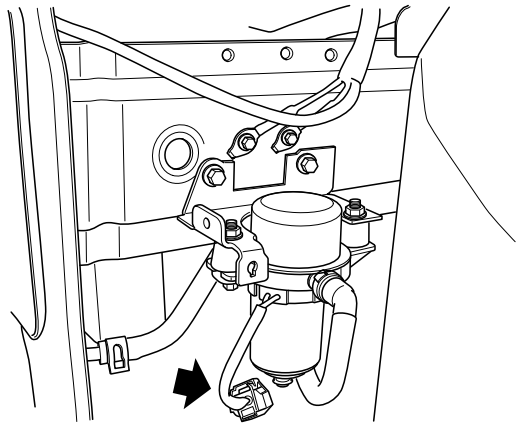
3. Connect the vacuum hose assembly to the electronic vacuum pump.



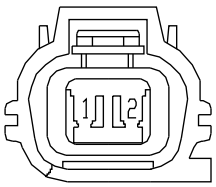
4. Connect the vacuum hose to the vacuum booster and intake manifold.
5. Insert a 30A fuse at F13 on the engine fuse box (part number: YQF100550), insert a relay at R3 (part number: 10071471).



6. Connect the vacuum pump connector (BY001 gray, part no. :7282-5575-10) on the power vacuum pump wiring harness to the vacuum pump.

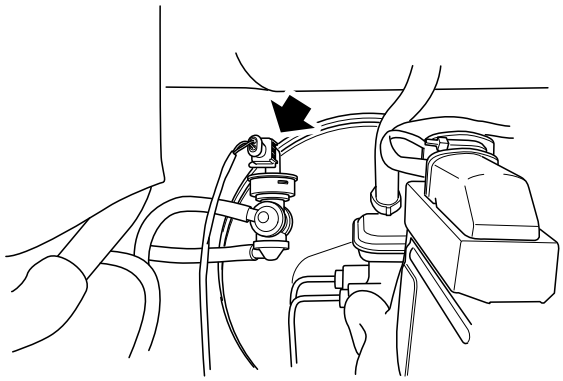


Connector BY001 End View

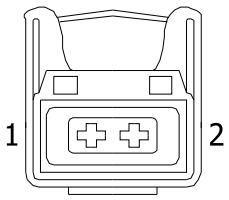


BY001

7. Connect the vacuum pump switch connector (BY012 brown part no. :963344-1) on the electronic vacuum pump wiring harness to the vacuum pump switch.

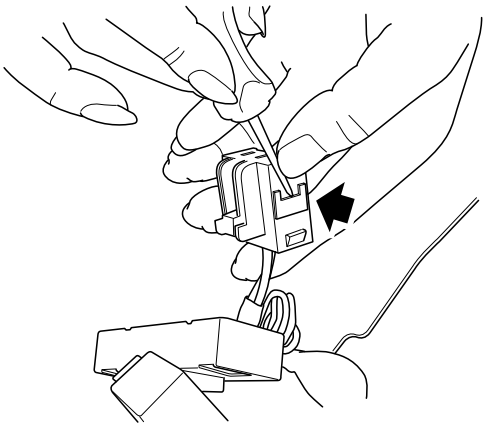


Connector BY012 End View

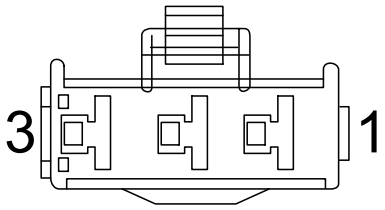


BY012

8. Insert the red wire with a terminal on the electronic vacuum pump wiring harness into PIN3 of the connector BY145 (black, 3 holes).



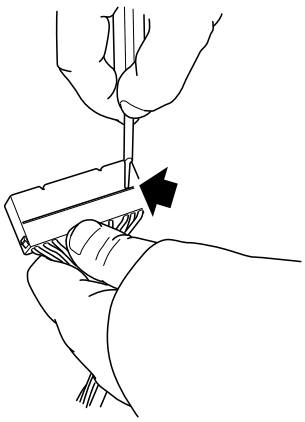
Connector BY145 End View



BY145

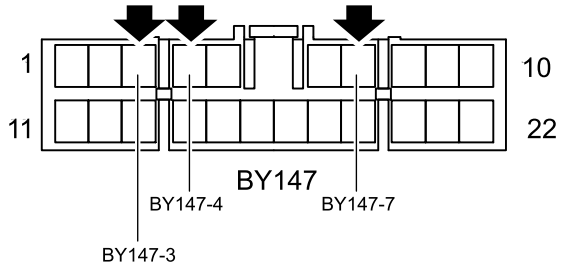
9. Insert the brown pink wire with a terminal on the the electronic vacuum pump wiring harness into PIN3 of the connector BY147 (white, 22 holes), insert the black and white wire with a terminal into PIN7 of the connector BY147 (white, 22 holes) , conbine the brown pink wire without a terminal into PIN4 of BY147 (white, 22 holes).

Caution: Before insert the terminal, please pick out the white lock of BY147.

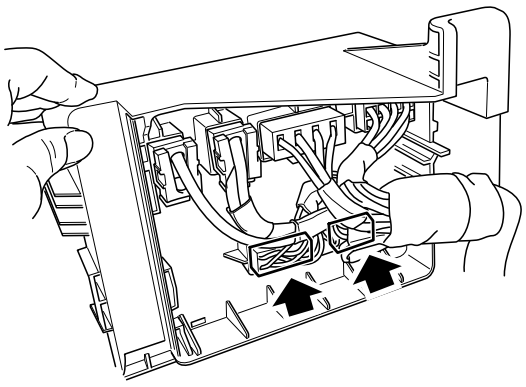


Combining method: Strip the enamel covering on the original wire inserted into BY147 PIN4, combine the brown white wire onto the portion stripped of the enamel covering (on the added wiring harness, the enamel covering of the brown-pink wire has been stripped off), press a retaining ring around the combined wire with a crimping pliers, and wrap a tape around the joint until no core wires are exposed.

Connector BY147 End View

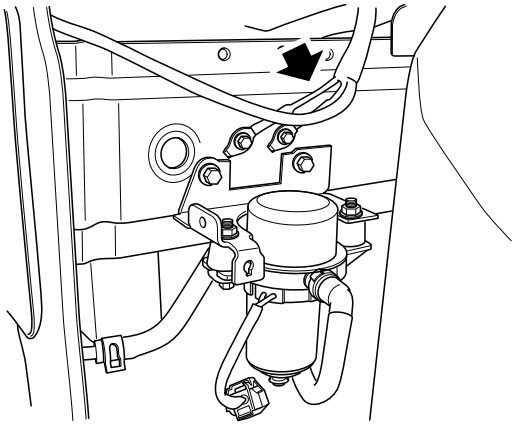


10. Insert the connectors BY145 and BY147 into the original locations on the fuse box.



11. Combine the two black wires without a terminals on the electronic vacuum pump wiring harness into the ground point on top of the electronic vacuum pump.

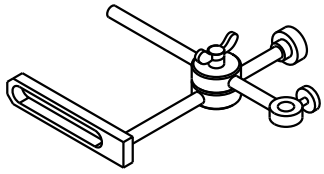
Combining method: Strip the enamel covering on the original grounded wire, combine the black wire onto the portion stripped of the enamel covering (on the added wiring harness, the enamel covering of the black lead has been stripped off), press a retaining ring around the combined leads with a crimping pliers, and wrap a tape around the joint until no core wires are exposed.



12. Fix the interference point between the electronic vacuum pump wiring harness and the vehicle body with a tape.
13. Fix the engine control module (ECM) to the battery tray, and fit and tighten the nut to **8–10Nm**.
14. Fix the engine control module (ECM) bracket and the battery tray to the front and rear battery bracket, fit and tighten the bolts to **20–28Nm**.
15. Fit the engine bay fuse box and tighten the bolts to **6–8Nm**.
16. Connect the ECM connector.
17. Place the battery into a suitable position in the battery tray.
18. Secure the battery to the battery tray with a battery clip, and fit and tighten the bolts to **20–28Nm**
19. Secure the battery strap clip to the battery tray, and fit and tighten the bolts to **20–28Nm**.
20. Fit the wheels.

☞ Wheel Refit

Special Tools

Tool Number	Description	Picture
TCH00022	Brake disc runout test kit	 TCH00022

Park Brake

Specifications

Torque

Description	Value
Nut - hand brake adjust	0.8–1.2Nm
Bolt - brake cable to body	7–10Nm
Bolt - brake cable to rear frame	19–25Nm

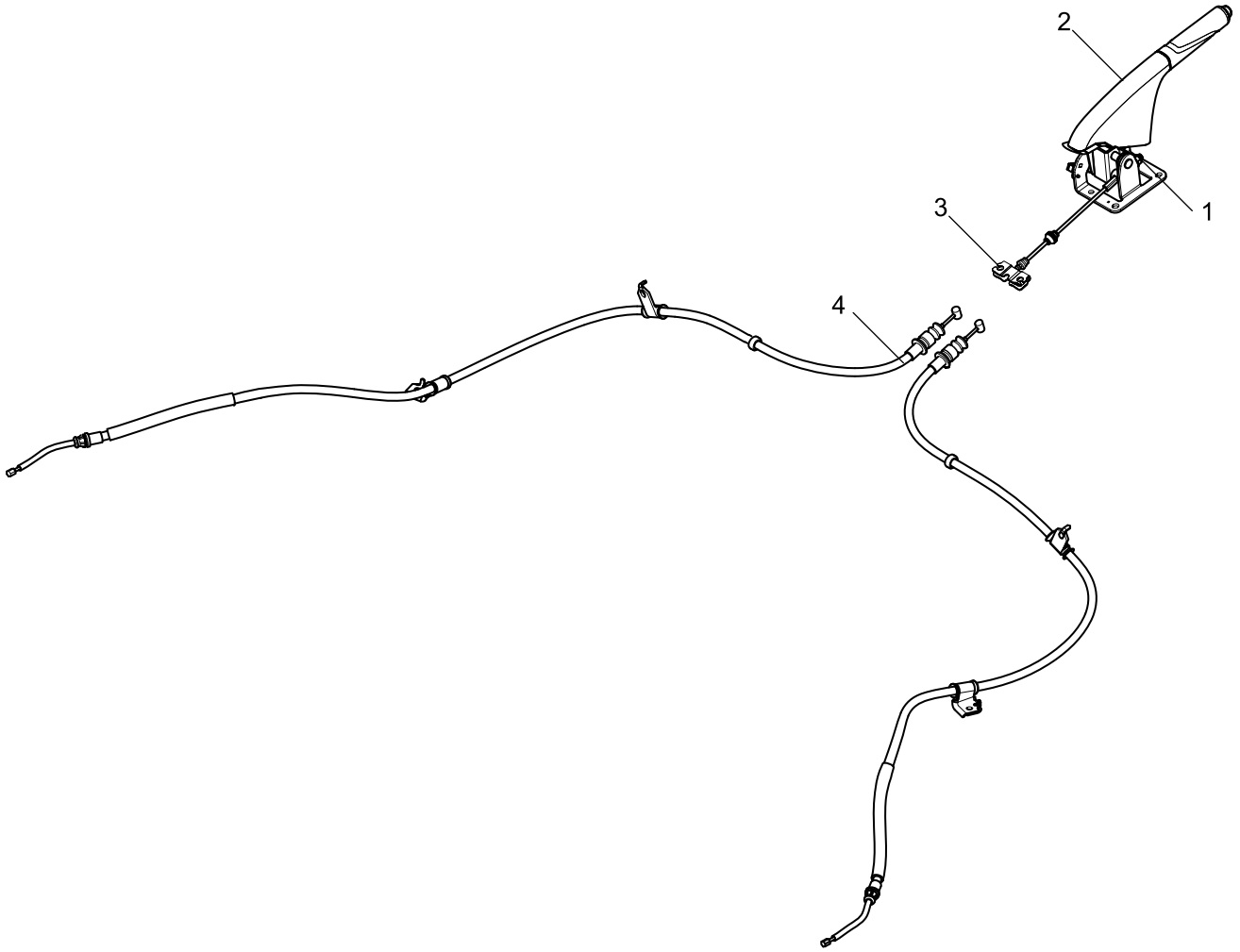
Specifications

Type	
Parking brake	Drum brake system

Description and Operation

System Component Layout

Parking Brake Component Location



1. Lever Assembly
2. Adjuster Nut
3. Front Cable and Compensator
4. Parking Brake Cables Assembly

Description

Handbrake

The handbrake consists of drum brakes, integrated into the rear discs of the main brakes, which are operated by cables connected to a lever assembly between the front seats. The lever assembly is mounted on the transmission tunnel. A warning switch on the lever operates the brake warning light in the instrument pack. While the handbrake is applied the warning switch connects an earth to the instrument pack which, if the ignition is on, illuminates the brake warning light. In some markets, the instrument pack performs a bulb check of the brake warning light each time the ignition is switched on. A front cable is connected between the lever assembly and a cable tensioner, and two handbrake cables are connected between the cable tensioner and the drum brakes. Clips and a guide bracket secure the handbrake cables to the underside of the vehicle, and grommets seal the handbrake cables where they pass through the transmission tunnel. The cable tensioner equalises the load applied by the handbrake cables when the handbrake is applied. The effective length of the cables can be adjusted by the adjuster nut securing the front cable to the handbrake lever.

Service Procedures

Handbrake - Adjustment

Adjust

Warning: Where possible, a road test should be on well surfaced, dry roads. Always comply with speed limits and local traffic regulations.

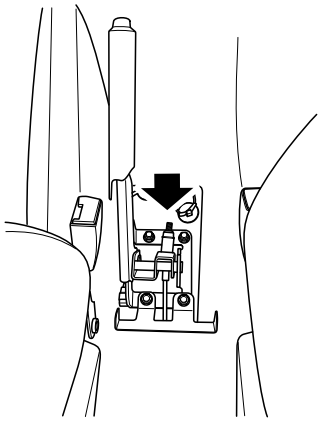
1. Remove the console assembly.

☞**Console Assembly Remove**

2. Lift up the vehicle with a lifter.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

3. Tighten the hand brake adjusting nuts. According to the requirements, when the hand brake is pulled to the third level, the torque should be **0.8–1.2Nm**.



4. Move up and down the hand brake lever sufficiently.
5. Inspect on each rear wheel the force required to rotate the rear brake disc. The brake disc must be able to rotate with slight block.
6. Release the hand brake lever and ensure that the rear brake disc can rotate without hindrance.
7. Turn the ignition key to the position II, inspect the operation condition of hand brake. Exert hand brake at each level respectively to ensure the occurrence of the following conditions:
   a. I level - the rear brake disc can rotate without hindrance, the hand brake warning lights on the instrument panel are turned on or turned off.
   b. 2 level there is slight hindrance existing in the rotation of the rear brake disc and the hand brake warning lights on the instrument panel are turned on.
   c. 3 level and above the rear brake disc has been locked and the hand brake warning lights on the instrument panel are turned on.
8. Rotate the ignition key to position 0.
9. Cover the small cap of the upper hand brake adjusting nut on the console.
10. Fit the rear wheels.
11. Lower the vehicle.

Handbrake Front Cable

Remove

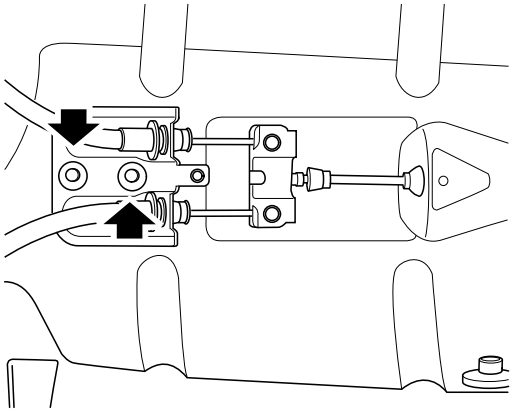
1. Remove centre console.

☞**Console Assembly Remove**

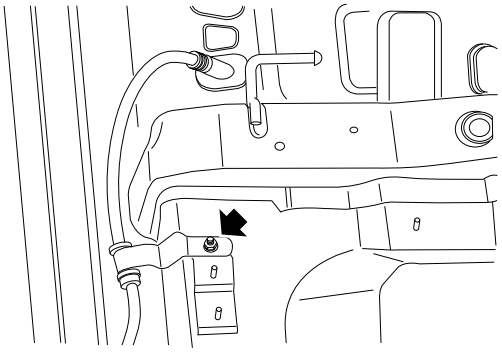
2. Remove handbrake cable adjusting nut.
3. Raise the vehicle on a lift.
4. Remove intermediate exhaust pipe.

☞**Intermediate Pipe Remove**

5. Take down the heat shield.
6. Take down two rear brake cables from the manual brake cable tension device.

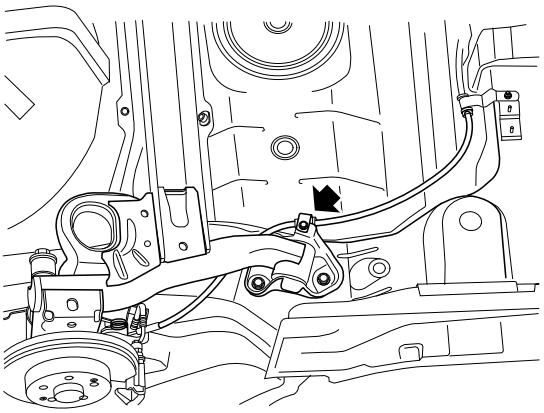


7. Release holes securing the cable to the body central channel.
8. Release bolts securing the cable to the floor.



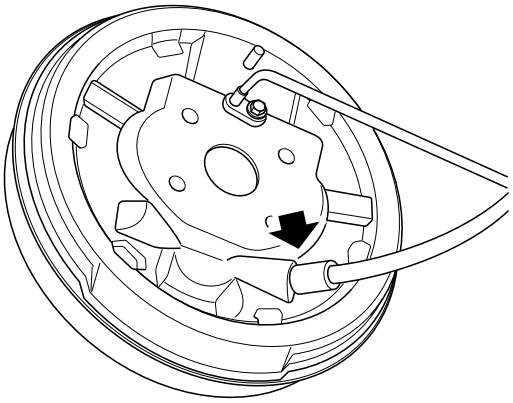
S402011

9. Release bolts securing the cable to the H frame.



S402012

10. Release the hand brake cable.



Refit

1. Let the front part of the cable go through the hole on the body central channel and then block the hole with the cable caulking.
2. Fix the cable to the floor and tighten bolts to**7–10Nm**.
3. Fix the cable to the H frame and tighten bolts to**19–25Nm**.
4. Let the cable bond go through the guide hole of the rear brake caliper and clip the spherical joint to the draw hook of the left rear brake caliper and then clip the cable bond to the guide hole.
5. Connect the hand brake cable to the H frame.
6. Fit centre console.

☞**Console Assembly Refit**

7. Adjust handbrake.

☞**Handbrake - Adjustment**

8. Lower the vehicle.

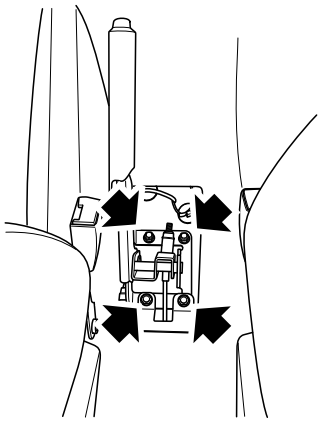
Handbrake Lever

Remove

1. Remove centre console.

☞**Console Assembly Remove**

2. Release the hand brake cable adjusting nuts and release the cable.
3. Release the bolts securing the hand brake lever to the body.



4. Release the connector of the hand brake warning switch and take down the hand brake warning switch.

Refit

1. Fit the hand brake warning switch to the hand brake lever assembly and fix with clips.
2. After the bolts have been fit to the hand brake refit position, tighten the rear/lower equipments with the designated torque so as to ensure they are fixed to the designated position. The torque is**19–25Nm**.
3. Fit the handbrake cable adjusting nuts, and don't tighten temporarily.
4. Adjust handbrake.

☞**Handbrake - Adjustment**

5. Fit centre console.

☞**Console Assembly Refit**

Brake Module

Specifications

Torque

Description	Value
Bolt - ABS to bracket	8–12Nm
Bolt - ABS bracket to body	19–25Nm
Rear brake pipes to modulator	16–18Nm

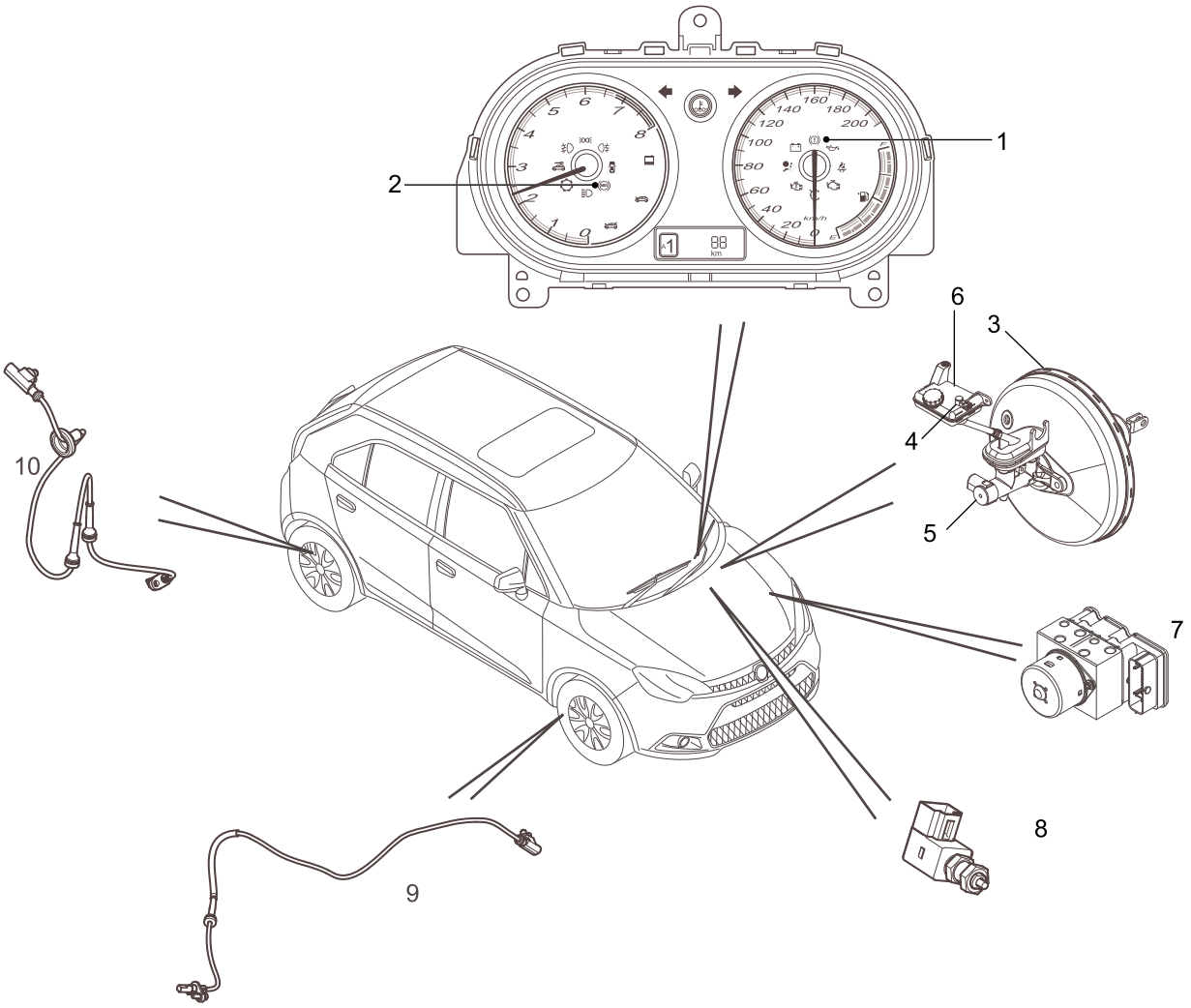
Specifications

Type	
ABS type	TRW EBC450 4 channel with electronic brake force distribution

Description and Operation

System Component Layout

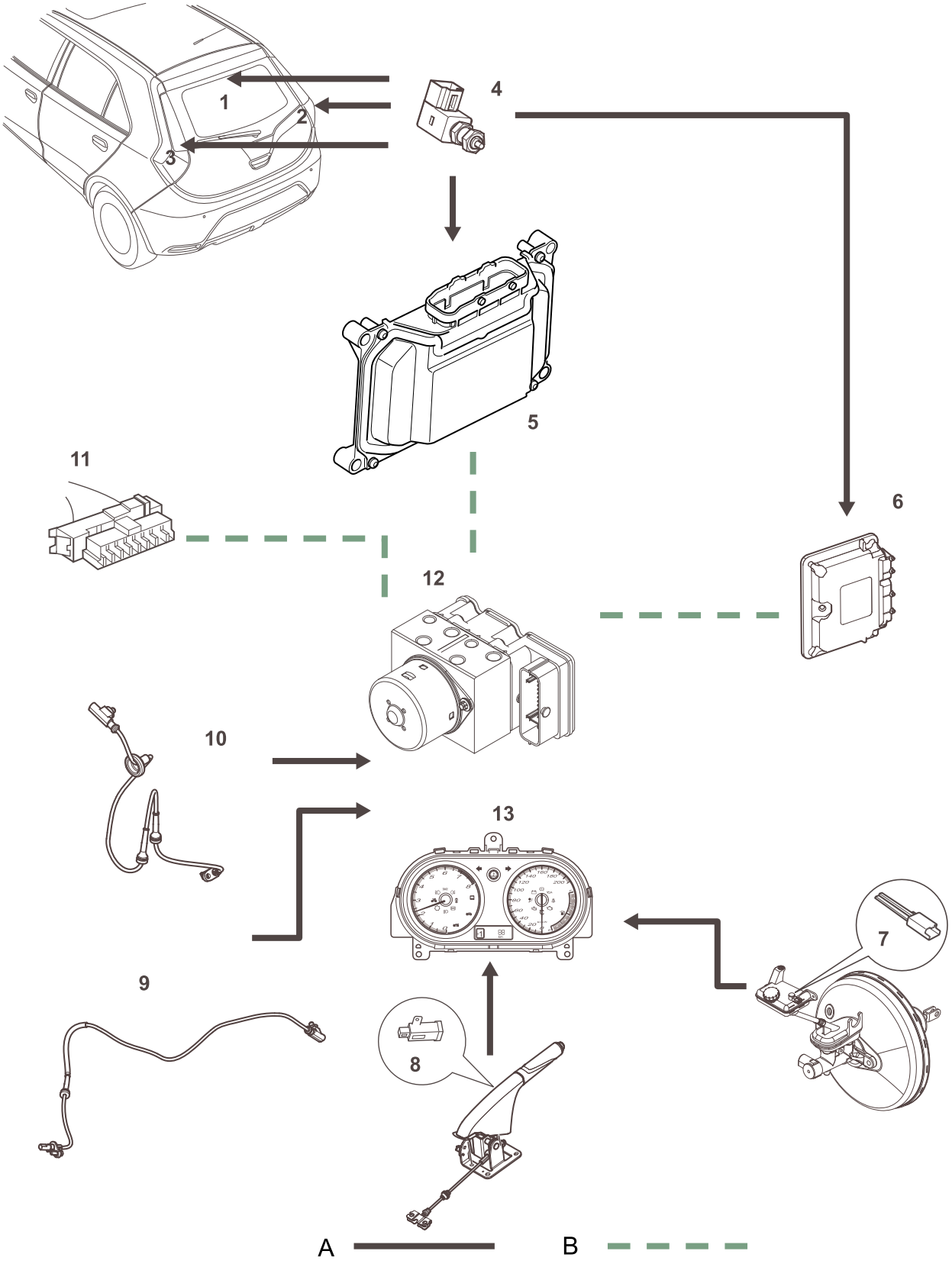
Brake System Control Component Location



1. Brake Pad Wear Warning Light
2. ABS Warning Light
3. Vacuum Booster
4. Brake Fluid Low Fluid Level Switch
5. Brake Master Cylinder
6. Brake Fluid Reservoir
7. ABS Modulator
8. Brake Lamp Switch
9. Front Wheel Speed Sensor Assembly
10. Front Wheel Speed Sensor Assembly

System Component Layout

Brake System Control Diagram



1. High Level Brake Lamp
2. LH Brake Lamp
3. RH Brake Lamp
4. Brake Lamp Switch
5. Engine Control Module
6. Automated Mechanical Transmission
7. Brake Fluid Low Level Sensor
8. Parking Brake Switch

9. Front Wheel Speed Sensor
10. Rear Wheel Speed Sensor
11. Diagnostic Socket
12. ABS Modulator
13. Instrument Pack And Message Centre

Description

ABS Sensor

The**ABS** sensors are active sensors (i.e. they receive a power feed from the**ABS** modulator) that supply the**ABS** modulator with wheel speed signals. An**ABS** sensor is installed in each front wheel hub and in each rear suspension trailing arm, in close proximity to the inboard seal of the related wheel bearing. The seals, which rotate with the wheels, each contain a magnetic element incorporating 48 pole pairs. When the wheels rotate, the pole pairs in the seals induce voltage fluctuations in the**ABS** sensors that are converted into square wave signals and output to the**ABS** modulator. The frequency of the signal is proportional to wheel speed. Each**ABS** sensor has a fly lead connecting it to the vehicle wiring in the engine compartment or the boot, as applicable.

Pressure Building

When braking, build brake pressure in the wheel cylinders through the vacuum booster and brake master cyliner. At this moment the normal open valve is open and normal closed valve is closed, and the brake pressure enters the wheel cylinder to make the wheel speed decrease quickly, until ABS identifies the wheels are likely to lock through the speed sensor.

Pressure Increasing

In order to ensure the brake efficiency, after the wheels rotation reach a certain speed, ABS will command the normal open valve to open and the normal closed valve to be closed again. With the brake pressure increasing, the brake or deceleration is applied to the wheel again.

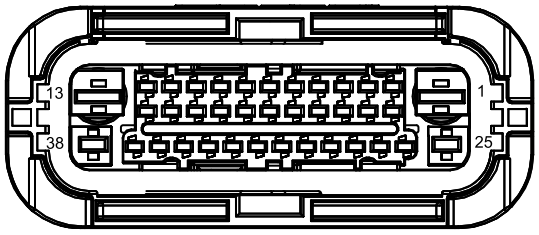
Pressure Holding

To prevent the speed increasing quickly and make sure to produce enough brake efficiency, when ABS detects that the efficiency of wheel lock has decreased to a certtain value, it enters the pressure holding process. At this moment, ABS closes the normal open valve, while the normal closed valve remains closed, and the pressure in the wheel brakes is kept constant, and the wheel speed increases slowly.

Pressure Decreasing

When ECU identifies the wheels are likely to lock, the ABS system will enter the pressure decreasing process. At this moment, ABS commands the normal closed valve to open and the normal open valve to close, the hydraulic pump begins to operate, the brake fluid flows from the wheel cylinder to the brake master cluster cylinder through the low-pressure accumulator, then the brake pressure decreases, the brake pedal shudders, the efficiency of wheel lock decreases, and the vehicle speed begins to increase.

ABS modulator harness connector (EB021)



BY002

ABS Modulator Harness Connector Pin Details

Pin No.	Pin Name	Pin Type	Pin Function
1	KL30_P	Power Supply	Pump Motor Voltage
2	-	-	-
3	WS_RF+	Power Supply	Wheel Speed RF+
4	WS_RF-	Input	Wheel Speed RF-
5	MAIN_CAN_H	Input/Output	CAN Bus Line High
6	MAIN_CAN_L	Input/Output	CCAN Bus Line Low
7	-	-	-
8	-	-	-
9	-	-	-
10	WS_RR-	Input	Wheel Speed RR-
11	WS_RR+	Power Supply	Wheel Speed RR+
12	-	-	-
13	GND_P	Power Supply	Pump Motor Grounding
14–24	-	-	-
25	KL30_V	Power Supply	Power Supply to Valve
26	-	-	-
27	WS_LF+	Power Supply	Wheel Speed LF+
28	WS_LF-	Input	Wheel Speed LF-

29	-	-	-
30	-	-	-
31	-	-	-
32	-	-	-
33	KL_15	Input	Ignition
34			
35	WS_LR-	Input	Wheel Speed LR-
36	WS_LR+	Power Supply	Wheel Speed LR+
37	VSO	Output	Vehicle Speed
38	GND_V	Power Supply	Valve and Logic Unit Grounding

Operation

The**ABS** function prevents the road wheels locking during brake application, thus maintaining vehicle stability even under emergency conditions.

Warning: ABS is an aid to retaining steering control and stability while braking:

- ***ABS cannot defy the natural laws of physics acting on the vehicle***
- ***ABS will not prevent accidents resulting from excessive cornering speeds, following another vehicle too closely, aquaplaning, etc.***
- ***The additional control provided by ABS must never be exploited in a dangerous or reckless manner which could jeopardise the safety of the driver or other road users***
- ***The fitting of ABS does not imply that the vehicle will always stop in a shorter distance.***

Tip: During normal braking the feel of the brake pedal on vehicles equipped with ABS will be the same as that on non ABS vehicles. During anti-lock braking operation, the driver will experience feedback in the form of a pulsating brake pedal and solenoid/pump motor noise from the ABS modulator.

Under normal braking mode conditions,**ABS** function is enabled but not active. Brake fluid flows straight from the fluid reservoir into each caliper via the HCU, and brakes each wheel. As soon as the**ABS** modulator**ECU** detects a wheel locking, via the**ABS** sensor, the**ECU** sends a command to shut the inlet solenoid valve, preventing the flow of brake fluid into the caliper. At the same time, the caliper outlet solenoid valve opens to drain the brake fluid from the caliper and allows the wheel to rotate. If, on the other hand, the**ECU** detects a wheel spinning normally, brake pressure is too low so the caliper outlet solenoid valve is shut, allowing brake fluid to flow into the caliper via caliper inlet solenoid valve, to increase brake pressure. If the wheel is locking in a critical situation, the caliper inlet solenoid valve and caliper outlet solenoid valve close to maintain brake pressure and ensure optimum brake performance.

EBD

To maintain vehicle stability during braking, the**EBD** optimises the distribution of hydraulic pressure between the front and rear axles under all vehicle load configurations and road conditions. The**EBD** operates in forward and reverse gears and is automatically enabled when the DSC**ECU** is in the normal braking mode at vehicle deceleration rates of 0.3 g and above (i.e. medium to high brake pedal loads).**EBD** operation is similar to that of **ABS**, but it is calibrated to intervene at lower wheel slip limits and operates on the rear brakes only.

TPMS

ITPMS is an indirect tyre pressure monitoring system. The system does not directly measure tyre pressure but compares individual wheels speeds, which must remain within set parameters. When a low tyre pressure situation occurs, the rolling radius of the affected wheel will decrease thus increasing the wheel speed. If the difference in wheel speeds is greater than set parameters the ITPMS will alert the driver via a warning light.

Warning Lamps and Text Messages

		ABS	Brake System
Activated	Light	No	Not Applicable
	Text Information	No	Not Applicable
Cancelled	Light	Not Applicable	Not Applicable
	Text Information	Not Applicable	Not Applicable
Malfunction	Light	Refer to Note 1	Refer to Note 1
	Text Information		

Service Procedures

ABS Modulator

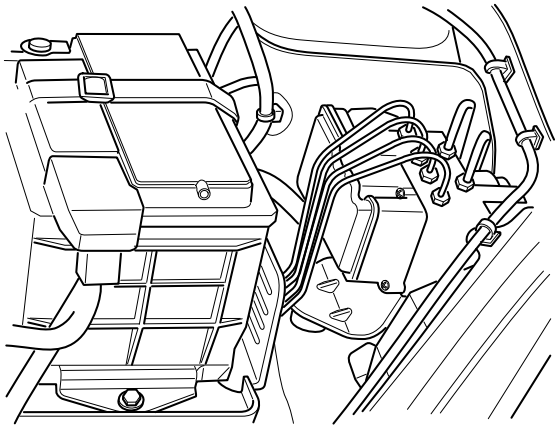
Remove

1. Remove ignition handset and disconnect battery earth lead.
2. Position absorbent cloth under modulator to absorb fluid spillage.

Caution: Brake fluid will damage paint finished surfaces. If spilled, immediately remove fluid and clean area with water.

3. Disconnect multiplug from modulator.
4. Disconnect 2 inlet brake pipes from modulator.

Caution: Before disconnecting or removing components, ensure the immediate area around joint faces and connections are clean. Plug open connections to prevent contamination.



5. Note fitted positions of 4 outlet pipes on modulator and disconnect pipes.
6. Remove one bolt and two nuts fixing ABS modulators to the range that is from the lower mounting bracket to the body, and take down ABS modulator lower bracket and ABS modulators.
7. Remove three rubber plugs fixing ABS modulators to the lower bracket.
8. Take down ABS modulator assembly.

Refit

1. Fit mounting bracket lower to modulator, fit bolts and tighten to **8–12Nm**.
2. Fit modulator bracket lower to body ensuring that fixing grommets are correctly engaged. Tighten bolts to **19–25Nm**.
3. Clean brake pipe unions.
4. Connect inlet and outlet brake pipes to modulator, ensuring pipes are connected to their correct ports. Tighten brake pipe unions to between **16–18Nm**.
5. Connect multiplug to modulator.
6. Connect battery earth lead.
7. Bleed the brake system.

☞ **Brake System Bleeding**

Drive Axle

Specifications

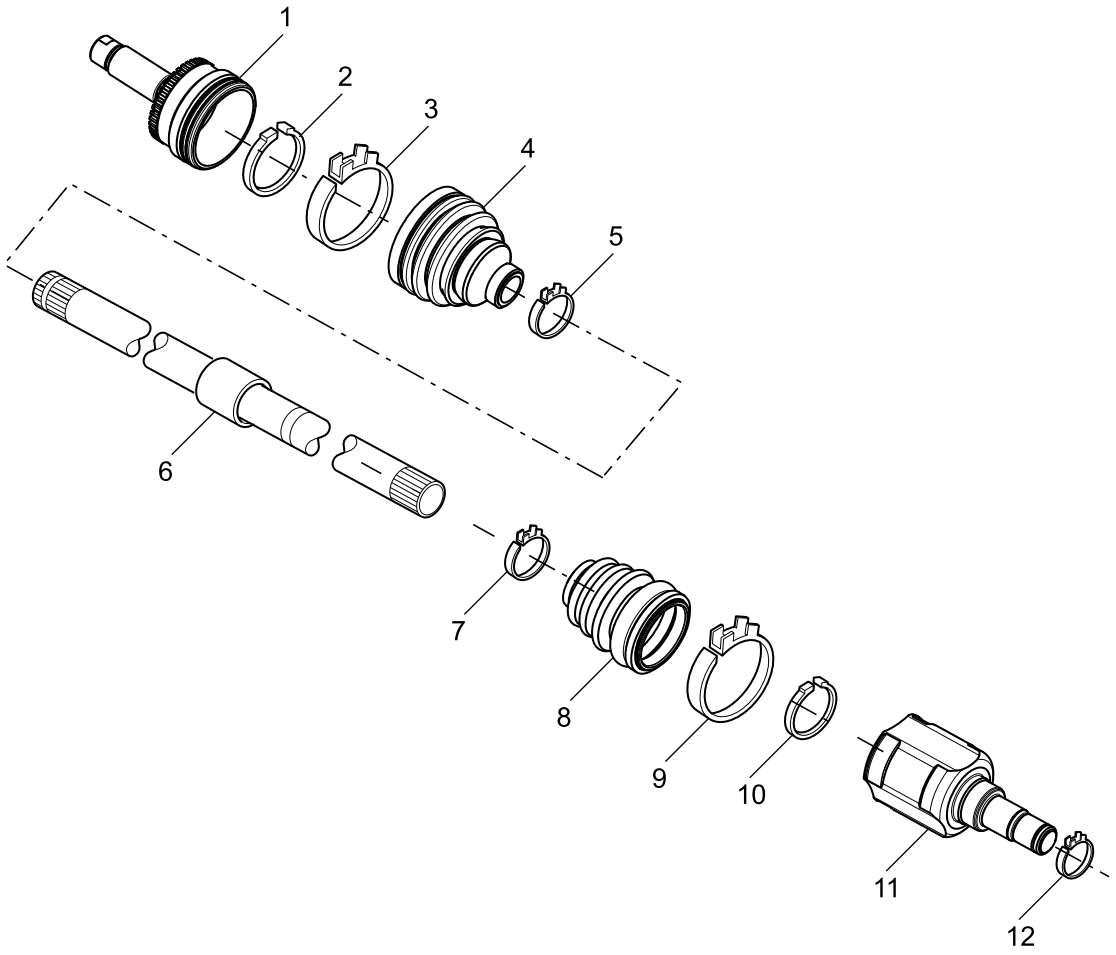
Torque

Description	Value
Bolt - lower arm outer ball joint to swivel hub	50–65Nm
Nuts - steering rod outer ball joint	28–32Nm
Nuts - anti-roll bar to links	45–55Nm
Nut - front drive shaft	350–370Nm
Bolt - road wheel	105–115Nm

Description and Operation

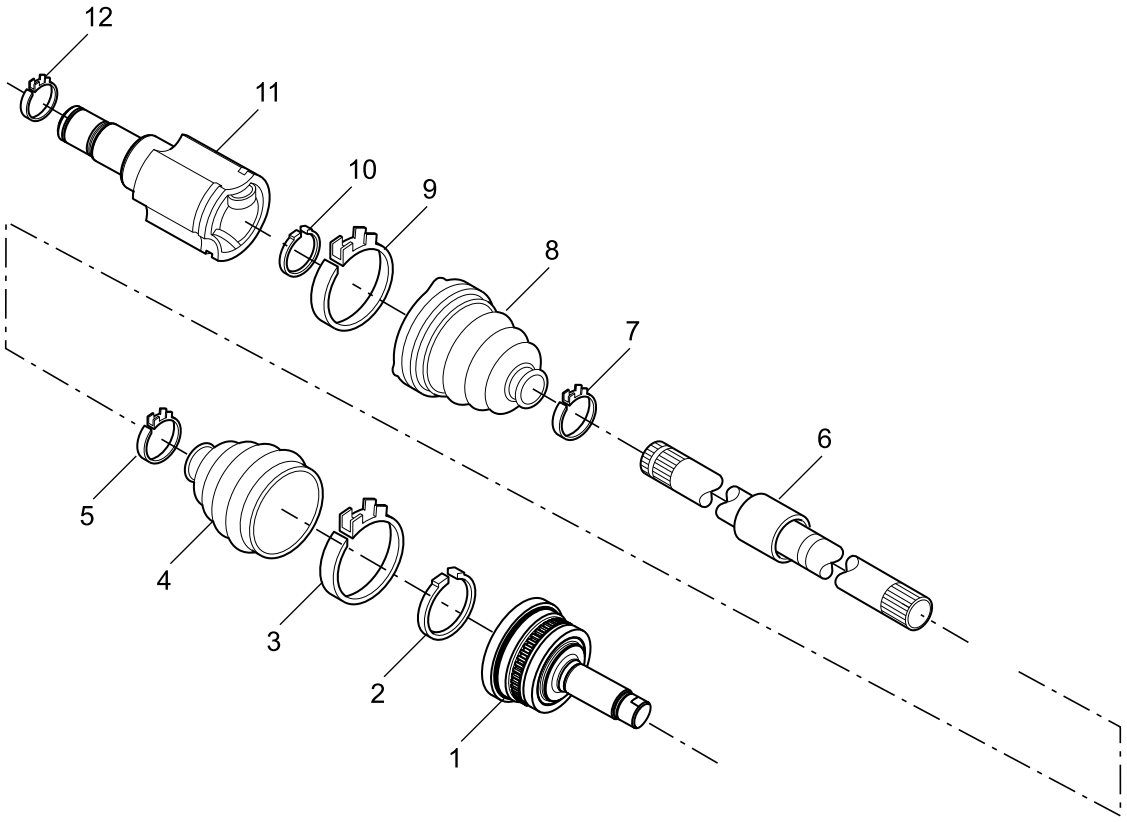
System Component Layout

RH Drive Shaft Components



1. Outer joint
2. Snap ring
3. Clamp (big)
4. Gaiter
5. Clamp (small)
6. Dynamic damper
7. Clamp (small)
8. Gaiter
9. Clamp (big)
10. Retaining Ring
11. Inner joint
12. Circlip

LH Drive Shaft Components



1. Outer joint
2. Snap ring
3. Clamp (big)
4. Gaiter
5. Clamp (small)
6. Dynamic Damping
7. Clamp (small)
8. Gaiter
9. Clamp (big)
10. Retaining Ring
11. Inner joint
12. Circlip

Description

Drive shaft comprises a solid shaft with inner and outer constant velocity joints. The intermediate shaft is fitted with a roller bearing and bearing housing which is secured to the rear of the cylinder block on the RH side. The other solid shaft with inner and outer constant velocity joints is fitted to the differential on the LH side. The inner joint is of the tripod type with spherical bushing to reduce sliding resistance. The shaft and joint are one assembly. The outer joint of the ball and socket type is splined to the shaft and secured with a snap ring. The joints are packed with grease and protected by gaiters. Both drive shafts are fitted with dynamic dampers.

The drive shaft transmits engine torque, via the gearbox, to the front wheels. The dynamic dampers reduce any vibration produced by the drive shaft's rotation.

Diagnostic

Diagnosis

Mechanical inspection

Click noise is heared when rotating

Click noise may be caused by the abrased or damaged front wheel drive shaft constant velocity universal joint in rotating, so if there is click noise, inspect whether the front wheel drive shaft constant velocity universal joint shield is cracked or damaged.

Tedious metallic sound is heared when accelerating by self-sliding

Inspect the following conditions if there is click noise existing in rotating:

- Whether the external universal joint has been abrased or damaged.
- Whether the seal is cracked or damaged.

Quiver or vibrate when accelerating

Shudder when starting

The phenomenon of shuddering when starting refers to the vibration sense felt on the steering wheel and/or in the front of the vehicle during the process of driving from midrange acceleration to quick acceleration when starting from stillness state. During the acceleration process, shudder when starting can also be reflected as front-rear vibration.

The phenomenon of shuddering when starting in the vehicle driven by the front wheels can be caused by the following conditions:

- Inner three-way universal joint has been abrased or damaged.
- The inner universal joint has been abrased into severe corniform.

The universal joint shows itself in severe corniform angle, which is usually caused by the overtop set for the height of the front joint or the spring. If the power assembly mounting is damaged or deflected, conditions as follows will also be caused:

- The angle of the universal joint is overlarge.
- Shudder when starting.

The height of the front suspension is increased due to the high torque of the vehicle power assembly in the process of accelerating quickly. When the height of the suspension is increased, the angle of the inner three-way universal joint will also be increased accordingly, and the phenomenon of shuddering when staring can be caused under the occurrence of following conditions:

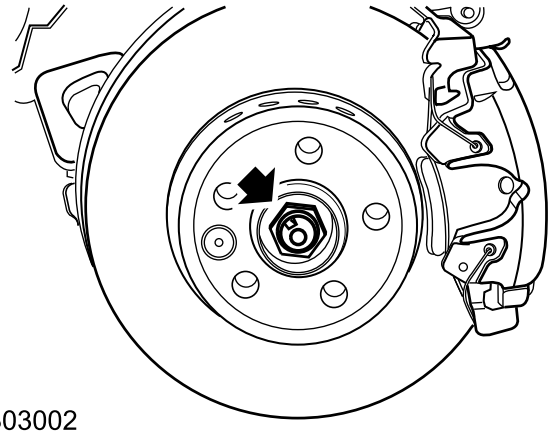
- The universal joint is abrased.
- The front angle has already been overlarge before accelerating.

Service Procedures

RH Shaft & Both Joints

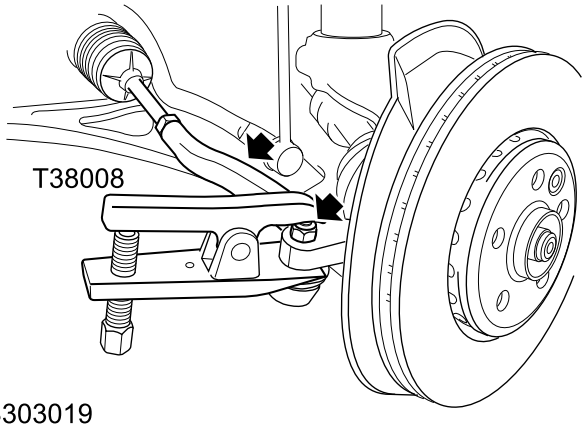
Remove

1. Raise vehicle on a lift.
2. Remove the wheel bolt FR.
3. Remove the wheel assembly FR.
4. Pry the securing equipment of front drive shaft nut, press the brake pedal, remove and dispose the drive shaft nut.



S303002

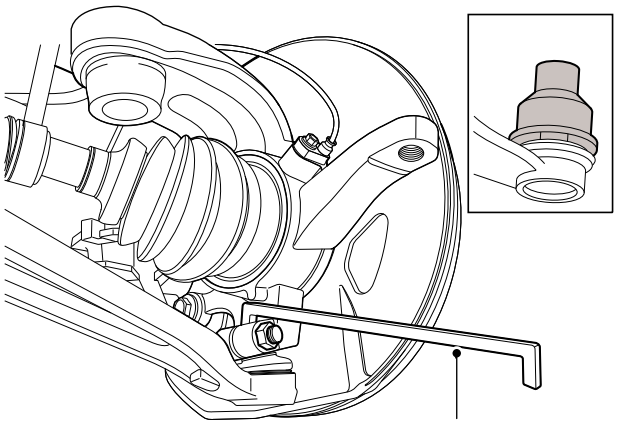
5. Remove the steering rod spring pin and loosen the steering rod set nut.
6. Use tool**T38008** to release the steering rod ball joint.



S303019

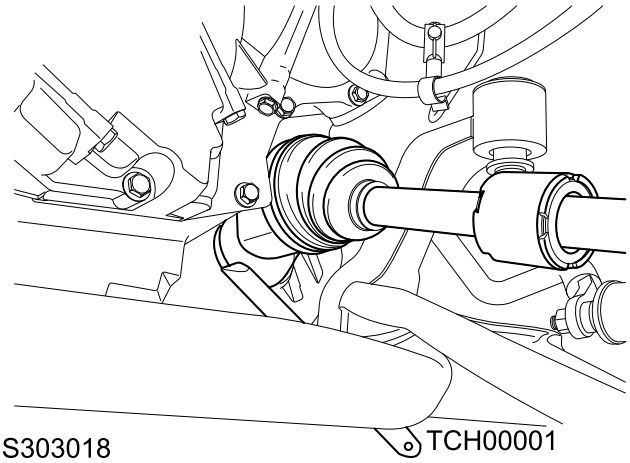
7. Remove the nut securing anti roll bar link to the anti roll bar, and release the anti roll bar link.
8. Remove the nuts and bolts securing the front lower arm to the front hub.
9. Use the special tool**T32011** to loosen front lower arm outer ball joint.

Caution: Care must be taken when removing the protector of the lower arm outer ball joint to avoid any damage.



S303011

10. Pull the front hub outward, and remove the drive shaft assembly from the hub.
11. Use the special tool**TCH00001**to separate the drive shaft assembly from the differential.



S303018

12. Remove the drive shaft assembly and dispose the circlip.

Refit

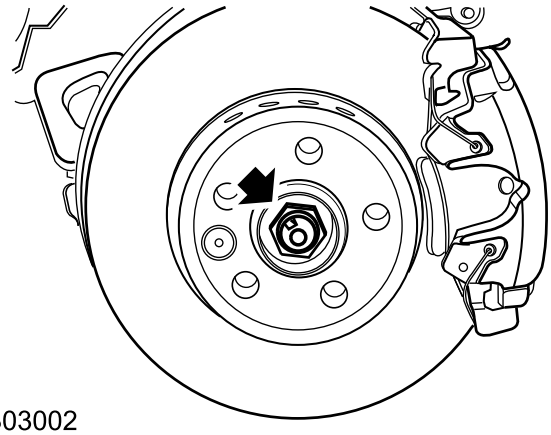
1. Fit the new circlip to the RH drive shaft.
2. Clean the drive shaft end and the matching face within the hub and differential.
3. Fit the drive shaft to the differential and ensure the full engagement.
4. Remove the front lower arm outer ball joint gaiter.
5. Pull the hub outward to engage the drive shaft and the hub spline, and fit the hub to the lower arm outer ball joint.
6. Fit the nut and bolt securing the hub to the lower arm, and tighten the bolt to**50–65Nm**.
7. Make sure that the lower arm ball joint pin is fully engaged with the hub, and the bolt is located in the groove of the ball joint.
8. Make sure that the steering rod ball joint and steering arm are clean, and the rubber protector is not damaged.
9. Fit the steering rod to the steering arm, and tighten the nut to **28–32Nm**.

10. Fit the spring pin and bend it to avoid dropping.
11. Make sure that the contact surface between the anti roll bar and the anti roll bar link is clean.
12. Position the anti roll bar link onto the anti roll bar, fit and tighten the nut to **45–55Nm**.
13. Fit a new drive shaft nut, and tighten the nut to **350–370Nm**
14. Secure the nut to the drive shaft.
15. Fit the RH front wheel and bolt, and tighten the bolt to**105–115Nm**.
16. Lower the vehicle.

LH Shaft & Both Joints

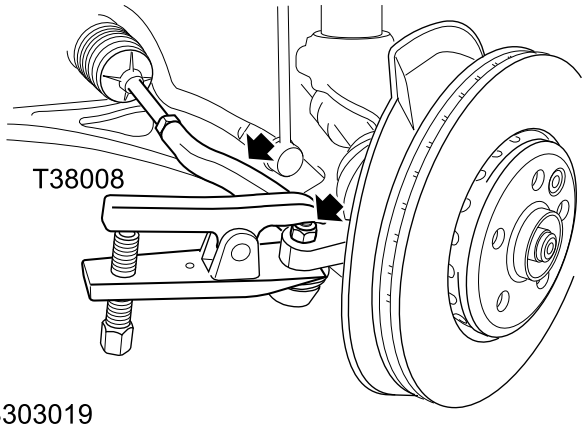
Remove

1. Raise vehicle on a lift.
2. Remove the wheel.
3. Remove the wheel assembly.
4. Pry the securing equipment of front drive shaft nut, step down the brake pedal, remove and dispose of the drive shaft nut.



S303002

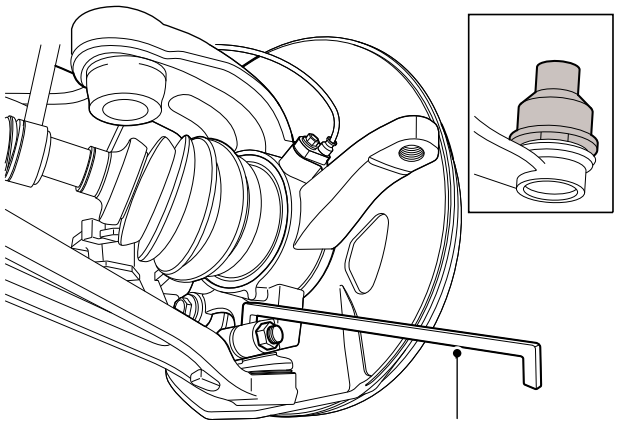
5. Remove the steering rod spring pin and remove the steering rod set nut.
6. Use the special tool**T38008** to release the steering rod ball joint.



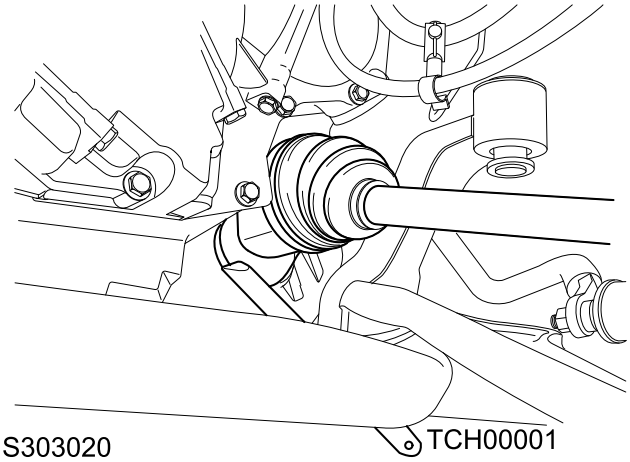
S303019

7. Release the nut securing the anti roll bar link to the anti roll bar, and release the anti roll bar link.
8. Remove the nuts and bolts securing the front lower arm to the front hub.
9. Use the special tool**T32011** to remove front lower arm outer ball joint.

Caution: Care must be taken when removing the protector of the lower arm outer ball joint to avoid any damage.



10. Pull the front hub outward, and remove the drive shaft assembly from the hub.
11. Use the special tool**TCH00074**to separate the drive shaft assembly from the differential.



12. Remove the drive shaft assembly and dispose of the circlip.

Refit

1. Fit the new circlip to the drive shaft LH.
2. Clean the drive shaft end and the matching face within the hub and differential.
3. Fit the drive shaft to the differential and ensure the full engagement.
4. Remove the front lower arm outer ball joint boot.
5. Pull the hub outward to engage the drive shaft and the hub spline, and fit the hub to the lower arm outer ball joint.
6. Fit the nut and bolt securing the lower arm to the hub, and tighten the bolt to**50–65Nm**.
7. Make sure that the lower arm ball joint pin is fully engaged with the hub, and the bolt is located in the groove of the ball joint.
8. Make sure that the steering rod ball joint and steering arm are clean, and the rubber protector is not damaged.
9. Fit the steering rod to the steering arm, and tighten the nut to **28–32Nm**.
10. Fit the spring pin and bend it to avoid dropping.
11. Make sure that the contact surface between the anti roll bar and the anti roll bar link is clean.
12. Position the anti roll bar link onto the anti roll bar, fit and tighten the nut to **45–55Nm**.
13. Fit a new drive shaft nut, and tighten the nut to **350–370Nm**.
14. Secure the nut to the drive shaft.
15. Fit the front left wheel and bolt, and tighten to**105–115Nm**.
16. Lower the vehicle.

Outer CV Joint

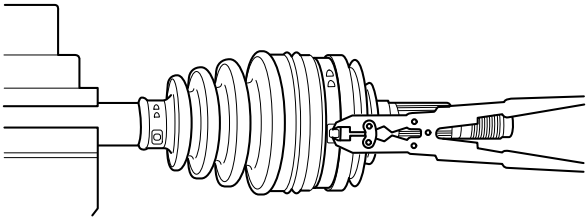
Remove

1. Remove drive shaft.

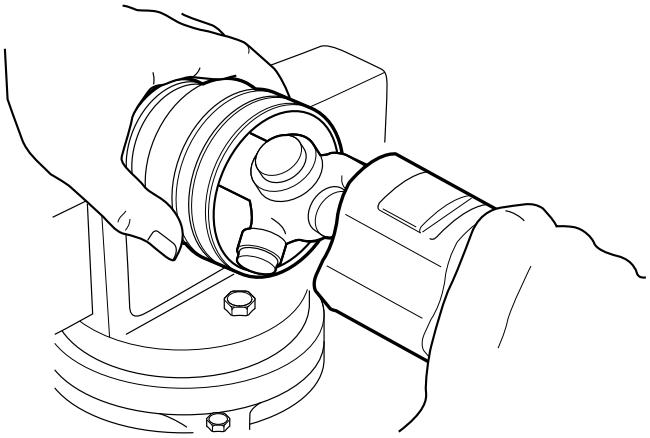
☞**RH Shaft & Both Joints Remove**

☞**LH Shaft & Both Joints Remove**

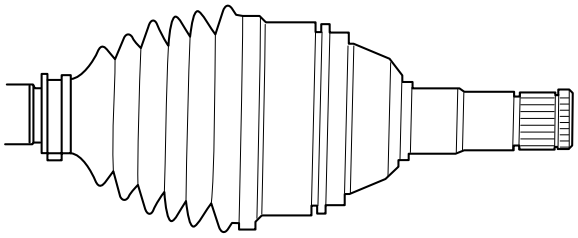
2. Place drive shaft in vice.
3. Release both gaiter clips and discard.



4. Remove the inner joint.



5. Remove and discard the tripod joint gaiter clamp.
6. Remove and discard the outer constant velocity joint clamp.



7. Remove the outer constant velocity joint assembly gaiter from the inner joint and discard it.

Refit

1. Clean the drive shaft inner and outer joints.
2. Use a tape to wrap the drive shaft.
3. Carefully position the outer constant velocity joint boot into the outer joint along the shaft.
4. Apply the grease to the outer constant velocity joint assembly.
5. Tighten the boot respectively with the large and small clamp.
6. Position the inner joint boot and clamp into the shaft bar.
7. Remove the tape from the shaft bar.
8. Fit the inner joint snap ring and apply grease to it.
9. Tighten the inner joint boot with the clamp.
10. Fit the drive shaft assembly.

☞**RH Shaft & Both Joints Refit**

☞**LH Shaft & Both Joints Refit**

Inner joint

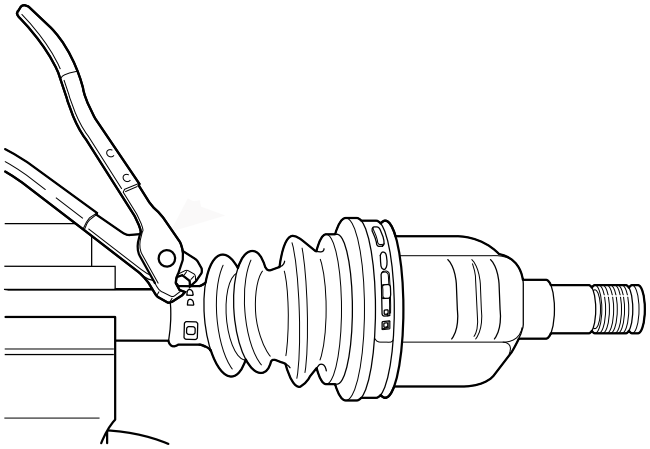
Remove

1. Remove drive shaft.

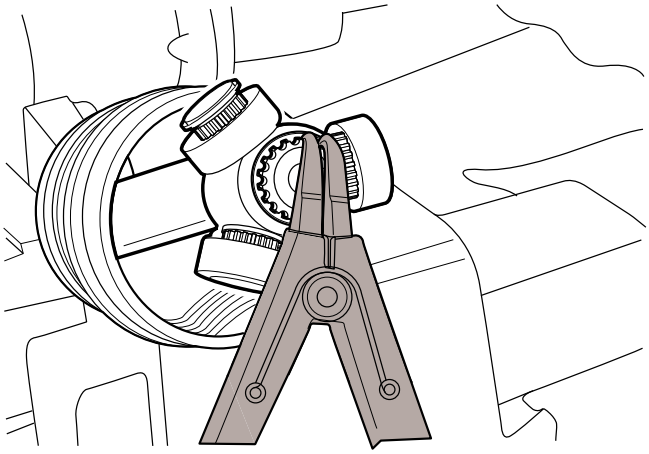
☞RH Shaft & Both Joints Remove

☞LH Shaft & Both Joints Remove

2. Place drive shaft in vice.
3. Release 2 gaiter clips and discard.



4. Remove intermediate drive shaft.
5. Remove intermediate drive shaft snap ring and discard.



6. Remove the tripod joint from the drive shaft intermediate shaft.
7. Remove the tripod joint rubber boot and discard.

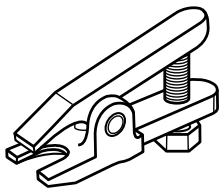
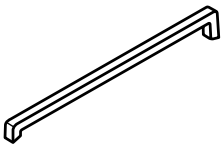
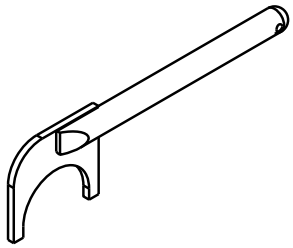
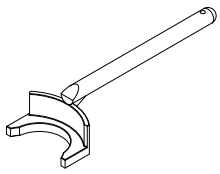
Refit

1. Clean the drive shaft and tripod joint assembly gaiter.
2. Fit 2 new clamp gaiter to the drive shaft.
3. Position the new tripod joint to the drive shaft.
4. Fit the new snap ring to the drive shaft intermediate shaft.
5. Apply grease to the inside of the tripod joint assembly.
6. Set the tripod joint assembly boot to the drive shaft.
7. Fit the drive shaft assembly.

☞RH Shaft & Both Joints Refit

☞LH Shaft & Both Joints Refit

Special Tools

Tool Number	Description	Picture
T38008	Remover ball joint	 T38008
T32011	Lever front lower arm ball joint	 T32011
TCH00001	Remover drive shaft	 TCH00001
TCH00074	Remover driveshaft	

Interior Trim and Paneling

Specifications

Torque

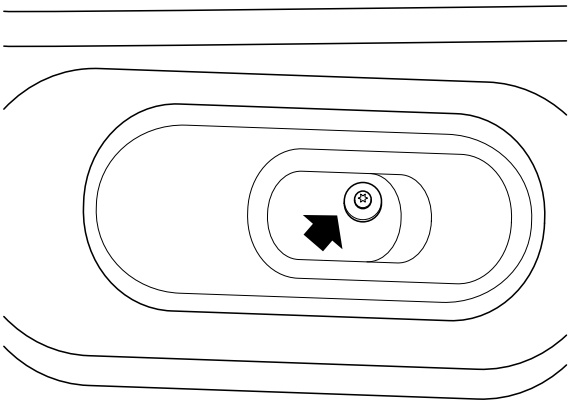
Description	Value
Screw - door trim casing to door	2–3Nm
Screw - door interior handle to door	1–2Nm
Screw - D pillar lower trim finisher to body	1.5–1.7Nm
Screw - sun visor assembly to roof	2–2.7Nm
Screw - spectacles box assembly to bracket	2–2.7Nm

Service Procedures

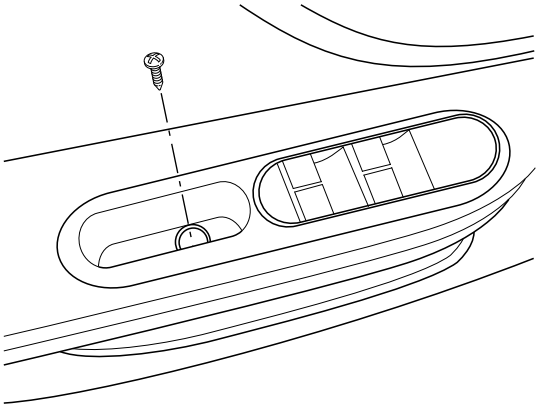
Front Door Interior Trim Panel

Remove

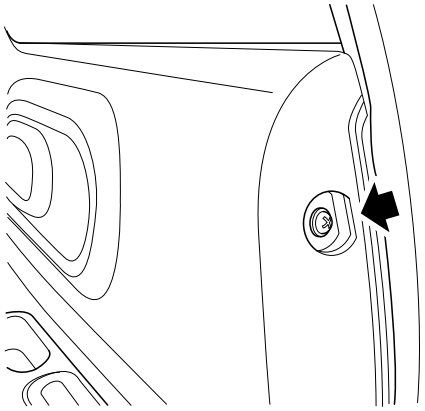
1. Disconnect battery earth lead.
2. Take away the inside pull handle trim cover, remove the screws securing the trim panel at the door inside pull handle.



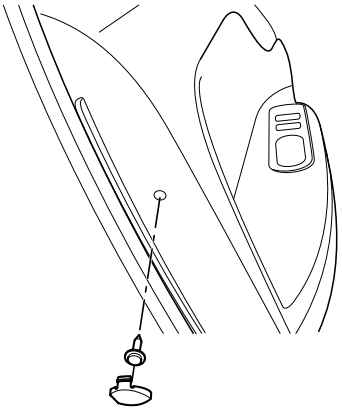
3. Take away the window switch trim cover, remove the window switch set screws.



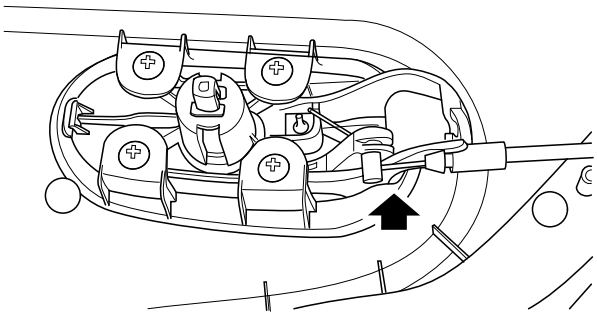
4. Remove the set screws at the front of the front door interior trim panel.



5. Remove the set screws at the rear of the front door interior trim panel.



6. Disconnect the tweeter and door switch connector.
7. Release the inside pull handle door lock cable.



8. Remove the front door interior trim panel.

Refit

1. Connect the tweeter and door switch connector.
2. Connect the inside pull handle door lock cable.
3. Fit the front door interior trim panel onto the front door.
4. Fit 2 set screws (front and rear) connecting the interior trim panel to the door, and tighten to**2–3Nm**. Fit the screw trim cover.
5. Fit the screws securing the trim panel at the front door inside pull handle, and tighten to **1–2Nm**. Fit the screw trim cover.
6. Connect battery earth lead.

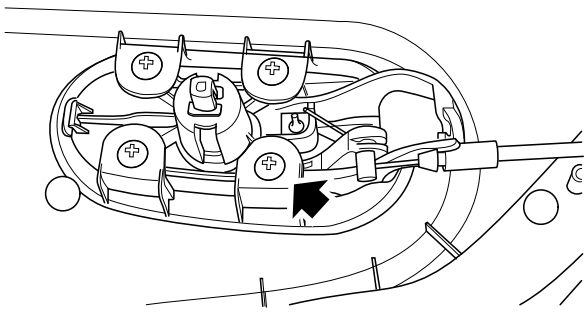
Front Door Inside Pull Handle

Remove

1. Remove the front door interior trim panel.

☞**Front Door Interior Trim Panel Remove**

2. Remove the 4 screws securing the inside pull handle to the door interior trim panel.



3. Remove the front door inside pull handle.

Refit

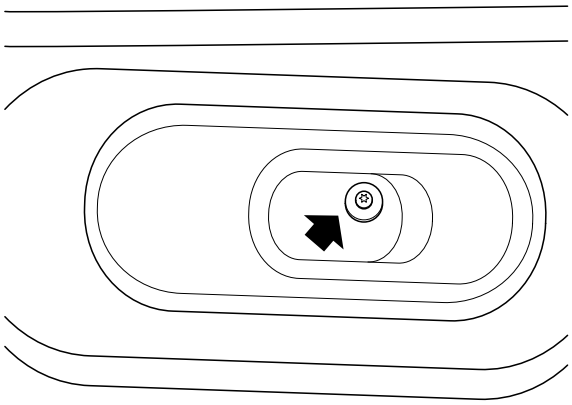
1. Fit the front door inside pull handle on the trim panel, fit the 4 screws and tighten them.
2. Fit the front door interior trim panel.

☞**Front Door Interior Trim Panel Refit**

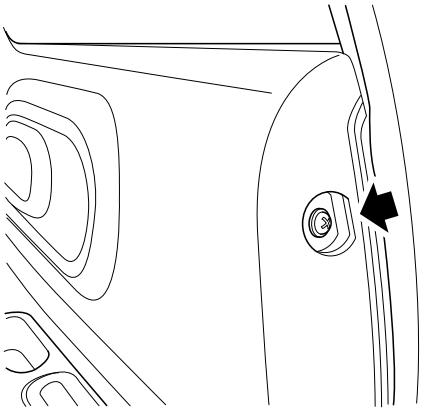
Rear Door Interior Trim Panel

Remove

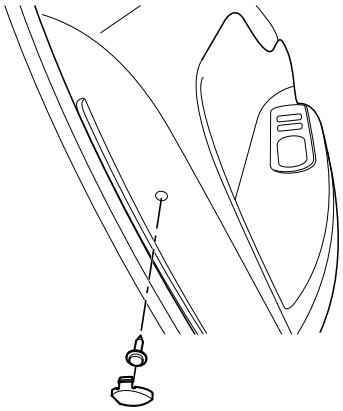
1. Disconnect battery earth lead.
2. Take away the inside pull handle trim cover, remove the screws securing the trim panel to the door inside pull handle.



3. Take away the window switch trim cover, remove the window switch set screws.
4. Remove the set screws at the front of the rear door interior trim panel.

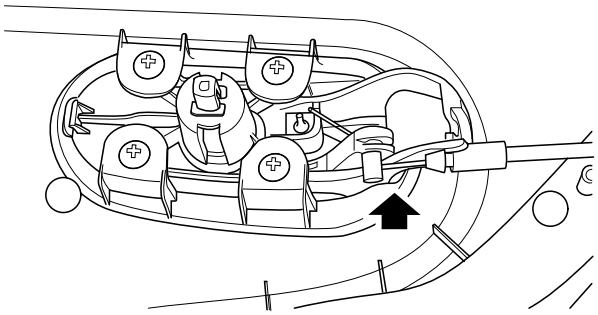


5. Remove the set screws at the rear of the rear door interior trim panel.



6. Disconnect the door switch connector.

7. Release the inside pull handle door lock cable.



8. Remove the rear door interior trim panel.

Refit

1. Connect the door switch connector.
2. Connect the inside pull handle door lock cable.
3. Fit the rear door interior trim panel onto the rear door.
4. Fit the 2 set screws (front and rear) connecting the interior trim panel to the door, and tighten to**2–3Nm**. Fit the screw trim cover.
5. Fit the screws securing the trim panel to the rear door inside pull handle, and tighten to **1–2Nm**. Fit the screw trim cover.
6. Connect battery earth lead.

Rear Door Inside Pull Handle

Remove

1. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

2. Remove 4 screws of the rear door inside pull handle.
3. Remove the rear door inside pull handle.

Refit

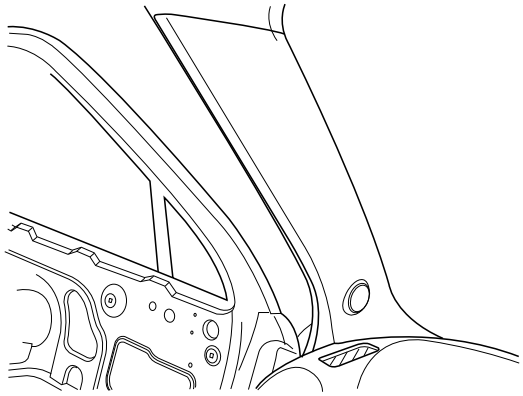
1. Fit the rear door inside pull handle to the trim panel.
2. Fit the 4 screws of the rear door inside pull handle.
3. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

A Post Upper Trim Finisher

Remove

1. Release the front door seal.
2. Release the A post upper trim finisher loudspeaker, and disconnect the electrical connector.



3. Release the A post upper trim finisher.

Warning: Always follow the 'SRS Precautions' and the correct procedures for working on SRS components. Persons working on SRS systems must be fully trained and have been issued with copies of the Safety guidelines.

Refit

1. Connect the electrical connector, and fit the loudspeaker.
2. Fit A post trim finisher to A post and secure clips.
3. Fit the front door seal.

A Post Lower Trim Finisher

Remove

1. Release front door seal.
2. Release 6 clips securing A post lower trim finisher to A post and remove finisher.

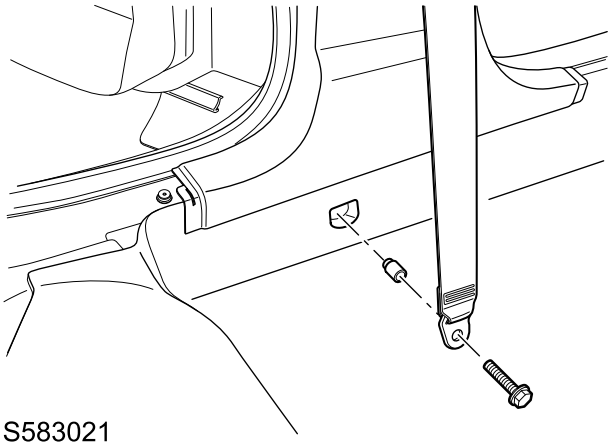
Refit

1. Fit A post lower trim finisher to A post and secure clips.
2. Fit front door seal.

B Post Upper Trim Finisher

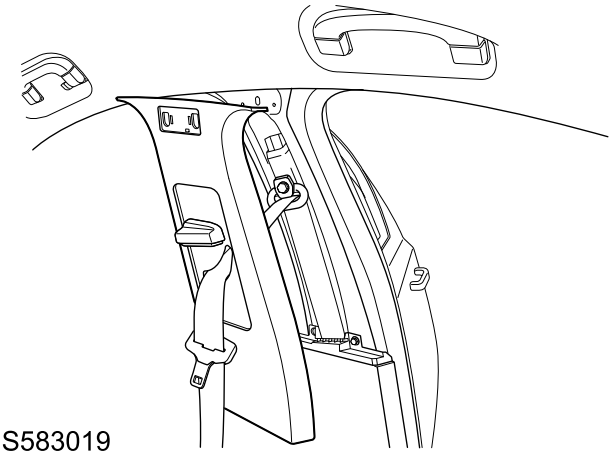
Remove

1. Release front and rear door seals.
2. Remove bolt securing seat belt to body and collect spacer.



S583021

3. Release 2 clips securing screw cover to B post trim and remove cover.
4. Remove 2 screws securing B post trim finisher to B post.



S583019

5. Release 2 clips securing B post upper trim finisher to B post lower trim finisher.
6. Release seat belt and remove B post upper trim finisher.

Refit

1. Position B post trim finisher and fit seat belt.
2. Fit B post upper trim finisher to B post lower trim finisher and secure clips.
3. Locate seat belt adjusting handle to adjusting mechanism and secure trim finisher to B post with screws.
4. Fit screw cover to B post trim finisher and secure with clips.
5. Position seat belt.
6. Fit front and rear door seals.

B Post Lower Trim Finisher

Remove

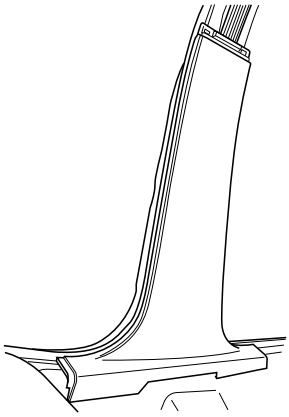
1. Remove A post lower trim finisher.

A Post Lower Trim Finisher Remove

2. Remove B post upper trim finisher.

B Post Upper Trim Finisher Remove

3. Remove the rear door sill.
4. Release 4 clips and 1 locating peg securing B post trim finisher to B post and remove the finisher.



Refit

1. Fit B post trim finisher to B post and secure clips and locating peg.
2. Fit B post upper trim finisher.

B Post Upper Trim Finisher Refit

3. Fit A post lower trim finisher.

A Post Lower Trim Finisher Refit

4. Fit the rear door sill.
5. Fit B post lower trim finisher.

C Post Upper Trim Finisher

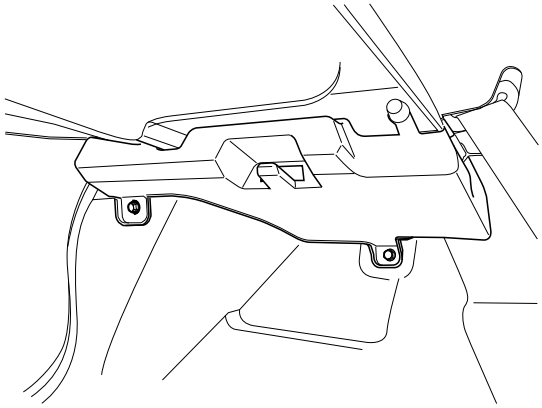
Remove

1. Remove the rear seat.

☞**Rear Seat Remove**

2. Take away the rear parcel shelf assembly.

☞**Rear Parcel Shelf Remove**



3. Remove the 2 bolts securing the C post upper trim finisher to the body.
4. Remove the C post upper trim finisher.

Refit

1. Pass the rear seat belt through the hole on C post upper trim finisher.
2. Fit the C post upper trim finisher.
3. Fit the rear parcel shelf.

☞**Rear Parcel Shelf Refit**

4. Fit the rear seat cushion.

☞**Rear Seat Refit**

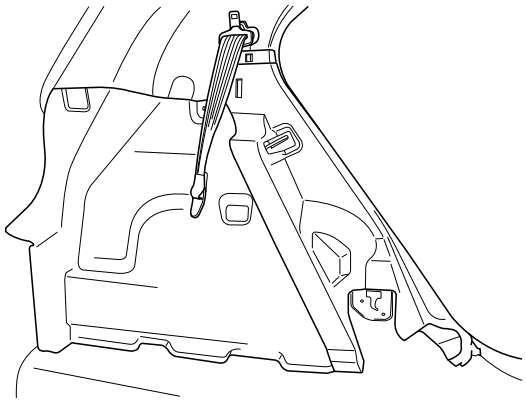
C Post Lower Trim Finisher

Remove

1. Open the tailgate.
2. Remove the rear seats.
3. Remove C post upper trim finisher.

☞**C Post Upper Trim Finisher Remove**

4. Release the screw to remove C post lower trim finisher.



Refit

1. Secure C post lower trim finisher to the body to**1.5–1.7Nm**.
2. Fit C post upper trim finisher.

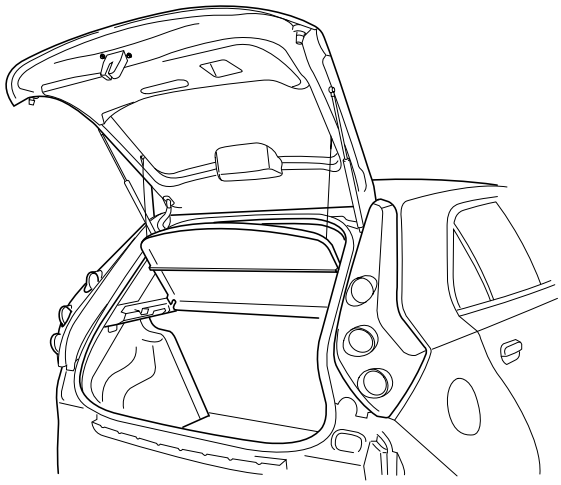
☞**C Post Upper Trim Finisher Refit**

3. Fit the rear seats.
4. Close the tailgate.

Rear Parcel Shelf

Remove

1. Open the tailgate.



2. Take away the rear parcel shelf assembly.

Refit

1. Fit the rear parcel shelf assembly.

Carpet

Remove

1. Disconnect battery earth lead.
2. Remove the rear seat cushion.

☞**Rear Seat Cushion Remove**

3. Remove the front door seal.
4. Remove the rear door seal.
5. Remove the LH and RH B post lower trim finishers.

☞**B Post Lower Trim Finisher Remove**

6. Remove the LH and RH A post lower trim finishers.

☞**A Post Lower Trim Finisher Remove**

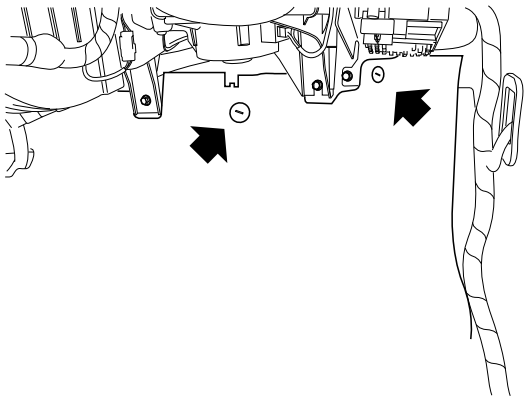
7. Remove the LH and RH C post lower trim finishers.
8. Remove the front seat.

☞**Front Seat Remove**

9. Move the centre console switch and the upper trim finisher of the floor console away.
10. Remove the centre console.

☞**Centre Console Remove**

11. Remove the 2 snap fits under the driver, the 2 snap fits under the passenger compartment and the 4 rear snap fits, then remove the carpet.



Refit

1. Place the carpet into the vehicle, secure it with 8 snap fits.
2. Fit the floor centre console.

☞**Centre Console Refit**

3. Fit the upper trim finisher and centre console switch of the floor console.
4. Fit the front seat.

☞**Front Seat Refit**

5. Fit the LH and RH A post lower trim finishers.

☞**A Post Lower Trim Finisher Refit**

6. Fit the LH and RH B post lower trim finishers.

☞**B Post Lower Trim Finisher Refit**

7. Fit the LH and RH D post lower trim finishers.
8. Fit the front door seal.
9. Fit the rear door seal.
10. Fit the rear seat cushion.

☞**Rear Seat Cushion Refit**

11. Connect battery earth lead.

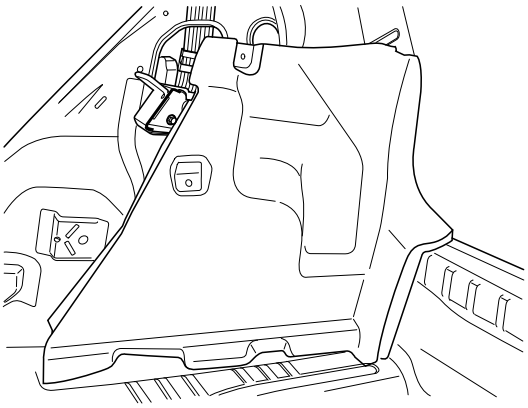
Luggage Compartment Trim Finisher

Remove

1. Open the tailgate.
2. Take out the luggage compartment carpet.
3. Remove the luggage compartment trim sill.

☞**Luggage Compartment Trim Sill Remove**

4. Remove the trunk seal.
5. Remove the 1 snap fit securing the trunk side trim panel to the body, and remove the luggage compartment trim finisher.



Refit

1. Fit the luggage compartment trim finisher, secure it with a snap.
2. Fit the luggage compartment seal to ensure the match of it and the surroundings.
3. Fit the luggage compartment trim sill.

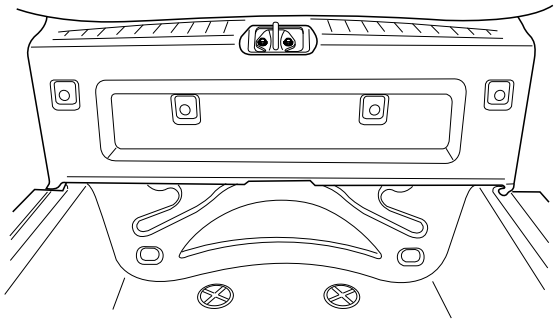
☞**Luggage Compartment Trim Sill Refit**

4. Place the luggage compartment carpet.
5. Close the tailgate.

Luggage Compartment Trim Sill

Remove

1. Open the tailgate.
2. Take out the luggage compartment carpet.
3. Remove the 4 snap fits securing the luggage compartment trim sill to the body.



4. Remove the luggage compartment striker cover.
5. Remove the luggage compartment trim sill.

Refit

1. Fit the luggage compartment trim sill.
2. Fit the luggage compartment striker cover.
3. Fit the luggage compartment carpet.
4. Close the tailgate.

Headlining

Remove

1. Disconnect battery earth lead.
2. Open the tailgate.
3. Remove the front door seal.
4. Remove the rear door seal.
5. Remove the A post upper trim finisher.

A Post Upper Trim Finisher Remove

6. Remove the B post upper trim finisher.

B Post Upper Trim Finisher Remove

7. Remove the C post trim finisher.

C Post Trim Finisher Remove

8. Remove the grab handle.

Grab Handle Remove

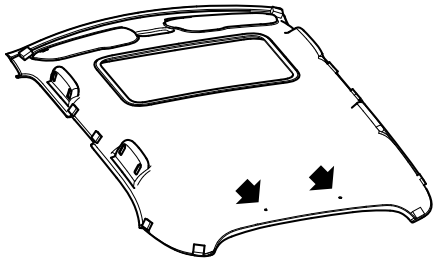
9. Remove the spectacles box.

Spectacles Box Remove

10. Remove the reading lamp.

Reading Lamp Remove

11. Loosen the 2 snap fits securing the headlining.



12. Remove the sun visor.

Sun Visor Remove

13. Tilt the 2 front seats.
14. Take the headlining out of the tailgate.

Refit

1. Tilt the 2 front seats.
2. Place the headlining into the mounting position.
3. Fit the sun visor and position the headlining, then secure it with snap fits.

Sun Visor Refit

4. Fit the spectacles box.

Spectacles Box Refit

5. Fit the grab handle.

Grab Handle Refit

6. Fit the A post upper trim finisher.

☞**A Post Upper Trim Finisher Refit**

7. Fit the B post upper trim finisher.

☞**B Post Upper Trim Finisher Refit**

8. Fit the C post trim finisher.

☞**C Post Trim Finisher Refit**

9. Fit the reading lamp.

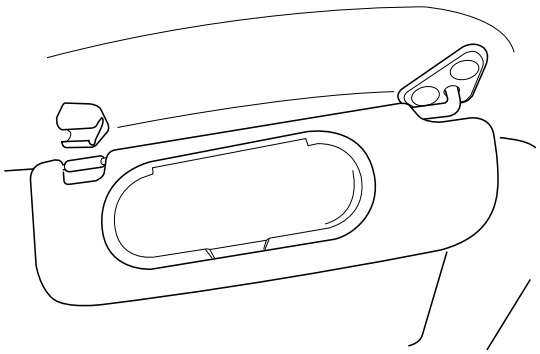
☞**Reading Lamp Refit**

10. Fit the front door seal.
11. Fit the rear door seal.
12. Close the tailgate.
13. Connect battery earth lead.

Sun Visor

Remove

1. Remove the screw trim cover, remove the 2 bolts securing the sun visor to the ceiling.



2. Remove the sun visor away from the ceiling.
3. Remove the sun visor bracket away from the ceiling.

Refit

1. Insert the sun visor bracket to the ceiling.
2. Secure the sun visor to the ceiling, then fit tighten the screws to**2–2.7Nm**.

Bulkhead Insulation

Remove

1. Remove the transmission assembly.

☞**Auto Transmission Assembly Remove**
☞**Manual Transmission Assembly Remove**

2. Remove the**ABS** modulator.

☞**ABS Modulator Remove**

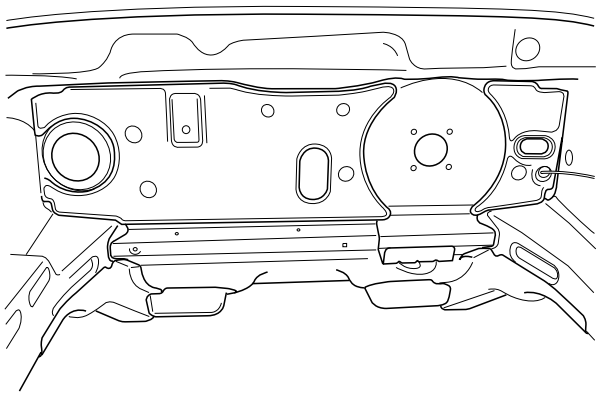
3. Remove the brake master cluster cylinder and the reservoir assembly.

☞**Brake Master Cluster Cylinder and Reservoir Assembly Remove**

4. Remove the vacuum booster assembly.

☞**Vacuum Booster Assembly Remove**

5. Disconnect the air conditioner heater water inlet and outlet hose.
6. Disconnect the air conditioner inlet and outlet hose connecting the expansion valve.
7. Remove the 5 plastic nuts securing the bulkhead insulation to the front of the body.



8. Remove the bulkhead insulation.

Refit

1. Fit the bulkhead insulation to the front of the body with 5 nuts.
2. Connect the air conditioner water inlet and outlet hose to the expansion valve.
3. The air conditioner heater water inlet and outlet hose.
4. Fit the vacuum booster assembly.

☞**Vacuum Booster Assembly Refit**

5. Fit the brake master cluster cylinder and the reservoir assembly.

☞**Brake Master Cluster Cylinder and Reservoir Assembly Refit**

6. Fit**ABS** modulator

☞**ABS Modulator Refit**

7. Fit the engine transmission case assembly.

☞**Auto Transmission Assembly Refit**
☞**Manual Transmission Assembly Refit**

Front Section Sound Insulation

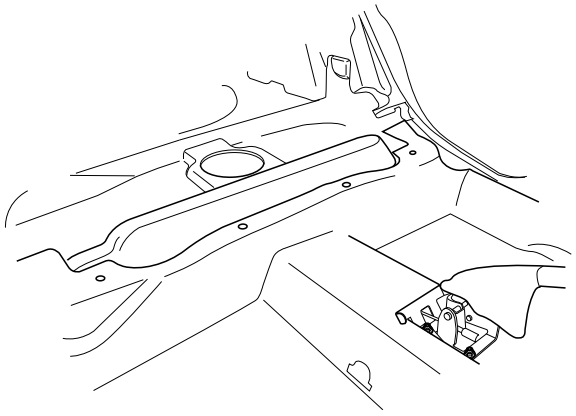
Remove

1. Remove the front seat.

☞**Front Seat Remove**

2. Remove the carpet.

☞**Carpet Remove**



3. Remove the centre console.

☞**Centre Console Remove**

4. Remove the shift level assembly.

☞**Shift Level Assembly - Auto Remove**

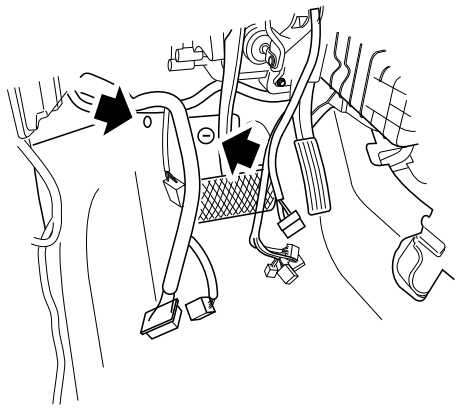
☞**Shift Level Assembly - Manual Remove**

5. Remove the instrument panel assembly.

☞**Instrument Panel Assembly Remove**

6. Remove the pedal mounting bracket.

☞**Brake Pedal Remove**



7. Remove the 5 snap fits securing the front section sound insulation to the front of the body.
8. Remove the front section sound insulation.

Refit

1. Place the front section sound insulation on the appropriate position of the body, and insert the location pin into the positioning hole.
2. Secure the front section sound insulation to the body with 5 snap fits.
3. Fit the pedal mounting bracket.

☞**Brake Pedal Refit**

4. Fit the instrument panel assembly.

☞**Instrument Panel Assembly Refit**

5. Fit the shift level.

☞**Shift Level Assembly - Auto Refit**

☞**Shift Level Assembly - Manual Refit**

6. Fit the centre console.

☞**Centre Console Refit**

7. Fit the carpet.

☞**Carpet Refit**

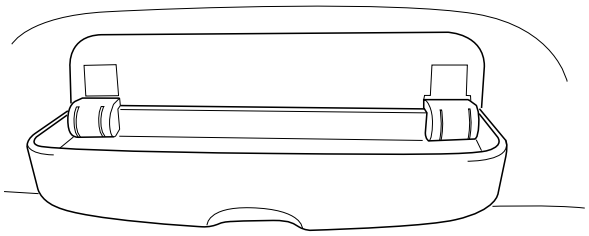
8. Fit the front seat.

☞**Front Seat Refit**

Spectacles Box

Remove

1. Open the spectacles box and the trim cover inside to expose the bolt securing the spectacles box.
2. Remove the 2 bolts securing the spectacles box to the ceiling.



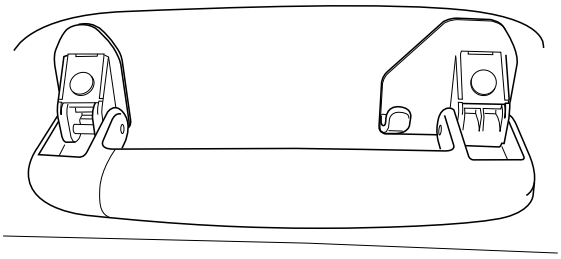
Refit

1. Secure the spectacles box to the ceiling, then fit the bolts and tighten to**2–2.7Nm**.

Grab Handle

Remove

1. Open the trim cover to expose the grab handle bolt.
2. Remove the 2 bolts securing the grab handle to the ceiling.



Refit

1. Secure the roof inner handle to the ceiling, then fit the bolt and tighten it.

Fascia and Console

Specifications

Torque

Description	Value
Bolt - fascia driver side to vehicle body	18–22Nm
Bolt - fascia (passenger side) to vehicle body	18–22Nm
Screw - console to fascia center lower panel	1.3–1.9Nm
Screw - console to CCB tunnel bracket	1.3–1.9Nm
Screw - console to the console bracket	1.3–1.9Nm
Screw - PND to fascia	1.3–1.9Nm
Screw - drive side lower panel to fascia	1.3–1.9Nm

Service Procedures

Instrument Panel (I/P) Assembly

Remove

1. Disconnect battery earth lead.
2. Remove the steering column joint.

☞**Steering Column Remove**

3. Remove the LH front door.

☞**LH Front Door Remove**

4. Remove the RH front door.

☞**RH Front Door Remove**

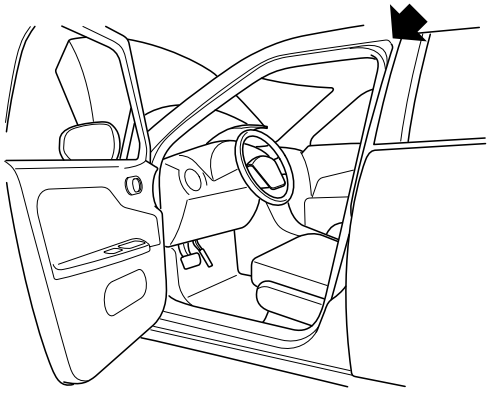
5. Remove the front seat.

☞**Front Seat Remove**

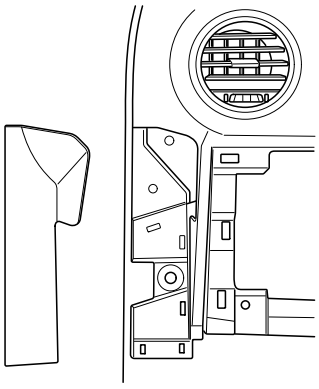
6. Remove the centre console.

☞**Centre Console Remove**

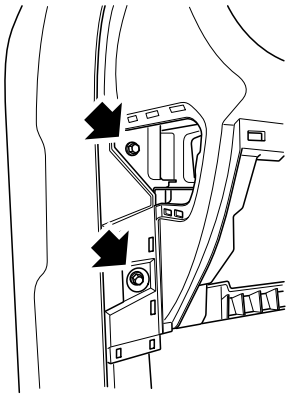
7. Remove the left door weatherstrip.



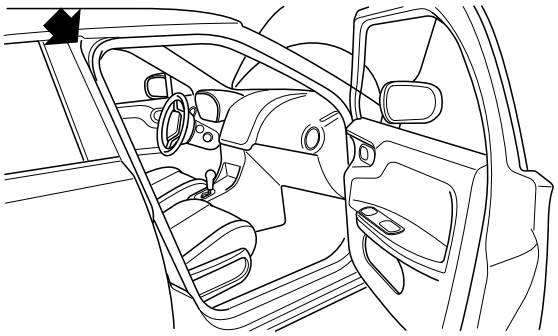
8. Pry the instrument panel assembly cover LH.



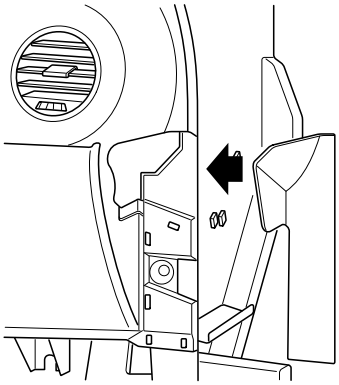
9. Remove the 2 bolts securing the driver side instrument panel assembly to the body.



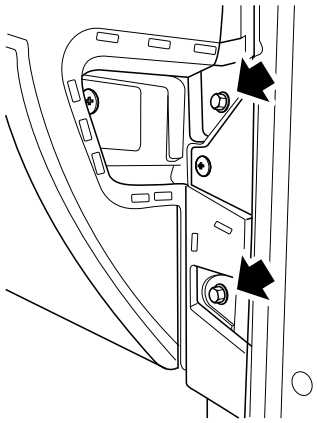
10. Remove the right door weatherstrip.



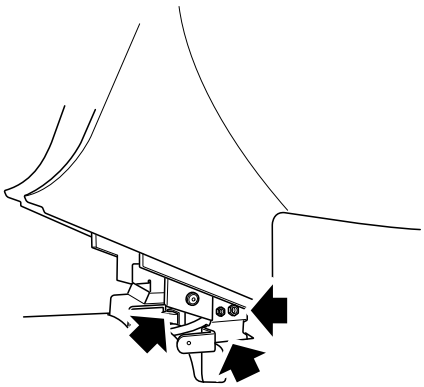
11. Pry the RH instrument panel assembly cover.



12. Remove the 2 bolts securing the passenger side instrument panel assembly to the body.



13. Remove the 6 bolts (bilateral symmetry) connecting the instrument panel assembly to the passage bracket.



14. Remove the air conditioner air intake grille.

☞**Air Conditioner Air Intake Grille Remove**

15. Remove the wiper motor and link assembly.

☞**Wiper Motor and Link Assembly Remove**

16. On one side of the engine compartment, remove the 1 bolt securing the instrument panel assembly to the front metal plate.
17. Carry out the instrument panel assembly with the help.

Refit

1. Fit the instrument panel and its support tie bar in the vehicle with the help.
2. Secure the front side of the instrument panel to the body on one side of the engine compartment, then fit the bolt and tighten to **18–22Nm**.
3. Fit the wiper motor and link assembly.

☞**Wiper Motor and Link Assembly Refit**

4. Fit the air conditioner air intake grille.

☞**Air Conditioner Air Intake Grille Refit**

5. Secure the instrument panel assembly to the passage bracket, then fit the bolt and tighten to **18–22Nm**.
6. Secure the left side of the instrument panel to the body, then fit the bolt and tighten to **18–22Nm**.
7. Fit the LH instrument panel cover.
8. Fit the left door weatherstrip.
9. Secure the right side of the instrument panel to the body, then fit the bolt and tighten to **18–22Nm**.
10. Fit the RH instrument panel cover.
11. Fit the right door weatherstrip.
12. Fit the centre console assembly.

☞**Centre Console Assembly Refit**

13. Fit the steering column joint.
14. Fit the front seat.

☞**Front Seat Refit**

15. Fit the front door.

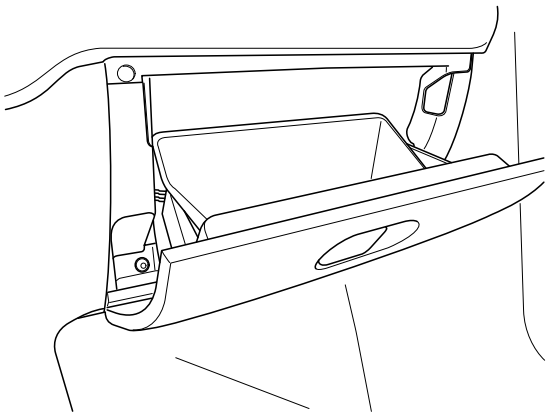
☞**Front Door Assembly Refit**

16. Connect battery earth lead.

Glove Box Assembly

Remove

1. Open the glove box door to a certain angle, then take the glove box assembly out of the IP frame.



Refit

1. Fit the glove box assembly to the IP frame.

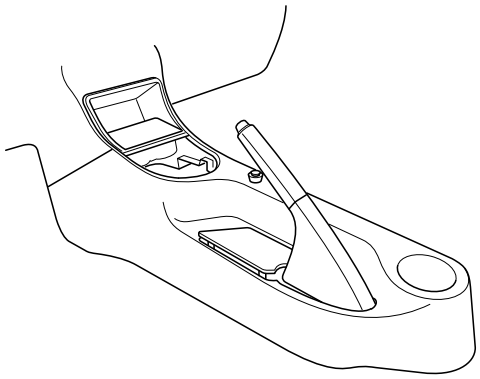
Console

Remove

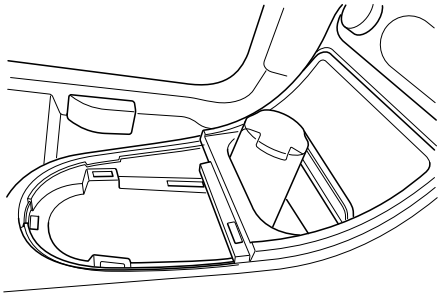
1. Remove the front seat.

☞**Front Seat Remove**

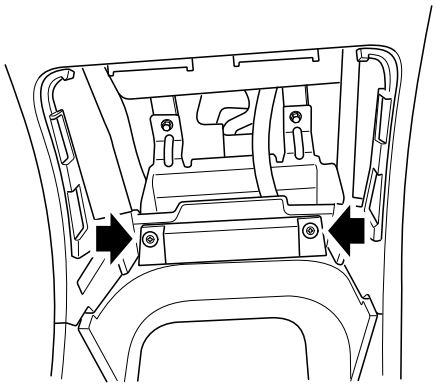
2. Remove the shift panel.
3. Remove the hand brake panel.



4. Remove the centre console storage box assembly.

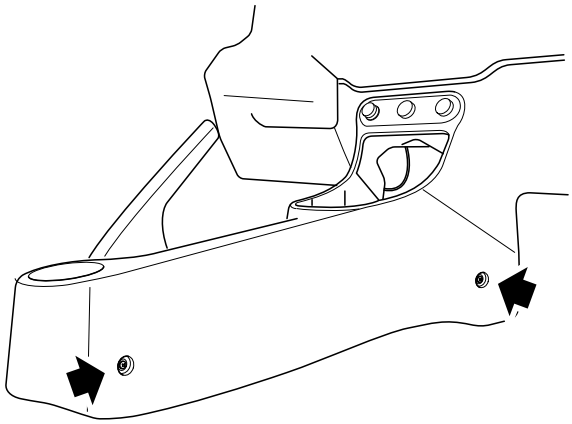


5. Remove the 2 screws securing the centre console front end to the instrument panel lower protector.



6. Pry the trim covers from both left and right end of the centre console front end, remove the 2 screws (1 on the left and 1 on the right) securing the front end to

the passage bracket.



7. Pry the trim covers from both left and right end of the centre console rear end, remove the 2 screws (1 on the left and 1 on the right) securing the rear end to the rear bracket.
8. Disconnect the cigarette lighter wiring harness connector.
9. Remove the centre console.

Refit

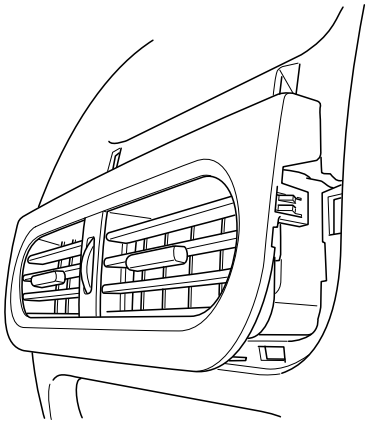
1. Connect the electrical connector of the cigarette lighter, fit the cigarette lighter.
2. Secure the front end of the centre console to the instrument panel lower protector, fit the screws and tighten to**1.3–1.9Nm**.
3. Secure the front end of the centre console to the passage bracket, fit the screws and tighten to**1.3–1.9Nm**.
4. Secure the rear end of the centre console to the rear bracket, fit the screws and tighten to**1.3–1.9Nm**.
5. Fit the centre console storage box assembly.
6. Fit the hand brake panel.
7. Fit the shift panel.
8. Fit the front seat.

☞Front Seat Refit

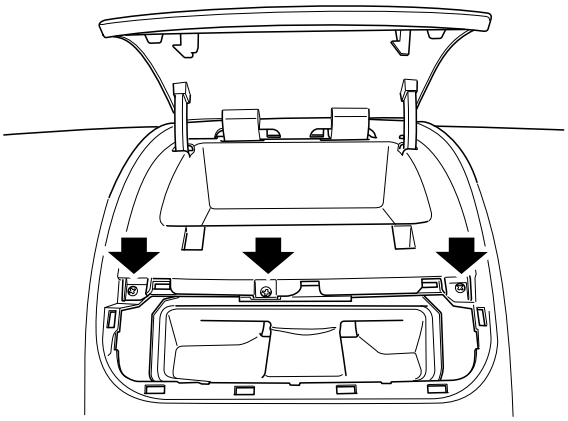
Central Upper Storage Box

Remove

1. Open the central upper storage box cover, and prize up the central air outlet assembly by using a tool.



2. Remove 3 screws within the range that is from the central upper storage box to the instrument panel assembly.



3. Remove the central upper storage box.

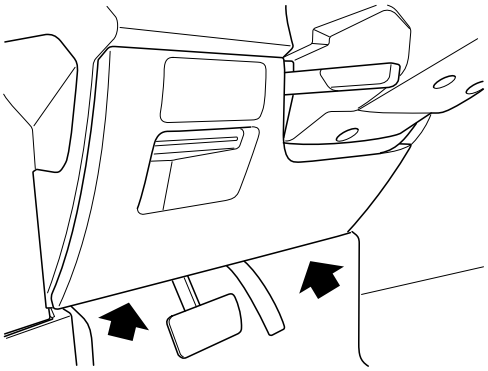
Refit

1. Fix the central upper storage box to the instrument panel assembly. Fit screws and tighten to **1.3–1.9Nm**.
2. Fit the upper central air outlet assembly.

Driver Side Lower Shield

Remove

1. Remove 2 screws fixing the driver side lower shield to the instrument panel frame.



2. Remove the driver side lower shield.

Refit

1. Fix the driver side lower shield to the instrument panel frame. Fit bolts and tighten to **1.3–1.9Nm**.

Seats

Specifications

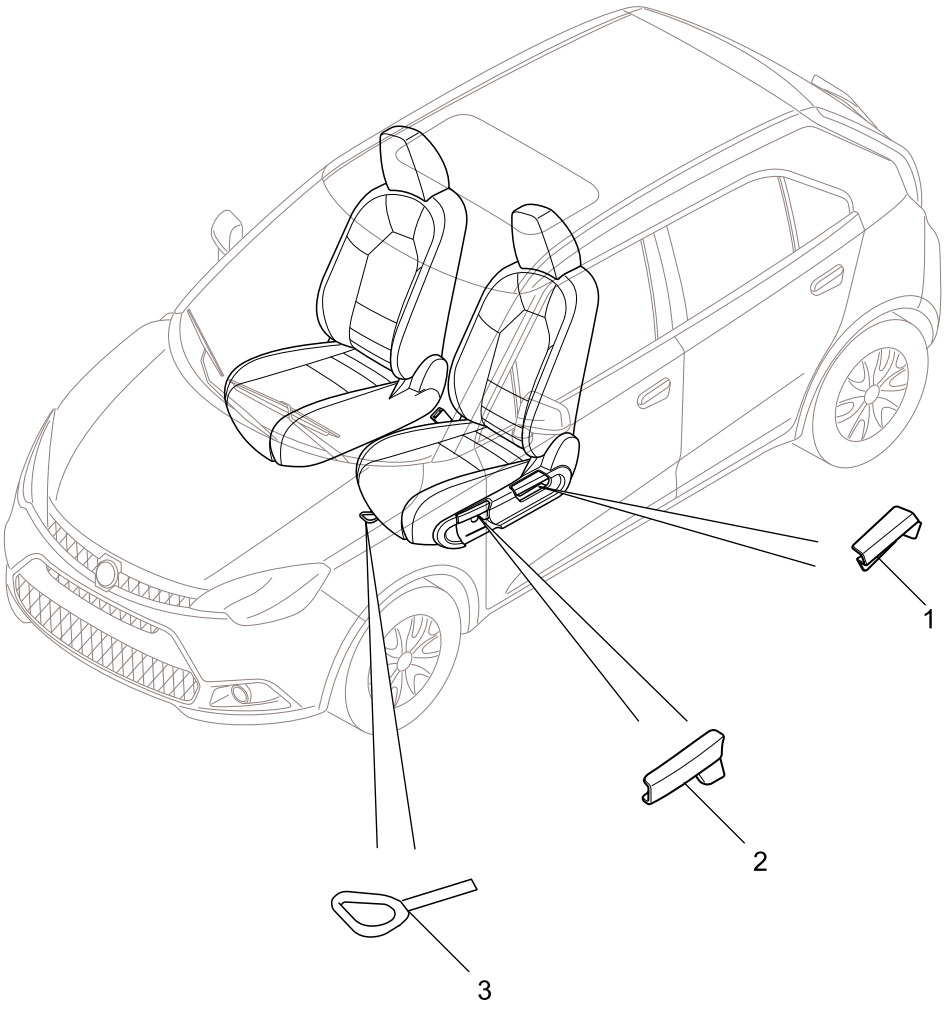
Torque

Description	Value
Screw - front seat to floor	40–50Nm
Bolt - squab to cushion	40–50Nm
Striker - striker to body	22Nm

Description and Operation

System Layout

Manual Seat Layout



1. Backrest Adjustment Handle
2. Seat Height Adjustment Handle*
3. Seat Forward-and-Backward Adjustment Handle

Description

Driver Seat

Depending on the different vehicle equipment and seat exteriors, the configuration of driver seat has different levels as follows:

- Advanced fabric 6-way manual seat (seat position sliding forward/backward, reclining, seat height);
- Advanced fabric 4-way manual seat (seat position sliding forward/backward, reclining);

Front Passenger Seat

Depending on the different vehicle equipment and seat exteriors, the configuration of front passenger seat has different levels as follows:

- Advanced fabric 4-way manual seat (seat position sliding forward/backward, reclining, **SBR**
- Advanced fabric 4-way manual seat (seat position sliding forward/backward, reclining, **SBR**, storage box);

Rear Seat

Depending on the different vehicle equipment and seat exteriors, the configuration of rear seat has different levels as follows:

- Advanced fabric 100% integral seat back;
- Advanced fabric 60% and 40% split-type seat back;

Operation

Manual Seat

Driver Seat

1. Seat height adjusting handle*
2. Seat back adjusting handle
3. Seat fore-and-aft adjustment handle

The fore-and-aft position of the seat can be adjusted by the handle located at the front of the seat. The desired position can be reached by lifting the handle. The seat is locked in the selected position when the handle is released. The second adjustment handle located at the front of the seat cushion outside trim panel is used to adjust the height of the seat. Lifting up or pressing down the handle repeatedly can respectively heighten or lower the height of the seat. The third adjusting handle behind the vertical adjusting hand wheel is used to adjust the inclination of the seat back. The desired position can be reached by lifting the handle. The seat is locked in the selected position when the handle is released.

Front Passenger Seat

The adjustment mode of passenger seat is the same as that of the driver seat. The seat can be adjusted forward and backward by the handle located at the front of the seat. The lateral adjusting handle can adjust the seat back position.

Service Procedures

Front Seat

Remove

1. If the seat can be adjusted, raise it upward sufficiently.
2. Move the seat backward sufficiently.
3. Remove the 2 bolts securing the front of the seat to the body and dispose of the bolts.
4. Move the seat forward sufficiently.
5. Remove the 2 bolts securing the rear of the seat to the body and dispose of the bolts.
6. Disconnect the seat belt pretensioner connector.
7. Move the seat away from the vehicle.

Refit

1. Place the front seat on its mounting position.
2. Connect the seat belt pretensioner connector and the seat wiring harness connector.

Warning: Always ensure SRS wiring is routed correctly. Be careful to avoidtrapping or pinching the SRS wiring. Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible points of chafing.

3. Secure the seat to the body, then fit 2 new rear retaining bolts and tighten to **40–50Nm**.
4. Move the seat backward sufficiently.
5. Fit 2 new front retaining bolts and tighten to **40–50Nm**.

Back - Front Seat

Remove

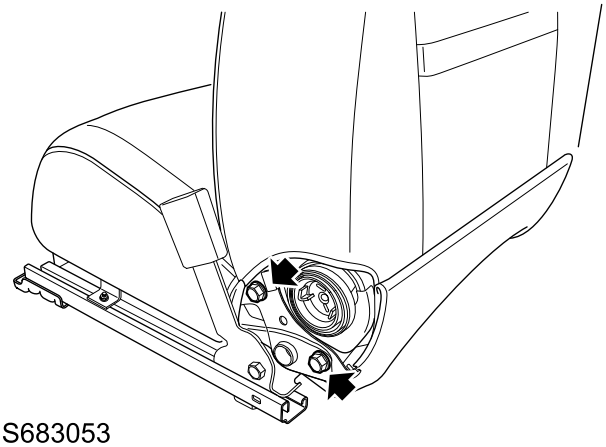
1. Remove the front seat.

☞**Front Seat Remove**

2. Loosen the set screw of the inside trim panel, then remove the inside trim panel.
3. Remove the driver seat outside trim panel.

☞**Driver Seat Outside Trim Panel Remove**

4. Loosen the cable and the J-clip securing the seat back fascia to the seat frame.
5. Remove the 4 bolts connecting the seat cushion assembly to the seat back assembly.



S683053

6. Remove the seat back assembly.

Refit

1. Position the seat cushion assembly and the seat back assembly, fit the 4 bolts and tighten to **40–50Nm**.
2. Secure the seat back fascia to the seat frame with the cable and J-clip.
3. Fit the outside trim panel.

☞**Driver Seat Outside Trim Panel Refit**

4. Position the inside trim panel, then fit the set screw and tighten it.
5. Fit the front seat.

☞**Front Seat Refit**

Back Cover - Front Seat

Remove

1. Remove the front seat back assembly.

☞**Front Seat Back Remove**

2. Pull the headrest up to the uppermost place, then loosen the snap fit fixing the headrest and remove the headrest.
3. Remove the 2 headrest guides.
4. Loosen the seatback fascia J-clip located on the seat lower end.
5. Pull the fascia upward and unfold the C-ring connecting the seatback foam to the inside of the fascia, then note and mark their precise position.
6. Remove the fascia.

Refit

1. Position the fascia to the seat back and set the inside of the fascia to the position marked on the seat back foam with the C-ring.
2. Close the seat back fascia J-clip located on the seat lower end.
3. Secure the seatback fascia to the frame with the J-clip.
4. Fit the 2 headrest guides.
5. Position and fit the headrest.
6. Fit the front seatback assembly.

☞**Front Seatback Refit**

Cushion - Front Seat

Remove

1. Remove the front seat.

☞**Front Seat Remove**

2. Remove the outside trim panel.

☞**Driver Seat Outside Trim Panel Remove**

3. Loosen the cable and J-clip securing the seat back fascia to the seat frame.
4. Remove the 4 bolts connecting the seat cushion assembly to the seat back assembly.
5. Remove the seat cushion assembly.

Refit

1. Fit the 4 bolts connecting the seat cushion assembly to the seatback assembly and tighten to**40–50Nm** .
2. Secure the seatback fascia to the seat frame with the cable and C-ring.
3. Fit the outside trim panel.

☞**Driver Seat Outside Trim Panel Refit**

4. Fit the front seat.

☞**Front Seat Refit**

Cushion Cover - Front Seat

Remove

1. Remove the front seat cushion assembly.

☞**Front Seat Cushion Assembly Remove**

2. Loosen the J-clip and C-ring securing the seat cushion fascia to the seat frame.
3. Unfold the C-ring connecting the seat cushion foam to the inside of the fascia, then note and mark their precise position.
4. Remove the fascia from the seat cushion.

Refit

1. Position the fascia to the seat cushion, and secure the inside of the fascia to the position marked on the seat cushion foam with the C-ring.
2. Secure the seat cushion fascia to the seat frame with the J-clip and the C-ring.
3. Fit the front seat cushion assembly.

☞**Front Seat Cushion Assembly Refit**

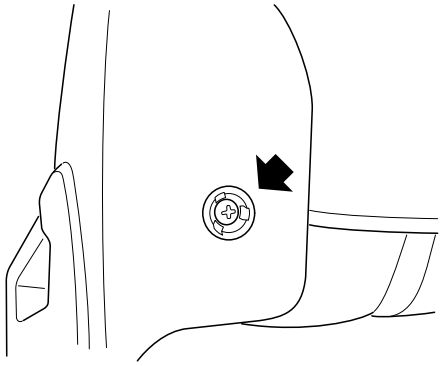
Outside Trim Panel - Driver Seat

Remove

1. Remove the front seat.

☞**Front Seat Remove**

2. Tilt the seat back sufficiently.
3. Remove the outside trim panel set screws.



4. Remove the seat back adjusting handle and the seat height adjusting handle (if equipped).
5. Remove the outside trim panel set screws under the handle.

Refit

1. Position the outside trim panel, then fit the 3 set screws and tighten them.
2. Fit the seat back adjusting handle and the seat height adjusting handle (if equipped).
3. Raise the seat back.
4. Fit the front seat.

☞**Front Seat Refit**

Cushion - Rear Seat

Remove

1. Untie the seat belt buckle from the penetration hole for the seat belt.
2. Pull the front of the seat cushion upward till it is released from the snap ring.
3. After lifting the front of the seat cushion, push the seat cushion backward and lift it until it is released from the 2 shaft sleeves.

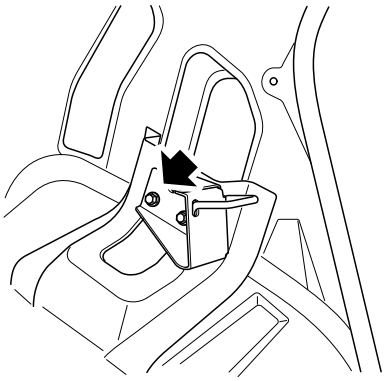
Refit

1. Ensure the seat belt is in the correct path and that the cushion is in correct position.
2. Put the rear of the seat cushion into the 2 shaft sleeves of the body.
3. Fit the front seat cushion into the snap ring.
4. Fit the rear seat revolving shaft with the screws securing the mounting bracket.
5. Pull the seat belt buckle out of the penetration hole for the seat belt buckle of the seat cushion.

Hinge - Rear Seat Back

Remove

1. Fold down the rear seat back assembly.
2. Mark the position of the seat back hinge shackle.
3. Remove the 2 bolts securing the hinge to the body.



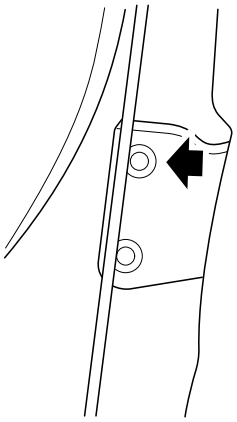
Refit

1. Position the hinge to the body, then fit the bolt and tighten to **22Nm**.
2. Fit the rear seat back assembly.

Back - Rear Seat

Remove

1. Undraw the rear seat back lock handle to unlock the rear seatback.
2. Remove the rear seat pivot mounting support retaining screw.



3. Push backwards the seat back and lift the seat back until it is released from 2 bushings.

Refit

1. Place the seat back into 2 bushings of the body.
2. Fit the rear seat pivot mounting support and fix with screws.
3. Close the rear seat back assembly.

Fixed Windows

Service Procedures

Quarter Window Glass

Remove

1. Disconnect battery earth lead.
2. Remove the rear door partition pillar.

☞**Rear Door Partition Pillar Remove**

3. Remove the quarter window glass weatherstrip.
4. Remove the quarter window glass.

Refit

1. Fit the quarter window glass.
2. Fit the quarter window glass weatherstrip.
3. Fit the rear door partition pillar.

☞**Rear Door Partition Pillar Refit**

4. Connect battery earth lead.

Front Windshield

Remove

1. Remove the air intake grille.

☞**Air Conditioner Air Intake Grille Assembly Remove**

2. Remove the inside rearview mirror.

☞**Inside Rearview Mirror Remove**

3. Remove the weatherstrip around the front windshield.
4. Cut adhesive around the front windshield with a scraper.
5. Remove the windshield from the vehicle.
6. Clear adhesive on the front windshield with a blade.
7. Clear adhesive on the front windshield frame with a blade.

Refit

1. Fit a new weatherstrip on the front windshield.
2. Apply cleaner to the area around the front windshield.
3. Coat the body primer around the body window frame.
4. Coat the area around the front windshield with glass primer.
5. Apply adhesive to the front windshield.
6. Fit the front windshield into the front windshield frame.
7. Apply tape to the weatherstrip, front windshield and front windshield frame to secure the front windshield.
8. Dry adhesive for 24 hours.
9. Remove the tape.
10. Pour water on the front windshield to check for water leak. If there is water leak, dry the front windshield and seal the leakage with adhesive. If water leak continues, remove the front windshield and repeat the whole repair procedures.
11. Fit the inside rearview mirror.

☞**Inside Rearview Mirror Refit**

12. Fit the air intake grille.

☞**Air Conditioner Air Intake Grille Assembly Refit**

Rear Windshield

Remove

1. Disconnect battery earth lead.
2. Disconnect the rear windshield electrical connector.
3. Remove the rear windshield wiper motor.

☞**Rear Windshield Wiper Motor Remove**

4. Remove the weatherstrip around the rear window glass.
5. Cut adhesive around the rear windshield with a scraper.
6. Remove the rear windshield from the vehicle.
7. Clear adhesive on the rear windshield with a blade.
8. Clear adhesive on the rear windshield frame with a blade.

Refit

1. Fit the NEW weatherstrip on the rear window glass.
2. Apply cleaner to the area around the rear windshield.
3. Coat the body primer around the body window frame.
4. Coat the area around the rear windshield with glass primer.
5. Apply adhesive to the rear windshield.
6. Fit the rear windshield into the rear windshield frame.
7. Apply tape to the weatherstrip, rear windshield and rear windshield frame to secure the rear window glass.
8. Dry adhesive for 24 hours.
9. Remove the tape.
10. Pour water on the rear windshield to check for water leak. If there is any water leak, dry the rear windshield and seal the leakage with adhesive. If water leak continues, remove the rear windshield and repeat the whole repair procedures.
11. Fit the rear windshield wiper motor.

☞**Rear Windshield Wiper Motor Refit**

12. Connect the rear windshield electrical connector.
13. Connect battery earth lead.

Bumpers, Fascias and Grille

Specifications

Torque

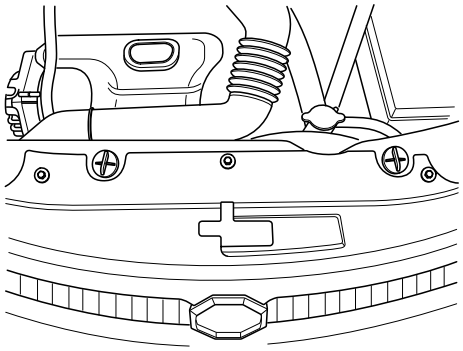
Description	Value
Screw - bulkhead lower rail	3–5Nm
Screw - front bumper support bracket	3–4Nm
Screw - bulkhead	9–10Nm
Nut - front bumper armature	40–50Nm
Screw self-tapping - rear bumper support bracket	3–4Nm
Screw self-tapping - body	3–4Nm
Nut - rear bumper armature	19–23Nm

Service Procedures

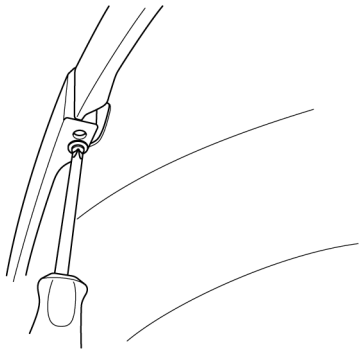
Front Bumper

Remove

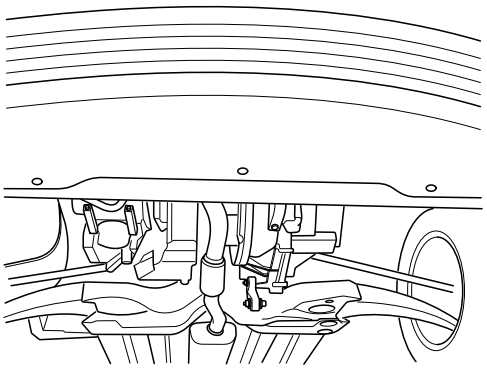
1. Disconnect battery earth lead.
2. Remove the 3 screws connecting the front bumper to the modular front end panel.



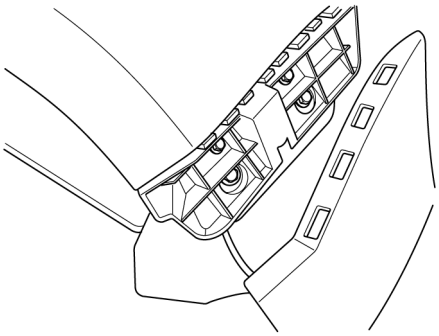
3. Remove the 2 screws securing both sides of the bumper to the bumper bracket.



4. Remove the 3 screws under the front bumper.



5. Turn over all the clips on both sides of the front bumper bracket.



6. Disconnect the joining between the vehicle main wiring harness joint and the fog lamp joint.
7. Remove the front bumper assembly.

Refit

1. Connect the vehicle main wire harness joint to the fog lamp joint.
2. Fit the 3 snap fits from the front into the hole in the MFE bottom bracket.
3. Secure the middle of the front bumper to the MFE with 3 screws according to specified torque, and tighten them to **3–5Nm**.
4. Snap the beads on both sides of the front bumper into the bumper bracket, make sure that the beads are snaped completely and check alignment of the bumper against the fender platform.
5. Secure both sides of the bumper on the bumper bracket with screws according to the specified torque, and tighten them to **3–4Nm**.
6. Fit the 3 bolts on the upper MFE, and tighten to**9–10Nm**
7. Connect battery earth lead.

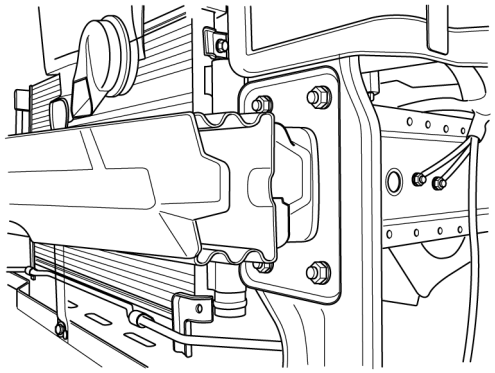
Front Armature

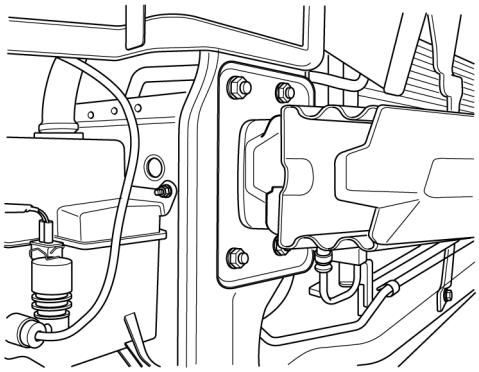
Remove

1. Disconnect the electrical connector.
2. Remove the front bumper.

☞**Front Bumper Remove**

3. Remove the 8 bolts and the front bumper armature.





4. Remove the front armature assembly.

Refit

1. Align the holes on front armature assembly back panel with the weld bolt on the front of the longitudinal member, and make sure the tow hook is on the left side of the vehicle.
2. Fit the front bumper.

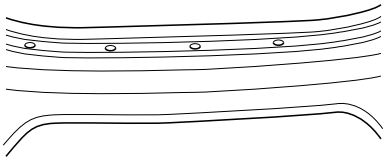
☞**Front Bumper Refit**

3. Fit the 8 flange nuts in left and right on the weld bolts according to the specified torque and sequence, and tighten to **40–50Nm**.

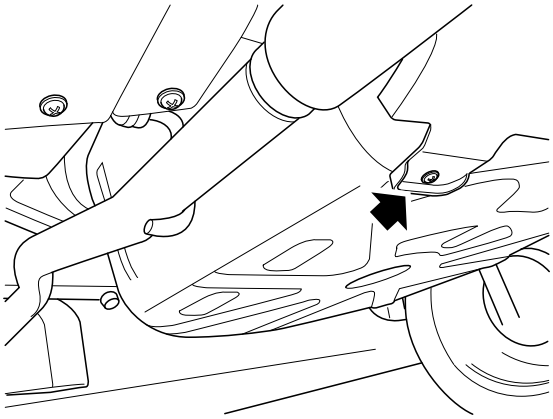
Rear Bumper

Remove

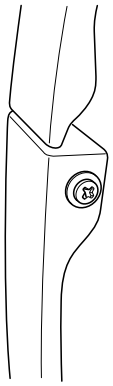
1. Open the endgate.
2. Remove the 5 cotter pins from the rear bumper.



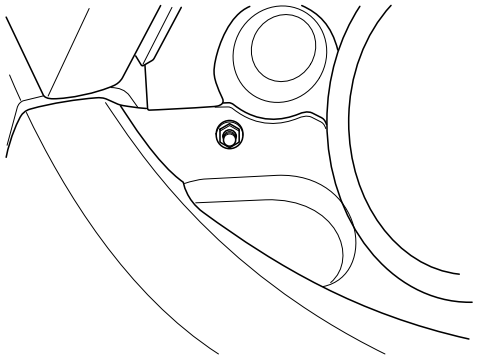
3. Remove the 2 plastic screws from the 2 holes on the bottom of the rear bumper.



4. Remove the 2 self-tapping screws from the bumper bracket of both sides.



5. Turn over all the clips on the rear bumper and the bracket.
6. Remove the nuts on both sides of the upper bumper.



7. Remove the rear bumper assembly.

Refit

1. Align both sides of the rear bumper with the clips on the rear bumper bracket, slap the rear bumper into all the clips, and make sure there is no problem about the alignment of rear bumper against the bodyside and its platform.
2. Fit the 2 self-tapping screws according to specification into the clips on both sides of the bumper bracket, and tighten to **3–4Nm**.
3. Fit the 2 plastic screws according to specification into the 2 plastic nuts on the bottom of the bumper.
4. Press the 5 cotter pins into the holes on the rear bumper and the body.
5. Fit the nuts on both sides of the bumper according to specification on the weld bolts, and tighten to **3–4Nm**.

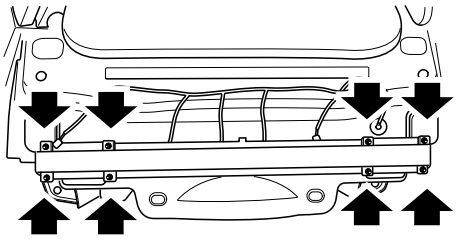
Rear Armature

Remove

1. Remove the rear bumper.

☞**Rear Bumper Remove**

2. Remove the 8 blots and shims, and remove the rear armature assembly.



Refit

1. Align the hole on the rear armature back panel with the weld bolt on the tail of the longitudinal member.
2. Fit the 8 shims and nuts in left and right on the weld bolts according to the specified torque and sequence, and tighten to **19–23Nm**.

Exterior Trim and Paneling

Service Procedures

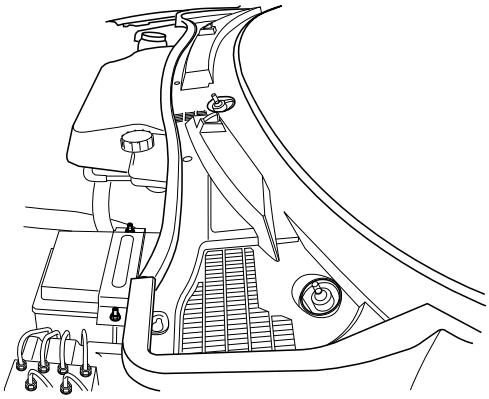
Air Conditioning Plenum Cover Assembly

Remove

1. Lift the bonnet and support it with the strut bar.
2. Remove the windshield wiper arm assembly.

☞ **Windshield Wiper Arm Assembly Remove**

3. Remove the seal.



4. Remove the snap fits securing the air conditioning plenum cover to the body, disconnect the windshield washer fluid hose, and take away the air conditioning plenum cover.

Refit

1. Secure the air conditioning plenum cover with 5 snap fits.
2. Fit the seal.
3. Connect the windshield washer fluid hose.
4. Fit the windshield wiper arm assembly.

☞ **Windshield Wiper Arm Assembly Refit**

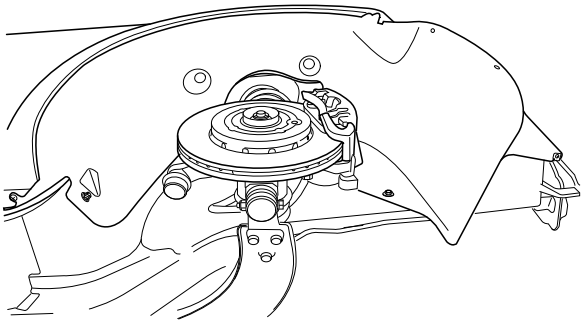
Front Wheelhouse Liner

Remove

1. Lift and support the vehicle properly.
2. Remove the front wheels.

☞ **Wheels Remove**

3. Remove the front splash shield (if equipped).
4. Remove the 3 nuts, 1 snap fit and 4 screws.



5. Remove the front wheelhouse liner.

Refit

1. Fit the nuts, and secure the screw to**3–4Nm**.
2. Fit the front wheelhouse liner.
3. Fit the front splash shield (if equipped).
4. Fit the front wheels.

☞ **Wheel Refit**

5. Lower the vehicle.

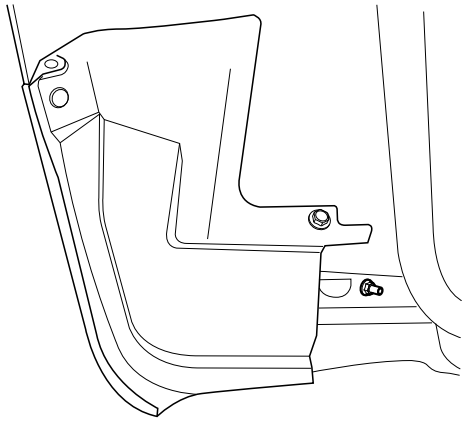
Rear Wheelhouse Liner

Remove

1. Lift and support the vehicle properly.
2. Remove the rear wheels.

Wheels Remove

3. Remove the rear splash shield (if equipped).
4. Remove the 2 screws and 3 snap fits, take away the rear wheelhouse liner.



Refit

1. Fit the snaps and secure the rear wheelhouse liner to**3–4Nm**.
2. Fit the rear splash shield.
3. Fit the rear wheels.

Wheel Refit

4. Lower the vehicle.

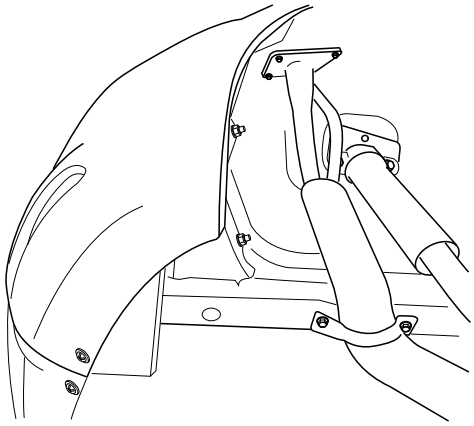
Under Flow Duct

Remove

1. Lift the vehicle on the lifting platform.
2. Remove the snaps and screws, and remove the under flow duct.

Refit

1. Position the under flow duct, and secure the screws to**3–4Nm**.
2. Lower the vehicle.



Mirrors

Specifications

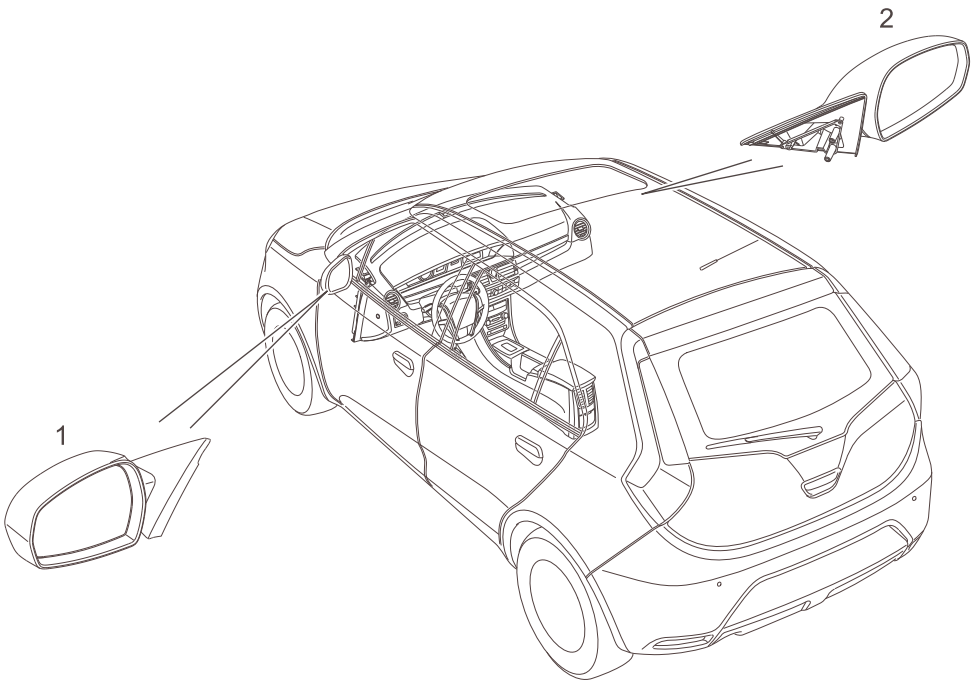
Torque

Description	Value
Screw - exterior mirror	9–10Nm

Description and Operation

System Layout

Outside Rearview Mirror Layout



1. Left Side Outside Rearview Mirror Package
2. Right Side Outside Rearview Mirror Package

Service Procedures

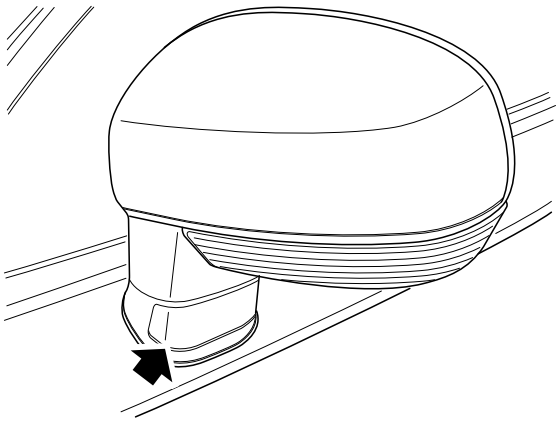
Exterior Rearview Mirror Assembly

Remove

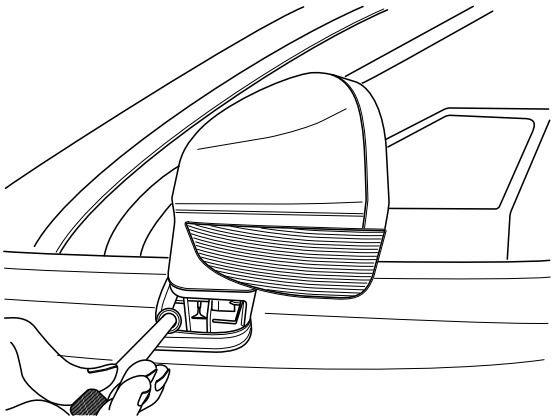
1. Remove the front door interior trim panel.

☞Remove of Front Door Interior Trim Panel

2. Pry the outside trim shell.



3. Remove the door trim panel and the waterproof film, now you can see the plug of the exterior review mirror connector, disconnect the connector.
4. Remove the 2 bolts securing the exterior review mirror to the body, and remove the exterior review mirror assembly.



Refit

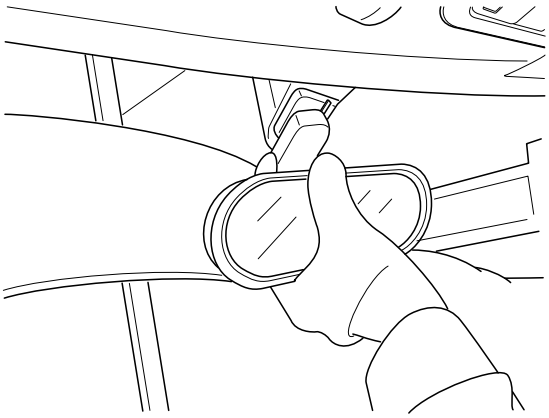
1. Position the exterior review mirror with the location pin on it to corresponding location hole on the door, fit 2 bolts, and tighten to **9–10Nm**.
2. Connect the exterior review mirror connector, and fit the waterproof film.
3. Fit the outside trim shell.
4. Fit the front door interior trim panel.

☞Front Door Interior Trim Panel Refit

Manual Dimming Interior Review Mirror Assembly

Remove

1. Knock the inside review mirror assembly down with a rubber hammer, and it can be removed from the socket.



Refit

1. Fit the inside review mirror on the mounting bracket, carefully push it into the slot and it will be clamped into position.

Roof

Specifications

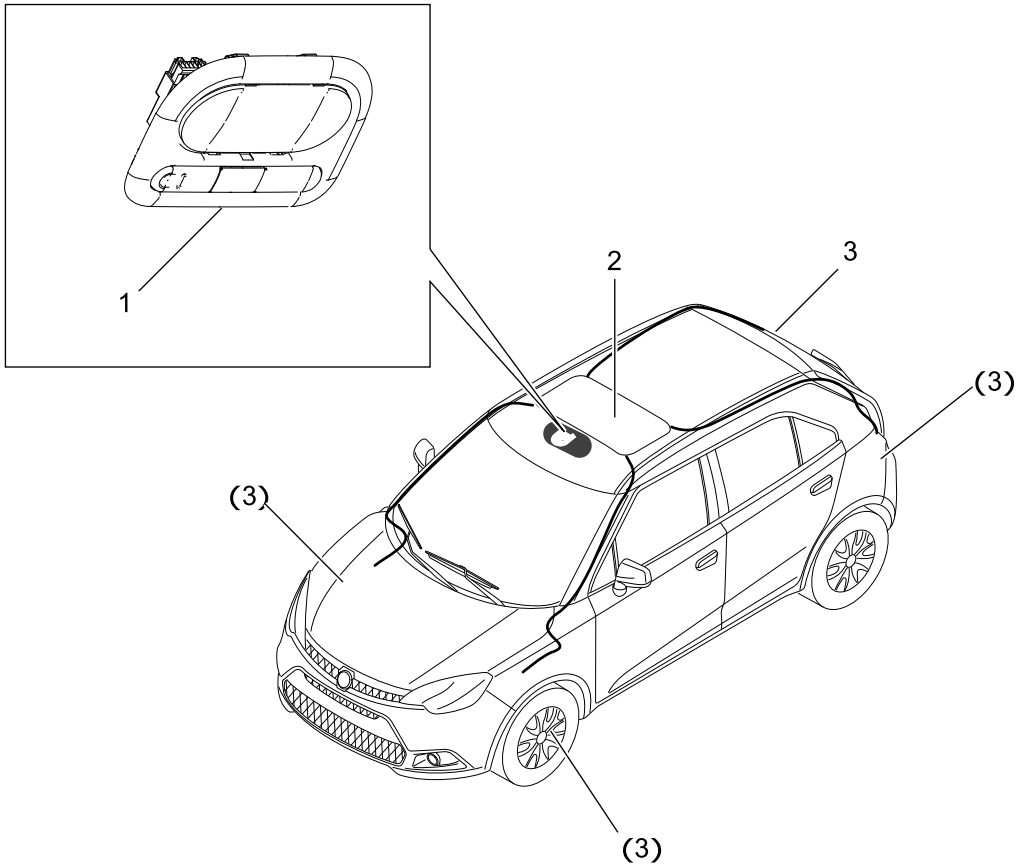
Torque

Description	Value
Screw - sunroof assy-comp elec glass	8±1Nm
Screw - sunroof glass	4.5±0.5Nm

Description and Operation

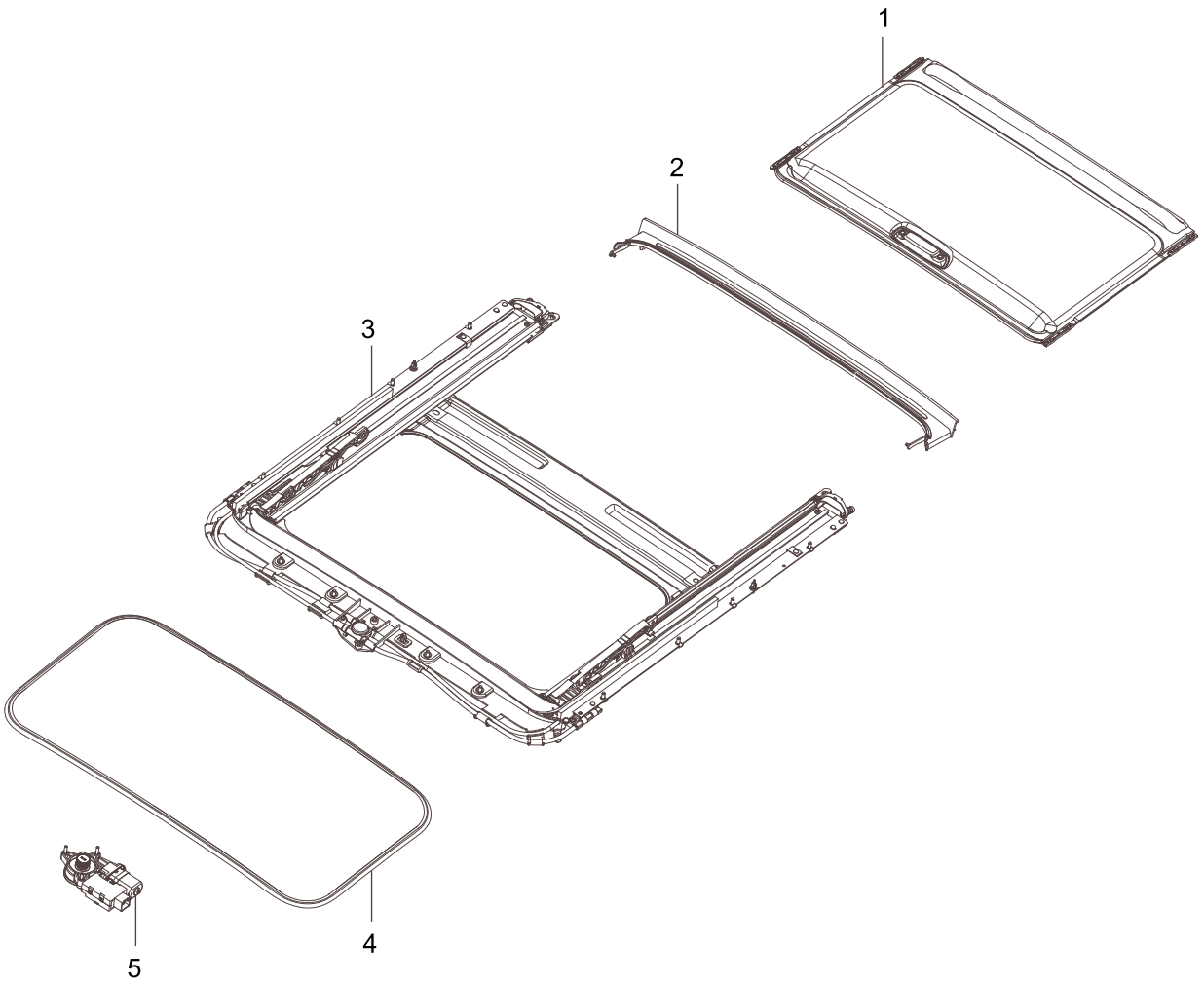
System Layout

Sunroof Layout



1. Sunroof Knob Switch
2. Sunroof Assembly
3. Drain Tubes (Four

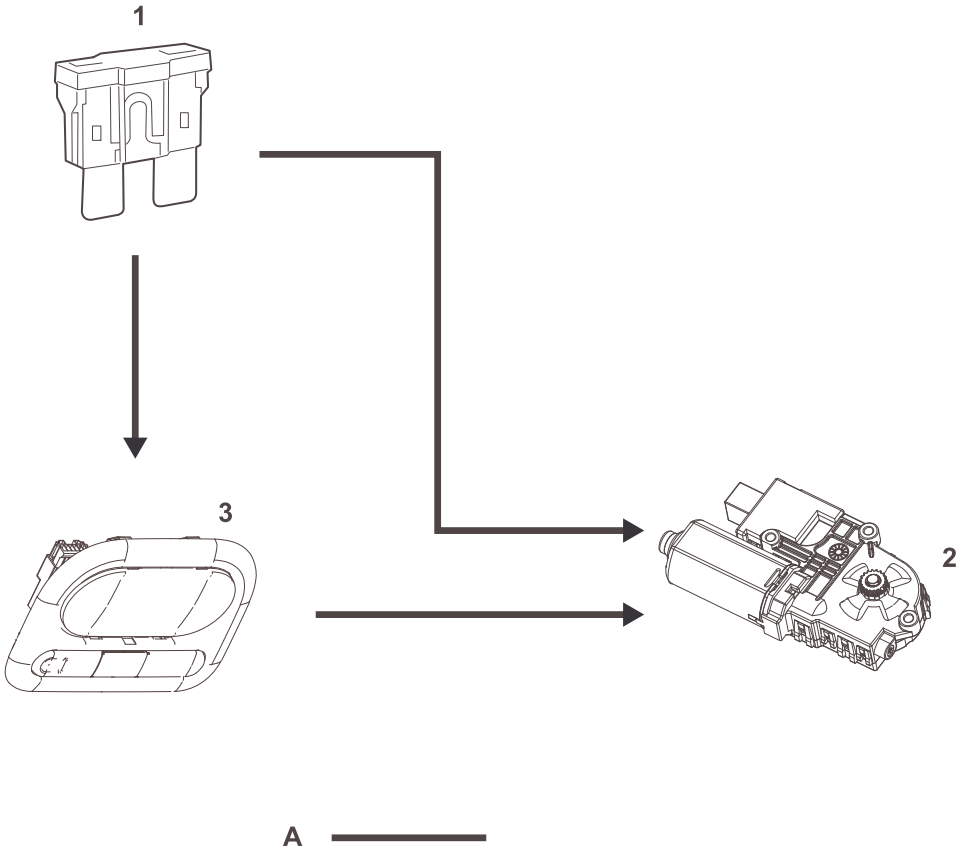
Sunroof Assembly Structural Drawing



1. Sunshade Assembly
2. Drain Gutter
3. Frame Assembly
4. Sunroof Glass Assembly
5. Sunroof Electronic Control Unit (**ECU**) and Motor

System Control Diagram

Sunroof System Control Diagram



A = Handwire

1. Fuse
2. Sunroof Electronic Control Unit (**ECU**) and Motor
3. Sunroof Knob Switch

Description

General Description

The sunroof is motor-driven with tilt and slide operation mode, consisting of the wind deflector, the glass panel and the sun visor.

This sunroof system has one-touch slide open function. All operations about this sunroof system can be carried out through a push-button switch.

Switch

This push-button switch controls the tilt and slide operation of the sunroof.

The switch controls the contact within the switch body, sends the ground output generated to the motor and driving devices in the sunroof assembly. Sunroof Electronic Control Unit (**ECU**) analyzes the ground signal, then supplies power to the motor to drive the sunroof glass panel move in the direction required.

Sunroof Control Signal

Pin 5	Pin 10	Description
0	0	No Action
1	0	Slide open/tilt close
0	1	Slide close/tilt open
0 = open circuit; 1 = ground		

Sunroof Assembly

The sunroof assembly consists of: 1 glass panel assembly, 1 sun visor assembly, 1 frame assembly between the roof and the roof inner garnish, and 1 wind deflector assembly and inner garnish molding assembly which are mounted on this frame.

The frame assembly consists of front pillar, center pillar, black aluminum track slide (both sides), and 1 drain gutter located on the center pillar. The front pillar, together with the front drain gutter and the motor bracket, is one-piece injection moulding, connected to the black track slide (both sides) with screws. The aluminum track slide is made of black anodising aluminium alloy material. The center pillar is made of galvanized steel, the moulding is connected to the aluminum track slide by rivet-free punching-riveting method. The rear drain duct is made of POM material, screw-locked to the aluminum track slide by screw securing method. The inner garnish molding is made of PVC material, embedded on the front pillar, center pillar and the black aluminum track slide (both sides).

The wind deflector is made of black anodising aluminum alloy material with moulding spring, which is mounted on the aluminum track slide. The tilt height of the wind deflector is 15mm.

The sunroof glass panel is made of safety glazing material with the thickness of 4mm; the entire glass panel is secured to the sunroof mechanical device with 4 M5 screws, and the center pillar has closure effect on the withdrawing zone of the sun visor and the sunroof glass panel.

The sun visor locates in the slot along the frame side face inner edge, and the sun visor stop block locates at the rear end of the sun visor; when the sunroof is closed, the sun visor stop block is at the rear end of the sunroof rear drain gutter. When the sunroof is opened by the method of sliding, the sun visor stop block makes the sun visor open together with the sunroof glass panel.

This sunroof assembly is designed with drainage control system, the water can be bypassed to 2 accumulation area of the front pillar and the rear drain gutter, then the water is routed to the drain gutter in the side of the frame, directed forward/backward into the drain duct, where it is exhausted.

Operation

General Description

After starting the vehicle, the sunroof can be operated.

Sunroof Switch

When pressing down the sunroof switch, the ground output signal is analyzed by ECU in the sunroof control box, and then direct the motor to drive the sunroof glass panel to the required position.

One-touch Tilt Open/Close Operation

On condition that the sunroof glass panel is closed, pressing and then quickly releasing the switch shown in the figure can make the sunroof glass panel tilt and open. When the sunroof is in tilt open mode, pressing any switch will immediately stop the sunroof from moving. During any operations said above, if the switch is held up to 0.4 second and then released, the sunroof will immediately stop moving. Then press switch 1 or 2, the sunroof will move to its full tilt or closed position. This sunroof system has one-touch tilt function.

One-touch Slide Open/Close Operation

On condition that the sunroof glass panel is closed, pressing and then quickly releasing the switch shown in the figure can make the sunroof glass panel slide backward and open. When the sunroof is in slide open mode, pressing any switch will immediately stop the sunroof from moving. During any operations said above, if the switch is held up to 0.4 second and then released, the sunroof will immediately stop motion. Then press switch 2 or 1, the sunroof will move to its full open or closed position. This sunroof system has one-touch open/close function.

Sunroof Anti-trap Function

The sunroof is with anti-trap function during its closing or going down, the anti-trap force is 100N.

When encountered with a force of 100N, the sunroof will start the anti-trap function at any position in the process of its sliding closed or going down, when the sunroof glass panel will automatically slide fully open or tilt open. In order to make sure that the sunroof glass panel can be fully closed, there is no anti-trap function when the glass panel front edge is 4 mm away from the roof front edge so that the motor can apply a higher load than the required force to fully close the sunroof glass.

Sunroof Motor Thermal Protection

ECU controls the operation of the motor according to the following principles to prevent the motor from overheat damage.

1. The sunroof can continuously operate for no longer than 30 seconds, otherwise it will stop operating.
2. The minimum cooling time is 30 seconds.

Sunroof Initialization

In case that the sunroof operational procedure is disturbed and the sunroof is not at its original zero position, the sunroof ECU need to be initialized. The procedures are as follows:

1. Press down tilt/slide close, the sunroof moves to the tilt position.
2. Press again the tilt/slide close and hold for 5 seconds, the sunroof will move in the direction of TILT UP, then turn back to the tilt position and stop. Release the switch, to finish the sunroof initialization.

Service Procedures

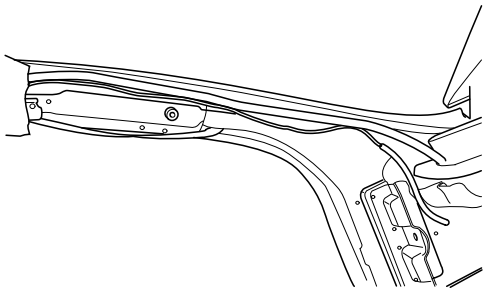
Sunroof Assembly

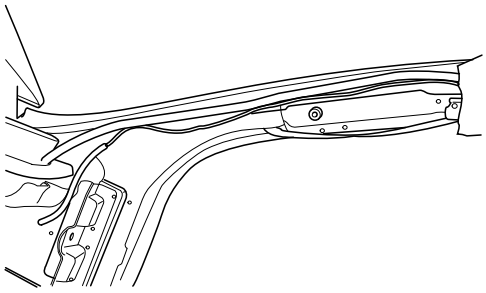
Remove

1. Remove the roof interior trim.

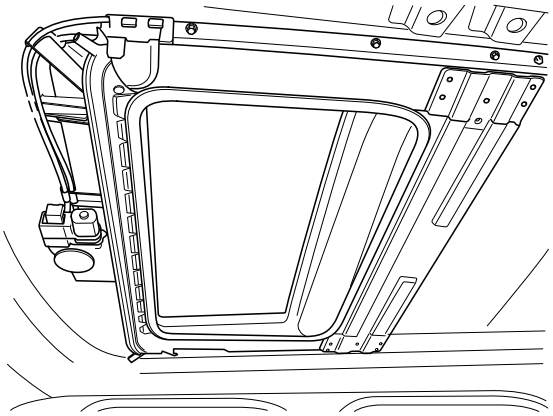
☞Roof Interior Trim Remove

2. Disconnect the 4 drain tube connector from the sunroof assembly.





3. With the help of the assistant, remove the 12 screws securing the sunroof assembly to the body.



4. Disconnect the motor connector, and remove the sunroof assembly.

Refit

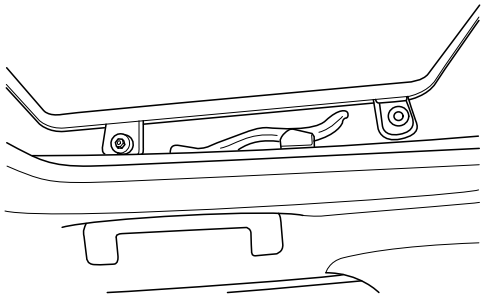
1. Connect the motor connector.
2. With the help of the assistant, position the sunroof assembly to the body, fit the 12 screws, and tighten them to **8±1Nm**.
3. Connect the drain tube to the sunroof assembly.
4. Fit the roof interior trim.

☞Roof Interior Trim Refit

Sunroof Glass Assembly

Remove

1. Disconnect battery earth lead.
2. Open the sunroof sun visor assembly.
3. Remove the 6 screws securing the glass assembly.



4. Remove the sunroof glass assembly.

Refit

1. Position the sunroof glass assembly onto the body, and fit the screws and DO NOT tighten them temporarily.
2. Align the glass assembly with the body, the alignment point should be 300 mm away from the two sides of the body centreline.
3. Tilt down the front edge of the sunroof glass, which has been aligned with the body, to form a 1.0 mm height difference. As shown in the figure.
4. Tilt up the rear edge of the sunroof glass, to form a 1.0 mm height difference. As shown in the figure.
5. To test the match of the roof and sunroof, open and close the sunroof. Insert a piece of paper between the sunroof and weatherstrip, close the sunroof glass and draw out the paper. If a slight resistance exists when you are drawing out the paper, it indicates a correct match.
6. Fit the mounting screws of the sunroof glass assembly, and tighten them to**4.5±0.5Nm**.
7. Connect the battery earth lead.
8. Refer to Description and Operation to initialize the sunroof motor.
9. Operate the sunroof to check for the alignment condition.
10. Close the sunroof sun visor.

Sunroof Glass Weatherstrip

Remove

1. Remove the sunroof glass assembly.

☞**Sunroof Glass Assembly Remove**

2. Loosen the weatherstrip from the glass assembly, and remove the weatherstrip from the seal groove.

Refit

1. Engage the weatherstrip into the glass seal groove, and make sure that the weatherstrip matches properly around the sunroof glass.
2. Fit the sunroof glass assembly.

☞**Sunroof Glass Assembly Refit**

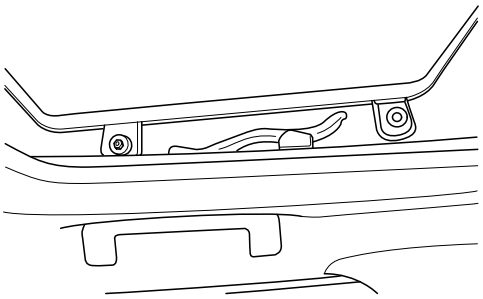
Track Type Sunroof Sun Visor Assembly

Remove

1. Remove the sunroof glass assembly.

☞**Sunroof Glass Assembly Remove**

2. Remove the 4 screws securing the LH sunroof slider.



3. Remove the LH sunroof slider.
4. Loosen the RH sun visor from the track.
5. Put the RH track away.

Refit

1. Make sure that the RH track matches the position.
2. Position the sun visor in the RH track, fit the LH slider and secure it with screws.
3. Make sure that the LH rear slider is located at the back of the sunroof retainer.
4. Try to operate the sun visor to check for the match condition.
5. Fit the sunroof glass assembly.

☞**Sunroof Glass Assembly Refit**

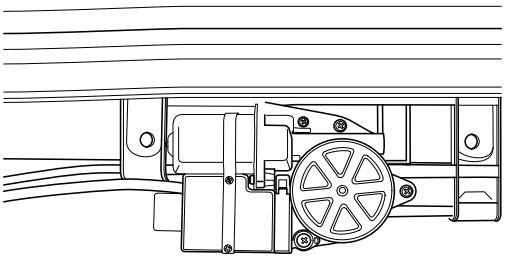
Sunroof Motor Assembly

Remove

1. Disconnect battery earth lead.
2. Remove the front reading lamp assembly.

☞**Front Reading Lamp Assembly Remove**

3. Remove the 3 screws securing the motor.



4. Disconnect the connector and remove the motor.

Refit

1. Position the sunroof motor, connect the connector, and engage the motor drive gear into the sunroof cable.
2. Fit and fasten the 3 sunroof motor mounting screws.
3. Turn on the ignition switch, when the sunroof switch is in the slide close or tilt open position, hold it for 15 seconds, and then the motor initialization is completed.
4. Fit the front reading lamp assembly.

☞**Front Reading Light Assembly Refit**

Sunroof Front Drain Tube

Remove

1. Remove the roof interior trim.

☞**Roof Interior Trim Remove**

2. Remove the A post upper trim panel assembly.
3. Remove the A post lower trim panel assembly.
4. Remove the instrument panel assembly.

☞**Instrument Panel Assembly Remove**

5. Remove the drain tube from the sunroof.
6. Take the drain tube out of the drain tube snap fits.
7. Remove the drain water valve connected to the drain tube from the body.
8. Remove the drain water valve from the drain tube, and put it away.

Refit

1. Fit the snap fits for the front drain tube on corresponding positions on the A post, with the iron snap fits being above of the plastic snap fits.
2. Place the upper end of the front drain tube (with affiliated casing) on the drain outlet located at the two corners of the front of the sunroof.
3. According to corresponding marks on the drain tube, fit the drain tube into corresponding snap fits.
4. Insert the drain water valve to the appropriate position of the body.
5. Connect the lower end of the drain tube to the drain water valve.
6. Fit the instrument panel assembly.

☞**Instrument Panel Assembly Refit**

7. Fit the A post upper trim panel assembly.
8. Fit the A post lower trim panel assembly.
9. Fit the roof interior trim.

☞**Roof Interior Trim Refit**

Sunroof Rear Drain Tube

Remove

1. Remove the roof interior trim.

☞**Roof Interior Trim Remove**

2. Remove the rear seat back assembly.
3. Remove the C post upper trim panel assembly.
4. Remove the C post lower trim panel assembly.
5. Remove the rear drain tube from the sunroof.
6. Take the drain tube out of the drain tube snap fits.
7. Remove the drain water valve on the rear drain tube from the body.
8. Remove the drain water valve from the drain tube, and put it away.

Refit

1. Fit the plastic snap fits for the rear drain tube on the corresponding position on the C post.

Caution: The opening end of the snap fit should be facing upward.

2. Place the upper end of the rear drain tube (with affiliated casing) on the drain outlet located at the two corners of the rear of the sunroof.
3. According to corresponding marks on the drain tube, fit the drain tube into corresponding snap fits.
4. Insert the drain water valve to the appropriate position of the body.
5. Pass the rear drain tube bellow through the rear drain tube.
6. Connect the lower end of the drain tube to the drain water valve.
7. Fit the C post upper trim panel assembly.
8. Fit the C post lower trim panel assembly.
9. Fit the rear seat back assembly.
10. Fit the roof interior trim.

☞**Roof Inner Garnish Refit**

Wipers and Washer

Specifications

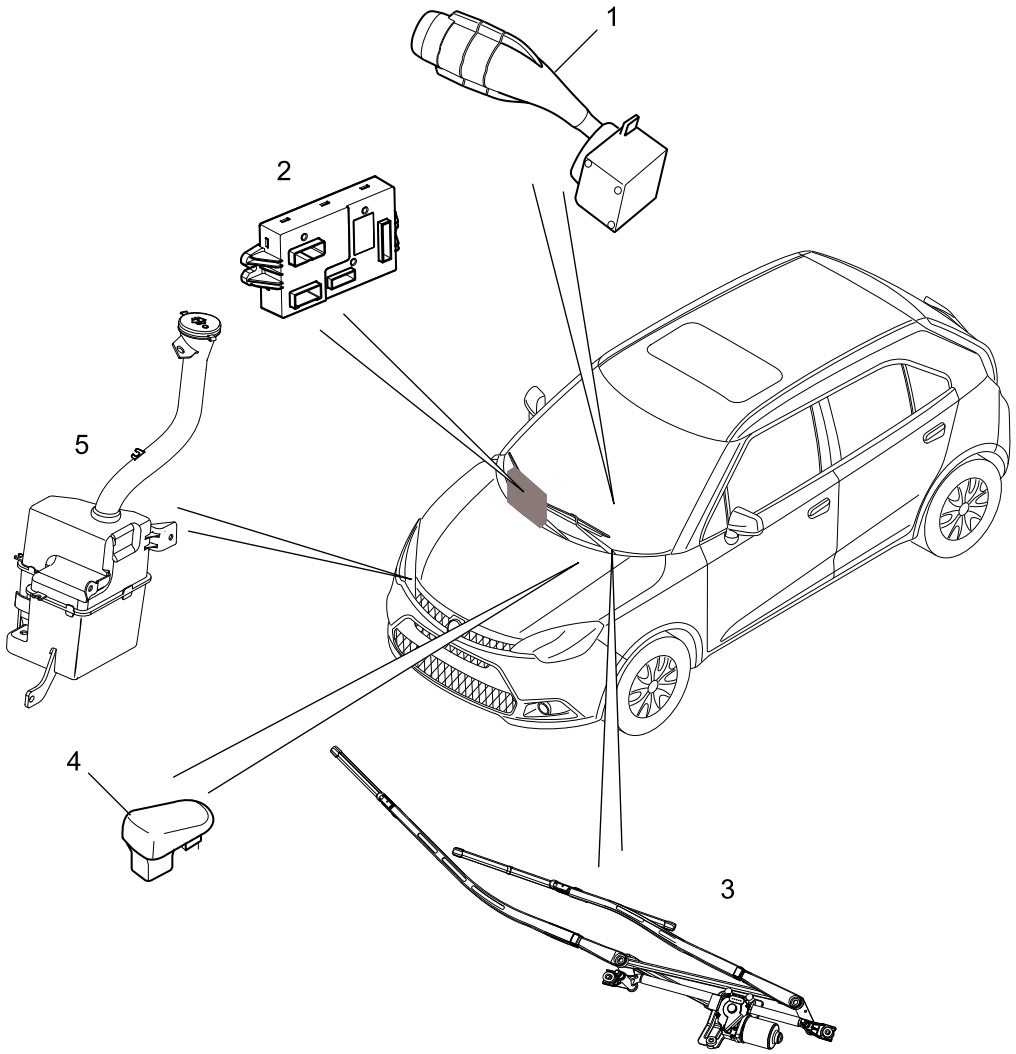
Torque

Description	Value
Nut - front windscreen wiper arm	14–16Nm
Screw - motor and Linkage	7–10Nm
Screw - washer tank	7–10Nm
Screw - washer filler neck	4–6Nm
Nut - rear wiper mounting bracker	6–8Nm

Description and Operation

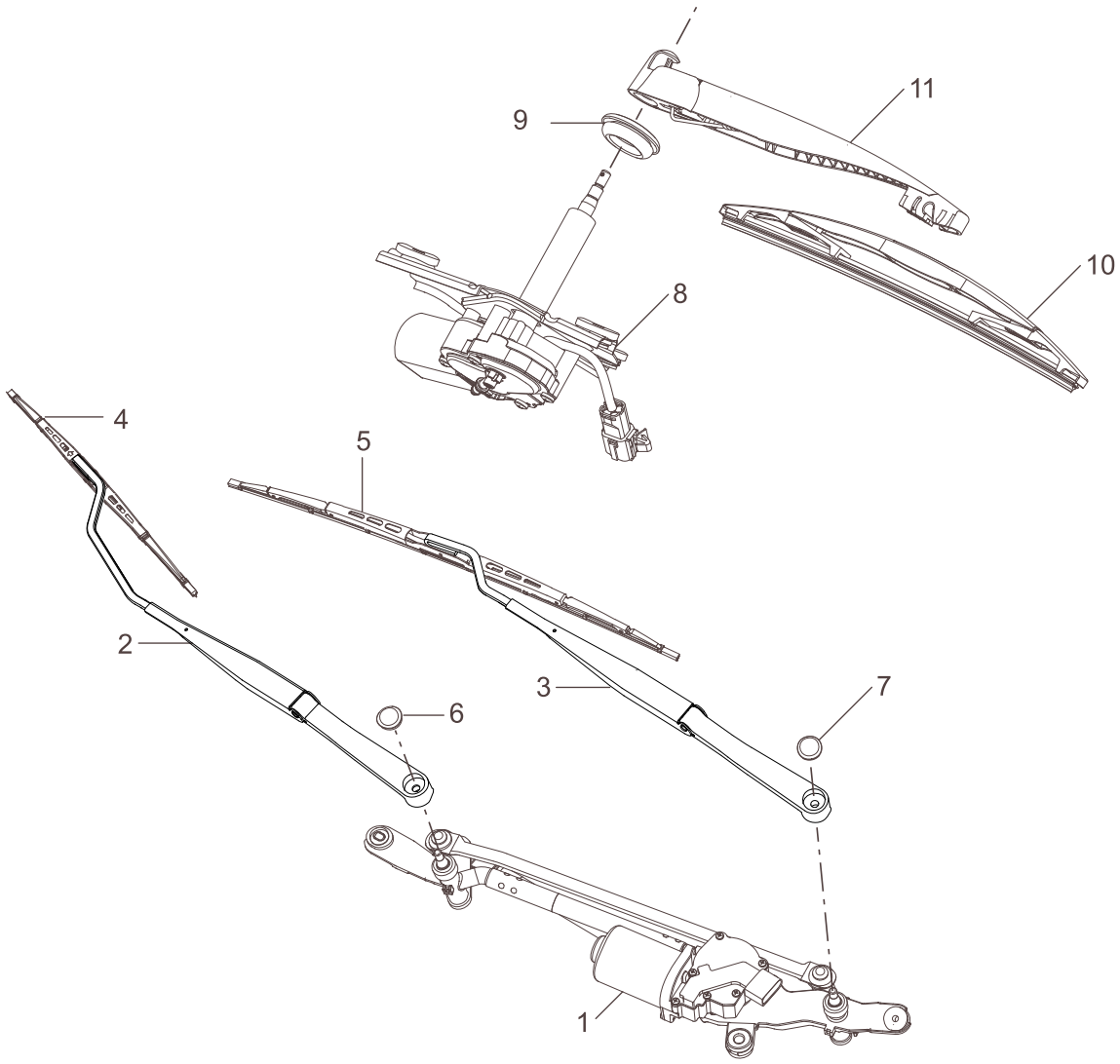
System layout

Wiper and washer layout



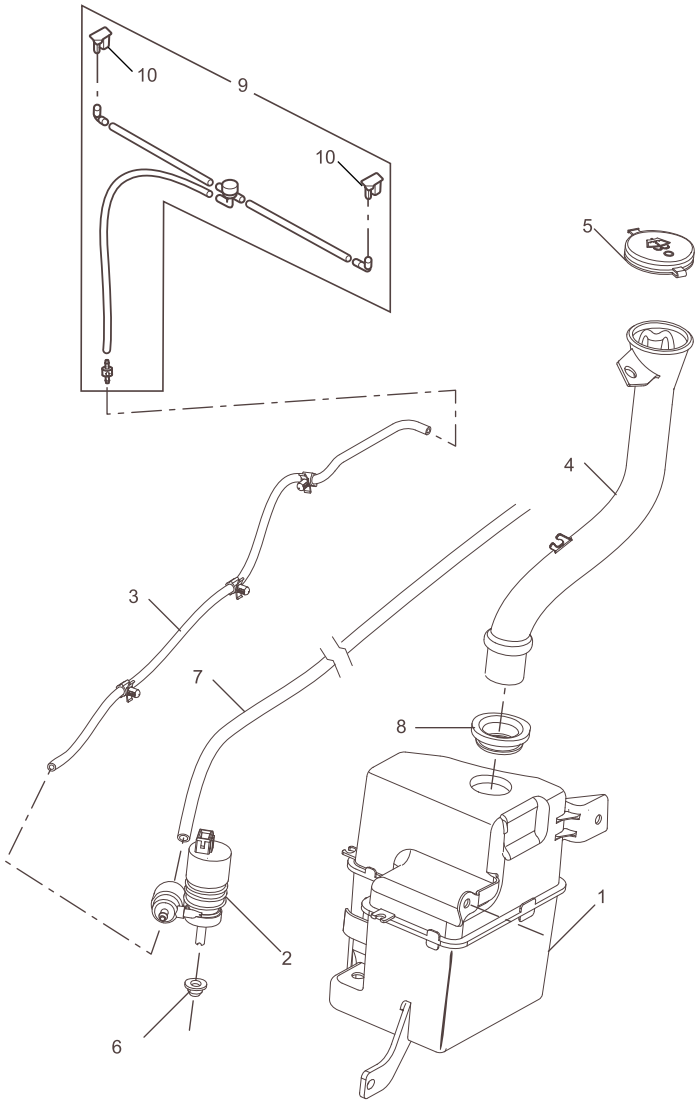
1. Wiper/Washer Selector Lever Switch
2. Body Control Module (**BCM**)
3. Windshield Wiper and Motor Assembly
4. Front Windshield Washer Nozzle
5. Washer Pot and Washer Pump

Wiper decomposition diagram



1. Front Wiper Motor
2. Passenger Side Wiper Arm Assembly
3. Driver Side Wiper Arm Assembly
4. Passenger Side Wiper Blade Assembly
5. Driver Side Wiper Blade Assembly
6. Shaft Cover
7. Shaft Cover
8. Rear Wiper Motor
9. Rear Windshield Seal Ring
10. Rear Wiper Blade
11. Rear Wiper Arm

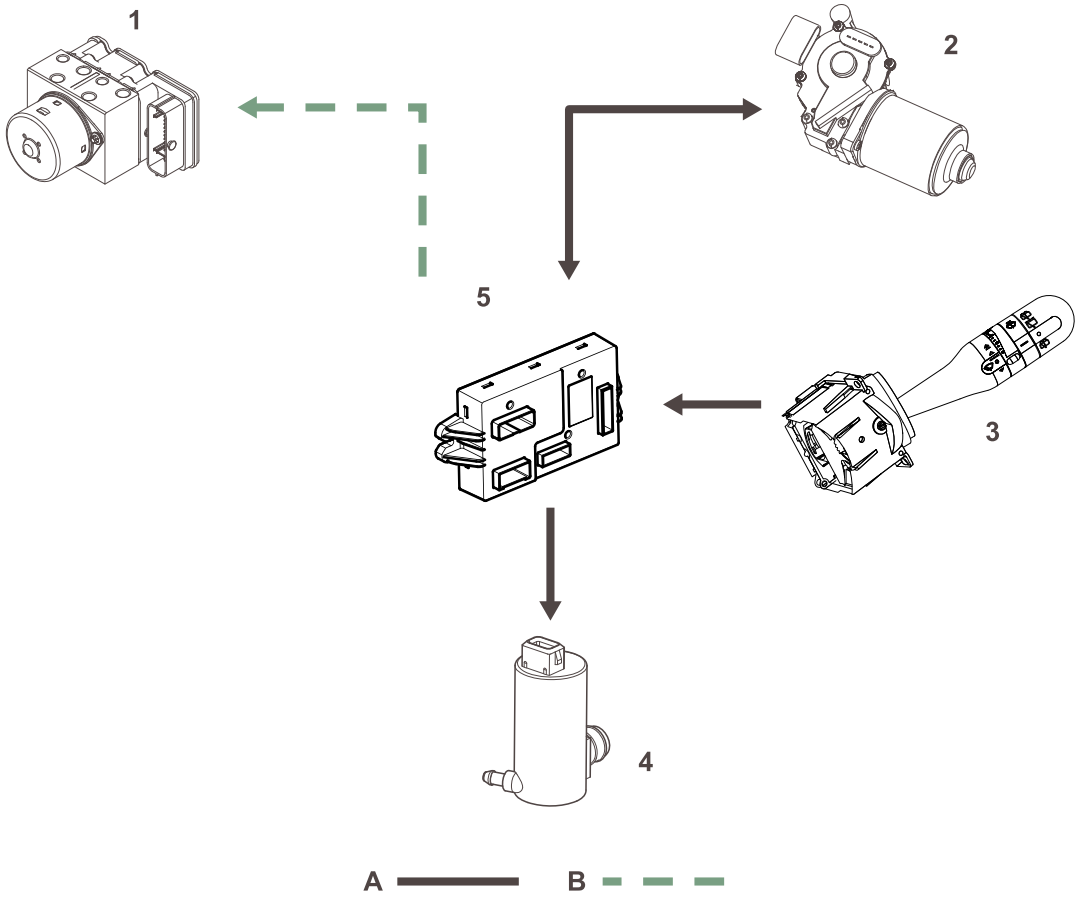
Washer decomposition diagram



1. Washer Pot
2. Windshield Washer Pump
3. Front Windshield Washer Pot Hose
4. Washer Pot Neck
5. Washer Pot Cover
6. Front Windshield Washer Nozzle
7. Endgate Washer Pot Hose
8. Washer Pot Neck Seal Ring
9. Front Windshield Washer Hose Assembly
10. Washer Pot Hose

Control diagram of system

Wiper and washer control diagram



*A = Handwire; B =**CAN**High-speed Bus*

1. **ABS**/**DSC**Control Module
2. Wiper Motor
3. Wiper/Washer Selector Lever Switch
4. Washer Pump
5. Body Control Module (**BCM**)

Description

General Description

Wiper and washer system is controlled by the body control module (**BCM**), and operates after it received a command from the driver or rain sensor (if equipped). Wiper functions are all controlled by wiper/washer lever switch assembly on the right side of the steering wheel. Wiper and washer system contains:

- Wiper Motor
- Wiper Link Mechanism
- Wiper Arm and Wiper Blade
- Washer nozzle
- Washer Fluid Reservoir and Washer Pump
- Wiper/Washer Lever Switch

It is possible to operate the wiper function after the wireless key is inserted. The wiper functions are all paused immediately after starting engine.

Body Control Module, Load Management.

Read the diagnosis messages of the wiper and washer system by the diagnostic tool.

Wiper/Washer Lever Switch

Wiper lever switch contains a 5th toggle switch and a rotary switch. The switch position of intermittent, low speed and high speed wiper operation and "OFF" position are locked, but the temporary operation switch and programmed washer/wiper operation switch are unlocked. The rotary switch can be used to select the intermittent delay time or to adjust the sensitivity of the rain sensor (if equipped).

Wiper Operation Mode

This wiper system supports the following operation mode:

- Programmed Washer/Wiper Operation
- Temporary Wiper Operation
- Low Speed Wiper Operation
- High Speed Wiper Operation
- Intermittent Wiper Operation (with delay time adjustment function due to speed, or function to adjust the wiper operation according to the rain sensor, if equipped)

Programmed Washer/Wiper Operation

Pull the lever switch towards the steering wheel, then the washer operates immediately. After a short interval, the wipers and washer will operate together. The wipers continue operating for a further three wipes after the lever switch is released. After a few seconds, the wiper will operate one more time to remove the washer fluid on the windshield.

Temporary Operation

When push upward the wiper/washer lever switch once from the stop position and release it quickly, the wiper will complete a low speed wiper operation. If the switch remains on, the wiper will operate at high speed, if the switch is off, the wiper will complete wiper operation once at low speed until the motor reaches the stop position.

Low Speed Wiper Operation

When the switch is on and locked in the low speed position, wiper will operate continuously at low speed.

High Speed Wiper Operation

When the switch is on and is locked in the high speed position, wiper will operate continuously at high speed.

Intermittent Wiper Operation

The intermittent wiper function is controlled by the BCM. When the switch is at the intermittent position, the BCM starts single low speed wiper operation. Between the two operations of the wiper, it stays at the stop position till the selection delay period is over. Use the 4 way rotary switch located at the end of the wiper lever to select the length of the delay. If a longer delay time is selected during the operation of one intermittent function, the longer delay time will be performed in the next wiper operation. If reselecting a shorter delay time in this period, the shorter delay time will be immediately performed. When programmed wiper/washer function is selected again after the intermittent wiper function is selected, the programmed wiper/washer operation starts immediately, and the intermittent wiper operation restarts after the programmed wiper/washer operation is ended and motor reaches the stop position.

Intermittent Wiper Operation with Rain Sensor (if equipped)

The intermittent wiper function with rain sensor is controlled by the BCM and the rain sensor. The rain sensor will constantly monitor the rainfall capacity or the glass humidity of the sensor optical area, and perform intermittent or continuous wiper operation as needed. The photosensitive sensor is a kind of photoelectric tube to increase the sensitiveness of the rain sensor, to make sure that the window keeps clean in hostile environment or driving at night. Apply heating element to make sure that the optical element keeps clean when covered with frost or ice. The heating element is controlled by the sensor, which obtains the surrounding temperature signal from the BCM or LIN bus. After is rain sensor is fit, normal speed sensing function and intermittent delay adjustment operation will be no longer available, and the rain sensor will completely control the intermittent wiper function. If the intermittent wiper function has speed sensing function and the switch is at the intermittent operation position, the BCM will adjust the intermittent length according to the vehicle speed. ABS

ECU monitors the wheel speed signal and sends it to BCM through HSCAN bus. If the wiper switch is at the intermittent wiper position, BCM will adjust the selected delay time by comparing the vehicle speed and the corresponding resistance for different intermittent delay rotary switch.

Front Windshield Wiper

The wiper motor is located in the lower side of the air intake grille under the windshield. This motor is fitted on a link mechanism on the bracket between inner and outer bulkhead. The motor is a DC motor which drives the worm wheel by the worm gear attached to the motor main shaft. External worm wheel is connected with the link mechanism, which can drive the wiper arm attached to the worm wheel block at the end of the link mechanism.

The front wiper motor consists of high speed coil, low speed coil and reset position switch. When a 12V DC is switched on to the high speed coil, the motor runs at high speed; when a 12V DC is switched on to the low speed coil, the motor runs at low speed. When the motor is at the reset position, the reset switch on the motor switch on and output low level.

The wiper arm is fitted on the link mechanism output shaft. There is a fulcrum between the wiper arms mounting points. Connect a spring at the both ends of the fulcrum, and apply appropriate pressure to the windshield wiper blade.

Rear Windshield Wiper

After rotating the rear windshield wiper switch, the wiper starts to operate continuously for 3 cycles and then enters the intermittent wiper mode, the intermittent time is decided by the set delay time of the front windshield wiper.

If the rear windshield selection is cancelled in the wiper cycle, the rear wiper will still operate after the wiper switch is turned off until it returns to the wiper stop position. When the BCM receives that the vehicle is in reverse gear, the rear windshield wiper will operate in set mode no matter the front windshield wiper is in high speed, low speed or intermittent wiper mode.

If the BCM receives the signal that the endgate is open, the rear windshield wiper will not operate till 5 seconds after the endgate is closed. (If the rear wiper switch is still selected) the BCM can receive the signal from the rear windshield wiper stop switch, the signal can be used to monitor whether the rear windshield wiper arm stops at the motor stop position or not.

Windshield Washer

Windshield washer system contains the washer fluid reservoir, washer fluid reservoir neck, washer pump, washer nozzle, one-way valve, hose and hose joint.

The washer fluid reservoir is located in the front of the RH vehicle wheel house with capacity of approximately 2.5 L. Add washer fluid to washer fluid reservoir by the funnel neck with shielding cap in the engine bay. A washer pump is under the washer fluid reservoir.

When the washer pump starts to operate, the fluid in the pump will be sent to the washer nozzle at the rear edge of the engine cover by the pressure. One-way valve in the line prevents the fluid of the nozzle and hose from flowing back into the washer fluid reservoir, thus ensuring the wiper is instant available.

Rain Sensor (if equipped)

The rain sensor sends the information it monitored to the BCM, in order to let the wiper select the best operation mode according to current environment conditions, keeping the windshield always clean. The rain sensor is a optical unit, whose operation wavelength is within the infrared wavelengths. The rain sensor apply the reflection law to the contact interfaces of two kinds of material of different refractive indexes. The optical unit is pasted on the inner surface of the windshield through thermodynamic effect when the windshield is manufactured, as a result, this unit can not be removed or replaced. If the optical unit or windshield is damaged, a new windshield needs to be fit only in the authorized SAIC MOTOR CO.,LTD dealers. The rain sensor unit is secured with self-hold snap fits to the bulge of the optical unit. The forward direction retention generated by the securing strip secures the self-hold snap fits on the bulge.

Operation

1. Programmed Washer/Wiper Operation
2. Automatic (intermittent) Wiper Operation (AUTO)
3. Low Speed Wiper Operation (LO)
4. High Speed Wiper Operation (HI)
5. Intermittent Delay Rotary Switch FAST—SLOW
6. Temporary Operation (MIST)

Front Windshield Wiper

Intermittent, low speed, high speed and temporary wiper operation switches are all form a ground close loop with**BCM** through either wire of the switch unions 1 and 2. Combination ground loop is monitored by**BCM** via one or two signals from selected functions. Refer to the table below for combination condition.

Switch Position	Switch 1	Switch 2
Stop	0	0
Temporary Wiper Operation	1	1
Intermittent Wiper Operation	1	0
Low Speed Wiper Operation	0	0
High Speed Wiper Operation	1	1
0 = Open Circuit, 1 = Closed Circuit		

Programmed Washer/Wiper Operation

Programmed washer/wiper operation function is controlled by **BCM**. When the switch is on, the washer pump operates the washer fluid to windshield immediately by washer nozzle. The washer pump operates once after 750 ms. If the switch is still ON, perform the lower speed wiper operation for three times, and the wipe operation will continue until the motor stops. The washer pump keeps working when the switch is ON, even if the switch is OFF, it still operates three times, and then operates once again after a short delay. If other wiper functions is selected before finishing the programmed washer/wiper operation, it will be cancelled, causing the wiper to operate according to the new selected function.

Low Speed Operation

The power source is supplied to the wiper motor through two normal close relays of the wiper (start relay and speed relay). The coil of the 2 relays is control by **BCM**. **BCM**circuit provides the start relay coil of the wiper with the ground connection when the low speed wiper operation mode is selected. The voltage is applied to the relay contact points by the start relay coil, in order to allow signals from fuse EF1 in engine bay fuse box to transmit to start relay contact points. The signal is sent to the motor through the wiper relay and a resistor. The resistor makes the motor run in low speed by reducing the power supply. The motor ground device is grounded by the connecting the motor casing and ball joint. During intermittent wiper operation,**BCM** make the wiper operate in low speed by the resistance. When wiper is off,**BCM** converts the wiper relay to complete the cycle in low speed.

High Speed Operation

When high speed operation is selected, electronic switch will apply voltage to wiper start relay as in low speed operation.**BCM** You can also apply voltage to wiper speed relay coil by using of another electronic switch in**BCM** to provide ground connection. The signal from fuse EF1, which passes through wiper relay contact point and then rounds the resistance that used for decelerating, is connected with motor directly, so that the wiper can operate at high speed.

Automatic (intermittent) Wiper Operation

Intermittent rotary switch can form a complete ground loop via the switch on **BCM**. Each switch corresponds to different resistances that monitored by **BCM**.**BCM** selects the appropriate timer according to the resistance value that has been measured to determine the delay time.

When**BCM** timer reaches a selected delay time, the wiper will operate once in low speed before it returns to the stop position. Then the**BCM** will turn on timer for another selected delay time before the following operation.

The correspondence between delay time and rotary switch position changes according to the position of wiper/washer lever switch and vehicle speed. When wiper/washer lever switch is in intermittent position, the correspondence of vehicle speed, delay rotary switch position and the delay time (s) of the wiper blade is shown in the table below.

Rotary Switch Position (Resistance kΩ)	Vehicle Speed km/h (mph)					
	<8 (<5	<32 <20	<64 <40	<92 <57	<128 <80	≥ 128 ≥ 80
0	8	6	5	4	3	3
1 1-3	26	19	17	15	15	13
2 3-5	7	12	11	10	9	7
3 5-7	10	6	6	5	4	3
4 7-9	5	3	3	2	2	2

When wiper/washer lever switch is in low speed position and the vehicle speed is lower than 8 km/h, the correspondence between the delay time of the wiper blade twice operation and the rotary switch position is shown in the table below.

Rotary Switch Position (Resistance kΩ)	Vehicle Speed km/h (mph)
	<8 <5
0	8
1 1-3	30
2 3-5	26
3 5-7	17
4 7-9	10

Note: The rotary switch position 0 indicates the resistance detected by BCM is out of 1–9 KΩ, i.e. the rotary switch is in a wrong position. And the time delay for this position will only be applied in the next wiper delay cycle.

Return Switch

Return switch contains an incomplete control chip (on the worm gear inside the wiper motor). The motor, motor ground control chip and worm gear are connected together. The command from the**BCM** is connected with one contact point of the wiper motor; the motor and return control chip are connected together to complete ground connection in**BCM** when the wiper in the return position. Closed circuit will provide ground function for the output from BCM.**BCM** will interpret the ground signal into of the wiper in the stop position signal.

Windshield Washer

Once the programmed washer/wiper operation is on, a complete ground route will be formed through**BCM** and washer pump on single wire via switch. Closed ground loop sends requirement of programmed control washer/wiper operation to**BCM**, and operates wiper accordingly. When closed ground loop is formed, washer pump is turned on.

When wireless key is inserted or the ignition switch is turned on, the washer pump receives 12**V** power by fuse F21 in the passenger compartment fuse box and fuse EF30 in the engine bay fuse box. When programmed washer/wiper operation is selected by wiper arm switch, a ground loop is formed through switch and washer pump, and it will operate at that time. The washer pump operates at least 750 ms whenever the switch is ON. When the rear windshield washer switch is ON, the body control module will activate one end of the bidirectional washer pump for the rear windshield, if the body control module detects that the endgate opens, the washer will stop operation.

Rear Windshield Wiper

The rear wiper is controlled by an individual relay, and the relay is controlled by the body control module according to the position of the rear wiper lever. The table below lists the rear wiper operative mode for different positions of the rear wiper lever switch and that of the ignition switch.

Rotary Switch Position	Ignition Switch Position				Rear Wiper Operative Mode
	OFF	KL.R	KL.15	KL.50	
OFF	X	X	X	X	OFF
ON	X			X	OFF
ON		X	X		ON

Rear Wiper Intermittent Wiper Operation

The intermittent wiper is controlled by BCM, when the switch is on the intermittent position, the rear wiper will perform single intermittent wiper operation. If the rear wiper switch is OFF, the rear wiper arm will perform a complete wiper operation, then stop at the motor stop position.

If the washer function is selected when the rear wiper is performing intermittent wiper operation, the rear wiper will perform programmed washer/wiper operation. If the rear wiper switch is still ON, it will return to intermittent wiper mode after the programmed washer/wiper operation finishes.

The corresponding intermittent delay for each position is as follows:

Switch Position	Delay Time (s)
Position 1	12
Position 2	9
Position 3	6
Position 4	3

If a longer delay time is selected during the operation of one intermittent function, the longer delay time will be performed in the next wiper operation. If reselecting a shorter delay time in this period, the shorter delay time will be immediately performed.

Rear Wiper Programmed Washer/Wiper Operation

Before turning on the programmed washer/wiper switch, the BCM will activate the washer pump to spray water and wash the rear windshield. After a short interval, the wipers and washer will operate together. If the programmed washer/wiper switch is turned off, the wiper will continue to

wipe for three times (configurable), and then return to the wiper motor stop position. If other wiper function is selected before finishing the programmed washer/wiper operation, the programmed washer/wiper operation will be cancelled, causing the wiper to operate according to the new selected function. If the wiper switch is not at the position of OFF when the programmed operation is finished, the rear wiper will continue the wiper operation according to the switch position. If the programmed washer/wiper function is selected during the intermittent wiper operation, the rear wiper will perform the programmed functions. If the switch is still at the position of ON when the programmed operation is finished, it will automatically return to the intermittent wiper mode.

Rear Wiper Operation in Reverse

Use the reverse gear when the front wiper switch is ON and KL15 is also ON, the BCM will always control the rear wiper to perform wiper operation no matter what position the rear wiper switch is.

The rear wiper will suspend the wiper operations when the endgate is open.

When the endgate is open, the rear wiper will be temporarily closed (configurable) regardless of its operation mode. After the endgate is closed, there will be a delay time of 5±0.5 seconds before the wiper re-accesses the former set operation mode and continue to work, in order to leave enough time for people to take their hands away from the wiper operation area. If the wiper switch is turned off after the endgate is opened, the rear wiper arm will return to the motor stop position after a delay time of 5 seconds.

Diagnostic

Diagnosis

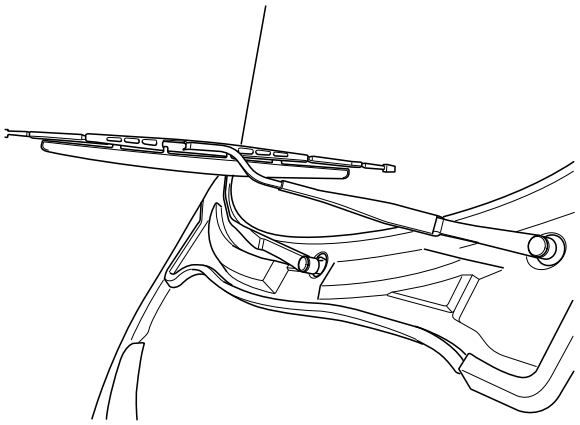
Diagnostic socket allows to communicate between**BCM** and T5. Diagnostic socket is located at the lower part of the driver side instrument panel sealing panel. Socket is connected with**CAN** bus line directly, which allows to inquire diagnosis messages and customize some special functions.**BCM** Forms a way that**CAN** bus line is connected to other electronic control units.**BCM** also converts T5 diagnosis messages to**CAN** bus line which can be recognized by system components. T5 enables to output wiper open or close signals forcibly, which means that it allows the wiper and washer to operate in each mode by the external diagnosis tools, and also detects the real-time operation condition of the wiper and washer.

Service Procedures

Windshield Wiper Blade Assembly

Remove

1. Lift the wiper blade from the windshield.



2. When pressing the safety snap fit, remove the wiper blade away from the wiper arm.

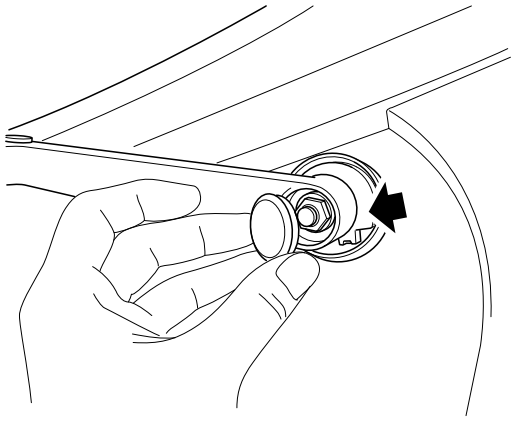
Refit

1. Fasten the wiper blade assembly into the safety snap fits, and then fit it on the wiper arm assembly.
2. Secure the wiper arm to the windshield.

Windshield Wiper Arm Assembly

Remove

1. Open the bonnet.
2. Remove the wiper arm shaft cover to expose the wiper arm nut.



3. Remove the nut fitting the wiper arm to the link mechanism.
4. Remove the wiper arm assembly.

Refit

1. Fasten the wiper brush assembly into the safety clips and fit it to the wiper arm assembly.
2. Fit the wiper brush and arm assembly to the pivot of the mechanism assembly.
3. Ensure that adhesive tapes of two wiper brushes are fit at the correct initial position, algning with small circles on the glass printing black edge.
4. Fit nuts on the pivot of the mechanism assembly and tighten them to **14–16Nm**.
5. Fit the wiper shaft cap on the pivot.
6. Close the bonnet.

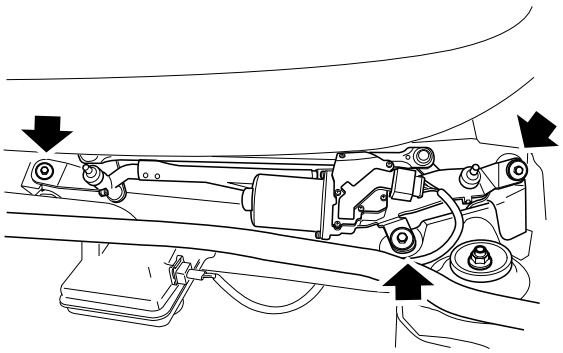
Windshield wiper link mechanism assembly — with electricity

Remove

1. Disconnect battery earth lead.
2. Remove the windshield wiper arm assembly.

☞**The Windshield Wiper Arm Assembly Remove**

3. Remove the assembly of the air-inlet grille.
4. Remove three bolts of the windshield wiper link mechanism assembly.



5. Remove the windshield wiper link mechanism assembly.

Refit

1. Fit the windshield wiper link mechanism assembly with three bolts and tighten them to **7–10Nm**.
2. Fit the assembly of the air-inlet grille.
3. Fit the windshield wiper arm assembly.

☞**The Windshield Wiper Arm Assembly Refit**

4. Connect battery earth lead.

Windshield wiper motor

Remove

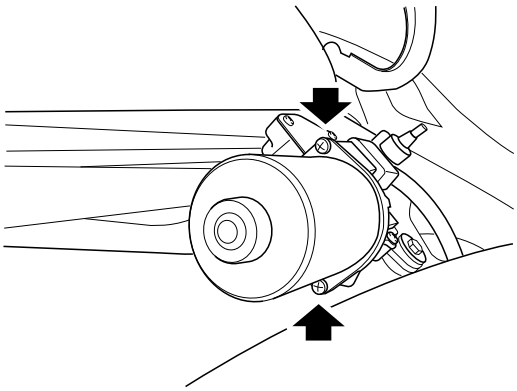
1. Disconnect battery earth lead.
2. Remove the windshield wiper arm assembly.

☞**The Windshield Wiper Arm Assembly Remove**

3. Remove the assembly of the air-inlet grille.
4. Remove the windshield wiper link mechanism assembly.

☞**The Windshield Wiper Link Mechanism Assembly Remove**

5. Remove the connector from the windshield wiper motor, remove bolts used to fit the motor and remove the motor.



Refit

1. Connect the connector to the windshield wiper motor.
2. Fit the motor with bolts.
3. Fit the assembly of the air-inlet grille.

☞**The Windshield Wiper Link Mechanism Assembly Refit**

4. Fit the windshield wiper arm assembly.

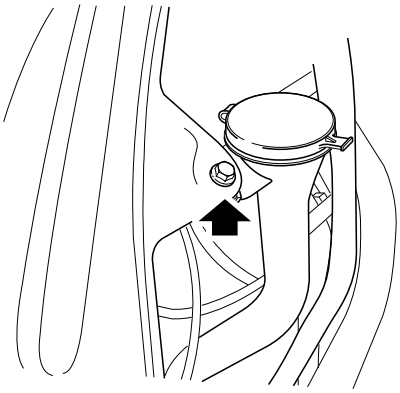
☞**The Windshield Wiper Arm Assembly Refit**

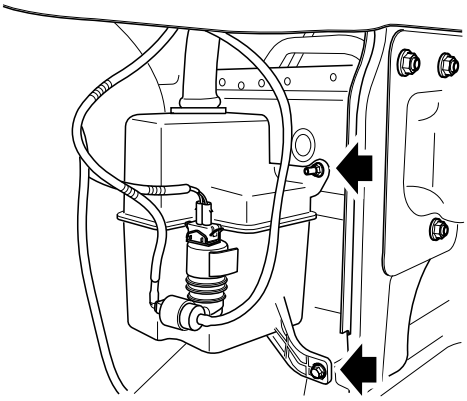
5. Connect battery earth lead.

Wash pot assembly

Remove

1. Disconnect the negative pole of the battery.
2. Prepare a container which can be used to collect the overflowing liquid.
3. Disconnect the wiring harness of the connection between the water pipe on the assembly and the washer pump.
4. Remove two nuts fixing the wash pot and one bolt fixing the filler pipe.





5. Disconnect the washer pump connector and remove the wash pot

Refit

1. Fasten the lug nuts into the mounting holes of the pot neck.
2. Fit 2 nuts fixing the washing pot and tighten them to **7–10Nm**.
3. Fit one bolt fixing the filler pipe and tighten it to **4–6Nm**.
4. Connect the washer pump electrical connector.
5. Connect the water pipe on the wiring harness assembly to the washer pump.
6. Connect the negative pole of the battery.

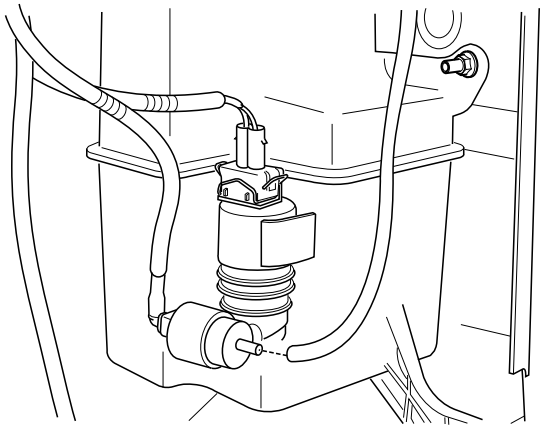
Washer pump assembly

Remove

1. Disconnect battery earth lead.
2. Remove the wash pot.

☞**Wash Pot Remove**

3. Disconnect the washer hose from the wash pot.
4. Disconnect the electric coupler.



5. Remove the washer solvent pump.

Refit

1. Connect the washer hose to the washer solvent pump.
2. Fit the washer solvent pump.
3. Connect the wash pot.

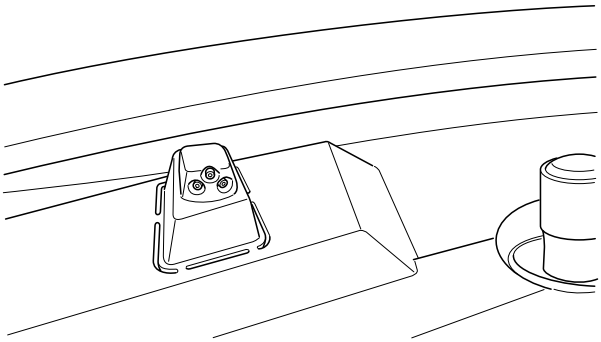
☞**Wash Pot Refit**

4. Connect battery earth lead.

Front windshield washing nozzle

Remove

1. Open the bonnet.
2. Remove the bonnet sound insulating pad.
3. Remove the air-inlet grille.
4. Disconnect the washer hose from the nozzle.



5. Remove the washing nozzle from the air-inlet grille.

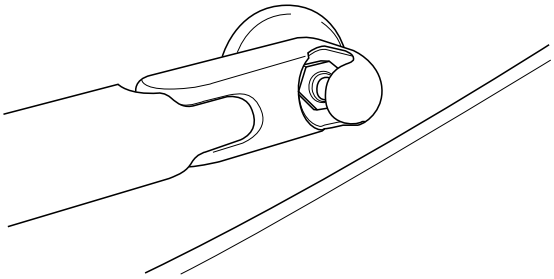
Refit

1. Fit the washing nozzle to the air-inlet grille.
2. Connect the washer hose to the nozzle.
3. Fit the bonnet sound insulating pad.
4. Close the bonnet.

Rear Windshield Wiper Arm Assembly

Remove

1. Detach the rear wiper arm lid, and remove the nuts fixing the rear windshield wiper arm assembly to the rear windshield.



2. Remove the rear windshield wiper arm assembly.

Refit

1. Fix the rear windshield wiper arm to the rear windshield with bolts.
2. Make sure that the blade adhesive tape is fit at the correct initial position, aligning with small dots on the glass priting black edge.

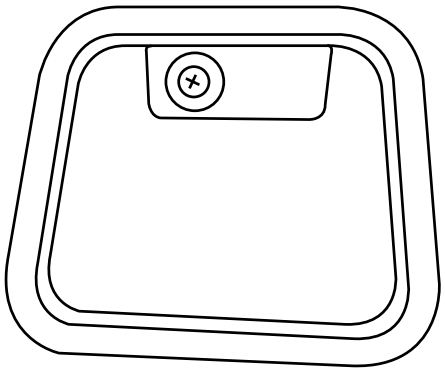
Rear Windshield Wiper Link Mechanism Assembly - with Motor

Remove

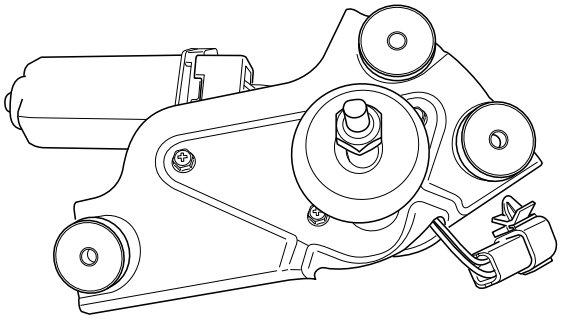
1. Disconnect battery earth lead.
2. Remove the rear windshield wiper arm assembly.

Rear Windshield Wiper Arm Assembly Remove

3. Remove the rear wiper motor seal ring from the wiper motor output shaft.
4. Open the endgate.



5. Remove the endgate trim cover bolts and the trim cover assembly.
6. Disconnect the main harness connector.
7. Remove two nuts and one screw on the wiper mounting support.



8. Remove the rear windshield wiper link mechanism assembly.

Refit

1. Fit the rear windshield wiper link mechanism assembly with two muts and one screw, and tighten to**6–8Nm**.
2. Connect the main harness connector.
3. Screw down a bolt to fit the endgate trim cover to the endgate.
4. Fit the seal ring and the windshield wiper arm assembly.

Rear Windshield Wiper Arm Assembly Refit

5. Connect battery earth lead.

Rear Windshield Wiper Motor

Remove

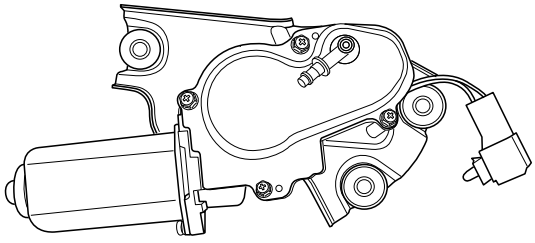
1. Disconnect battery earth lead.
2. Remove the rear windshield wiper arm assembly.

☞**Rear Windshield Wiper Arm Assembly Remove**

3. Remove the rear windshield wiper link mechanism assembly.

☞**Rear Windshield Wiper Link Mechanism Assembly Remove**

4. Remove the connector from the rear windshield wiper motor, and remove the motor and link mechanism.



Refit

1. Connect the connector to the rear windshield wiper motor.
2. Fit the motor and link mechanism with bolts.

☞**Rear Windshield Wiper Link Mechanism Assembly - Refit**

3. Fit the rear windshield wiper arm assembly.

☞**Rear Windshield Wiper Arm Assembly - Refit**

4. Connect battery earth lead.

Lighting

Specifications

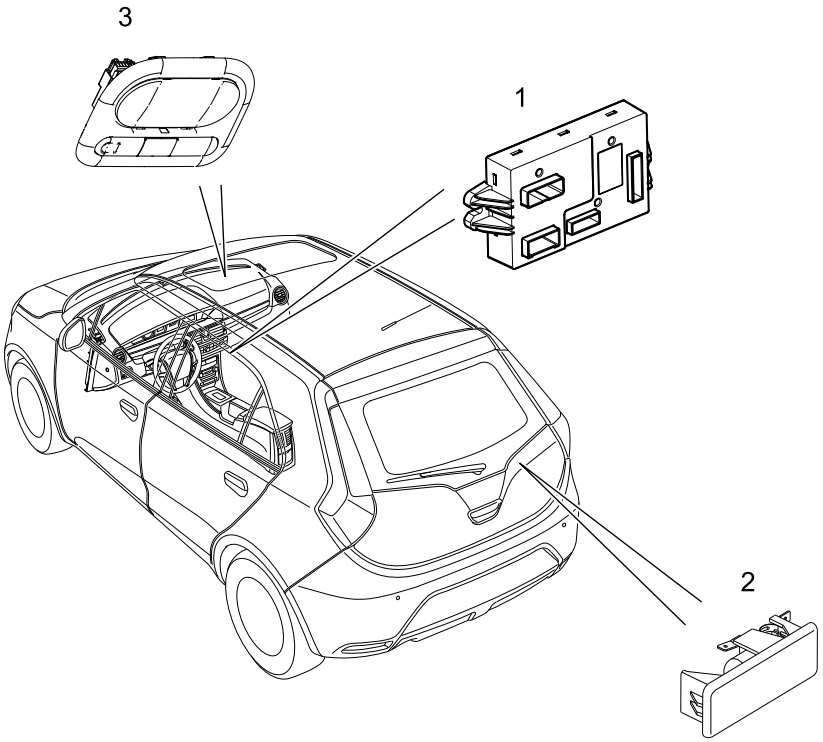
Torque

Description	Value
Screw - centre high mounted stop lamp	1.5–2Nm
Screw self-tapping - reading lamp	1.5–2Nm

Description and Operation

System layout

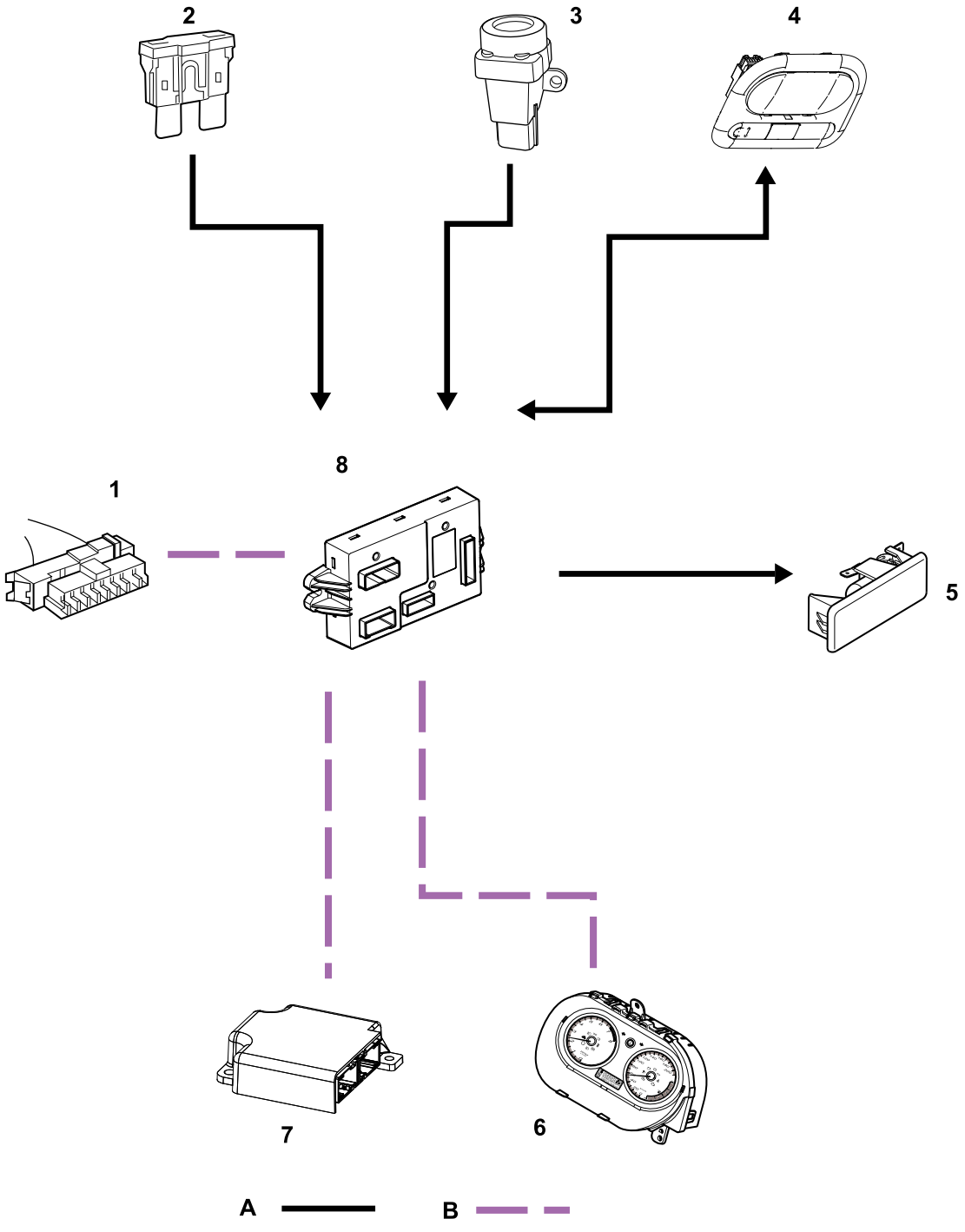
Interior lighting layout



1. Body Control Module (**BCM**)
2. Trunk Light
3. Front Reading Light

Control diagram of system

Interior lighting control diagram



*A = Hardwire; B = High-speed**CAN**Bus*

1. Diagnostic Socket
2. Passenger Compartment Fuse
3. Inertia Switch
4. Front Reading Light
5. Trunk Light
6. Instrument Pack
7. Airbag Control Module
8. Body Control Module (**BCM**)

Description

Overview

The vehicle interior lighting system is controlled by the body control module fit**BCM** at the back of the driver instrument panel.

The vehicle interior lighting system includes:

- Front reading lamp
- Trunk lamp

Front reading lamp

The front reading lamp is fit at the roof interior trim panel which is situated at the midpoint over the windshield. The assembly is fixed with two screws which are fit to the mounting bracket connected with the roof front crossmember, and is fixed to the top with two pinchcocks and two solid clips.

The front reading lamp assembly has a spot-movement switch controlling the reading lamp and a reflex switch controlling the sunroof.

The front reading lamp bulb is a single filament bulb. Translucence treatment has been made to the lens front reading lamp, which makes lighting in the vehicle become even.

The lamp bulb can be replaced after removing the lens. The lamp bulb can be fit just by pushing it into the support, while it can be removed just by pulling the lamp bulb lightly.

Trunk lamp

The trunk lamp is situated on the right panel of the trunk space. The exterior part is a plastic casing with lenses and lamp clips inside. When the trunk is opened, the trunk lamp will work automatically. The trunk lamp bulb is a single filament bayonet-coupled bulb.

Lamp bulb specification

Lamp	Lamp bulb type	Voltage and power
Front reading lamp	C10W	12V 10W
Trunk lamp	C5W	12V 5W

Operation

Overview

Power supply used for interior lighting comes from the battery which is connected to the power supply through the engine compartment fuse and the passenger compartment fuse. After lamps in the vehicle have been illuminated for 15 minutes (for example, under the condition that the door is not closed or the door is locked by mistake), the interior lamps will enter into**PWM** control mode and will gradually darken until all lamps in the vehicle are turned off finally. When locking the vehicle with keys **BCM** all lamps in the vehicle will be extinguished.

Interior lighting

The interior lighting includes:

- Front reading lamp
- Trunk lamp

When**BCM** receives signals from the front reading lamp main switch, signals indicating that the door or trunk cover is opened or the vehicle is not locked,**BCM** lamps controlling interior lighting are illuminated.

PWM By controlling

the main switch on the reading lamp assembly, the front reading lamp can be controlled. The interior lamps controlled by**PWM** include: the front reading lamp and the trunk lamp. When the internal lamps are illuminated, for example, when the vehicle door is opened**PWM** the output will be increased linearly so as to meet the interior lighting demand, and after about 1.3 seconds all lamps inside the vehicle will be illuminuated. and if the interior lighting is turned off (unless the ignition switch is in "**AUX**"position and the marker lamp is illuminated),**PWM** the output will be reduced linearly and the interior lights will be extinguished within about 2.8 seconds. When the engine is started, if the interior lights are illuminated, all interior lights will be turned off immediately and lighting will be recovered after the completion of starting automatically.

The following are the relevant function operations

- When pushing the unlock button on the remote key, or when unlocking the door lock with a mechanical key, the rear and front reading lamps will become bright gradually. If there is no door opened within 30 seconds, the front and rear reading lamps will darken gradually.
- After turning off the ignition switch, the reading lamp will become bright gradually. If there is no door opened within 30 seconds, the front/rear reading lamps will darken gradually.
- Under the condition that the interior lights are illuminated and all doors are closed, when the ignition switch is turned from KL.R to other positions, the internal lights will darken gradually after 30 seconds.
- When pushing the locking button on the remote key or locking the door with a mechanical key, the interior lights will darken gradually.
- When all doors are closed and the ignition switch is in "**AUX**"position, the interior lights will gradually darken.
- When all doors are closed and the ignition switch is in "ignition" position, the interior lights will gradually darken.

Synchronization control (Timed-Relay control)

The relay switch control is on-off control. Interior lights controlled by the relay switch include: glove box lamp, vanity mirror lamp and front/rear reading lamps. When the ignition switch is in"**AUX**"position and the door lock is unlocked by pushing the unlock button on the remote key or with a mechanical key, for the front/rear reading lamp,**BCM** the synchronization control function of the relay will be activated.

The following are the relevant function operations

- The front reading lamp will be illuminated immediately when pushing the reading lamp switch.
- When opening the glove box, the glove box lamp will be controlled by the linkage switch and illuminated immediately.
- When opening the vanity mirror cover, the tang on the cover will drive the smart switch, closing the loop and illuminating the vanity mirror lamp.

Under the following conditions,**BCM** Timed-Relay function can be used to control the reading lamp:

- When the ignition switch is in"**AUX**"position.
- When the door lock is unlocked by pushing the unlock button on the remote key or with a mechanical key.

Under the following conditions,**BCM** Timed-Relay function cann't be caused to control the reading lamp:

- 15 minutes after the ignition switch is turned off.
- When the door is locked by pressing the lock button on the remote key or with a mechanical key.
- When the vehicle lock system is in the state of locking outside.
- When the ignition switch is in "start" position.

Inertia switch operation

Under vehicle collision condition, if the inertia switch is activated, or if the crash sensor receives collision signals, **BCM**all interior lights of the vehicle will be controlled and illuminated immediately (the interior lights of the vehicle will be illuminated for at least 15 minutes) and the power supply of the fuel pump will be cut off and the lock will be unlocked (if

it has been locked). When resetting the inertia switch**BCM**all lamps controlling interior lighting will be turned off.

Instrument panel back lighting and dimming

LED provides lighting for all switches and panels. When the headlight switch is rotated to the marker lamp or the headlamp position,**BCM** power supply**LED** will be provided to . All**LED** lightings are all **PWM**controlled by .

Diagnostic

Diagnosis

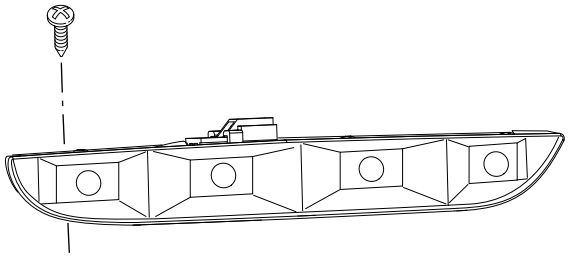
The diagnostic socket is situated in the driver side sealing panel with its structure conforming to**ISO** standard. The diagnostic socket passes through**CAN** the bus, which makes**BCM** can exchange information with the diagnostic equipnent. The diagnosis units can respectively realize**PWM** the force output control of the interior lighting by the relay, and reading of the working state parameters of the interior lights under two types of control.

Service Procedures

Height mount brake lamp assembly

Remove

1. Disconnect battery earth lead.
2. Remove the tailgate upper trim panel.
3. Release three screws fixing the height mount brake lamp assembly to the tailgate upper trim panel.



4. Disconnect the electrical connector.

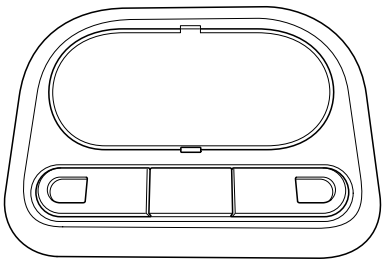
Refit

1. Connect the electrical connector.
2. Fit three height mount brake lamp mounting screws to the tailgate upper trim panel and tighten them to**1.5–2Nm**.
3. Connect battery earth lead.

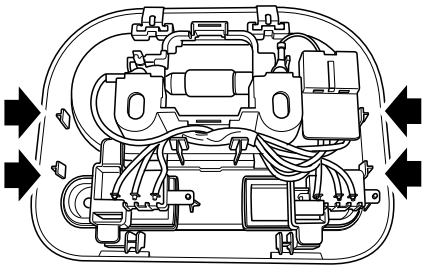
Front reading lamp assembly

Remove

1. Disconnect battery earth lead.
2. Remove the reading lamp glass cap.



3. Remove two self-tapping screws fit to the reading lamp support
4. Prize up clips and remove the reading lamp.



5. Disconnect the electrical connector.

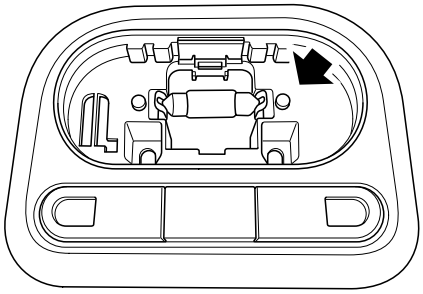
Refit

1. Connect the electrical connector.
2. Fit 2 self-tapping screws to the lamp support and tighten them to**1.5–2Nm**.
3. Fit the reading lamp glass cap.
4. Connect battery earth lead.
5. Fit the reading lamp

Front reading lamp bulb

Remove

1. Disconnect battery earth lead.
2. Remove the front reading lamp glass cap.
3. Remove the front reading lamp bulb.



Refit

1. Fit the front reading lamp bulb.
2. Fit the front reading lamp glass cap.
3. Connect battery earth lead.

Lamps

Specifications

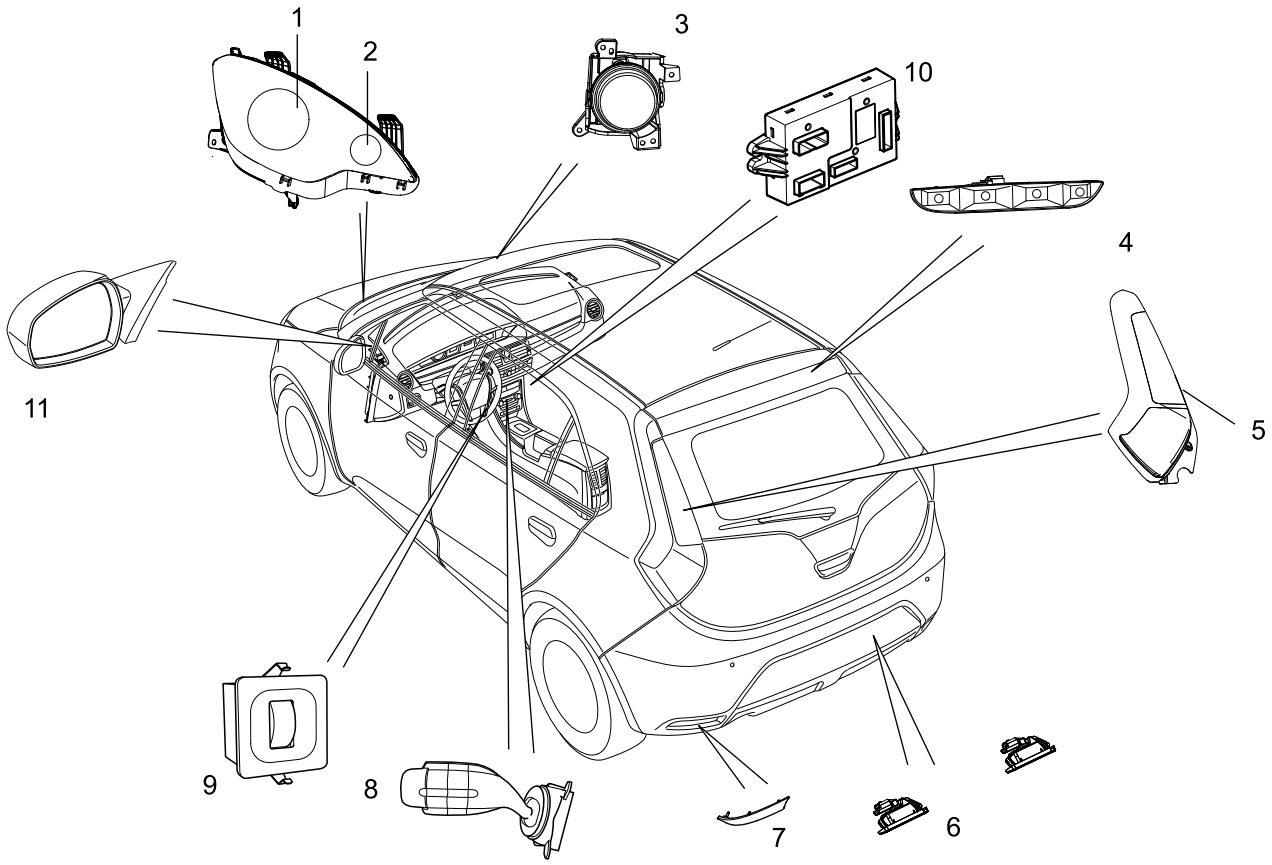
Torque

Description	Value
Bolt - headlamp assy	3–5Nm
Bolt - rear lamp assy	3–5Nm

Description and Operation

System layout

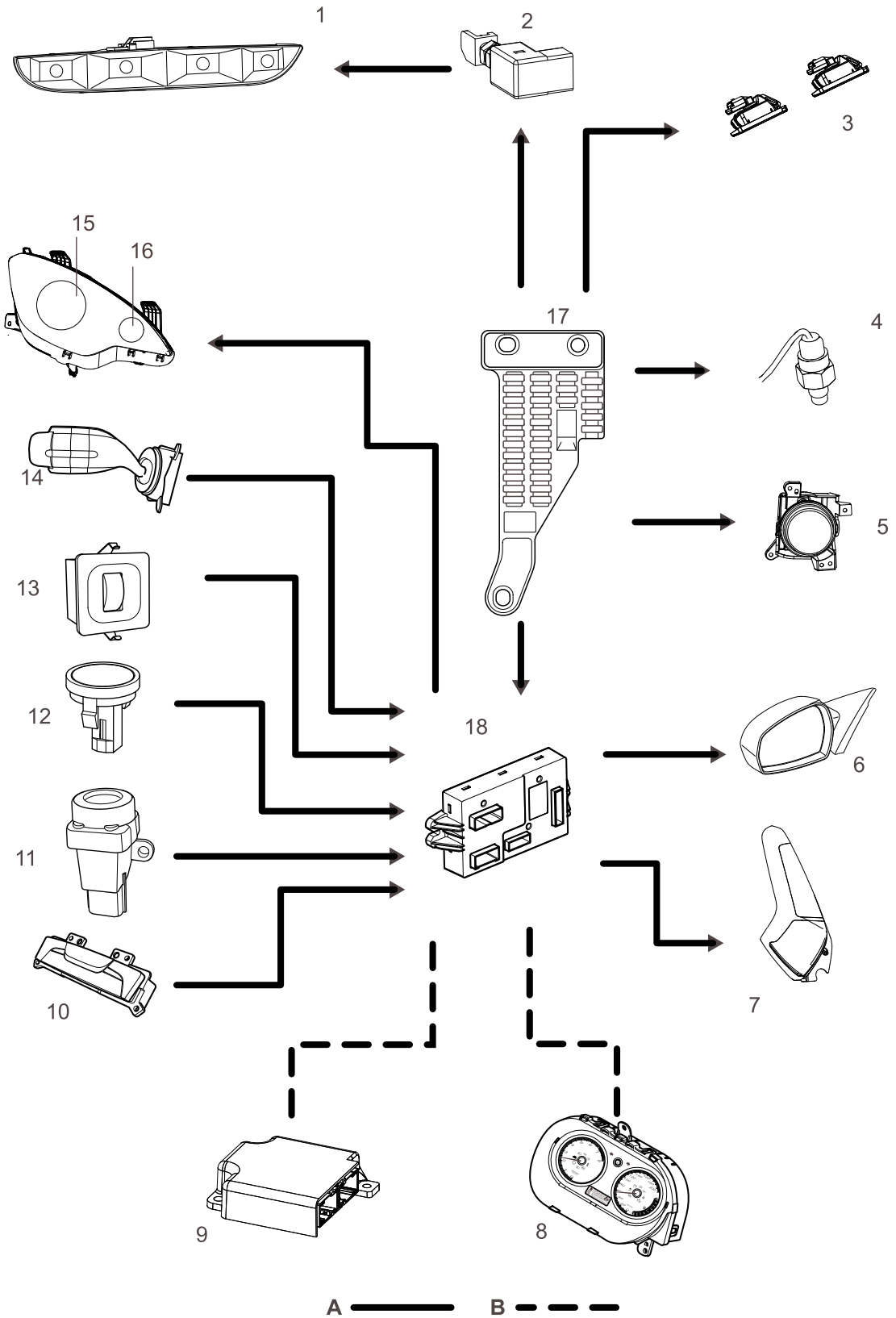
Exterior lighting layout



1. Low Beam Light and High Beam Light
2. Front Direction Lights
3. Front Fog Lights
4. High Mount Stop Lights
5. Tail Lights
6. Rear License Plate Light
7. Reflex Reflector
8. Direction Light/High Beam Light Selector Lever Switch
9. Headlight Height Adjustment Thumbwheel (if fit)
10. Body Control Module (**BCM**)
11. Side Turn Signal Lamps

Control diagram of system

Exterior lighting control diagram



*A = Hardwire; B = Mid-Speed**CAN** Bus; C=**LIN** Bus*

1. High Mount Brake Lamps
2. Brake Switch

3. Rear License Plate Lamp
4. Reverse Gear Switch
5. Front Fog Lamps
6. Side Turn Signal Lamps
7. Tail Lamps
8. Instrument Pack
9. Airbag Control Module
10. Hazard Warning Switch
11. Inertia Switch
12. Sun Sensor
13. Headlight Horizontal Adjustment Switch
14. Turn Signal Lamp/High Beam Selector Lever Switch
15. Low Beam and High Beam
16. Front Turn Signal Lamps
17. Engine Compartment Fuse Block
18. Body Control Module (**BCM**

Description

Overview

The exterior lighting system includes each external lamp and is operated by the headlight switch and the automatic light control sensor. The exterior lighting system includes

- Marker lamp
- Tail lamp
- Low beam light
- High beam light
- Rear license plate lamp
- Brake lamp/height mount brake lamp
- Turn light/turn signal lamp at two sides
- Front fog lamp
- Rear fog lamp
- Reverse lamp

Headlight switch — MLS

1. Lighting mode control switch
2. Instrument panel backlight dimming thumbwheel

After inserting the remote key or the ignition is turned on, the headlight switch backlight is always illuminated. Under the nighttime driving condition, if the marker lamp or the headlight is turned on, the instrument panel lighting will become dark automatically so as to prevent dazzle to the driver.

Automatic light control sensor

The automatic light control sensor is integrated inside the rain sensor and fit on the windshield at the back of the interior rearview mirror.

Headlight

The headlight is fit on the member front end panel with screws and the headlight assembly includes low beam light, high beam light and marker lamp.

Both the low beam light and high beam light bulbs are halogen bulbs and a smaller bulb by the side of the high beam light bulb is used for marker lamp lighting. Each halogen bulb has a lamppress so as to ensure correct refit of the bulb. The rear end of the headlight assembly is protected by the coverage of the sealing rubber diaphragm so as to prevent the entrance of moisture and dust.

Marker lamp and tail lamp

The marker lamp is fit on the inner side of the high beam light. The marker lamp bulb is a single filament bulb. The tail lamp bulb is fit on the bulb-saver behind the lens tail lamp.

Rear license plate lamp

Two rear license plate lamps are embeded in the underside of the rear bumper molding and fixed by clips.

Turn lamp

The front turn lamp is situated inside the inner region of the headlight assembly, while the rear turn lamp is situated inside the inner region of the tail lamp assembly. The turn signal lamps at two sides are integrated to the rear external rearview mirror with both the lens turn lamps being translucent and bulbs being orange single filament bulbs.

Turn lamp/high beam light selector lever switch

The turn lamp/high beam light selector lever switch is on the left side of the steering pipe column and used to control the following parts:

- Left steering signal lamp
- Right steering signal lamp
- Front headlight twinkle
- Low beam/high beam light switch
- Trip computer

Brake lamp/height mount brake lamp(CHMSL)as well as brake lamp switch

The brake lamp bulb locates inside the upper region of the tail lamp assembly. It is a double filament bayonet-coupled bulb. The bulb extends from the corresponding lens tail lamp, lighting the brake lamp region.

The height mount brake lamp is situated on the upper part of the rear windshield and composed of four bulbs. It is fixed on the tail door sheet metal vertically with 2 stud bolts.

The brake lamp switch is connected with the pedal fixed support which is situated at the back of the instrument panel. The brake lamp switch is a Hall effect proximity sensor and activated by the tang on the upper part of the brake pedal.

The brake pedal is fit on the pivot of the engine bulkhead upper pedal fixed support. Lever pins and U-clips are used to connect the vacuum booster input lever to the brake pedal. The "instant disconnection" Hall-effect brake lamp switch of the pedal fixed support is activated by the tang at the end of the brake pedal.

The brake lamp switch includes a built-in sensor which is situated inside an outside mounting slide valve. To ensure correct positioning, the sensor should be connected to the mounting sleeve which is connected to the pedal mounting bracket. Fit a slide valve and a sensor to make the built-in sensor maintain at its correct position inside the slide valve with a matching sawtooth. For safety considerations, the brake lamp switch includes two independent loops with one loop being normally open and the other one being normally closed. For information related to the two loops, see " brake main signal" and "brake safety signal".

Front fog lamp

The front fog lamp is situated on the front bumper. Each front fog lamp has a halogen bulb with power supplied by the relay in the engine compartment fuse block. The fuse of the fog lamp circuit is also situated inside the engine compartment fuse block.

Rear fog lamp

The rear fog lamp bulb is situated in the lower region of the left tail lamp. The rear fog lamp is a single filament bayonet-coupled bulb. The bulb extends from the spacing of the lens tail lamp, illuminating the lens rear fog lamp region.

Reverse lamp

The reverse lamp bulb is situated in the lower region of the right tail lamp. The reverse lamp is a single filament bayonet-coupled bulb.

The reverse lamp relay integrated in**BCM** is connected with the reverse lamp switch. For the vehicle fit with a manual transmission, the reverse lamp switch is fit at the back of the transmission. For the vehicle fit with an automatic transmission, the reverse lamp switch is fit in the neutral drive switch.

Lamp bulb specification

Lamp	Lamp bulb type	Voltage and power
Low/high beam	H4	12V 60/55W
Turn lamp	PY21W	12V 21W
Marker lamp	W5W	12V 5W
Reverse lamp	W16W	12V 16W
Brake lamp,rear marker lamp	PR21/5W	12V 21W/5W
Turn lamp	PY21W	12V 21W
Front fog lamp	H11	12V 55W
Rear fog lamp	P21W	12V 21W
Side turn lamp	WY5W	12V 5W
License plate lamp	W5W	12V 5W

Operation

Overview

BCM Control the following exterior lights:

- Low beam light
- High beam light
- Rear fog lamp
- Marker lamp/tail lamp
- Rear license plate lamp

BCM Monitor the following exterior lights:

- Reverse lamp
- Front fog lamp

BCM Control and monitor the following exterior lights:

- Turn lamp (the side turn lamp is not included)
- Hazard warning light

Turn lamp, hazard warning light

turn lamp

When the ignition key is in the auxiliary position and the steering switch is at the left or right flash position, the corresponding turn lamps will flash with the ON/OFF frequency of 1:1.

The turn lamp is still maintained in working state at ignition instant.

The turning indicator and the sound prompting device fit on the instrument panel remind the driver of messages of various states of the turn lamps.

Turn lamp failure monitoring (the side turn lamp is not included)

BCM The fault conditions of the turn lamp bulbs can be monitored by the internal circuits, such as open circuit or short circuit. If short circuit appears in one of turn lamps in the direction selected,**BCM** This sidelight will be controlled to flash at double frequency to remind the driver. When short circuit appears in one light,**BCM** the drive of this side turn light will be cut off and retry after 30 seconds. If the short circuit disappears, this side turn lamp will enter into normal working state, otherwise the monitoring process will be kept circulating.

Hazard warning light

The hazard warning light is composed of all turn lamps and always keeps working under the condition that the battery has electricity.

The hazard warning light is controlled by a point contact switch. When the hazard warning light switch is contacted for the first time, the hazard warning light will start flashing; when the switch is contacted again, the hazard warning light will be turned off.

The turn lamp and the hazard warning light have priorities as follows:

With the hazard warning light turned on, if the steering switch is turned on, the working mode will be immediately converted to the turn lamp mode. If the steering switch is reset or the ignition switch is turned off at this moment, the working mode will be reverted to the hazard warning light working state.

If the hazard warning light switch is turned on when any side turn light is working, the hazard warning light mode will immediately replace the steering system working mode. If the hazard warning light switch is contacted again, the working mode will return to the turn lamp working mode.

If**BCM** hazard warning signals**CAN** are received from the bus, the operation of all turn lamps will be controlled immediately, to be exactly, entering into the hazard warning light mode. And it will last for at least 5 seconds.

Collision triggers the operation of the hazard warning light

When**BCM** the collision signal are detected, it will activate the hazard warning light automatically with the hazard warning light flashing constantly. At this moment the hazard warning light cannot be turned off until the hazard warning light switch has been contacted for over 5 seconds, which is designed for preventing the occurrence of turning off the hazard warning light once the hazard warning light switch is contacted by mistake during the collision process.

The operation of the hazard warning light is triggered by the inertial switch

When**BCM** detects signals signifying that the inertial switch is in release state,the hazard warning light will be activated automatically. At this moment the hazard warning light cannot be turned off until the hazard warning light switch has been contacted for over 5 seconds, which is designed for preventing the occurrence of turning off the hazard warning light once the hazard warning light switch is contacted by mistake during the collision. At this moment the hazard warning light is still kept in working state even the inertial switch is reset. And when the inertial switch is pressed again, you will exit from the hazard warning light working state.

Rear fog lamp

Under the condition that the ignition switch is turned on and the low beam light or the front fog lamp are turned on, press the rear fog lamp switch, the rear fog lamp will be illuminated. By pressing the rear fog lamp switch again, the rear fog lamp will be extinguished,**BCM** Send "on or off" state of the rear fog lamp to the instrument panel to prompt with the sign signifying that the fog lamp is turned on or turned off.

If the engine is started at the moment when the rear fog lamp is in the working state, the rear fog lamp will still be kept in illuminated state after the starting moment.

Marker lamp/tail lamp, license plate lamp

marker lamp/tail lamp and license plate lamp are**BCM** controlled by the same outlet. When the headlight and the marker lamp knobs are moved to the marker lamp position**BCM** signals of turning on the marker lamp/tail lamp as well as license plate lamp can be detected, and therefore, an external sensor is turned on by outputting signals so as to illuminate the marker lamp/tail lamp and license plate lamp at the same time.

Low beam light

The low beam light will be illuminated when the ignition switch is turned on and the headlight switch is rotated to the low beam light position. The low beam light is mainly controlled by the relay in **BCM**.

High beam light

The high beam light can work only when the low beam light is turned on. The high beam light can be turned on by just moving the exterior light selector lever to the high beam light position. The turn lamp headlight twinkle function is operated by pulling the exterior light selector lever towards the steering wheel direction. The high beam light keeps lighting state until the low beam light knob is rotated off.

If the high beam light has been illuminated when starting the engine, the high beam light will be turned off at the moment of starting so as to ensure that the starter motor can obtain maximum current.

Car finder lamp

Car finder lamp function is used for the lighting control of the timer of the vehicle low beam light/or rear fog lamp so as to illuminate areas surrounding the vehicle and assist the vehicle in finding the vehicle position under dark conditions. Use the function menu within the instrument pack to configurate this function. This menu allows the user to select the following items:

- Automatic illumination for the low beam light only.
- Automatic illumination for the rear fog lamp only.
- Automatic illumination of the low beam light and the rear fog lamp.
- Lamp turn-off delay (within 0-5 minutes, it darkens gradually with the increment of 30 seconds).

If the high beam light switch is turned on within one minute (configurable) when the ignition switch is turned from ON to Off, the car finder lighting function will be activated, the high beam light or the rear fog lamp will be illuminated automatically (configurable) and turned off automatically after 5 minutes.

Under the condition that the car finder function is activated, if the ignition switch state is changed, the low beam light will be turned off. Under low voltage condition, the car finder function will be turned off automatically. After the voltage is restored, this function cannot be initiated automatically and needs to be operated again. Opening any vehicle will interrupt the timer, and the vehicle will enter into the car finder function again after closing the vehicle door.

Front fog lamp

The front fog lamp will work when the exterior light selector lever switch knob is moved to the position of turning on the marker lamp or the headlight and the ignition switch is turned on. If the headlight and the maker lamp knobs return to the original locked position (OFF) or the ignition key is moved to the position of assisting**AUX**) or the ignition key is taken away, the front fog lamp will be extinguished. As long as the front fog lamp is turned on, the front fog lamp signal lamp will be illuminated to remind the driver in the instrument pack.

If the fog lamp is operated before starting the engine, the fog lamp will be extinguished during the process of staring the engine so that the starter motor could obtain maximum current.

Reverse lamp

When the ignition switch is turned on to put the shifting switch into the reverse gear, the reverse lamp will be illuminated. For the automatic transmission vehicle, the reverse lamp will be activated after delaying one second for the purpose of triggering by mistake the reverse lamp

and the brake lamp (two rear brake lamps and a height mount brake lamp are included) in shifting into D gear from P gear by passing through R gear.

When the ignition switch is turned on and the brake pedal is stepped on, the brake lamp will come on, meanwhile, **ECM**the brake lamp is monitored through hardwires and **CAN** the brake state signals will be sent by the bus to other**ECU** to use.

Diagnostic

Diagnosis

Turn lamp, hazard warning light, rear fog lamp, low beam light, high beam light, marker lamp and license plate lamp can be turned on and turned off by the force output of the external diagnostic equipment.

Service Procedures

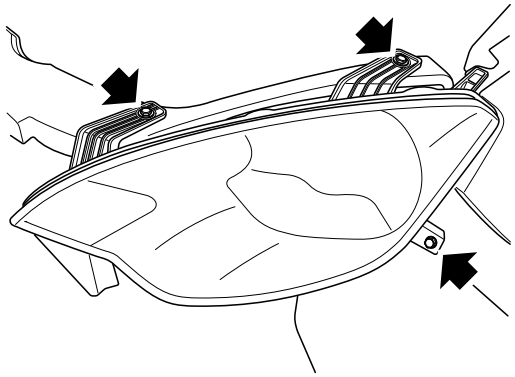
Headlight assembly

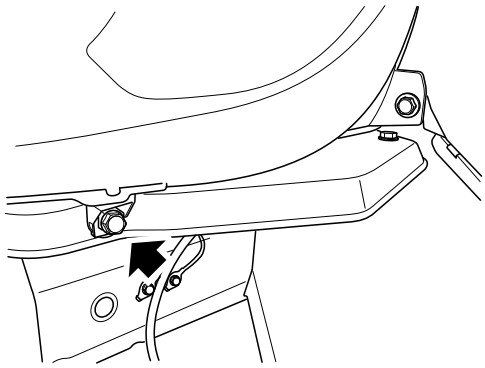
Remove

1. Disconnect battery earth lead.
2. Remove the front bumper.

☞Front Bumper Remove

3. Remove mounting nuts and bolts of the headlight.





4. Remove the headlight assembly.
5. Disconnect the electrical connector.

Refit

1. Connect the electrical connector.
2. Fit bolts to the headlight assembly and tighten them to**3–5Nm**.
3. Fit the front bumper.

☞Front Bumper Refit

4. Connect battery earth lead.

Headlight bulb

Remove

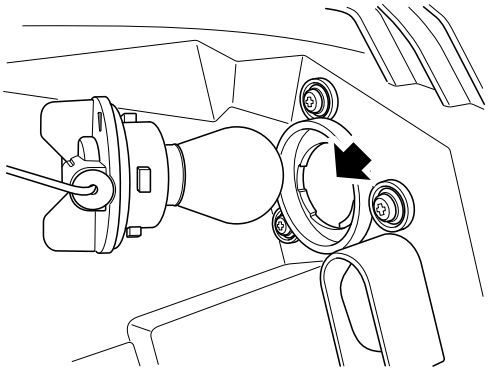
1. Disconnect battery earth lead.
2. Remove the front bumper.

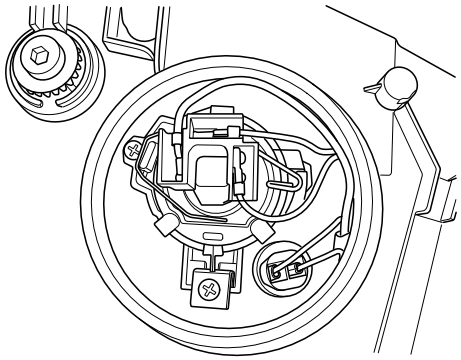
☞Front Bumper Remove

3. Remove the headlight assembly.

☞Headlight Assembly Remove

4. Screw out the lamp bulb indicated by the arrow.





Refit

1. Screw in the lamp bulb according to the clockwise direction indicated by the arrow.
2. Fit the headlight assembly.

☞Headlight Assembly Refit

3. Fit the front bumper.

☞Front Bumper Refit

4. Connect battery earth lead.

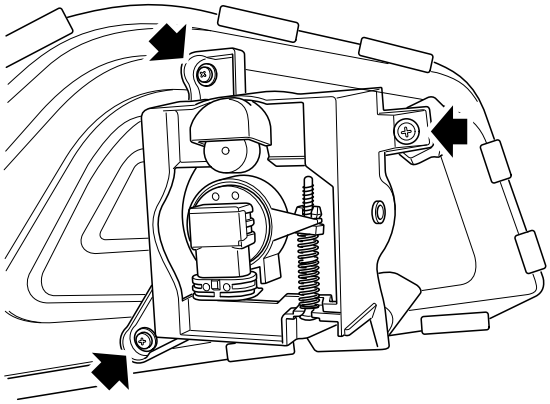
Front fog lamp assembly

Remove

1. Remove the front bumper.

☞**Front Bumper Remove**

2. Disconnect the electrical connector.
3. Remove three screws fixing the front fog lamp to the front bumper assembly.



4. Remove the front fog lamp from the front bumper.

Refit

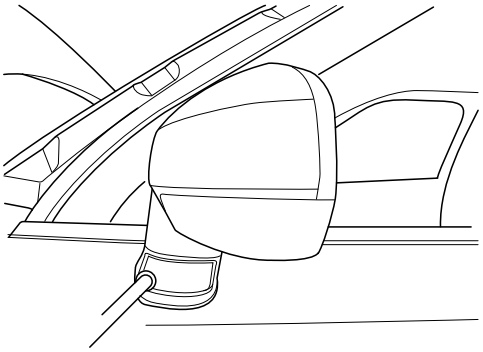
1. Fit the front fog lamp to the front bumper.
2. Fit screws fixing the front fog lamp to the front bumper and tighten them.
3. Connect the electrical connector.
4. Fit the front bumper.

☞**Front Bumper Refit**

Side turn lamp assembly

Remove

1. Disconnect battery earth lead.
2. Remove the plastic shell.
3. Remove two outside rearview mirror mounting screws.



4. Remove exterior rearview mirrors fit with side turn lamps.
5. Disconnect the electrical connector.

Refit

1. Connect the electrical connector.
2. Fit screws and outside rearview mirrors.
3. Fit outside rearview mirror plastic shell.
4. Connect battery earth lead.

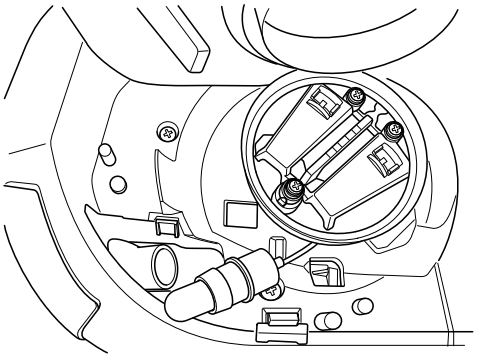
Side turn lamp bulb

Remove

1. Remove the side turn lamp assembly.

☞**Side Turn Lamp Assembly Remove**

2. Pull out the rearview mirror lenses.
3. Pull out the side turn lamp bulb from the mould.



Refit

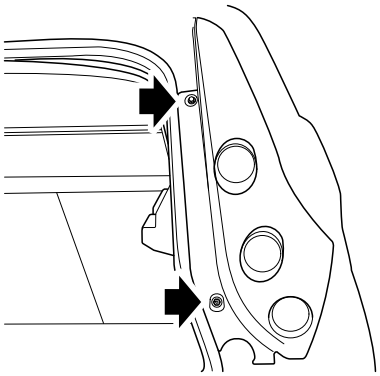
1. Insertion-side turn lamp bulb.
2. Press the side turn lamp assembly mould into the side turn lamp assembly.
3. Fit rearview mirror lenses.
4. Fit the side turn lamp assembly.

☞**Side Turn Lamp Assembly Refit**

Tail lamp assembly

Remove

1. Disconnect battery earth lead.
2. Remove the tail lamp assembly screws.



3. Disconnect the electrical connector.
4. Remove the tail lamp assembly.

Refit

1. Connect the electrical connector.
2. Fit tail lamp assembly screws and the tail lamp assembly and tighten them to**3–5Nm**.
3. Connect battery earth lead.

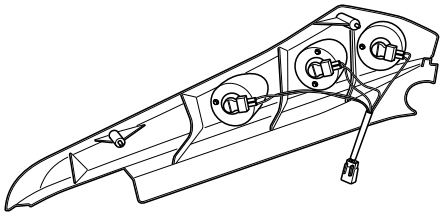
Tail lamp assembly bulb

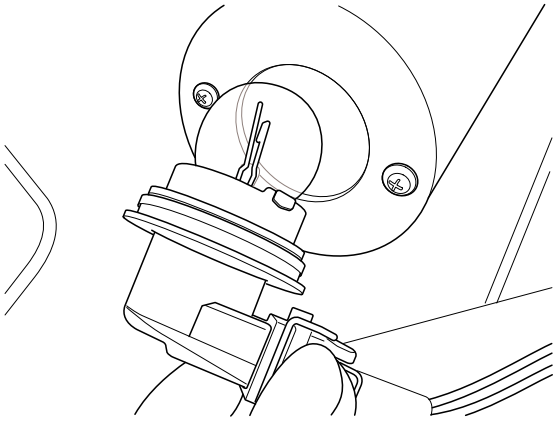
Remove

1. Disconnect battery earth lead.
2. Remove the nuts and remove the tail lamp assembly.

☞Tail Lamp Assembly Remove

3. Remove the bulb in a counterclockwise direction.





Refit

1. Put two independent rear license plate lamps to the rear bumper assembly.
2. Connect the electrical connector.
3. Fit the rear bumper.

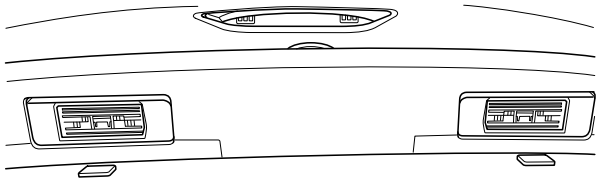
☞Rear Bumper Refit

4. Connect battery earth lead.

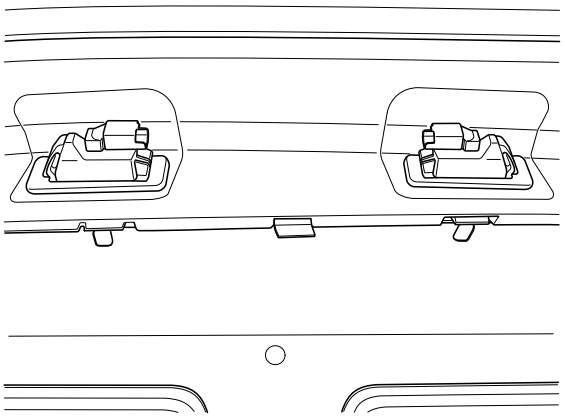
Rear license plate lamp assembly

Remove

1. Disconnect battery earth lead.
2. Remove the rear bumper.



3. Disconnect the electrical connector.
4. Pull out two independent rear license plate lamps from the rear bumper assembly.



Refit

1. Embed the rear license plate lamp into the rear bumper.
2. Connect the electrical connector.
3. Fit the rear bumper.

☞Rear Bumper Refit

4. Connect battery earth lead.

Rear license plate lamp bulb

Remove

The rear license plate lamp bulb is integrated with the rear license plate lamp and cannot be removed independently.

Refit

Rear license plate lamp assembly replacement.

Doors

Specifications

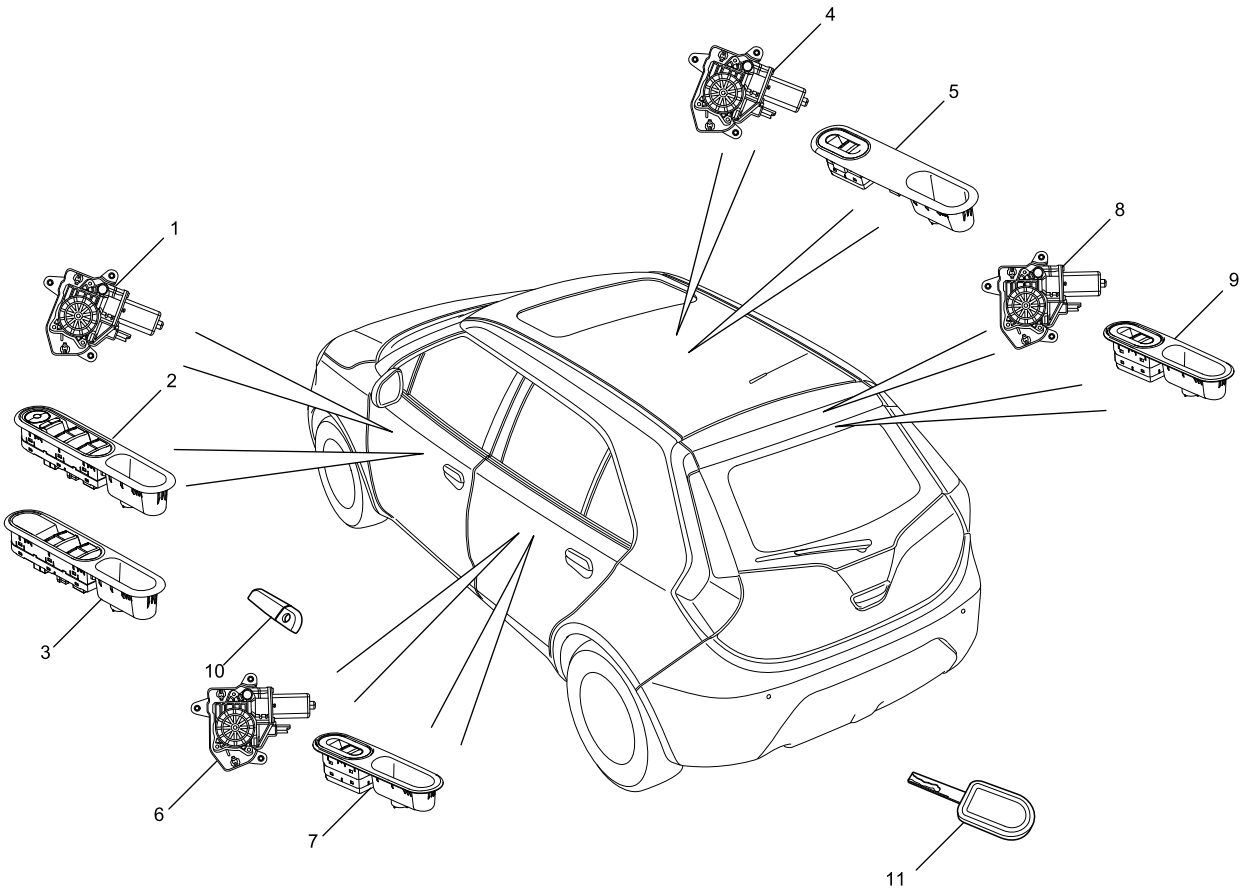
Torque

Description	Value
Bolt - door hinge to door	22–28Nm
Bolt - striker to door body	25±5Nm
Bolt - door hinge to body	30–36Nm
Bolt - door handle–outer to door panel	3.5–5Nm
Bolt - latch assy to door inner panel	8–10Nm
Bolt - glass to regulator	2–4Nm
Nut - regulator to door	6.5–7.5Nm
Bolt - division bar to door	6–8Nm

Description and Operation

System layout

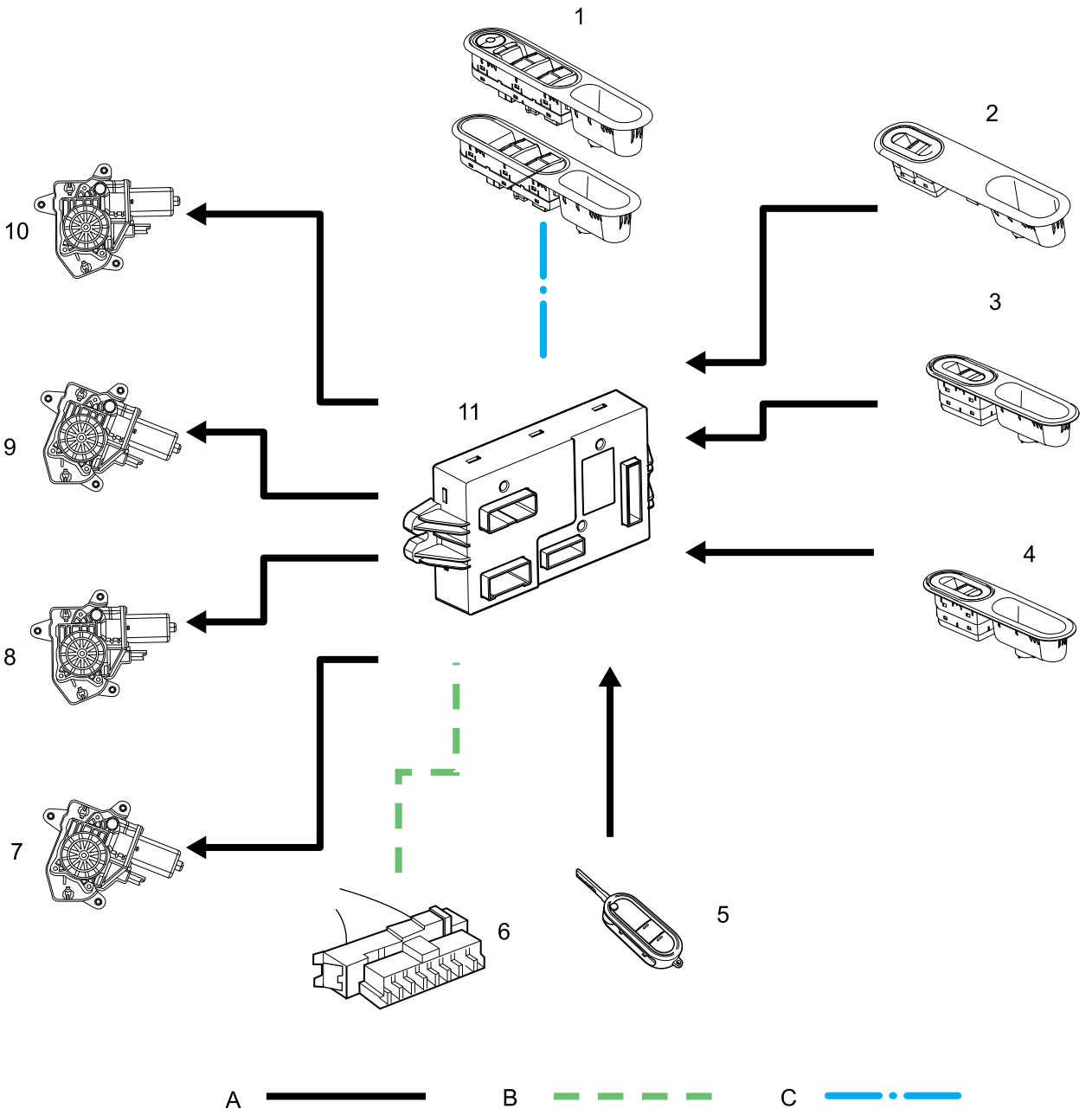
Window system component layout



1. Driver Side Window Regulator Motor
2. Driver Side Window Switch (Outside Rearview Mirror Adjustment)*
3. Driver Side Window Switch*
4. Front Passager Side Window Regulator Motor
5. Front Passenger Side Window Switch
6. Left Rear Passager Side Window Regulator Motor
7. Left Rear Passenger Side Window Switch
8. Right Rear Passager Side Window Regulator Motor
9. Right Rear Passenger Side Window Switch
10. Door Lock
11. Key

Control diagram of system

Control diagram of window system



1. Driver Side Window Switch
2. Front Passenger Side Window Switch
3. Right Rear Passenger Side Window Switch
4. Left Rear Passenger Side Window Switch
5. Remote Keyless Entry
6. Diagnostic Socket
7. Driver Side Window Regulator Motor
8. Left Rear Passager Side Window Regulator Motor
9. Right Rear Passager Side Window Regulator Motor
10. Front Passager Side Window Regulator Motor
11. Body Control Module

Description

Overview

All models are equipped with the front and rear power window system. This system is controlled by the body control module (**BCM**) behind the front passenger side glove box.

The power window system includes

- Front and rear power window LH and RH.
- Driver door switch module (**DDSP**).
- Single switches on the front and rear passenger doors.
- Window regulator motor and regulator mechanism.

Lift/press type switches are fitted on each door inner garnish and are used to control power windows on each door.**DDSP** has 4 power window switches to control the operation of all windows by the driver. Power windows can be operated after the ignition key is in**AUX** range or within 30 seconds after the wireless key is removed. Just after starting, the windows have no motion by operating the window switches.

Operation

Power window

When the key is inserted into the keyhole, and turned to "**AUX**" gear position or within 30 seconds after the ignition switch is turned off, the power window system is in operation. Four window motors are connected to the power source positive respectively through four fuses in the engine bay fuse box.**BCM** responds to the signals from each switch, and supplies power to each appropriate window motor, to raise or lower the windows.

Manual mode

The manual mode starts when the driver side window switch is operated for more 400 ms in certain direction, i.e. the selected window continues running in the required direction, and the window stops moving in this direction immediately until the switch is released. For the window switches of the front passenger side and the rear passenger, the people can perform the manual mode in addition to operating the driver switch for above 400ms, they can also perform the individual manual switch operation to the window controlled by operating the appropriate window up or down switch separately for more than 400ms.

Operation of opening and closing all windows

After the ignition switch is turned off, press (for more than 2 seconds) the driver side door lock switch to the lock position under the condition that there are one or more windows or the sunroof is open, all of the opened windows or sunroof will be closed. Also, after the ignition switch is turned off, press (for more than 2 seconds) the driver side door lock switch to the unlock position under the condition that there are one or more windows or the sunroof is closed, all of the closed windows or sunroof will be opened.

When all of the windows is operating, stop using the lock/unlock switch, and the operation of opening and closing all of the windows will stop immediately.

Thermal protection

DO NOT drive the window motor for more than 15 seconds to avoid damaging the power window motor.

Rear window disable

The rear window disable switch on the**DDSP** enables/disables the function of the rear window switches. After the rear window disable switch is activated, LED indicator on the driver side rear window disable switch turns on, and the rear passenger cannot control the rear window through the rear passenger power window switch. The**BCM** stores your selection until you use the rear window disable switch again.

Open in a collision

If the vehicle involves in collision and the collision acceleration reaches a certain value, the inertia switch will be activated. This switch will allow all the windows to open automatically.

Switch conflict

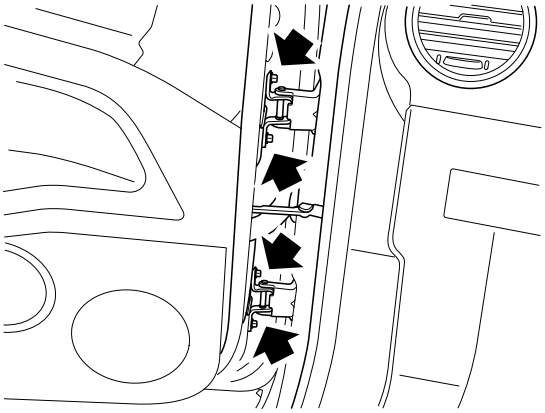
If there is a signal command conflict between the window switch in the**DDSP** and the special switch the door of this window,**DDSP** has a priority. If any window stops due to a command conflict between the**DDSP** and the special switch on the door of this window, the window only moves to the required direction in a step mode if this window continues to be operated again after any switch is released. If any switch is activated for more than 20 seconds, the**BCM** will determine this switch as a trouble switch (such as stuck), and ignore all the further commands from the switches in this start circulation after that.

Service Procedures

Front door hinge adjustment

Adjust

1. Open the front door.
2. Put the block to the jack, then put the jack to the lower part of the body so as to support the front door.
3. Remove four bolts securing the door upper and lower hinges to the front door.



4. Correct the door by using a jack to support.
5. Pre-tighten the hinge bolts.
6. Take away the jack, close the door so as to inspect whether the it is corrected correctly.
7. After desirable effect has been realized by correcting, tighten the door side hinge bolts to the specified torque **22–28Nm**.

Front door striker adjustment

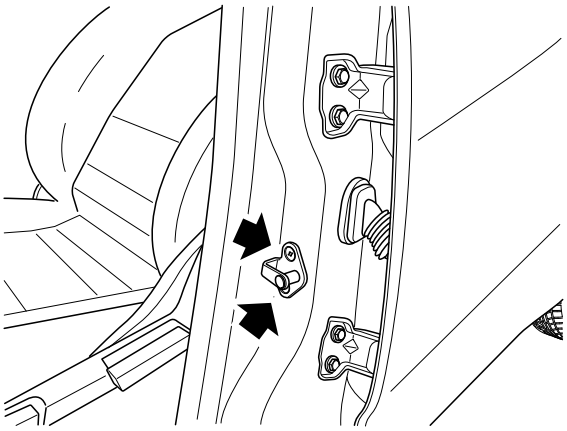
Adjust

The front door striker is a crossbar button with two bolts. It is necessary to adjust the striker up and down and inside and outside under many circumstances.

- The frame is caused to be damaged by collision.
- Fit new door weatherstrips.
- The customer repair wind noise is excessive.
- It is difficult to open and close the door.

Adjust the striker up and down and inside and outside according to the following procedures

1. The door must be positioned correctly.
2. Open the front door.
3. Release two striker screws. Adjust the striker so as to align with the door pin, then pre-tighten the screws.

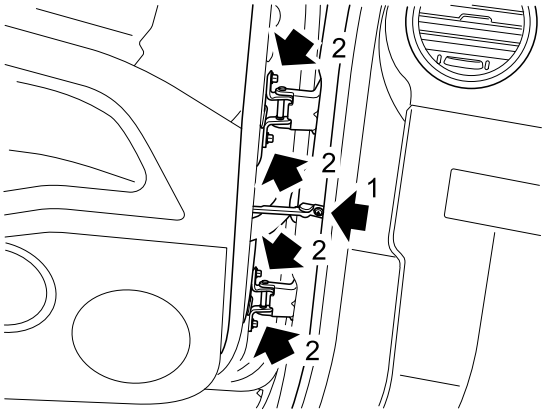


4. Close the door, and check if the rear of the door is flush with the panel of the body side panel and if the door can open and close normally.
5. After correcting, open the door and tighten screws to **25±5Nm**.
6. Close the door.

Front door assembly

Remove

1. Disconnect battery earth lead.
2. Remove the fixed bolt 1 of the door limiter at the body side.



3. Prize up the body side wiring harness jacket with care and pull out the connector so as to disconnect the body wiring harness connector interface.
4. With the help of your assistant, remove four construction bolts 2 between the front door upper and lower hinges and the door side.
5. Remove the front door assembly.

Refit

1. With the help of your assistant, position the door to the body.
2. Connect connector interfaces, and embed rubber seal rings into body mounting holes.
3. Fit respectively fixed bolts between the front door upper/lower hinge and the door side, but don't tighten them.
4. Fit the fixed bolts between the door limiter and the body side.
5. Close the door and verify the effect of opening and closing the door, after obtaining satisfactory results, tighten the fixed bolts of the upper and lower hinges at the door side to the torque **22–28Nm**.
6. Close the door and connect battery earth lead.

Front door hinge assembly

Remove

1. Remove the front door assembly.

☞**Front Door Assembly Remove**

2. Remove four construction bolts between the upper, lower hinges and the body side, and remove the upper, lower hinges.

Refit

1. Fix and fit the upper and lower hinges respectively to the body with bolts with the tightening torque of **30–36Nm**.
2. With the help of your assistant, position the door to the body, and fit the upper and lower hinges respectively to the door with bolts with the tightening torque of **22–28Nm**.

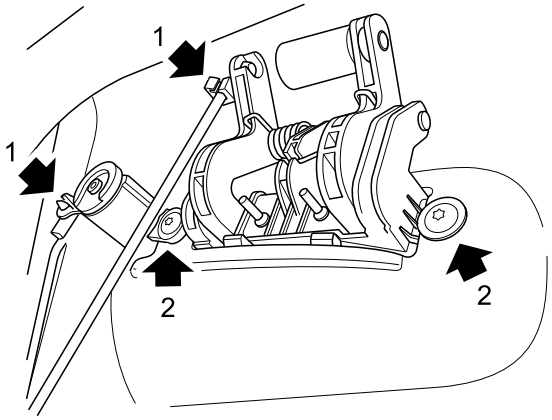
Driver side door outside handle and lock cylinder assembly

Remove

1. Ensure that windows have been fully risen.
2. Disconnect battery earth lead.
3. Remove the driver side door interior trim panel.

☞**The Front Door Interior Trim Panel Remove**

4. Remove the waterproof film.
5. Release the clip 1 fixing the outside assist handle link and the lock cylinder link.
6. Remove the fixing bolt 2 of the door outside handle.



7. Remove the door outside handle and the lock cylinder assembly.

Refit

1. Position the door outside handle and the lock cylinder assembly to the front door via hole.
2. Pre-fit the fixing bolts of the door outside handle from the door inner panel via hole.
3. Clip respectively the outside assist handle link and the lock cylinder link into the corresponding clips.
4. Tighten the two bolts on the outside assist handle to **3.5–5Nm**.
5. Fit the waterproof film.
6. Fit the driver side door interior trim panel.

☞**The Driver Side Door Interior Trim Panel Refit**

7. Connect battery earth lead.

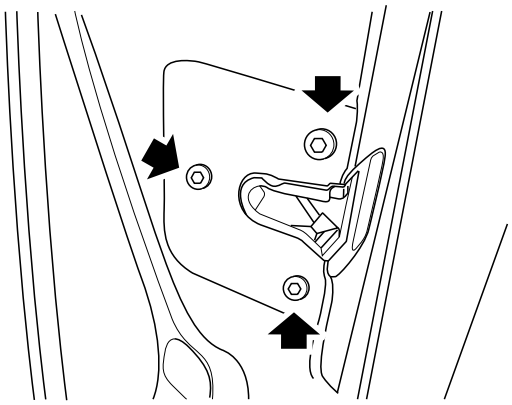
Driver side door lock body assembly

Remove

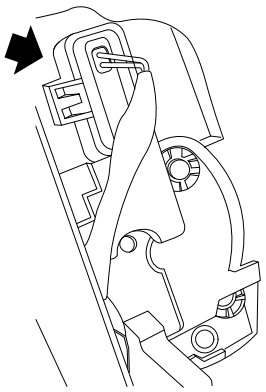
1. Ensure that windows have fully risen.
2. Disconnect battery earth lead.
3. Remove the driver side door interior trim panel.

☞**The Front Door Interior Trim Panel Remove**

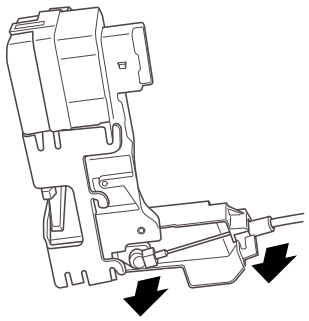
4. Remove the waterproof film.
5. Release the clips of two links connected to the door outside handle and the door lock cylinder.
6. Remove three bolts securing the door lock.



7. Pull out the lock body from the door internal cavity so as to disconnect the door lock electric coupler.



8. Separate the inner assist handle cable from the lock body so as to remove the lock body assembly.



Refit

1. Fit the door lock into the door internal cavity from the interior door with care and position it.
2. Fit three fixing bolts of the door lock in sequence from top to down with the tightening torque of **8–10Nm**.
3. Fix with care two door lock cables connected to the door outside handle and the door lock cylinder with clips by making use of a straight screwdriver.
4. Connect the electric coupler.
5. Fit the door waterproof film.
6. Fit door interior trim panels.

☞**The Front Door Interior Trim Panel Refit**

7. Pull the door outside handle and inspect whether the connection between it and the door lock cable is firm.
8. Connect battery earth lead.

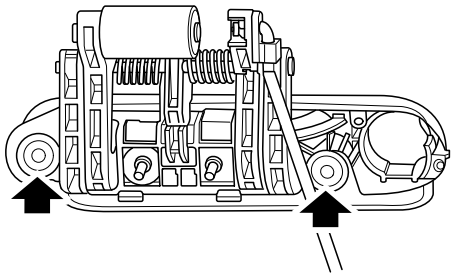
Front seat passenger side door outside handle

Remove

1. Ensure that windows have been fully risen.
2. Disconnect battery earth lead.
3. Remove the front seat passenger side door interior trim panel.

☞**The Front Door Interior Trim Panel Remove**

4. Remove the waterproof film.
5. Release the clip 1 between the outer handle link and the outside assist handle side.
6. Remove two bolts 2 securing the door outside handle.



7. Remove the door outside handle.

Refit

1. Position the passenger side door outside handle to the via hole of the right front door.
2. Fit the fixing bolts of the door outside handle from the door internal cavity with the tightening torque of **3.5–5Nm**.
3. Clip the link into the outside assist handle clips.
4. Fit the waterproof film.
5. Fit the driver side door interior trim panel.

☞**The Front Door Interior Trim Panel Refit**

6. Connect battery earth lead.

Rear door hinge adjustment

Adjust

1. Open the rear door.
2. Put the block to the jack, then put the jack to the lower part of the body so as to support the rear door.
3. Remove four bolts fixing the door upper and lower hinges to the rear door side.
4. Correct the door with a jack.
5. Pre-tighten the hinge bolts.
6. Take away the jack, close the door so as to inspect whether it is corrected correctly.
7. After desirable effect has been realized by correcting, tighten the hinge bolts to the specified torque **22–28Nm**.

Rear door striker adjustment

Adjust

The rear door striker is a crossbar button with two bolts. Usually it is necessary to adjust the striker up and down and inside and outside:

- The frame is caused to be damaged by collision.
- Fit new door weatherstrips.
- The customer repair wind noise is excessive.
- It is difficult to open and close the door.

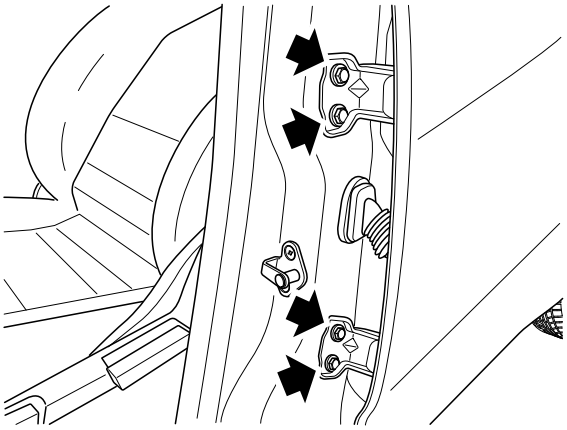
Adjust the striker up and down and inside and outside according to the following procedures:

1. The door must be positioned correctly.
2. Open the rear door.
3. Release two screws of the striker. Adjust the striker so as to align with the door pin, then pre-tighten the screws.
4. Close the door, and check if the rear of the door is flush with the panel of the body side panel and if the door can open and close normally.
5. After correcting, open the door and tighten screws to **25±5Nm**.
6. Close the door.

Rear door assembly

Remove

1. Disconnect battery earth lead.
2. Remove the fixed bolts between the door limiter and the body side.
3. With the help of your assistant, remove four construction bolts 1 between the upper/lower hinges of the rear door and the body side so as to remove the door assembly.



4. Remove bolts securing the hinge door leaf to the door so as to separate the upper/lower hinge from the door assembly.

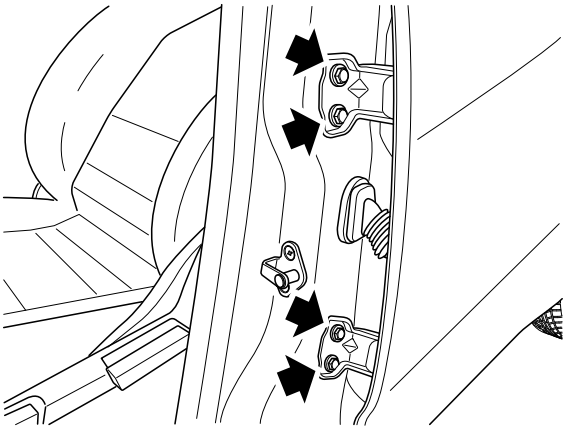
Refit

1. Fit the upper/lower hinge body leaf of the rear door to the door and tighten the torque to **22–28Nm**.
2. With the help of your assistant, position the door to the body.
3. Fit the fixing bolts of the door hinge body leaf, but do not tighten them to the specified torque.
4. Fit the fixed bolts between the door limiter and the body side.
5. Close the door and verify the effect of opening and closing the door, after checking that it meets requirements, tighten the bolts of the upper /lower hinge body leaf to the specified torque **30–36Nm**.
6. Connect battery earth lead.

Rear door hinge assembly

Remove

1. With the help of your assistant, remove respectively four construction bolts 1 between the upper/lower hinge and the body side and remove the rear door.



2. Remove respectively four construction bolts between the upper/lower hinge and the door side so as to separate the upper/lower hinge from the rear door assembly.

Refit

1. Fix and fit the upper and lower hinges respectively to the rear door with bolts and tighten the torque to **22–28Nm**.
2. With the help of your assistant, position the door to the body, and fit the upper and lower hinges respectively to the door with bolts, but don't tighten bolts at this moment.
3. Fit the door limiter.
4. Connect the body wiring harness connector and embed the boot into the body side again.
5. Close the door and verify the effect of opening and closing the door, after checking that it meets requirements, tighten the fixed bolts of the upper/lower hinge body leaf to **30–36Nm**.

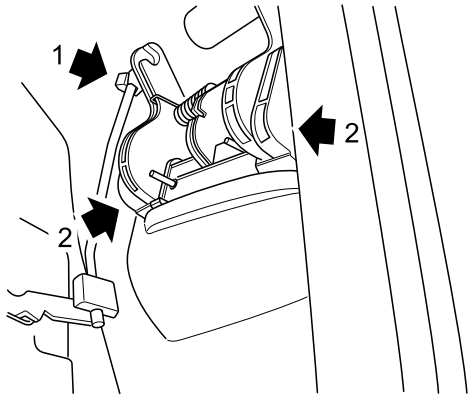
Rear door outside handle

Remove

1. Ensure that windows have fully risen.
2. Disconnect battery earth lead.
3. Remove the rear door interior trim panel.

☞**The Rear Door Interior Trim Panel Remove**

4. Remove the waterproof film.
5. Release the outside assist handle link clip 1.
6. Remove two bolts 2 securing the outside assist handle from the door internal cavity.



7. Remove the door outside handle.

Refit

1. Position the door outside handle to the rear door via hole.
2. Clip the lock body link into the outside assist handle clips.
3. Fit two bolts fixing the outside assist handle from the door internal cavity and tighten them to **3.5–5Nm**.
4. Fit the waterproof film.
5. Fit the rear door interior trim panel.

☞**The Rear Door Interior Trim Panel Refit**

6. Connect battery earth lead.

Rear Door Lock Body Assembly

Remove

1. Make sure the windows are fully raised.
2. Disconnect battery earth lead.
3. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

4. Remove the waterproof film.
5. Release the clips at the side of the lock body link and the outside assist.
6. Remove 3 bolts securing the door lock.
7. Carefully remove the door lock from the door inner chamber.

Refit

1. Carefully fit the door lock into the door inner chamber from the inner side of the door and position it.
2. Engage the lock body link into the clip of the outside assist.
3. Fit 3 bolts holding the door lock with the tightening torque of **8–10Nm**.
4. Door Waterproof Film.
5. Fit the door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

6. Pull the door outside handle to check if the door lock cable is firmly connected.
7. Connect battery earth lead.

Front Door Upper Molding

Remove

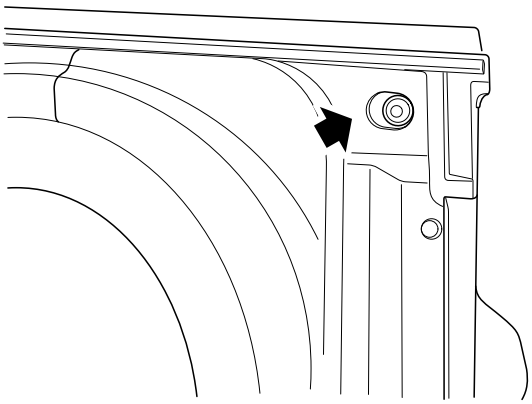
1. Remove the door windowsill outer sealing straps.

☞**The Door Windowsill Outer Sealing Straps Remove**

2. Remove the front door interior trim panel.

☞**The Front Door Interior Trim Panel Remove**

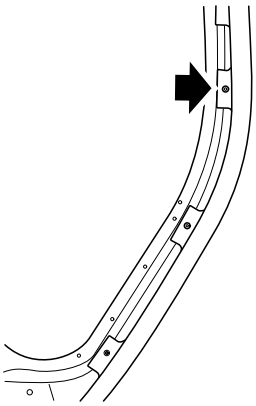
3. Remove one screw fixing the door upper molding to the door frame.



4. Remove the front door glazing runner sealing straps.
5. Remove the front door glazing runner inner sealing straps.
6. Remove the front door partition posts.

☞**The Front Door Partition Posts Remove**

7. Remove the front door quarter window assembly.
8. Knock out rivets and remove the front door upper molding.



Refit

1. Assemble the upper sealing straps to the door window frame, and fit from the middle part bend angle in fitting, aligning with the rivet hole.
2. Fix the upper sealing straps to the door frame with rivets.
3. Fit one clamping screw of the upper sealing strap.
4. Fit the front door quarter window assembly.
5. Fit the front door partition posts.

☞**The Front Door Partition Posts Refit**

6. Fit the sealing strap inside the front door glazing runner.
7. Fit the front door glazing runner sealing strap.
8. Fit upper front door interior trim panel.

☞**The Front Door Interior Trim Panel Refit**

9. Fit the door windowsill outer sealing straps.

☞**Door Windowsill Outer Sealing Straps Refit**

Rear door upper molding

Remove

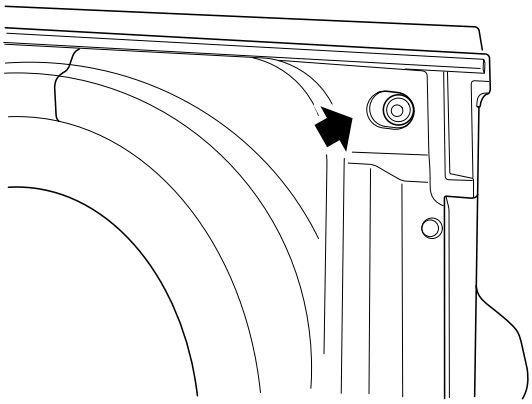
1. Remove the door windowsill outer weatherstrip.

☞**Door Windowsill Outer Weatherstrip Remove**

2. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

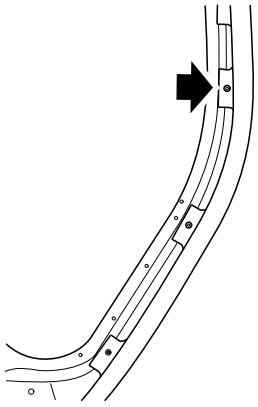
3. Remove one screw fixing the door upper molding to the door frame.



4. Remove the rear door glazing runner weatherstrip.
5. Remove the rear door glazing runner inner weatherstrip.
6. Remove the rear door partition pillar.

☞**Rear Door Partition Pillar Remove**

7. Remove the rear door triangular window assembly.
8. Knock off the rivet and remove the rear door upper molding.



Refit

1. Fit the upper weatherstrip to the door window frame, and fit from the central corner, aligning to the rivet hole.
2. Fix the upper weatherstrip to the door frame with rivets.
3. Fit one upper weatherstrip set screw.
4. Fit the rear door triangular window assembly.
5. Fit the rear door partition pillar.

☞**Rear Door Partition Post Refit**

6. Fit the rear door glazing runner inner weatherstrip.
7. Fit the rear door glazing runner weatherstrip.
8. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

9. Fit the door windowsill outer weatherstrip.

☞**Door Windowsill Outer Weatherstrip Refit**

Door Window Outer Weatherstrip

Remove

1. Carefully pry up the door window outer weatherstrip fixed to the door in sequence from the foreside to the end of the door and remove it.

Refit

1. Position the door window outer weatherstrip to the door.
2. Carefully tap the door window outer weatherstrip fixed to the door with a rubber mallet in sequence from the foreside to the end of the door so as to fasten the weatherstrip to the body.

Door Glass

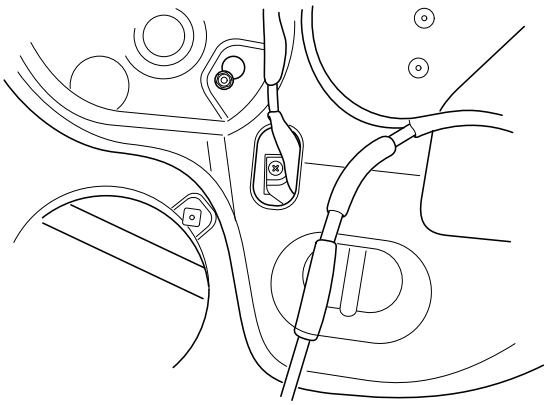
Remove

1. Remove the door interior trim panel.

☞**Front Door Interior Trim Panel Remove**

☞**Rear Door Interior Trim Panel Remove**

2. Remove the waterproof film.
3. Remove 2 set screws fixing the glass to the window regulator.



S91004

4. Carefully take the door glass out of the door inner chamber.

Refit

1. Fit the glass to the door inner chamber so as to fit it into the window glass regulator. Hang the glass onto the sliding block with the small step on the boot, and align the boot hole on the glass with the glass regulator sliding block hole.
2. Fit the glass to the window regulator, and fix with 2 screws, and tighten to **2–4Nm**.
3. Fit the waterproof film.
4. Fit the door interior trim panel.

☞**Front Door Interior Trim Panel Refit**

☞**Rear Door Interior Trim Panel Refit**

Front Door Glass Regulator

Remove

1. Disconnect battery earth lead.
2. Remove the outside rearview mirror.

☞**Outside Rearview Mirror Remove**

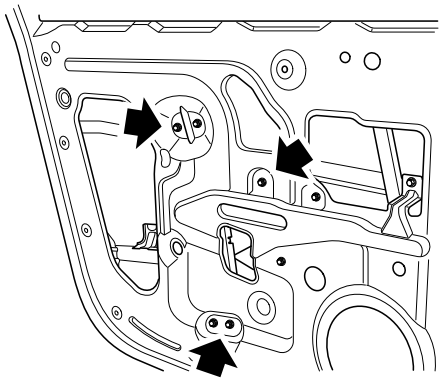
3. Remove the door window outer weatherstrip.
4. Remove the front door interior trim panel.

☞**Front Door Interior Trim Panel Remove**

5. Remove the waterproof film.
6. Remove the door glass.

☞**Door Glass Remove**

7. Unsrew 7 mounting nuts fixing the front door glass regulator, and remove the glass regulator.



Refit

1. Fit 7 mounting nuts of the front door glass regulator from top to bottom, and tighten from left to right to **6.5–7.5Nm**.
2. Fit the door glass.

☞**Door Glass Refit**

3. Fit the waterproof film.
4. Fit the front door interior trim panel.

☞**Front Door Interior Trim Panel Refit**

5. Fit the door windowsill outer weatherstrip.
6. Fit the outside rearview mirror.

☞**Outside Rearview Mirror Refit**

7. Connect battery earth lead.

Rear Door Glass Regulator

Remove

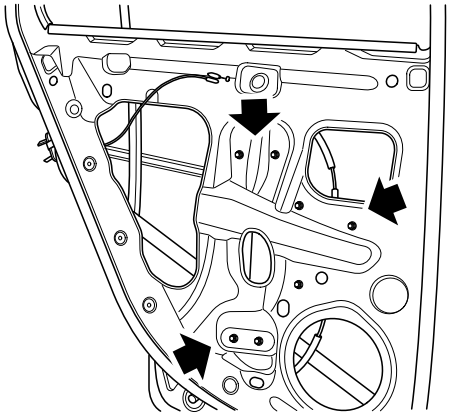
1. Disconnect battery earth lead.
2. Remove the door windowsill outer weatherstrip.
3. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

4. Remove the waterproof film.
5. Remove the door glass.

☞**Door Glass Remove**

6. Unsrew 7 mounting nuts of the rear door glass regulator and remove the glass regulator.



Refit

1. Fit 7 rear door glass regulator mounting nuts from top to bottom, and tighten from left to right to **6.5–7.5Nm**.
2. Fit the door glass.

☞**Door Glass Refit**

3. Fit the waterproof film.
4. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

5. Fit the door windowsill outer weatherstrip.
6. Connect battery earth lead.

Front Door Partition Pillar

Remove

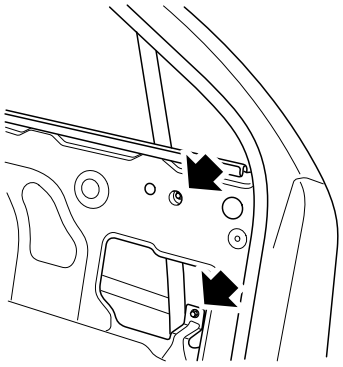
1. Remove the front door interior trim panel.

☞**Door Interior Trim Panel Remove**

2. Remove the waterproof film.
3. Remove the door glass.

☞**Door Glass Remove**

4. Remove 2 bolts mounting the front door partition pillar to the door.



5. Remove the front door partition pillar.

Refit

1. Fit the partition pillar next to the weatherstrip from top to bottom.
2. Fix with bolts, and tighten to **6–8Nm**.
3. Fit the door glass.

☞**Door Glass Refit**

4. Fit the waterproof film.
5. Fit the front door interior trim panel.

☞**Front Door Interior Trim Panel Refit**

6. Fit the door windowsill outer weatherstrip.
7. Connect battery earth lead.

Rear Door Partition Pillar

Remove

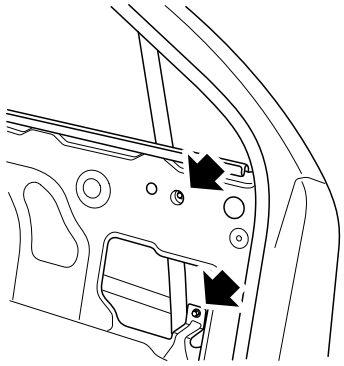
1. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

2. Remove the waterproof film.
3. Remove the door glass.

☞**Door Glass Remove**

4. Remove 2 rear door partition pillar set screws.



5. Remove the rear door partition pillar.

Refit

1. Fit the partition pillar next to the weatherstrip from top to bottom.
2. Fix with bolts, and tighten to **6–8Nm**.
3. Fit the door glass.

☞**Door Glass Refit**

4. Fit the waterproof film.
5. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

Power Window Switch - Driver Side

Remove

1. Remove the front door interior trim panel.

☞**Front Door Interior Trim Panel Remove**

2. Disconnect the switch connector.
3. Remove the power window switch.

Refit

1. Connect the switch connector.
2. Fit the switch to the front door trim panel.
3. Fit the front door interior trim panel.

☞**Front Door Interior Trim Panel Refit**

Power Window Switch - Other

Remove

1. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Remove**

2. Disconnect the switch connector.
3. Remove the power window switch.

Refit

1. Connect the electrical connector.
2. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Panel Refit**

Front Closures

Specifications

Torque

Description	Value
Bolt - member front end panel assembly to front lamp mounting assembly	7–10Nm
Nut - hood hinge to hood	26–34Nm
Bolt - hood hinge to body front end	26–34Nm
Bolt - hood lock to platform	6–8Nm

Service Procedures

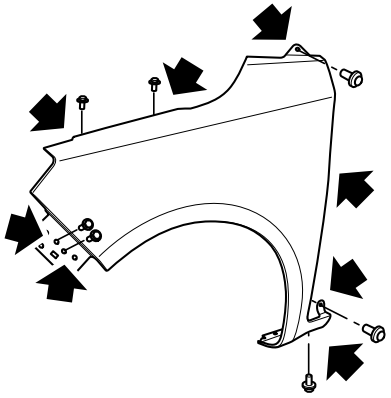
Fender

Remove

1. Remove front wheel mud shields.
2. Remove the headlight assembly.

☞**Headlight Assembly Remove**

3. Remove the front bumper bracket.
4. Remove post A trim panel.
5. Remove the eight bolts securing the fender to the body.



6. Remove the fender.

Refit

1. Position and adjust the fender.
2. Fit the fender to the body and don't tighten bolts.
3. Adjust spacings between the fender and each adjacent panel to make the gaps become even. Tighten eight bolts securing the fender to the body.
4. Fit post A trim panel.
5. Fit the front bumper bracket.
6. Fit the headlight assembly.

☞**Headlight Assembly Refit**

7. Fit front wheel mud shields.

Member front end panel

Remove

1. Remove the front bumper.

☞**Front Bumper Remove**

2. Remove the headlight assembly.

☞**Headlight Assembly Remove**

3. Remove horns.

☞**Horns Remove**

4. Remove radiators.

☞**Radiators Remove**

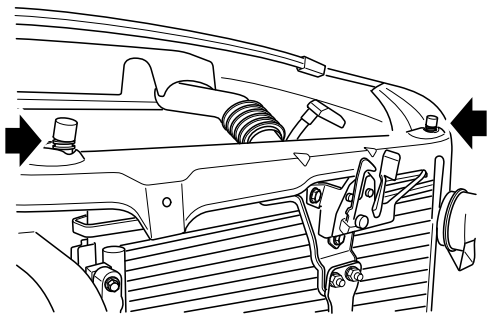
5. Remove the bonnet lock body assembly.

☞**Bonnet Lock Body Assembly Remove**

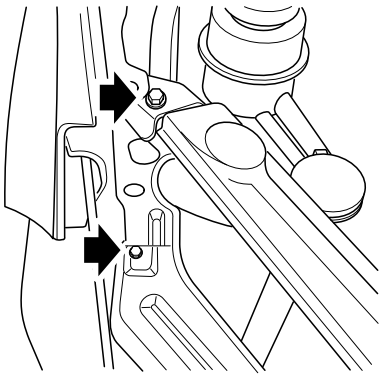
6. Remove the front bumper buffer beam.

☞**Front Bumper Buffer Beam Remove**

7. Remove the bumper.



8. Remove two screws securing the member front end panel to body.



9. Remove two screws securing the member front end panel to body.
10. Remove the member front end panel from the body.

Refit

1. Position the member front end panel to the water tank.
2. Fit the member front end panel to the left support with

two screws with the tightening torque of **7–10Nm**.

3. Fit the member front end panel to the right support with two screws with the tightening torque of **7–10Nm**.
4. Fit bumper pads.
5. Fit radiators.

☞**Radiator Refit**

6. Fit the front bumper buffer beam.

☞**Front Bumper Buffer Beam Refit**

7. Fit the bonnet lock body assembly.

☞**Bonnet Lock Body Assembly Refit**

8. Fit horns.

☞**Horns Refit**

9. Fit the headlight assembly.

☞**Headlight Assembly Refit**

10. Fit the front bumper.

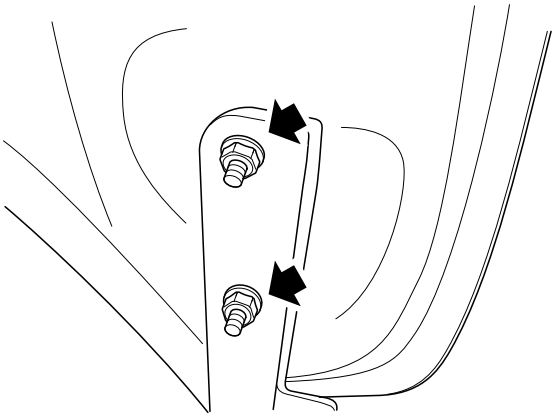
☞**Front Bumper Refit**

Bonnet Assembly

Remove

Warning: Take special attention to avoid vehicle damage and personal injury.

1. Open and support the bonnet steady.
2. Make a mark at the hinge position which is relative to the bonnet so as to position in fitting.
3. Remove four nuts fixing the bonnet to hinges at two sides.



4. With the help of your assistant, remove the bonnet.

Refit

Warning: Bonnet will drop by its own weight during removal and refit, so make sure to support it safely.

1. With the help of your assistant, assemble and position the bonnet and align it with positions marked in removing.
2. Fit four nuts securing hinges at two sides to the bonnet and tighten the torque to **26–34Nm**.
3. Close the bonnet, inspect whether the bonnet is positioned accurately.

☞**The bonnet Adjustment**

Bonnet Hinge Assembly

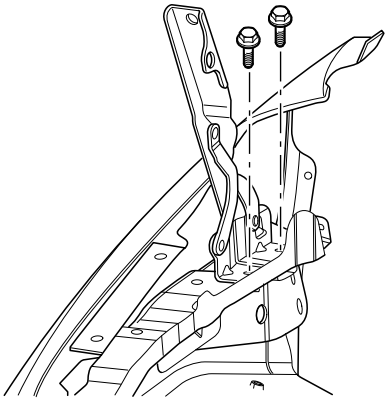
Remove

Warning: Take special attention to avoid vehicle damage and personal injury.

1. With the help of your assistant, remove the bonnet.

☞**Bonnet Remove**

2. Remove four nuts at the connections between the hinges at two sides and the body front end so as to remove the hinge assembly.



Refit

1. Position respectively hinges at two sides to the front end of the body and tighten the mounting bolts to **26–34Nm**.
2. With the help of your assistant, fit the bonnet.

☞**Bonnet Refit**

Warning: Bonnet will drop by its own weight during removal and refit, so make sure to support it safely.

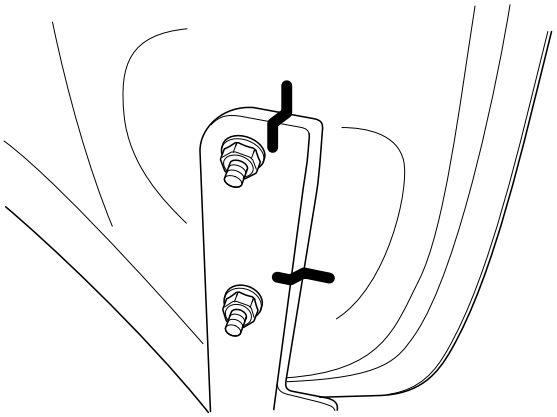
Adjustment of the Bonnet

Check

1. Inspect the position of the bonnet and the curve from the bonnet to the front fender must be smooth; the clearance between the bonnet and the front fender must be even; the front angle of the bonnet must be aligned with the front fender.

Adjust

1. Adjust the rear end of the bonnet
   a. Make marks on the outer profile of the bonnet hinge with a non-permanent marker.



   b. Release nuts securing the hinge to the bonnet.
   c. Adjust the bonnet position so that the bonnet is aligned with the front fender.
   d. Screw down the hinge nuts to **26–34Nm**.
2. Adjust the front end of the bonnet
   a. Release the striker lock nuts.
   b. Adjust the striker and the bonnet bumper so that the bonnet can be aligned with the front fender.
   c. Screw down the striker lock nuts.
3. Adjust the clearance/front angle
   a. Make marks on the outer profiles of two hinges on the body with a non-permanent marker.
   b. Release bolts securing the hinge to the body.
   c. Adjust the position of the bonnet in transverse direction and front/rear direction so that the bonnet could be aligned with the front fender with its front angle being in the same plane as the front fender.
   d. Screw down the hinge bolts to **26–34Nm**.

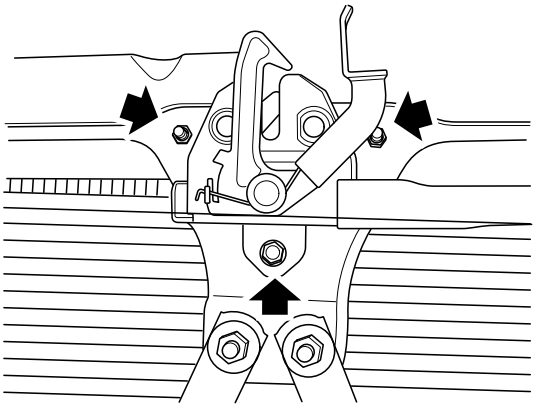
Bonnet Lock Body Assembly

Remove

1. Open and support the bonnet steady.
2. Remove the front bumper assembly.

☞**Front Bumper Remove**

3. Make a mark on the position of the lock body on the member front end panel support so as to position in fitting.
4. Remove three bolts, release the spherical end of the bonnet opening cable on the back of the lock body assembly from the locking hook groove so as to remove the bonnet lock body assembly.



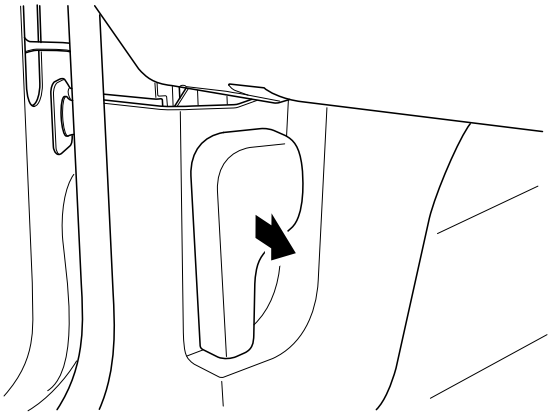
Refit

1. Clip the spherical end of the opening cable of the bonnet into the locking hook groove on the the back of the lock body and meanwhile put the cable heart yarn into the trough and align the ring-shaped groove on the cable sleeve end socket with the mounting groove on the back of the lock body. Press forcibly until "click" is heared, in this way the connection between the cable and the bonnet lock body is finished.
2. Position the bonnet lock body to the member front end panel support and align with the position marked in removing.
3. Fit three fixing bolts and fit the bonnet lock body to the member front end panel support with the tightening torque of **6–8Nm**.
4. Pull the opening assist handle of the bonnet inside the cockpit and verify the effect of opening the bonnet.

Bonnet Releasing Cable

Remove

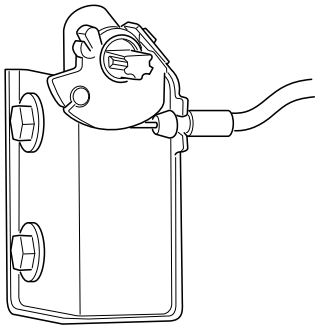
1. Pull the opening assist handle of the bonnet so as to open the bonnet and support reliably with the strut bar.
2. As indicated by the arrow, remove carefully the bonnet opening assist handle.



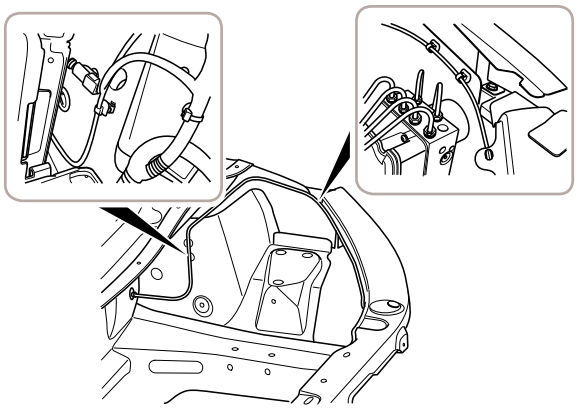
3. Remove post A lower trim panel.

☞**Post A Lower Trim Panel Remove**

4. Remove the cable end from the opening assist handle seat.



5. As indicated by the arrow,remove and release the bonnet cable.



6. Release five clips in sequence so as to release the cable.

7. Remove the bonnet lock body assembly.

☞**Bonnet Lock Body Assembly Remove**

8. Pull the cable assembly out of the engine compartment side.

Refit

1. Position the cable assembly to the engine compartment, insert the cross-head end into the cockpit through holes of the front compartment baffle plate from the engine compartment and fix the rubber seal rings of the cable assembly to the baffle plate holes.
2. Fit the bonnet lock body assembly.

☞**Bonnet Lock Body Assembly Refit**

3. Insert the cross-head end of the cable assembly into the opening assist handle seat. Meanwhile, align the cable heart yarn with the mounting groove of the seat, and press forcibly until "click" is heard. Connection is finished in this way.
4. Fit post A lower trim panel.

☞**Post A Lower Trim Panel Refit**

5. Fit the bonnet opening assist handle, ensuring that the assist handle is pressed firmly to the end.
6. Pull the opening assist handle of the bonnet inside the cockpit and verify the effect of opening the bonnet.

Rear Closures

Specifications

Torque

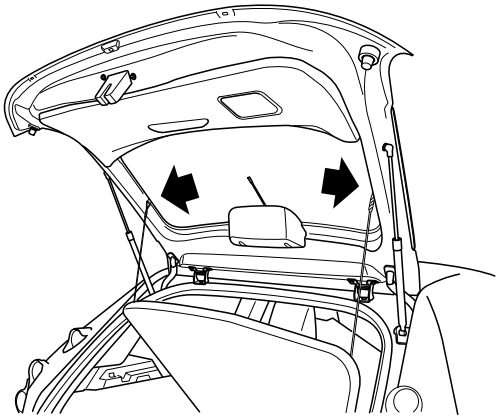
Description	Value
Bolt - tailgate hinge to tailgate panel	7–10Nm
Spigot-gas strut - bodyside mounting bracket and tailgate inner panel	20–29Nm
Nut - tailgate hinge to body	26–34Nm
Bolt - tailgate lock to tailgate panel	6–8Nm
Bolt - striker to body	8.5–11.5Nm
Bolt - tailgate outer handle to tailgate	6–8Nm
Bolt - fuel filler flap to body	8–12Nm
Screw - tailgate finisher lower–tailgate	2–3Nm

Service Procedures

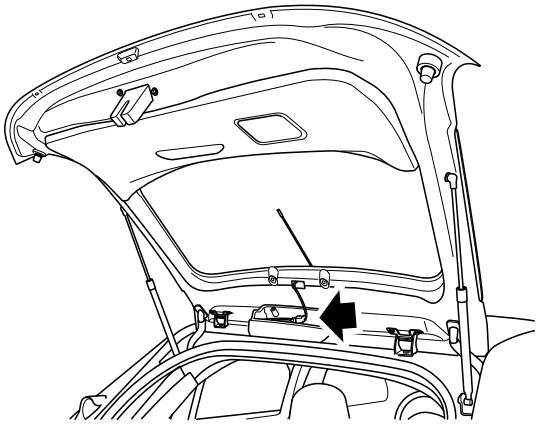
Tailgate assembly

Remove

1. Unlock the door lock, and then disconnect battery earth lead.
2. Open the tailgate.
3. Release the hat tree dragline from the tailgate pothook.



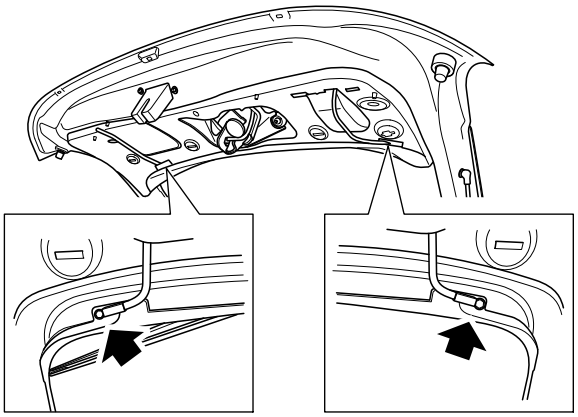
4. Remove high mount brake lamps and disconnect their wiring harness connectors.



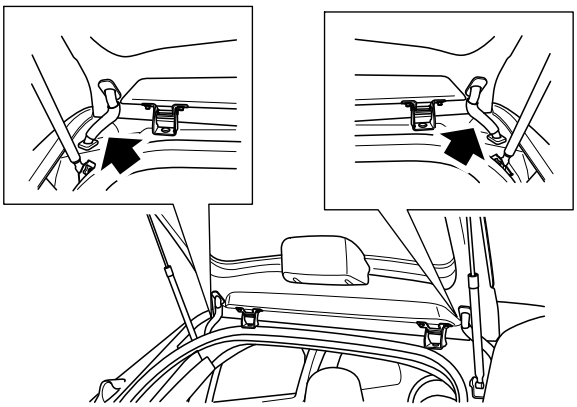
5. Remove the tailgate trim panel.

☞**Tailgate Trim Panel Remove**

6. Disconnect the wiring harness connector of the rear windshield wiper motor.
7. Disconnect the tailgate lock body connector.
8. If the tailgate still needs to be reassembled, reference positions should be marked on the hinges.
9. Release interfaces of the heating resistance wires at two sides of the tailgate windshield.



10. As indicated by the arrow in the diagram, release the wiring harness jackets at two sides of the tailgate to pull out the electric equipment wiring harness from the tailgate internal cavity.



11. With the help of your assistant, remove four bolts within the range that is from the hinges at two sides to the tailgate.

Warning: As the large weight of the tailgate, operations should be performed after the safety feature is set, and take extra care to prevent the vehicle from damaging and personal injury.

12. With the help of your assistant,prize up with care the retaining clips of the gas spring piston ends at two sides and pull out forcibly the ball head seat at the piston end from the tailgate so as to remove the tailgate assembly.

Warning: As the large weight of the tailgate, operations should be performed after the safety feature is set, and take extra care to prevent the vehicle from damaging and personal injury.

13. Remove the lock body assembly and the rear windshield wiper motor from the tailgate assembly.

Refit

1. With the help of your assistant, position the tailgate to the body and align it with the corresponding marks.
2. Fit the connecting bolts between the tailgate and the

hinge, but do not tighten them to the even twisting moment.

Warning: As the large weight of the tailgate, operations should be performed after the safety feature is set, and take extra care to prevent the vehicle from damaging and personal injury.

3. Press respectively the ball head seats of the gas spring piston ends at two sides into the ball head of the tailgate side plate until "click" is heared, which means that they have been assembled to the designated position.

Caution: Oil seals are waxed and must not be lubricated prior to fitting.

4. Fit the electric equipment wiring harness into the tailgate internal cavity and connect interfaces of the heating resistance wires at two sides of the windshield.
5. Fit the tailgate lock body assembly and connect the lock body connector.
6. Fit the rear windshield wiper motor and its connector.
7. Connect the wiring harness interfaces of the high mount brake lamps and fit high mount brake lamps.
8. Inspect and adjust the fit clearance and surface difference between the tailgate and the body sidewall as well as the rear sidewall. After adjusting, tighten the bolts to the torque **7–10Nm**.
9. Fit the tailgate trim panel.

☞**Tailgate Trim Panel Refit**

10. Hang hanging lines at two sides of the hat tree to the pothook of the tailgate inner trim panel.
11. Connect battery earth lead.

Tailgate Gas Spring and Mounting Knob

Remove

1. Open the endgate, and ensure that during the remove process the tailgate is reliably supported.

Warning: As the large weight of the tailgate, operations should be performed after the safety feature is set, and take extra care to prevent the vehicle from damaging and personal injury.

2. Carefully unclench the fixed buckle at the left-side gas spring piston end, so as to forcefully pull out the knob base of the piston gate from the knob of the tailgate.
3. Forcefully pull out the knob base of the gas spring socket end from the knob of the left-side small bracket of the vehicle body.
4. Repeat the step 2-3, and remove the right-side gas spring.
5. Finally, remove the gas spring mounting knobs on the tailgate inner panel and side brackets of the vehicle.

Refit

1. Respectively align the gas spring mounting knobs to the left-side gas spring mounting bracket via hole and the via hole in the left side of the tailgate inner panel.
2. Respectively tighten to**20–29Nm** to fit the gas spring mounting knob.
3. Check the steel spring buckles on the knob bases of the two ends of gas spring, to ensure they are at appropriate positions in the spring buckle channel.
4. Align the knob base of the gas spring socket to the knob on the left-side bracket, and ensure the position part of the gas spring is downward.
5. Grasp the socket end with a hand, and press the knob base to the knob with the thumb, then a crack sound will be heard and this means they have been fit well.

Caution: To avoid damaging the airtightness of the air spring, never hold the centre of the air spring and laterally apply force to it by hand.

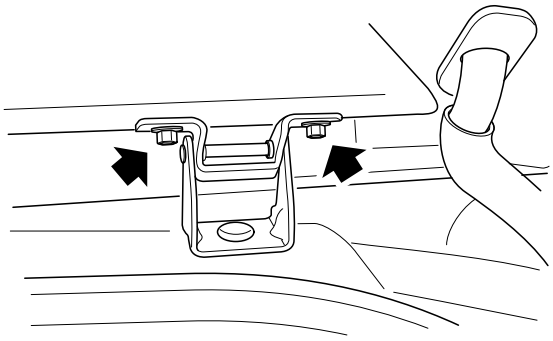
6. Align the knob base of the gas spring position end to the knob on the inner panel of the tailgate, grasp the piston end part, press the knob of the knob base, then a crack sound will be heard and this means they have been fit well.
7. Repeat step 1-6, and fit the gas spring at the right side of the tailgate.

Tailgate hinge assembly

Remove

1. With the help of your assistant, remove bolts fixing the hinge assembly to the tailgate assembly.

Warning: As the large weight of the tailgate, operations should be performed after the safety feature is set, and take extra care to prevent the vehicle from damaging and personal injury.



2. Remove nuts fixing the hinge assembly to the body so as to remove the tailgate hinge assembly.

Refit

1. Position the tailgate hinge assembly to the body and tighten nuts to **26–34Nm**.
2. Fix the hinge assembly to the tailgate assembly with bolts and tighten them to **7–10Nm**.
3. Close the tailgate, inspect whether the matching points are aligned with the surrounding sheet metal components so as to check the hinge refit effect.

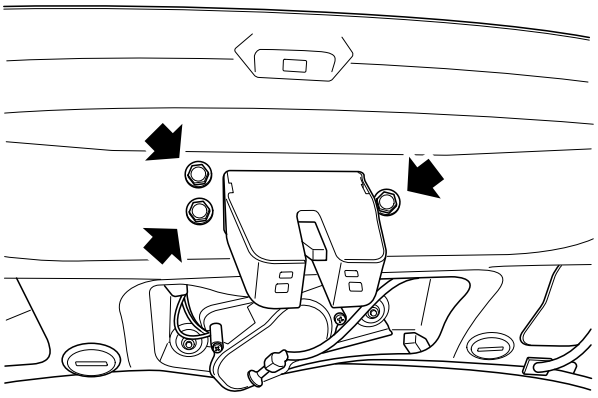
Tailgate lock body assembly

Remove

1. Disconnect the negative pole of the battery.
2. Open the tailgate.
3. Remove the tailgate trim panel.

☞**Tailgate Trim Panel Remove**

4. Remove three bolts fixing the lock body.



5. Disconnect the electrical equipment interfaces on the rear winshield wiper motor and remove the motor.
6. Release clips at the connection between the tailgate handle link and the lock body.
7. Pull the lock body out of the tailgate internal cavity, disconnect the connector so as to remove the tailgate lock body assembly.

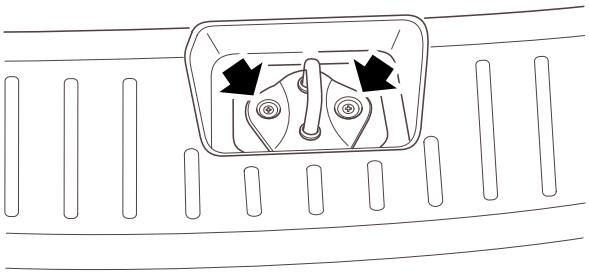
Refit

1. Fit the lock body assembly into the tailgate internal cavity.
2. Connect the electric coupler of the lock body and clip the tailgate assist handle link into the lock body assembly.
3. Screw on three construction bolts, but don't tighten them.
4. Fit the rear windshield wiper motor, and fix and connect its electrical equipment interfaces.
5. Inspect and adjust the fit clearance and surface difference between it and the surrounding sheet metal components, and after adjusting, tighten the lock body bolts to **6–8Nm**.
6. Close the tailgate.
7. Connect the negative pole of the battery.

Tailgate Striker

Remove

1. Open the tailgate.
2. Remove two bolts on the tailgate striker so as to remove the striker.



Refit

1. Position the striker to the body tailgate sill, ensuring that the arrow on the striker points into the vehicle. And pay attention to the corresponding relationship between the position scale mark on the striker and the scale mark on the body.
2. Fix the tailgate striker to the body with bolts, but don't tighten them.
3. Open and close the tailgate for several times, inspect and adjust the fit clearance and surface difference between the tailgate and the surrounding sheet metal components. After adjusting, tighten the bolts to the torque **8.5–11.5Nm**.
4. Ensure that the tailgate lock enters into the full lock state, inspect whether the tailgate lock electrical equipment signals are correct.

Tailgate Exterior Handle

Remove

1. Open the tailgate.
2. Remove the trim panel of the tailgate.

☞**Tailgate Trim Panel Remove**

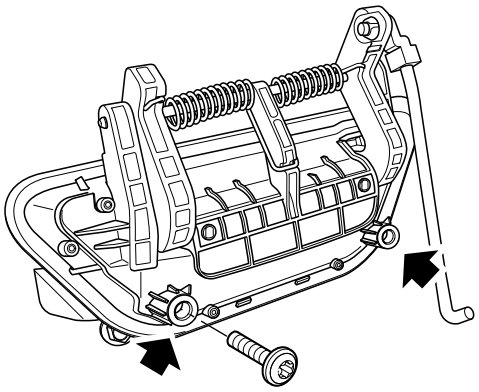
3. Remove the motor for the rear windshield wiper.

☞**Rear Windshield Wiper Motor Remove**

4. Remove the tailgate lock body assembly.

☞**Tailgate Lock Body Assembly Remove**

5. Remove 2 bolts securing the tailgate handle to the tailgate.



6. Remove the exterior handle assembly from the outside of the tailgate.

Refit

1. Position the tailgate exterior handle from the exterior side to the outer panel.
2. Fit fixed bolts of the exterior handle from the inner side of the tailgate, and tighten to **6–8Nm**.
3. Fit the tailgate lock body assembly.

☞**Endgate Lock Body Assembly Refit**

4. Fit the motor for the rear windshield wiper.

☞**Rear Windshield Wiper Motor Refit**

5. Fit the trim panel of the tailgate.

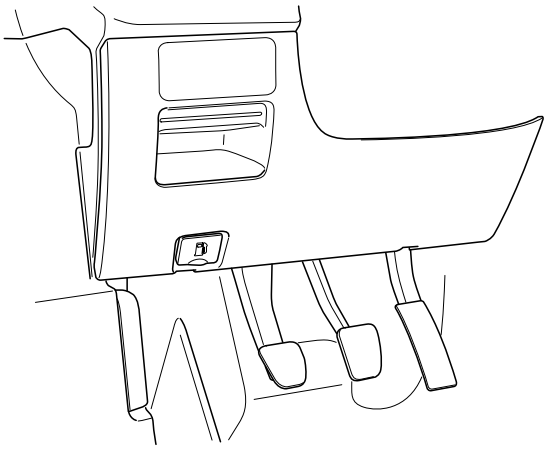
☞**Tailgate Trim Panel Refit**

6. Close the tailgate, and repeatedly open it for several times to check whether it is normal or not.

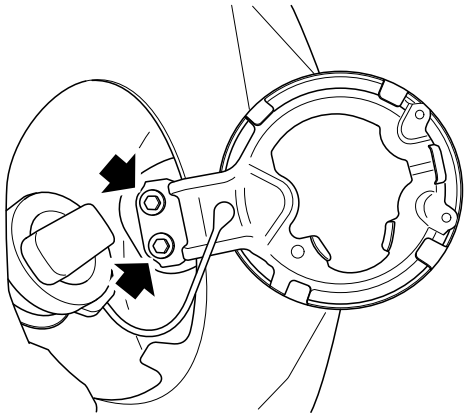
Fuel Filler Door Assembly

Remove

1. Lift up the opening handle of the fuel filler door so as to open the fuel filler door.



2. Remove 2 construction bolts of the connection between the fuel filler door and the body.



3. Release the fuel filler cover cables so as to remove the fuel filler door assembly.

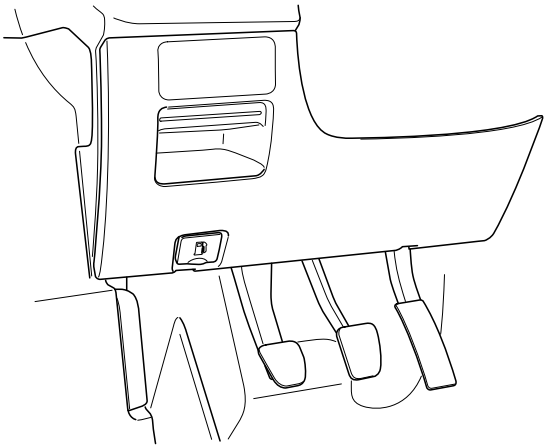
Refit

1. Position the fuel filler door to the body and tighten it to the specified torque with bolts **8–12Nm**.
2. Close the fuel filler door.

Fuel Filler Door Release Cable Assembly

Remove

1. Open the driver side door, pull the opening handle of the lower fuel filler door of the driver side instrument panel so as to open the fuel filler door.



2. Pry up and pull out the fuel filler door puller with a straight screwdriver.

Caution: The opener plastic part can be damaged but the fuel filler door panel around it should be kept in good condition.

3. Open the tailgate, remove the trunk right trim panel.

☞**Trunk Side Trim Panel Remove**

4. Remove the trunk carpet, release clips fixing the cable to the body floor.
5. Remove the left rear door sill trim panel.
6. Remove the left post C lower trim panel.

☞**Post C Lower Trim Panel Remove**

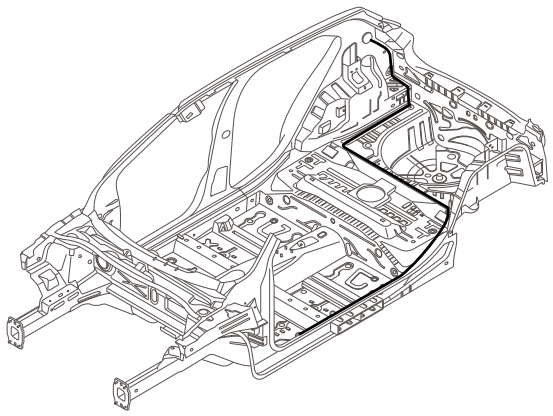
7. Remove the left rear door sill trim panel.
8. Remove the B post lower trim panel.

☞**The Left Post B Lower Trim Panel Remove**

9. Remove the driver side A post lower trim panel.

☞**The Post A Lower Trim Panel Remove**

10. Remove the cable from the opening handle seat.
11. Release all clips on the cable so as to pull out all cables from the fuel filler door.



Refit

1. Thread one end of the puller manual cable assembly into the trunk through the puller mounting hole on the right body sidewall and push forcibly the puller into the hole along the hole axis until "click" is heard and clips at two sides of the puller are locked into the sidewall fully.
2. Make the cable assembly enter into the rear end of the trunk through the right side of the trunk, fix the cable in order with clips in the direction from the trunk rear seat bottom to the trunk left side, and finally lock the cylindrical end of the cable assembly in the direction of the body left C post lower trim panel and the left sill into the gap of the opening handle seat.
3. Fit driver side post A lower trim panel.

☞**Post A Lower Trim Panel Refit**

4. Fit post B lower trim panel.

☞**Post B Lower Trim Panel Refit**

5. Fit the left rear vehicle door sill trim panel.
6. Fit left post C lower trim panel.

☞**Post C Lower Trim Panel Refit**

7. Fit the trunk carpet.
8. Fit the trunk right trim panel.

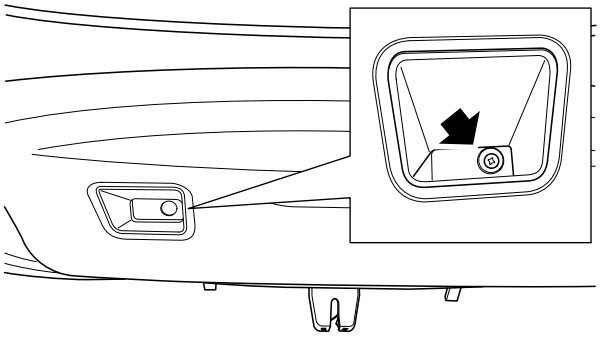
☞**Trunk Right Trim Panel Refit**

9. Pull the opening handle of the fuel filler door at the driver side sill, verify the connection effect of the puller manual cable assembly.

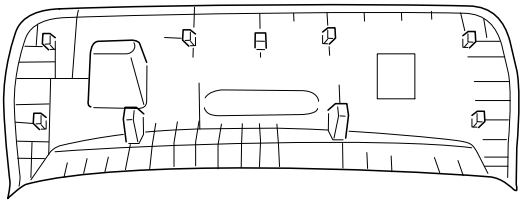
Tailgate Trim Panel

Remove

1. Open the tailgate.
2. Remove the bolts fixing the tailgate trim panel to the tailgate.



3. Prize up the tailgate trim panel carefully and release it from the tailgate inner plate so as to remove the panel.



Refit

1. Position the tailgate trim panel to the tailgate inner panel and lock it with clips.
2. Fit the bolts with the tightening torque of **2–3Nm**.

Horns

Specifications

Torque

Description	Value
Bolt - horn to member front end assembly	7–10Nm

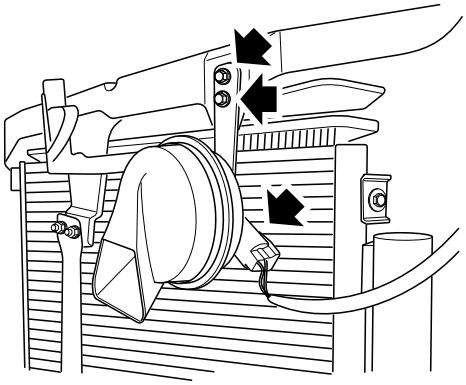
Service Procedures

Horn

Remove

1. Disconnect battery earth lead.
2. Remove the front bumper assembly.

☞**Front Bumper Assembly Remove**



3. Disconnect the connector.
4. Remove 2 bolts fixing the high-tone horn assembly to the member front end panel.

Refit

1. Fit the high-tone horns to the member front end panel, fit bolts and tighten to **7–10Nm**.
2. Connect the connector.
3. Fit the front bumper assembly.

☞**Front Bumper Assembly Refit**

4. Connect battery earth lead.

Body Control

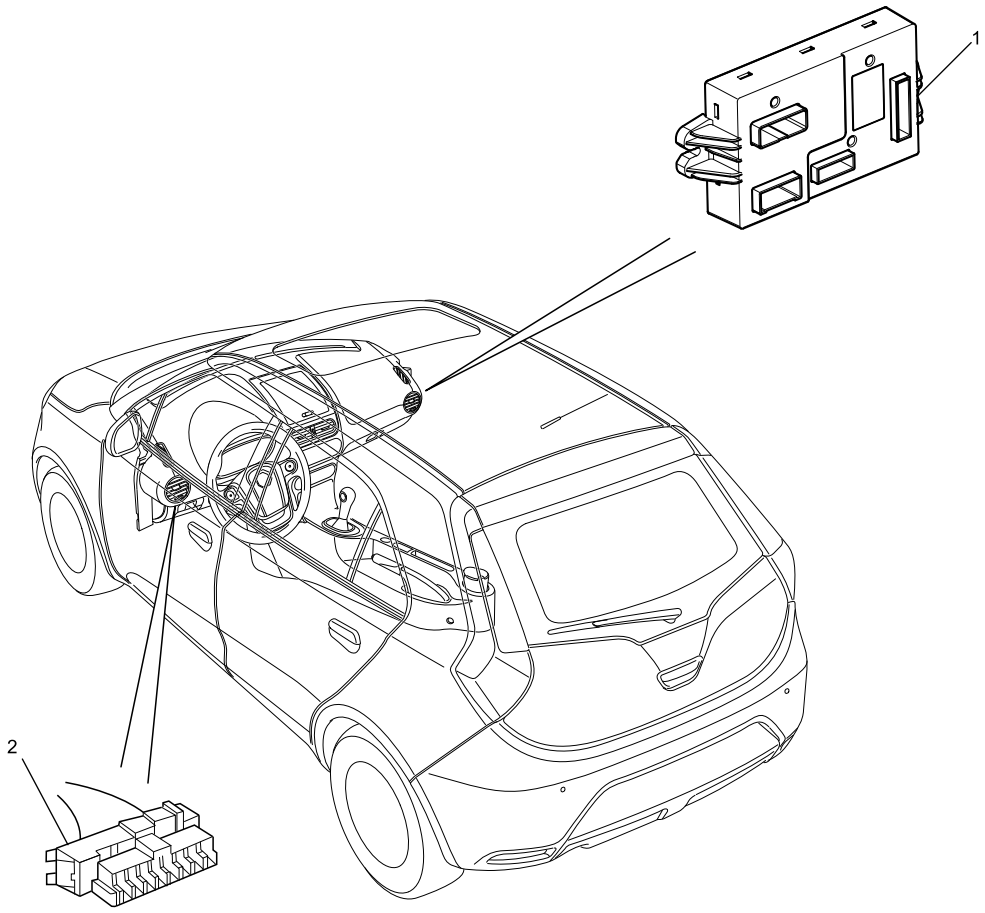
Specifications

Torque

Description	Value
Bolt - BCM to body	5–7Nm

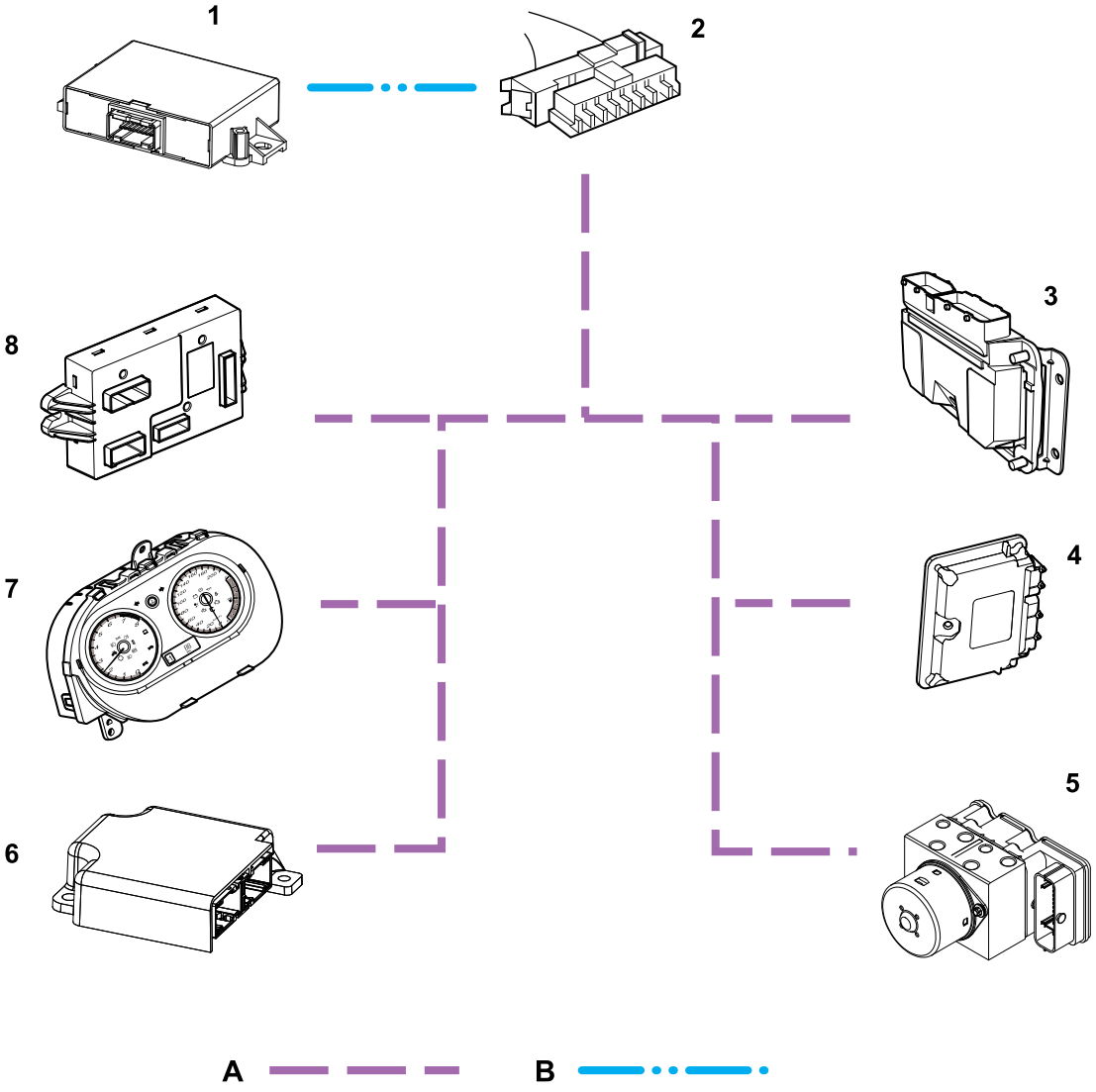
Description and Operation

System Layout



1. Body Control Module
2. Diagnostic Socket

System Control Diagram



A = HS CAN Bus; B = K Line

1. Parking Distance Controllor
2. Diagnostic Socket
3. Engine Control Module
4. Automatic Transmission Controllor
5. ABS/DSC Control Module
6. Airbag Control Unit
7. Instrument Pack
8. Body Control Module

Description

BCM is located behind the glovebox secured with two bolts.**BCM** is responsible for a number of functions on the vehicle and interacts with other major electrical systems using the HS CAN Bus and minor electrical systems using the**K** Bus.

Using the HS **CAN**, the**BCM** receives information from and interacts with the following vehicle features:

- Engine Control Module (**ECM**)
- Automatic Transmission Module (**TCM**)
- Supplementary Restraint System ECU (**SRS ECU**)
- **ABS**/**DSC** ECU
- Instrument pack including all gauges and warning indicators

The **ABS**/**DSC** ECU is connected to the**SRS** and yaw rate sensor using a local HS CAN.

Using the**K** Bus, the**BCM** receives information from and interacts with the following vehicle features:

- Parking Distance Controller PDC

In addition, the**BCM** controls the operation of, and stores information for the following ancillary systems:

- Battery Voltage

  The**BCM** receives the alternator load status. This is published on the**CAN** for alternator load management purposes.

- Vehicle Odometer

  The**BCM** stores the vehicle odometer reading (up to a maximum of 999999 km). The instrument pack displays the latest maximum reading. Once stored, it is not possible to amend the odometer reading.

- Vehicle Identification Number (**VIN**) is stored

  The**VIN** is stored in the **BCM**. It is not possible to amend the VIN once the vehicle has reached a preset mileage.

- Vehicle Configuration Information

  The**BCM** stores vehicle configuration information. The vehicle configuration code contains information about the vehicle construction, including which options are fitted.

- Service interval display

  The**BCM** stores the service interval data for display in the instrument pack.

- Diagnostic code data

  The**BCM** performs self-diagnostic checks when the ignition is on and stores any errors detected in the**EEPROM** as diagnostic trouble codes. Errors within the**CAN** &**K** Buses are also stored.

Programme Function

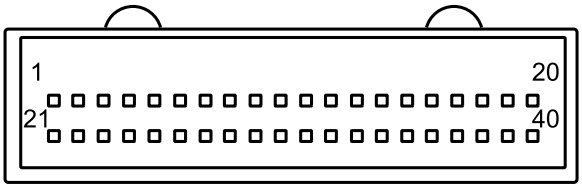
The authorized diagnostic tool allows the implementation of the following functions:

- The addition of a new blank key.
- Enable/disable an existing vehicle key.
- Learn the cipher key from the**EMS** when replacing the **BCM**.
- Teach the cipher key to the**EMS** when replacing the Engine Control Module (**ECM**).
- Generate a new cipher key when replacing**BCM** and**ECM** together.
- Set the battery load management status.
- Write new application software (only under manufacturer's guidance).

Body Control Moudle Connector

There are four connectors in **BCM**: MG644114, MG644088, MG643335-R00 and MG643314, which provide signal input/output service for the body control unit.

BCM connector MG644114

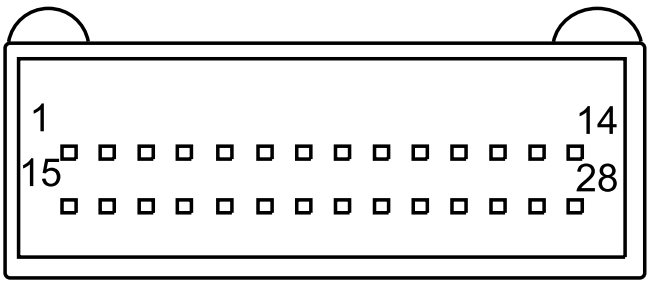


MG644114

Pin No.	Description
1	Exterior Antenna Input
2	Start Switch Input
3	Rear Water Spray Switch
4	Front Water Spray Switch
5	Driver Window Lower Switch
6	Front Passenger window Lower Switch
7	Rear Window Raise/Lower Disable Switch
8	Rear Wiper Return Signal
9	Rear Wiper Switch
10	Front Wiper Mode Control Switch 1
11	Right Turn Lamp Switch
12	Sidelight Switch
13	Driver Window Raise Switch

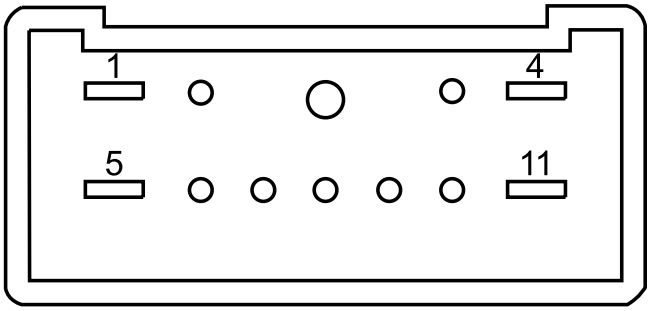
14	Trunk Unlocking Switch
15	Driver Door Open Warning Switch
16	Driver Door Key Door Lock Signal
17	High Beam Light Flashing Switch
18	Data Line of IMMO SPI Bus
19	Clock Line of IMMO SPI Bus
20	Reserve Wake-up Input Switch
21	ACC Switch
22	Ignition Switch
23	Reverse Switch
24	Low Beam Light Switch
25	Front Passenger window Raise Switch
26	Inertia Switch, Wake-up Input
27	Rear Window Heating Switch
28	Front Wiper Return Signal
29	Front Wiper Mode Control Switch 2
30	Emergency Warning Light Switch
31	Left Turn Lamp Switch
32	Horn Switch
33	Trunklid Open Warning Switch
34	Passenger Door Open Warning Switch
35	Driver Door Key Unlocking Signal
36	High Beam Light Switch
37	Rear Fog Lamp Switch
38	Low CAN Bus
39	High CAN Bus
40	Reserve

BCM Connector MG644088



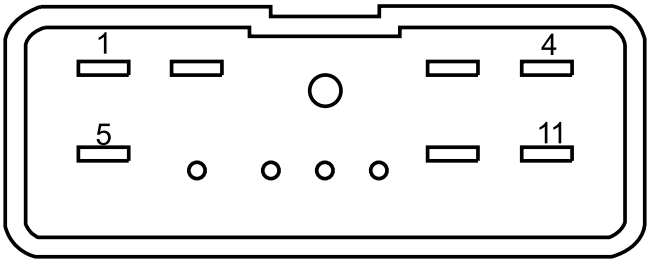
Pin No.	Description
1	Rear Window Disable Switch Illumination
2	High Beam Relay Coil
3	Rear Window Heating Relay Coil
4	Drive Driver Window to Lower
5	Starter Motor Relay Coil
6	Raise Front Passenger Window to Raise
7	Drive the Rear Right Window to lower
8	Safety Lock Relay Coil
9	Drive Driver Window to Raise
10	Reserve Low Side Drive Output 2
11	Reserve Low Side Drive Output 4
12	Door Lock Status Indicator
13	Reserve Analog Input
14	Wiper Interval Time Selection Signal
15	Front Wiper Speed Selection
16	Rear Wiper Relay Coil
17	Sidelight Coil
18	Front Wiper Enable Relay Coil
19	Wiper Analog Quantity Ground
20	Drive the Rear Left Window to Lower
21	Drive the Rear Left Window to Raise
22	Raise the Rear Right Window to raise
23	Drive the Front Passenger Window to Lower
24	Reserve Low Side Drive Output 1
25	Reserve Low Side Drive Output 3
26	Rear Window Heating Switch Status Indicator
27	Interior Central Control Lock Switch
28	Sunroof Auto Close Signal

BCM Connector MG643335-R00



Pin No.	Description
1	Right Turn Lamp Output
2	Rear Fog Lamp Output
3	Horn Relay Output
4	Front Water-jet Pump Output
5	Battery Power
6	Room Light Delay Relay Output
7/8	Window Raise/Lower Function Enabled
9/10	Rear Window Function Disable
11	Battery Power

BCM Connector MG643314



Pin No.	Description
1	Battery Power
2	Low Beam Light Output
3	Door Locking Output
4	Battery Power
5	Low Current Ground
6	Left Turn Lamp Output
7	Room Light PWM Output
8	Reserve
9	Warning Request Signal
10	Door Unlocking Output
11	High Current Ground

Operation

General

With the handset removed, the**BCM** allows the security, lighting and diagnostic system to operate. With the remote key in the**AUX** position, the**BCM** also allows the wash/wipe and window system to operate. When the remote key is moved to the IGN position, the fuel system is operational. The**BCM** communicates with and passes information between ECUs on the**CAN** and**K** buses.

The**BCM** operates in a number of electrical load management configurations. Each mode reduces battery drain such as when vehicles are stored, transported or not used for a period of time.

Transit Mode

Transit mode is configured to prevent excessive battery drain when the vehicle leaves the factory and is delivered to a dealer. The**BCM** is programmed at the factory, after the vehicle has been assembled, with the correct market program and programmed to operate in transit mode and remains in this mode until the Pre-Delivery Inspection (PDI) is performed. Transit mode will allow limited functionality of electrical functions.

The vehicle load management configuration is changed from transit mode to normal mode by the dealer using the authorized diagnostic tool.

Normal Mode

This is the default setting and is used during normal vehicle operation after the PDI has been completed.

Sleep Mode

The**BCM** remains in sleep mode, drawing a minimal current, when the remote key is removed, provided the permanent battery feed is connected and the**CAN** and**K** buses are in an inactive state. The**BCM** remains in readiness for receiving**CAN** and**K** Bus signals.

Service Procedures

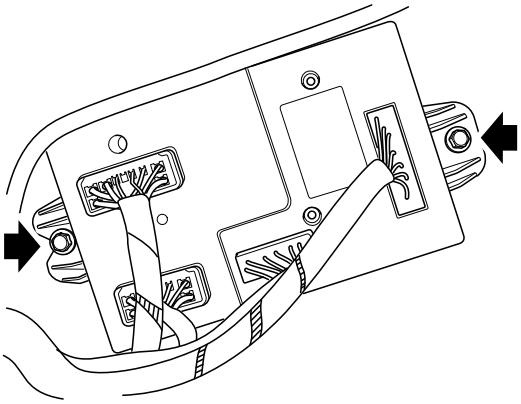
Body Control Module (BCM)

Remove

1. Disconnect battery earth lead.
2. Remove glovebox.

☞ Glovebox Remove

3. Disconnect the connector.
4. Remove 2 screws fixing the body control module to the body.



Refit

1. Fix the body control module to the body, fit screws and tighten to **5–7Nm**.
2. Connect the connector.
3. Fit glovebox.

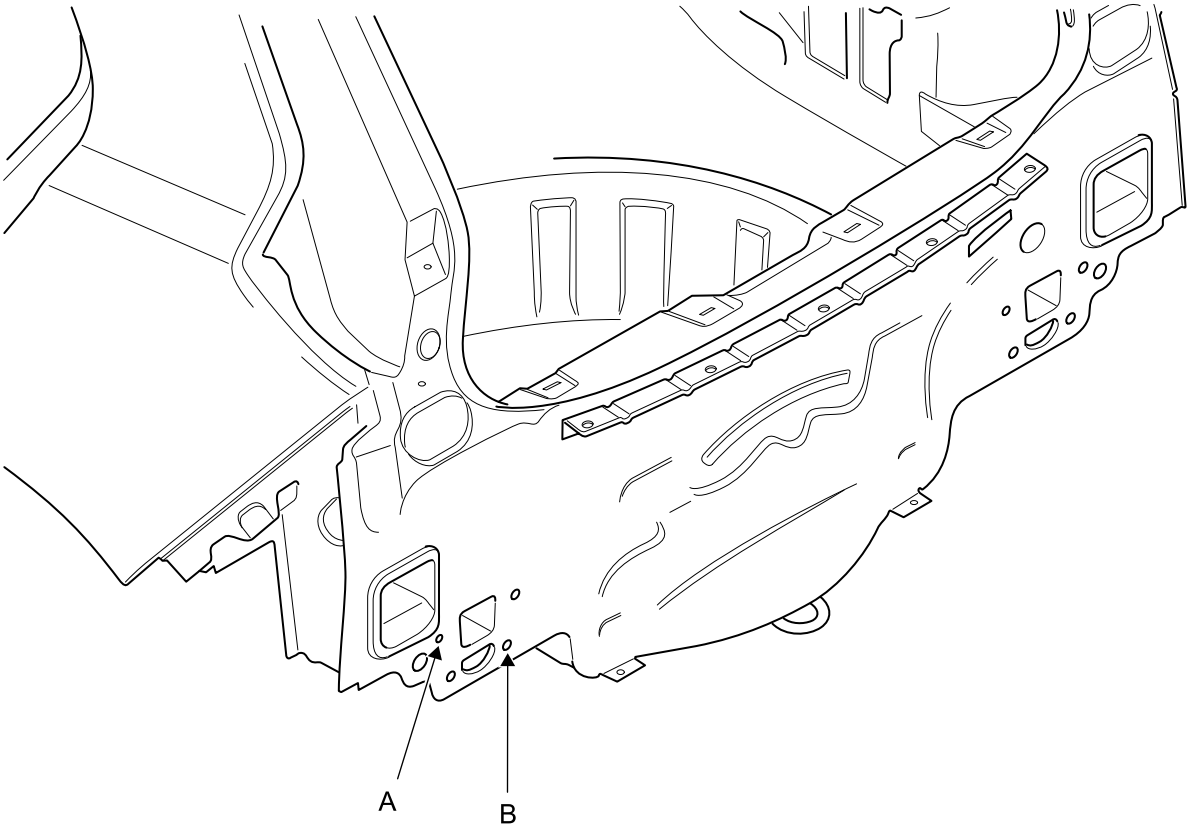
☞ Glovebox Refit

4. Connect battery earth lead.

Body Dimension

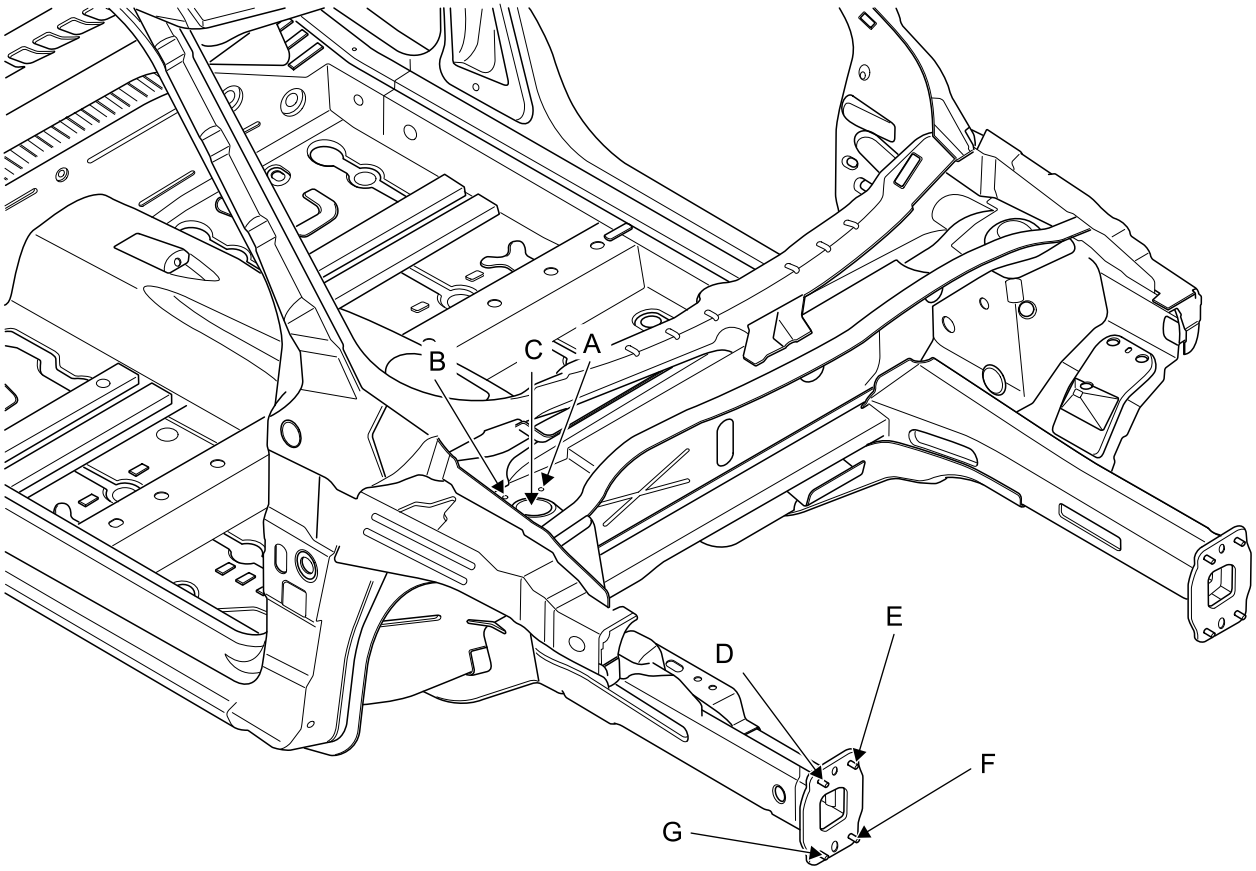
General Information

Rear End Information



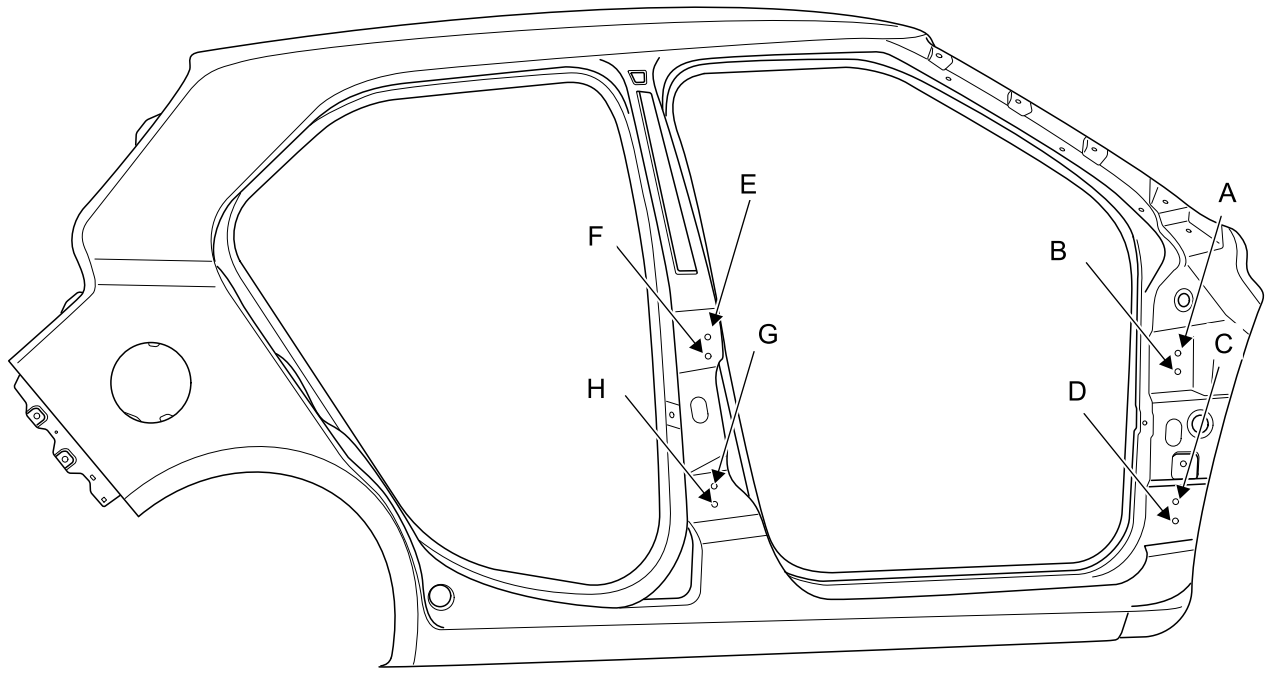
Area	Description	X(mm)	Y(mm)	Z(mm)	Feature value of the hole
A	Rear bumper buffer beam mounting point	3941	-535	290	Φ12
B	Rear bumper buffer beam mounting point	3941	-421	225	Φ12

Front End Information



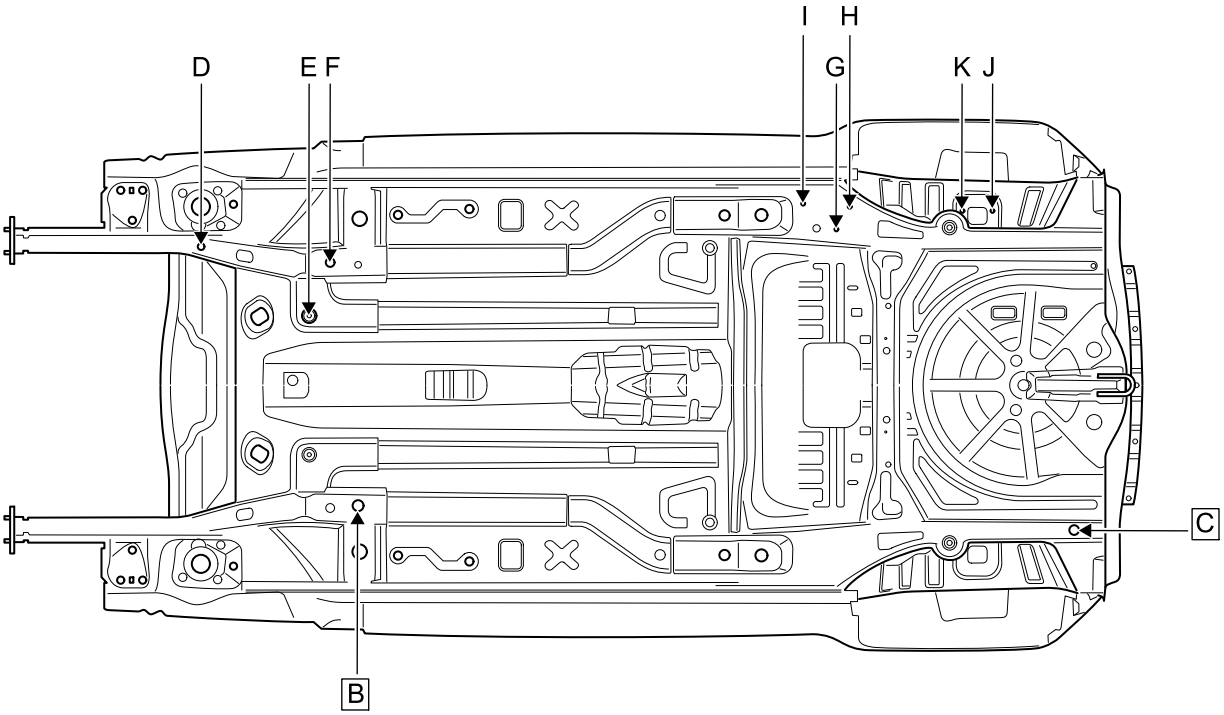
Area	Description	X(mm)	Y(mm)	Z(mm)	Feature value of the hole
A	Front damper mounting hole	1080	518	679	M6
B	Front damper mounting hole	1071	629	685	M6
C	Front damper mounting hole	1018	580	703	Φ59
D	Front bumper buffer beam mounting point	403	504	400	Φ10
E	Front bumper buffer beam mounting point	403	430	400	Φ10
F	Front bumper buffer beam mounting point	403	430	248	Φ10
G	Front bumper buffer beam mounting point	403	504	248	Φ10

Bodyside Information



Area	X(mm)	Y(mm)	Z(mm)	Feature value of the hole
A	1434	-750	634	M8
B	1433	-751	595	M8
C	1429	-756	334	M8
D	1428	-756	296	M8
E	2469	-764	711	M8
F	2466	-765	674	M8
G	2445	-772	412	M8
H	2442	-773	375	M8

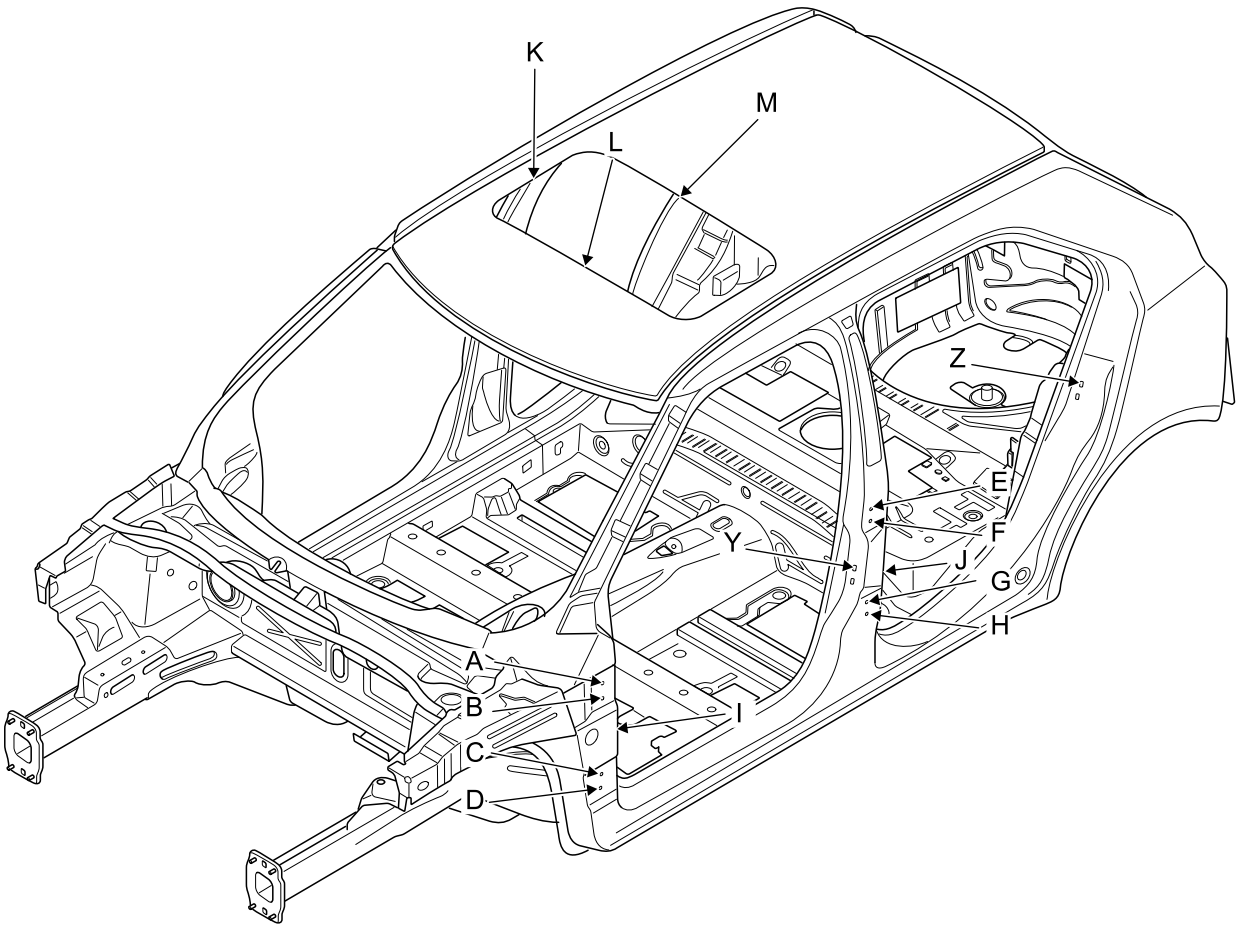
Under Body Information



Area	Description	X (mm)	Y (mm)	Z (mm)	Hole Eigenvalue
B	(Main Reference) Hole	1526	391	45	Φ25
C	(Sub Reference) Hole	3826	469	248	Φ25
D	Front subframe assembly mounting hole	1077	440	230	Φ25
E	Front subframe assembly mounting hole	1367	-226	60	M10
F	Front subframe assembly mounting hole	1393	395	45	M10
G	Rear H frame mounting hole	3088	506	167	M12×1.25
H	Rear H frame mounting hole	3112	581	174	M12×1.25
I	Rear H frame mounting hole	2997	580	141	M12×1.25
J	Rear damper mounting hole	3580	552	574	M10×1.5
K	Rear damper mounting hole	3480	553	574	M10×1.5

Point to Point Dimensional Information

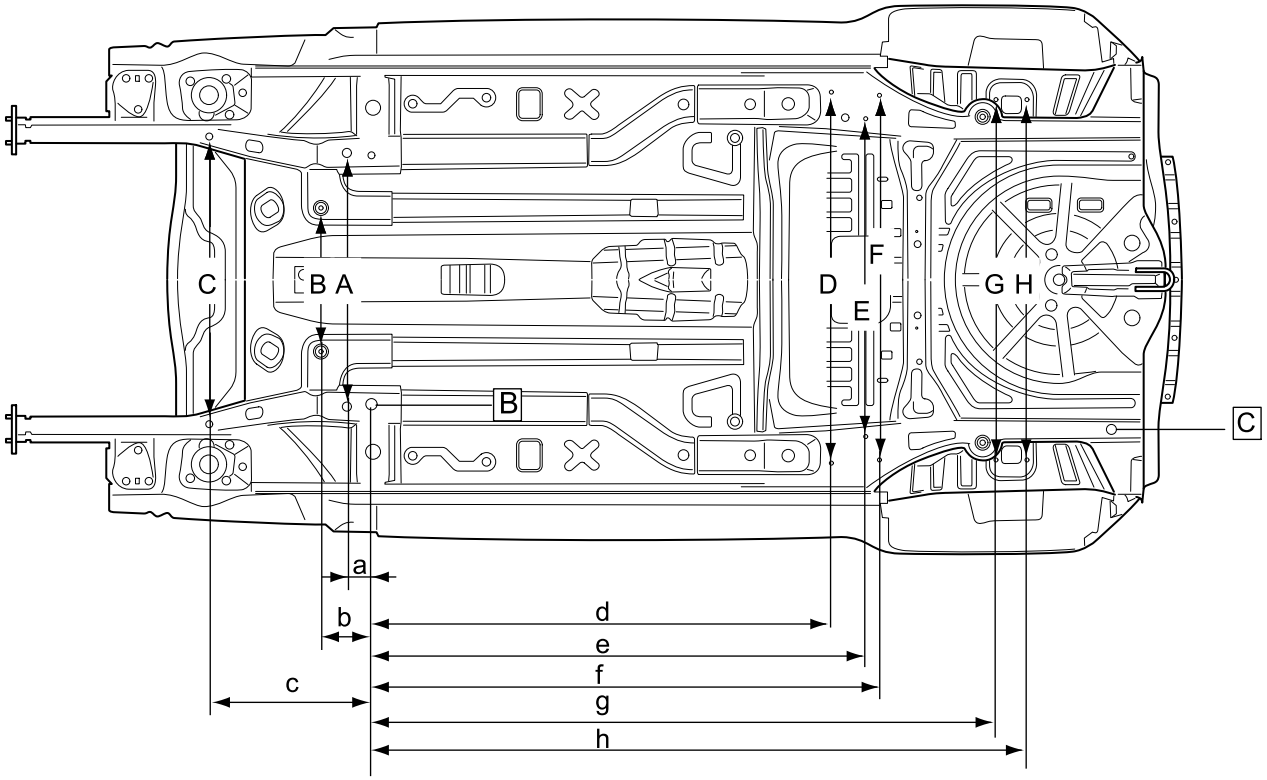
Bodyside and Roof Information



Area	From	to	Length (mm)
A-Y	Front door hinge mounting hole	Front door striker mounting hole	1008
B-Y	Front door hinge mounting hole	Front door striker mounting hole	1005
C-Y	Front door hinge mounting hole	Front door striker mounting hole	946
D-Y	Front door hinge mounting hole	Front door striker mounting hole	1025
I-Y	Retainer mounting hole	Front door striker mounting hole	1034
E-Z	Rear door hinge mounting hole	Rear door striker mounting hole	885
F-Z	Rear door hinge mounting hole	Rear door striker mounting hole	887
G-Z	Rear door hinge mounting hole	Rear door striker mounting hole	941
H-Z	Rear door hinge mounting hole	Rear door striker mounting hole	955
J-Z	Retainer mounting hole	Rear door striker mounting hole	837
K-M	Sunroof matching point	Sunroof matching point	413

L-M	Sunroof matching point	Sunroof matching point	406
L-K	Sunroof matching point	Sunroof matching point	487

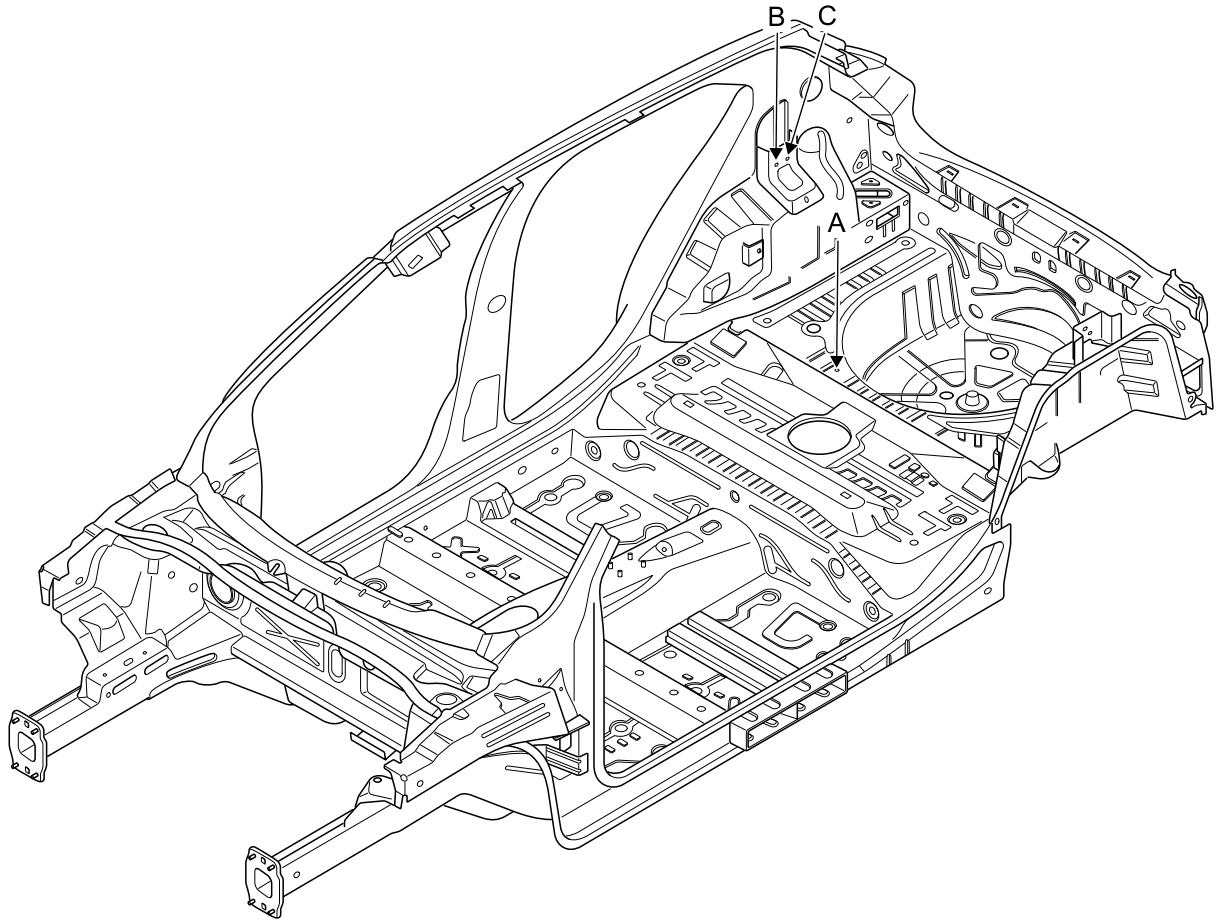
Under Body Information



Area	From	to	Length (mm)
A	Front subframe assembly 3rd mounting hole - RHS	Front subframe 3rd mounting hole - LHS	790
B	Front subframe assembly 2nd mounting hole - RHS	Front subframe 2nd mounting hole - LHS	452
C	Front subframe assembly 1st mounting hole - RHS	Front subframe 1st mounting hole - LHS	880
D	Rear H frame 1st mounting hole - RHS	Rear H frame 1st mounting hole - LHS	1160
E	Rear H frame 2nd mounting hole - RHS	Rear H frame 2nd mounting hole - LHS	1012
F	Rear H frame 3rd mounting hole - RHS	Rear H frame 3rd mounting hole - LHS	1162
G	Rear damper 1st mounting hole - RHS	Rear damper 1st mounting hole - LHS	1106
H	Rear damper 2nd mounting hole - RHS	Rear damper 2nd mounting hole - LHS	1104
a	Main reference hole	Front subframe assembly 3rd mounting hole - RHS	133

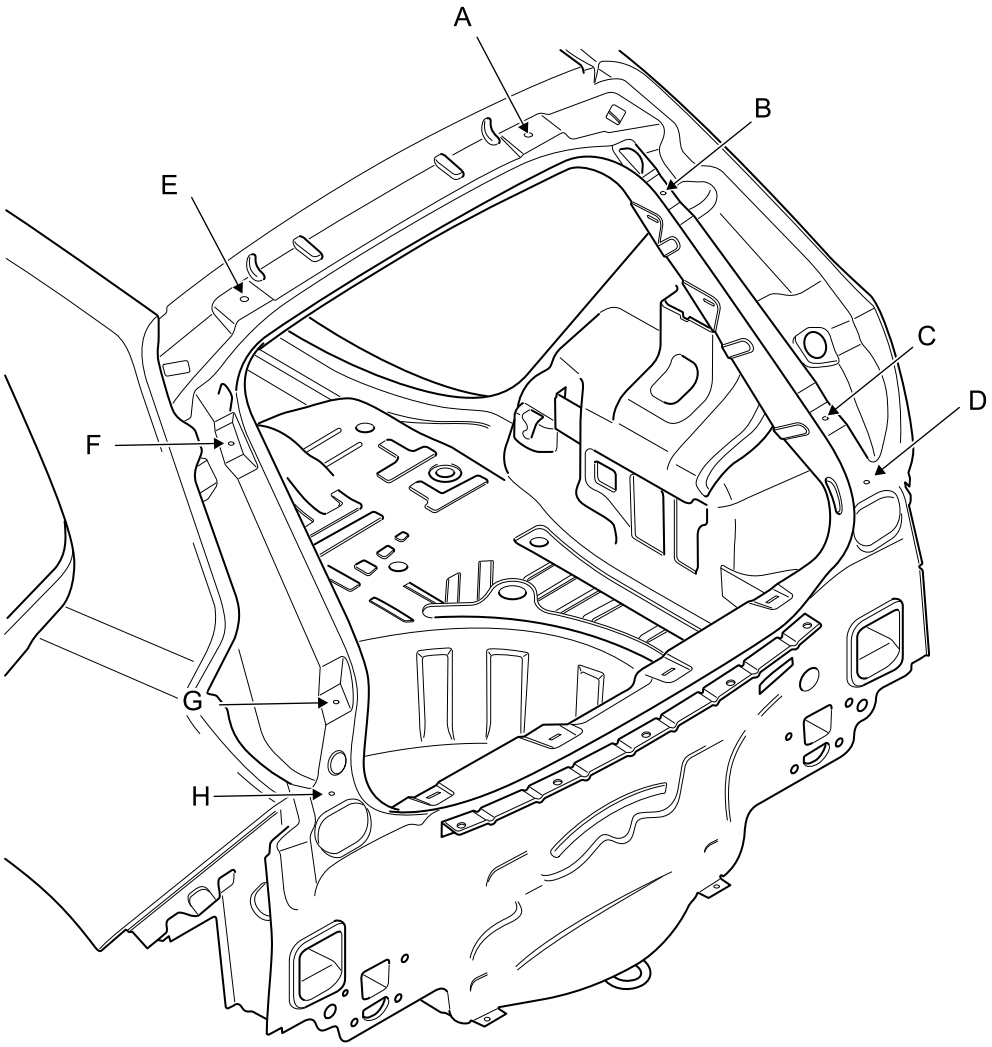
b	Main reference hole	Front subframe assembly 2nd mounting hole - RHS	159
c	Main reference hole	Front subframe assembly 1st mounting hole - RHS	449
d	Main reference hole	Rear H frame 1st mounting hole - RHS	1470
e	Main reference hole	Rear H frame 2nd mounting hole - RHS	1562
f	Main reference hole	Rear H frame 3rd mounting hole - RHS	1586
g	Main reference hole	Rear damper 1st mounting hole - RHS	1954
h	Main reference hole	Rear damper 2nd mounting hole - RHS	2054

Rear Floor Information



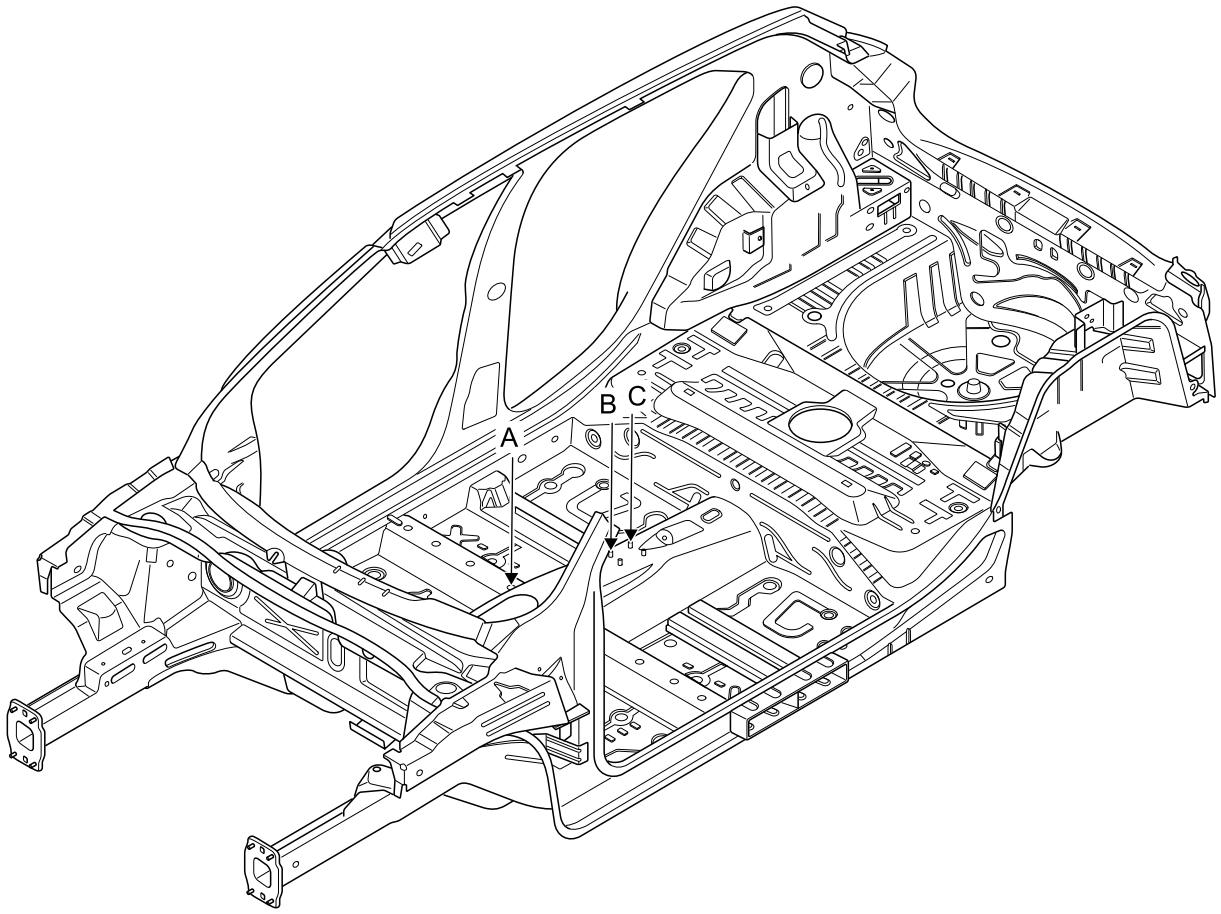
Area	From	to	Length (mm)
A-B	Seat mounting hole	Seat support retaining hole - RHS	616
A-C	Seat mounting hole	Seat support retaining hole - RHS	632
B-C	Seat support retaining hole - RHS	Seat support retaining hole - RHS	46

Rear End Information



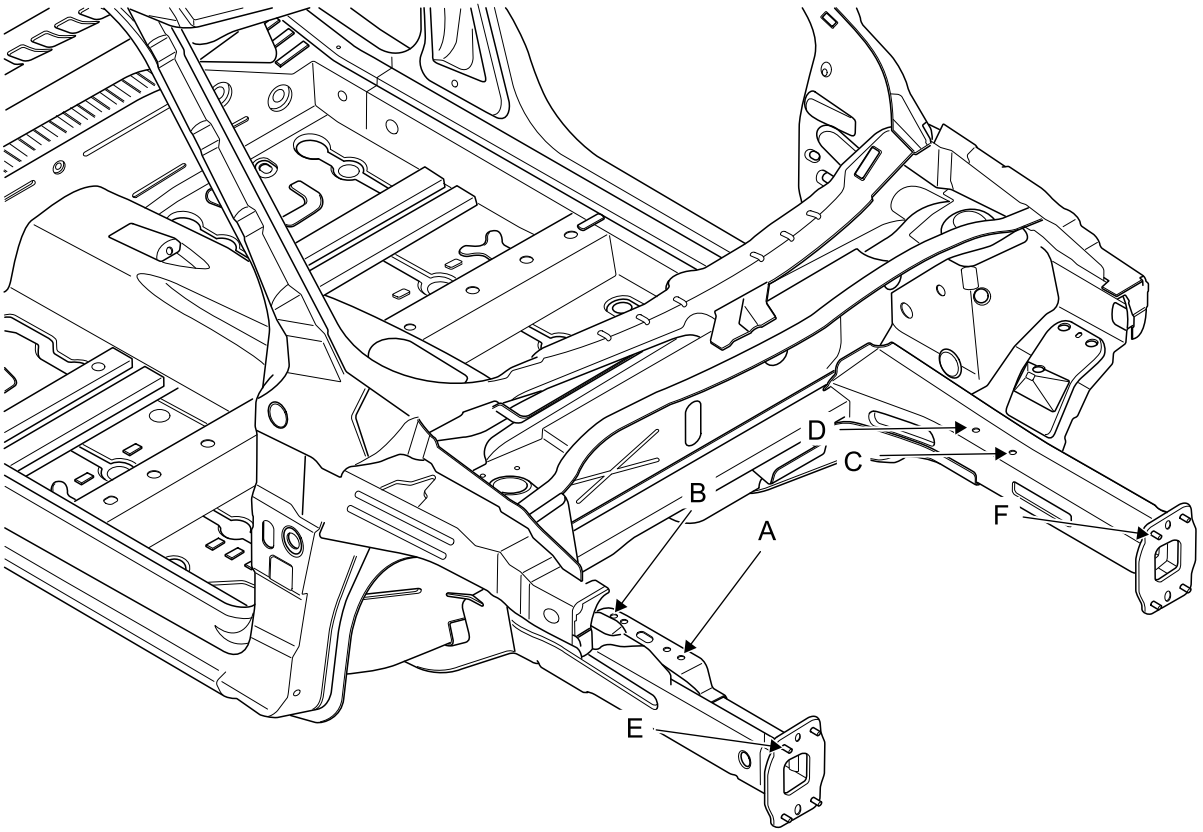
Area	From	to	Length (mm)
A-E	Tail lamp mounting via hole - RHS	Tail lamp mounting via hole - LHS	604
B-F	Tail lamp mounting hole - RHS	Tail lamp mounting hole - LHS	920
C-G	Tail lamp mounting hole - RHS	Tail lamp mounting hole - LHS	1031
D-H	Rear bumper mounting hole - RHS	Rear bumper mounting hole - LHS	1140

Internal Information



Area	From	to	Length (mm)
A-B	Seat beam position hole	Hand brake mounting hole	280
B-C	Hand brake mounting hole	Hand brake mounting hole	93
A-C	Seat beam position hole	Hand brake mounting hole	358

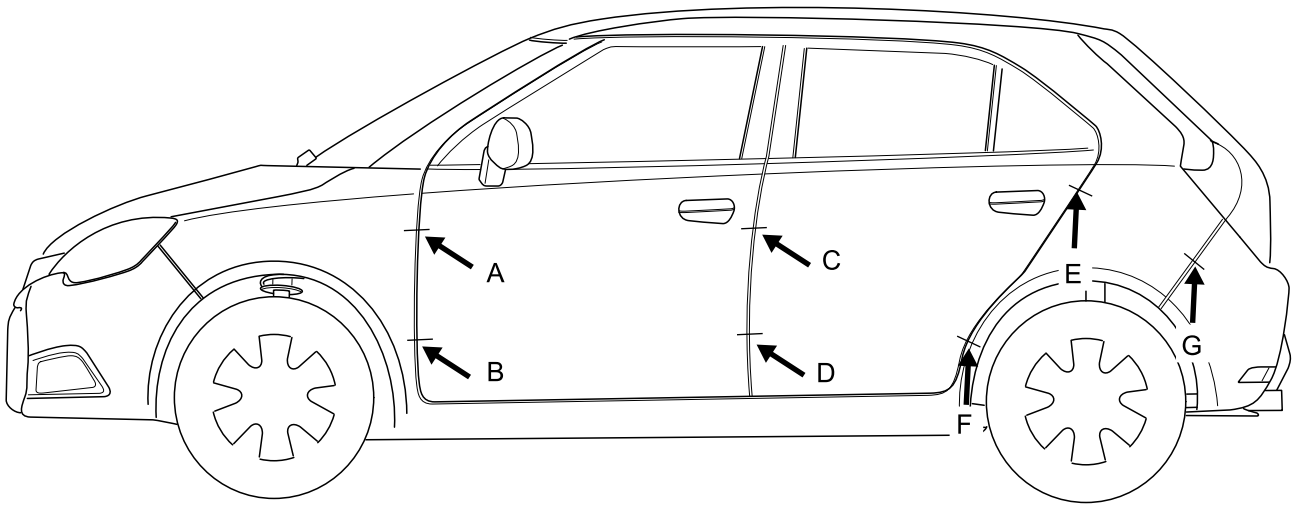
Front End Information



Area	From	to	Length (mm)
A-C	Engine 1st mounting hole - RHS	Transmission 1st mounting hole - LHS	927
A-D	Engine 1st mounting hole - RHS	Transmission 2nd mounting hole - LHS	940
B-C	Engine 2nd mounting hole - RHS	Transmission 1st mounting hole - LHS	929
B-D	Engine 2nd mounting hole - RHS	Transmission 2nd mounting hole - LHS	922
E-F	Front bumper buffer beam mounting hole - RHS	Front bumper buffer beam mounting hole - LHS	935

Gap Information

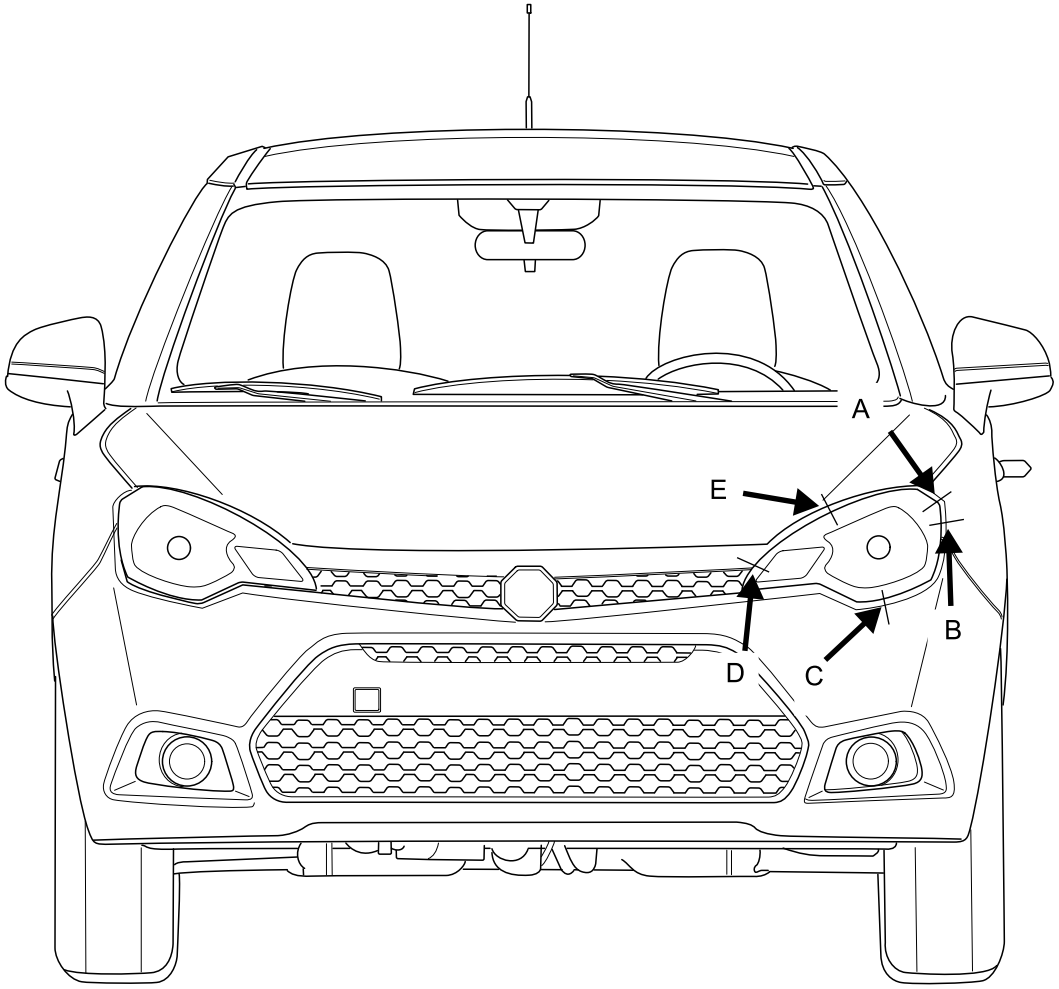
Bodyside Information

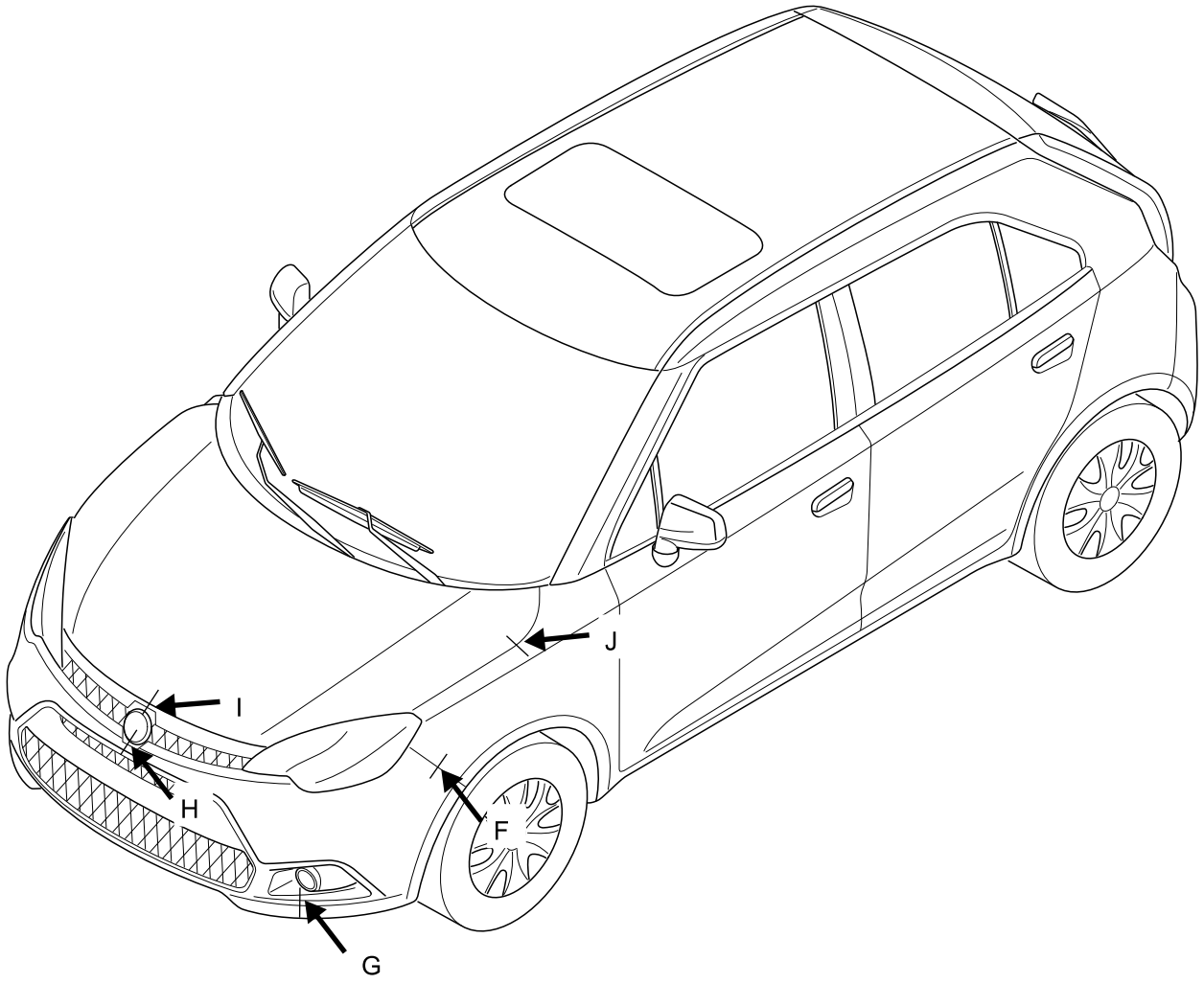


Gap

Area	Detailed Description	Gap Dimension (mm)	Profile (mm)
A	Front door to front fender	4.0±1.0	0+1.0/-0
B	Front door to front fender	4.0±1.0	0+1.0/-0
C	Front door to rear door	4.0±1.0	0+1.0/-0
D	Front door to rear door	4.0±1.0	0+1.0/-0
E	Front door to rear fender	4.0±1.0	0+1.0/-0
F	Front door to rear fender	4.0±1.0	0+1.0/-0
G	Rear bumper to rear fender	0+0.5	0±0.5

Front End Information

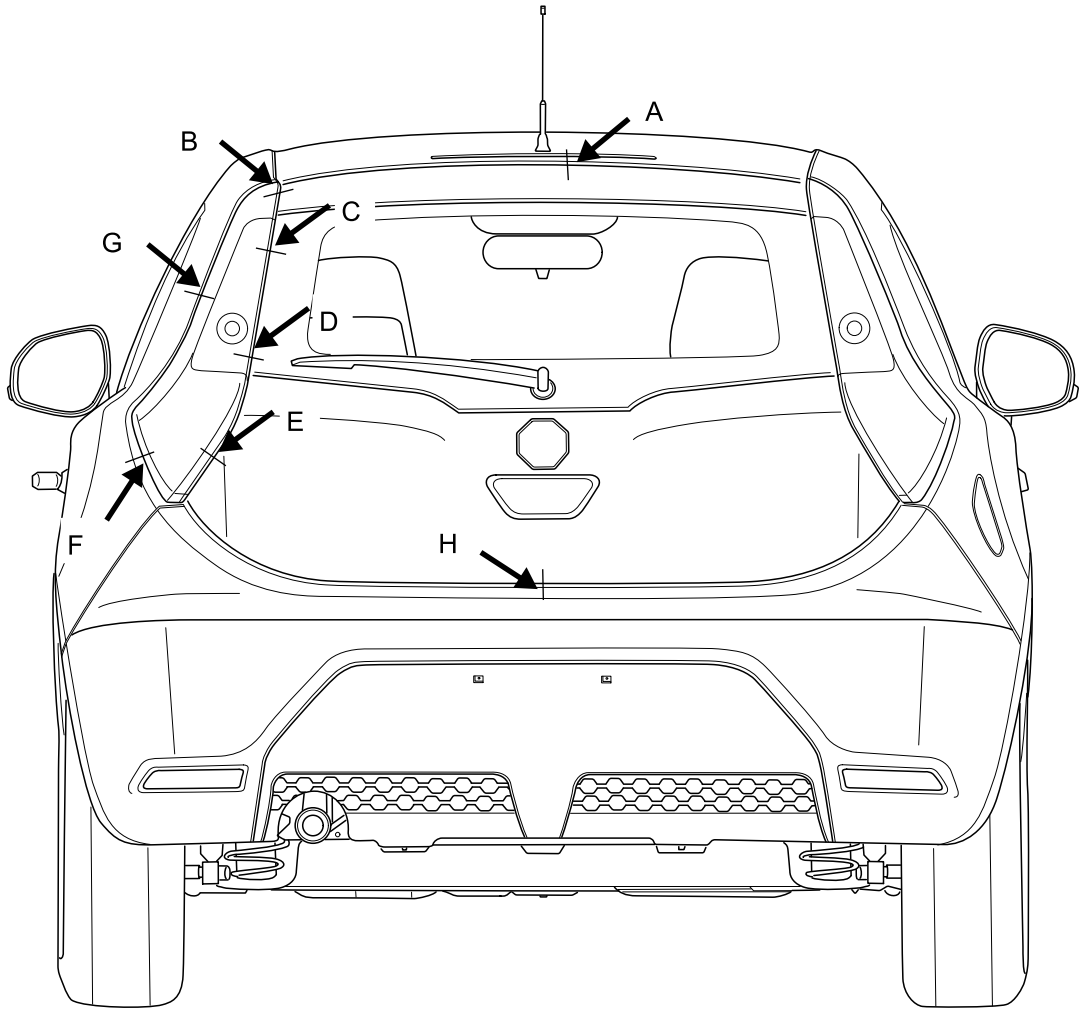




Gap

Area	Detailed Description	Gap Dimension (mm)	Profile (mm)
A	Headlight to front fender	3.0±1.2	0±1.0
B	Headlight to front fender	3.0±1.2	-2.5±1.5
C	Headlight to front bumper	2.4±1.0	NA
D	Headlight to front bumper	4.0±1.0	0±1.0
E	Headlight to bonnet	4.5±1.0	0±1.0
F	Front bumper to front fender	0+0.5	0±0.5
G	Foglamp to front bumper grill	1.0±0.3	NA
H	Lower end of the grill to front bumper	1.0±0.3	NA
I	Upper end of the grill to bonnet	7.0±1.0	-3.0±2.0
J	Bonnet to front fender	3.5±0.7	0+0/-0.7

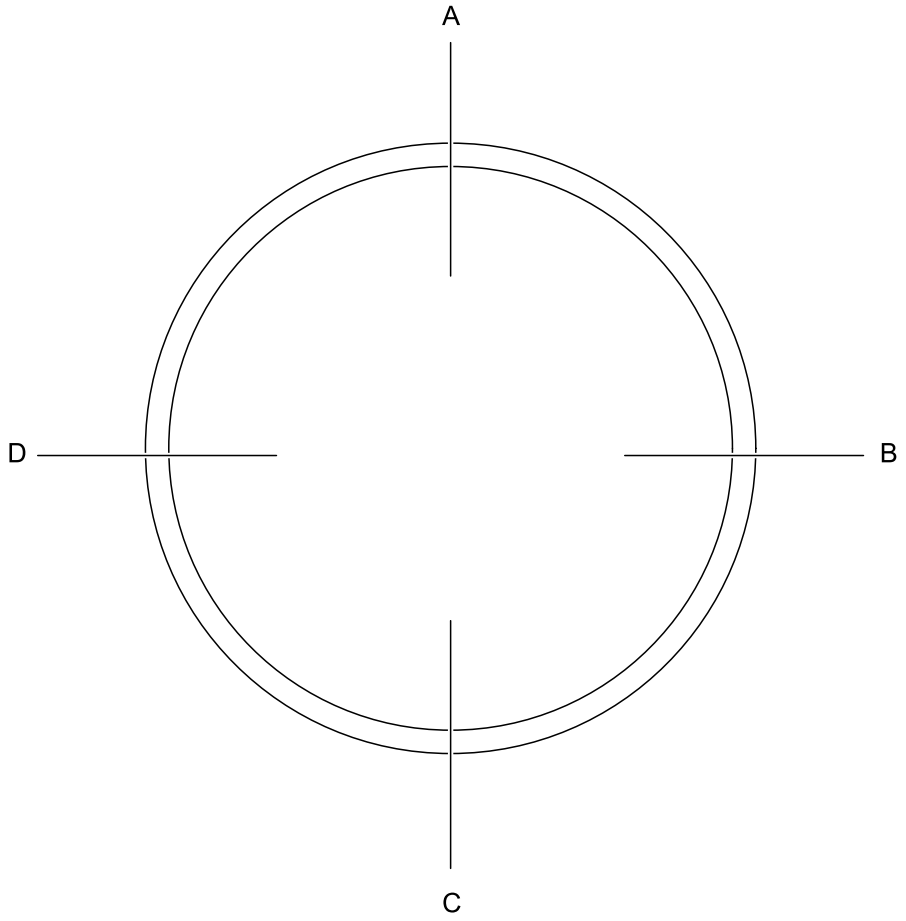
Rear End Information



Gap

Area	Detailed Description	Gap Dimension (mm)	Profile (mm)
A	Tailgate to roof	6.6±1.0	-2.0±1.0
B	Tail lamp to tailgate	4.5±1.0	6.3±1.3
C	Tail lamp to 50 mm from the upper edge of the tailgate window	4.5±1.0	11.0±2.0
D	Tail lamp to 50 mm from the lower edge of the tailgate window	4.5±1.0	15.5±2.0
E	Tail lamp to tailgate	4.5±1.0	NA
F	Tail lamp to rear fender	1.0±0.5	-7.6±0.6
G	Tail lamp to rear fender	1.0±0.5	NA
H	Tailgate to rear bumper	6.5±1.5	NA

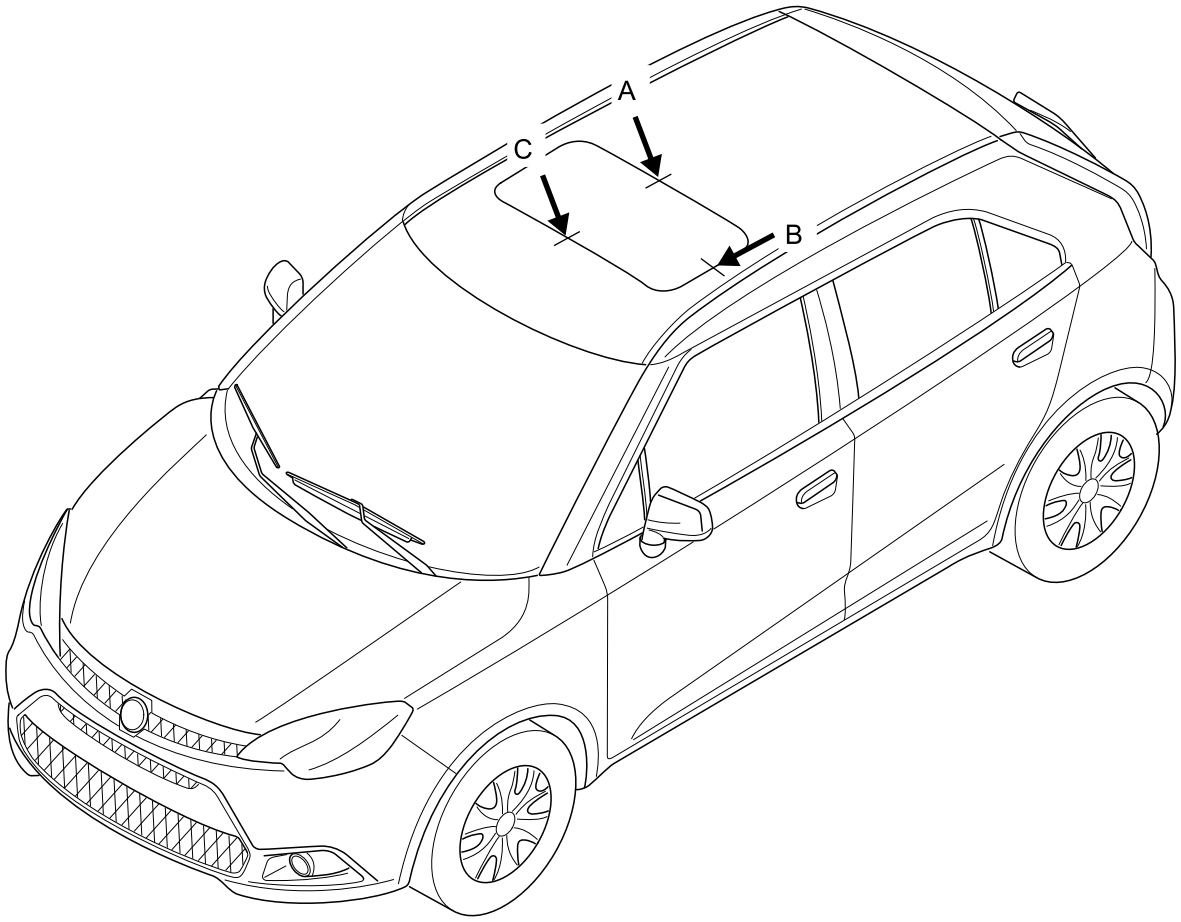
Fuel filler door Information



Gap

Area	Gap Dimension (mm)	Profile (mm)
A	3.0±0.5	0+0/-0.5
B	3.0±0.5	0+0/-0.5
C	3.0±0.5	0+0/-0.5
D	3.0±0.5	0+0/-0.5

Sunroof Information



Gap

Area	Detailed Description	Gap Dimension (mm)	Profile (mm)
A	Roof to sunroof	0	0±1.0
B	Roof to sunroof	0	0±1.0
C	Roof to sunroof	0	0±1.0

Collision Repair

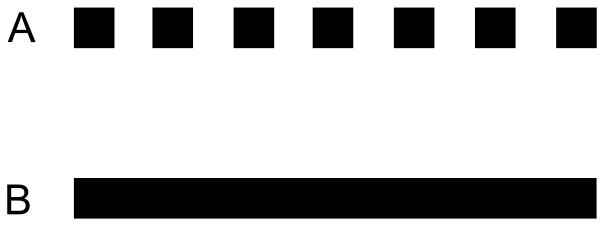
Description and Operation

General Welding Precautions

General

For ease of reference, the diagrams on the following pages show only the type of weld used in repair where it varies from that used in production.

The replacement welds in the welding diagrams are denoted by the following symbols:



S883029

A. = Single/Multiple thickness plug welds

B. = MIG seam weld

When carrying out welding operations the following criteria must be observed:

- Where resistance spot welds have been used in production, these must be reproduced with new spot welds in replacement where possible. All such reproduction spot welds must be spaced 30 mm apart.
- When spot welding, it is recommended that test coupons of the same metal gauges and materials are produced to carry out peel tests to ensure that welding equipment being used can produce a satisfactory joint. Plug welds must be used if a satisfactory spot weld cannot be produced.
- The electrode arms on hand-held spot welding guns must not exceed 300 mm in length;
- Single-side spot welding is not acceptable.
- Gas welding and brazing are not acceptable. MIG brazing is the preferred method.
- Where 3 metal thicknesses or more are to be welded together it is imperative to use MIG plug welds to ensure joint strength.
- MIG plug welds must be used in repair joints where there is no access for a resistance spot welder. To replace each production spot weld, an 8mm (approx.) hole must be drilled and/or punched, and a MIG plug weld then made in its place. The number of plug welds must match exactly the number of spot welds which have been removed.
- Where holes are left in an existing panel after removal of the spot welds, a single MIG plug weld will be made in each hole as appropriate.

Electronic Control Units

The Electronic Control Units (ECU) fitted to vehicles make it advisable to follow suitable precautions prior to carrying out welding repair operations. Harsh conditions of heat and vibration may be generated during these operations which could cause damage to the units.

In particular, it is essential to follow the appropriate precautions when disconnecting or removing the airbag Diagnostic Control Unit (DCU).

Supplementary Restraint System Precautions

Any work undertaken which involves the removal or replacement of any item of the Supplementary Restraint System (SRS), requires extreme caution and adherence to the appropriate precautions.

Equipment

Prior to commencing any test procedure on the vehicle, ensure that the relevant test equipment is working correctly and any harness or connectors are in good condition. This particularly applies to electronic control units.

Seat Belt Anchorages

Seat belt anchorages are safety critical. When making repairs in these areas, it is essential to follow design specifications. Note that High Strength Low Alloy (HSLA) steel may be used for seat belt anchorages.

Where possible, the original production assembly should be used, complete with its seat belt anchorages, or the cut line should be so arranged that the original seat belt anchorage is not disturbed.

All welds within 250 mm of seat belt anchorages must be carefully checked for weld quality, including spacing of spot welds.

Panel Replacement Procedure

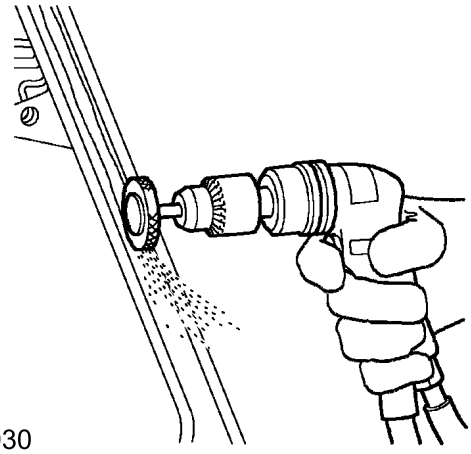
This procedure is designed to explain the basic panel removal and replacement method. The main criterion in removal and replacement of body panels is that the original standard is maintained as far as possible. While individual repairs will differ in detail, this procedure has been devised placing emphasis on ease of repair and the elimination of unnecessary work.

Body panels are being increasingly manufactured in high strength steels to meet design requirements for safety and weight saving. As panels in high strength steels cannot be visually identified, and as they are more sensitive to excess

heat than panels manufactured from low carbon steel, it is advisable that the following procedure be observed at all times.

Remove Panel

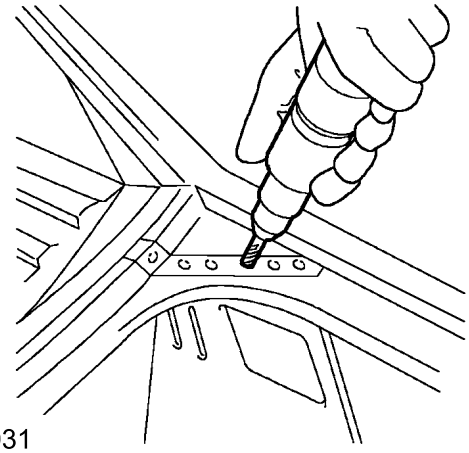
1. Expose resistance spot welds. For those spot welds which are not obviously visible, use a rotary drum sander or wire brush fitted to an air drill, or alternatively a hand held wire brush.



S883030

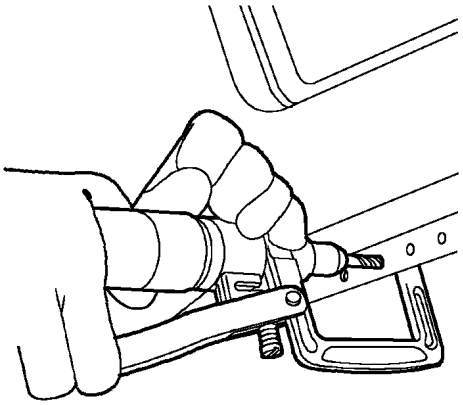
Caution: In wheel arch areas it may be necessary to soften underbody coating, using a hot air gun, prior to exposing spot welds.

2. Cut out welds using a cobalt drill.



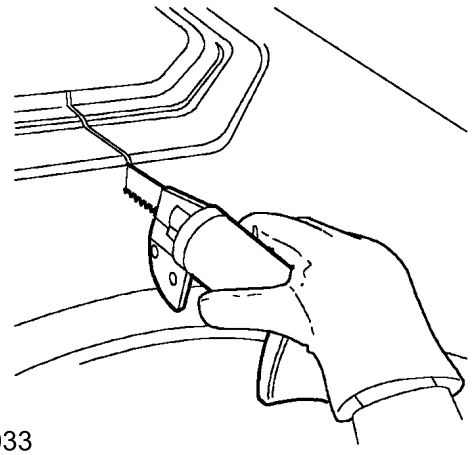
S883031

3. Alternatively, use a clamp-type spot weld remover.



S883032

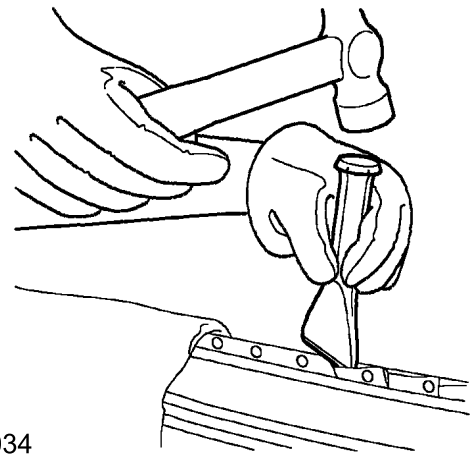
4. Cut away the bulk of the panel as necessary using an air saw.



S883033

Caution: On certain panel joints MIG welds and braze should be removed using a sander where possible, before cutting out the panel bulk.

5. Separate spot welded joints and remove panel remnants using hammer, bolster chisel and pincers.



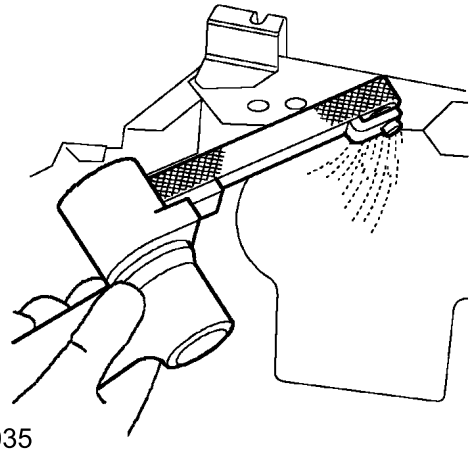
S883034

Prepare Old Surfaces

1. Remove any remaining sealant using a hot air gun to minimise the risk of toxic fumes caused by heat generated during welding.

Warning: Care must be taken to avoid excessive heat build-up when using the hot air gun.

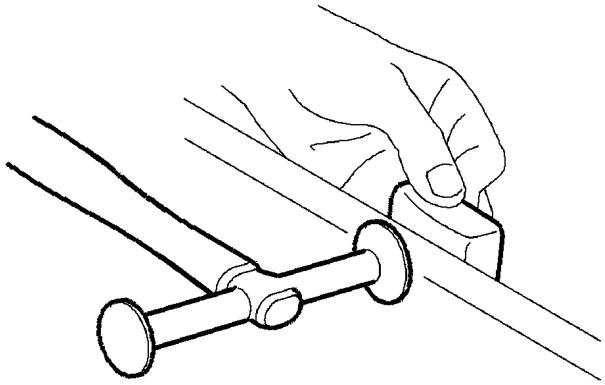
2. Clean all panel joint edges to a bright smooth finish, using a belt-type sander.



S883035

Note: As an alternative, a disc sander may be used.

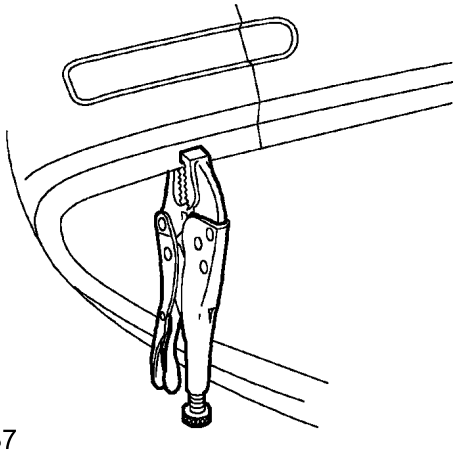
3. Straighten existing panel joint edges using a shaping block and hammer.



S883036

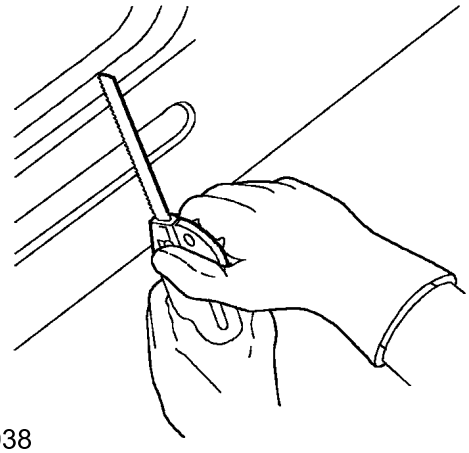
Prepare New Surfaces

1. Mark out bulk of new panel and trim to size, leaving approximately 50 mm overlap with existing panel. Offer up new panel/section, align with associated panels (e.g. new body side panel aligned with door and boot lid). Clamp into position.



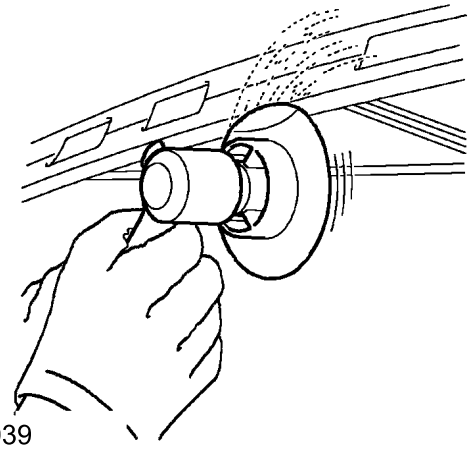
S883037

2. Cut new and existing panels as necessary to form butt, joggle or brace joint as required. Remove all clamps and metal remnants.



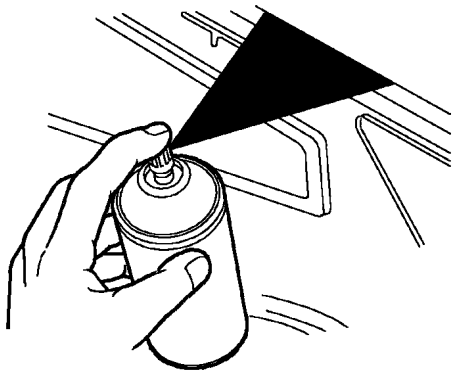
S883038

3. Prepare new panel joint edges for welding by sanding to a bright finish. This must include inner as well as outer faces.



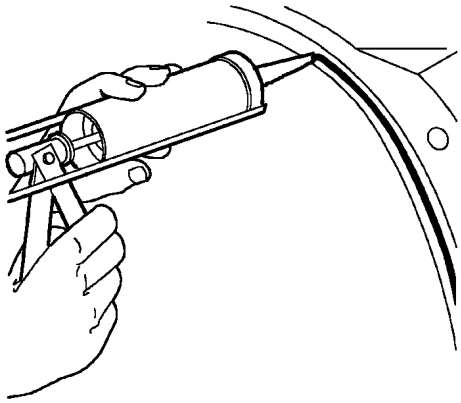
S883039

4. Apply suitable weld-through primer, to panel joint surfaces to be welded, using brush or aerosol can.



S883040

5. Apply correct sealant or adhesive, as applicable, to panel joint surfaces.



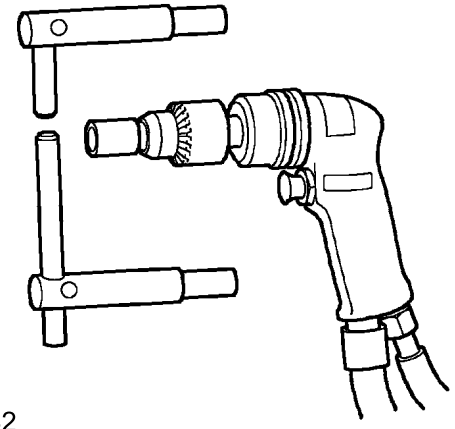
S883041

Offer up And Align

Offer up new panel and align with associated panels. Clamp into position using welding clamps or other clamps. Where a joggle or brace joint is being adopted, make a set in the original panel joint edge or insert a brace behind the joint.

Caution: In cases where access for welding clamps is difficult, it may be necessary to use tack welds.

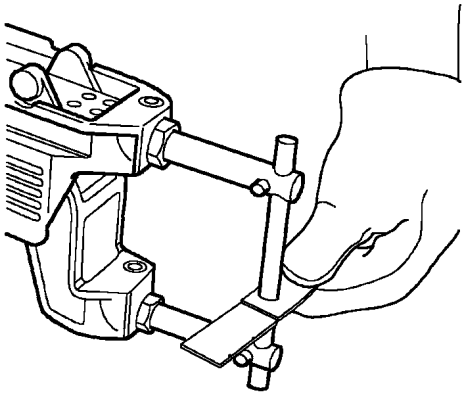
1. Select arms for resistance spot welding and shape electrode tips using a tip trimmer. Tips should be dressed so the diameter is equal to twice the thickness of the metal to be welded plus 3.0 mm.



S883042

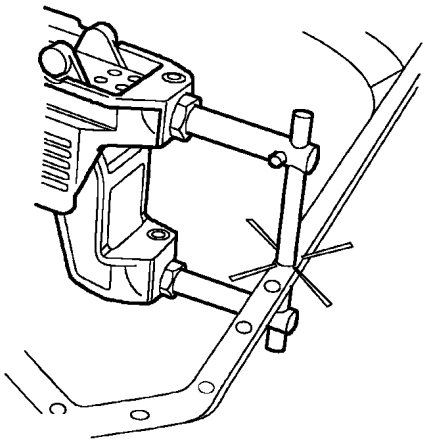
Caution: Use arms not exceeding 300 mm in length.

2. Fit resistance spot welding arms and test equipment for satisfactory operation, using test coupons. Where monitoring equipment is not available, verify weld strength by checking that metal around the weld puddle pulls apart under tension during pulling.



S883043

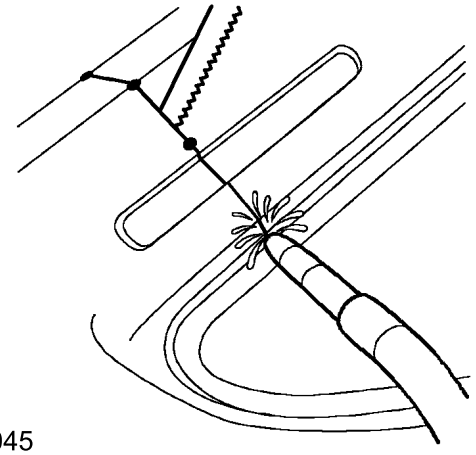
3. Use a resistance spot welder where access permits. Try to ensure weld quality by using a welding monitor where possible.



S883044

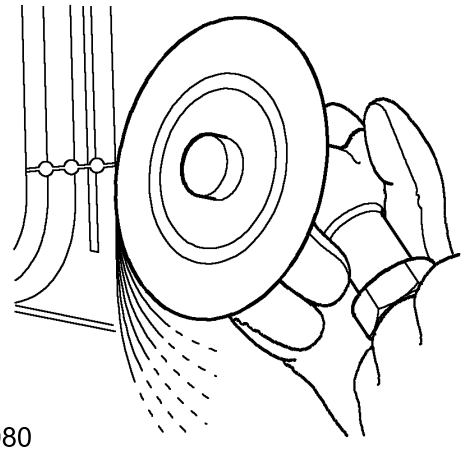
4. MIG tack weld butt joints and re-check alignment and panel contours where necessary. Ensure that a gap is

maintained to minimise welding distortion, by inserting a hacksaw blade as an approximate guide.



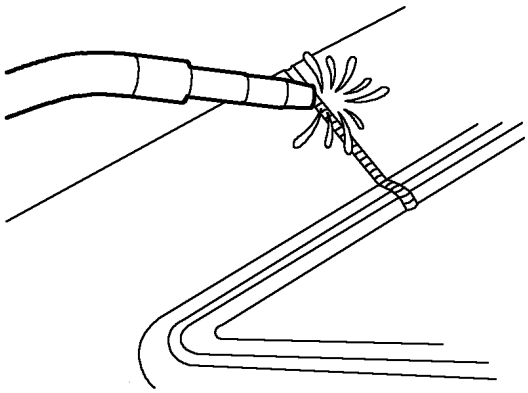
S883045

5. Dress MIG tack welds using a sander with 36 grit disc, or a belt-type sander where access is limited.



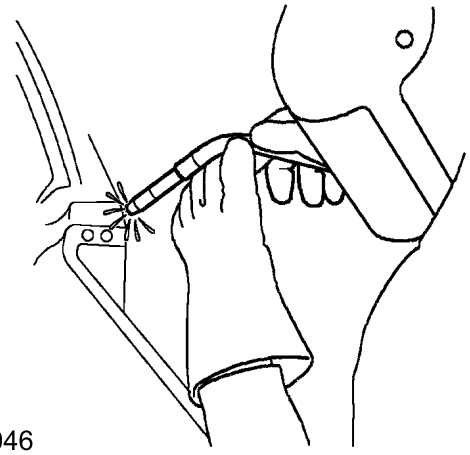
S883080

6. MIG seam weld butt joints.



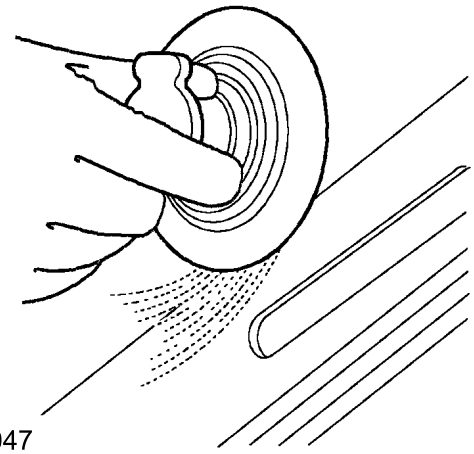
S883081

7. Always use MIG plug welds where excessive metal thickness or limited access make resistance spot welding impractical. Make plug welds either by using holes left by the spot weld cutter, or through holes punched and drilled for the purpose, approximately 8mm diameter.



S883046

8. Dress all welds using either a sander with 36 grit disc, or a belt-type sander and/or wire brush. When dressing welds ensure an area as small as possible is removed to protect the zinc coating.



S883047

Corrosion Prevention

Factory Treatments

During production, vehicle bodies are treated with the following anti-corrosion materials:

- A PVC-based underbody sealer which is sprayed onto the underside of the main floor, rear floor and the rear wheel arches.
- An application of cavity wax which is sprayed into the sill panels, side member extensions and the lower areas of the door panels.
- A coat of protective wax is applied to areas of the wheel arch not covered by the liners. Whenever body repairs are carried out, ensure the anti-corrosion materials in the affected area are repaired or renewed as necessary using the approved materials.

Precautions During Body Repairs and Handling

Take care when handling the vehicle in the workshop. Underbody sealers, seam sealers, underbody wax and body panels may be damaged if the vehicle is carelessly lifted.

Proprietary Anti-corrosion Treatments

The application of proprietary anti-corrosion treatments, in addition to the factory-applied treatment, could invalidate the Corrosion Warranty and should be discouraged. This does not apply to homologated compatible, preservative waxes which may be applied on top of existing coatings.

Fitting Approved Accessories

When fitting accessories ensure that the vehicle's corrosion protection is not affected, either by breaking the protective coating or by introducing a moisture trap.

Do not screw self-tapping screws directly into body panels. Fit suitable plastic inserts to the panel beforehand. Always ensure that the edges of holes drilled into panels, chassis members and other body parts are protected with a suitable zinc rich or acid etch primer, and follow with a protective wax coating brushed onto the surrounding area.

Do not attach painted metal surfaces of any accessory directly to the vehicle's bodywork unless suitably protected. Where metal faces are bolted together always interpose a suitable interface material such as weldable zinc rich primer, extruded strip, or zinc tape.

Steam Cleaning and De-waxing

Due to the high temperatures generated by steam cleaning equipment, there is a risk that certain trim components could be damaged and some adhesives and corrosion prevention materials softened or liquefied. Adjust the equipment so that the nozzle temperature does not exceed 90° C (194° F). Take care not to allow the steam jet to dwell on one area, and keep the nozzle at least 300 mm from panel surfaces.

DO NOT remove wax or lacquer from underbody or underbonnet areas during repairs. Should it be necessary to steam clean these areas, apply a new coating of wax or underbody protection as soon as possible.

Maintenance Inspection

Carry out the following operations to check bodywork for corrosion:

- With the vehicle on a lift, carry out visual check of underbody sealer for damage.
- With the vehicle lowered, inspect exterior paintwork for damage and body panels for corrosion.

Note: If the vehicle is dirty, it will need to be washed prior to inspection of bodywork.

The checks described above are intended to be visual only. It is not intended that the operator should remove trim panels, finishers, rubbing strips or sound-deadening materials when checking the vehicle for corrosion and paint damage.

1. With the vehicle on a lift, and using an inspection or spot lamp, visually check for the following:

- Corrosion damage and damaged paintwork, condition of underbody sealer on front and rear lower panels, sills and wheel arches;
- Damage to underbody sealer. Corrosion in areas adjacent to suspension mountings and fuel tank fixings.

Note: *The presence of small blisters in the underbody sealer is acceptable, providing they do not expose bare metal.*

Pay special attention to signs of damage caused to panels or corrosion protection material by incorrect jack positioning.

Warning: It is essential to follow the correct jacking and lifting procedures.

2. With the vehicle lowered, visually check for evidence of damage and corrosion on all visible painted areas, in particular the following:

- Front edge of bonnet.
- Visible flanges in engine compartment.
- Lower body and door panels.

Rectify any bodywork damage or evidence of corrosion found during inspection as soon as is practicable, both to minimise the extent of the damage and to ensure the long term effectiveness of the factory-applied corrosion prevention treatment. Where corrosion has become evident and is emanating from beneath a removable component (e.g. trim panel, window glass, seat etc.), remove the component as required to permit effective rectification.

Underbody Protection Repairs

Whenever body repairs are carried out, ensure that full sealing and corrosion protection treatments are reinstated. This applies both to the damaged areas and also to areas where protection has been indirectly impaired, as a result either of accident damage or repair operations.

Remove corrosion protection from the damaged area before straightening or panel beating. This applies in particular to panels coated with wax, PVC underbody sealer, sound deadening pads etc.

Warning: DO NOT use oxy-acetylene gas equipment to remove corrosion prevention materials. Large volumes of fumes and gases are liberated by these materials when they burn.

Note: *Equipment for the removal of tough anti-corrosion sealers offers varying degrees of speed and effectiveness. The compressed air-operated scraper (NOT an air chisel) offers a relatively quiet mechanical method using an extremely rapid reciprocating action. Move the operating end of the tool along the work surface to remove the material.*

The most common method of removal is by means of a hot air blower with integral scraper. One of the most efficient methods, is the rapidcutting 'hot knife'. This tool uses a wide blade and is able to be used easily in profiled sections where access is otherwise difficult.

Use the following procedure when repairing underbody coatings:

1. Remove existing underbody coatings.
2. After panel repair, clean the affected area with a solvent wipe, and treat bare metal with an etch phosphate material.
3. Re-prime the affected area.

Caution: DO NOT, under any circumstances, apply underbody sealer directly to bare metal surfaces.

4. Replace all heat-fusible plugs which have been disturbed. Where such plugs are not available use rubber grommets of equivalent size, ensuring that they are embedded in sealer.
5. Mask off all mounting faces from which mechanical components, hoses and pipe clips, have been removed. Underbody sealer must be applied before such components are refitted.
6. Brush sealer into all exposed seams.
7. Spray the affected area with an approved service underbody sealer.
8. Remove masking from component mounting faces, and touch-in where necessary.

After refitting mechanical components, including hoses and pipes and other fixtures, mask off the brake discs and apply a coat of approved underbody wax.

Note: Where repairs include the application of finish paint coats in the areas requiring underbody wax, carry out paint operations before applying wax.

Underbody Wax

The underbody wax must be reinstated following all repairs affecting wheel arch panels. The wax is applied over paints and underbody sealers.

Remove old underbody wax completely from a zone extending at least 200 mm beyond the area where new underbody sealer is to be applied.

Cavity Wax Injection

After repairs, always treat areas with an approved cavity wax. In addition, treat all interior surfaces which have been disturbed during repairs whether they have been treated in production or not. This includes all box members, cavities and door interiors. It is permissible to drill extra holes for access where necessary, provided these are not positioned in load-bearing members. Ensure that such holes are treated with a suitable zinc rich primer, brushed with wax and then sealed with a rubber grommet.

Before wax injection, ensure that the cavity to be treated is free from any contamination or foreign matter. Where necessary, clear out any debris using compressed air.

Ensure that cavity wax is applied AFTER the final paint process and BEFORE refitting any trim components.

During application, ensure that the wax covers all flange and seam areas and that it is adequately applied to all repaired areas of both new and existing panels.

It should be noted that new panel assemblies and complete body shells are supplied without wax injection treatment. Ensure that such treatment is carried out after repairs.

Effective cavity wax protection is vital. Always observe the following points:

- Complete all paint refinish operations before wax application.
- Clean body panel areas and blow-clean cavities if necessary before treatment.
- Maintain a temperature of 18° C (64° F) during application and drying.
- Check the spray pattern of injection equipment.

- Mask off all areas not to be wax coated and which could be contaminated by wax overspray.
- Remove body fixings, such as seat belt retractors, if contamination is at all likely.
- Move door glasses to fully closed position before treating door interiors.
- Treat body areas normally covered by trim before refitting items.
- Check that body and door drain holes are clear after the protective wax has dried.
- Keep all equipment clean, especially wax injection nozzles.

Body Sealing

Underbody Sealer Treatment Areas

Underfloor areas and sill outer panels are treated with a Plastisol PVC underbody sealer. This material is not suitable for re-treatment. When repairing areas of underbody sealer, strip the factory-applied underbody sealer back to a suitable break point. Ensure that a clean metal surface is exposed and that the edge of the existing sealer adheres soundly to the panel.

Apply new underbody sealer between primer and surfacer paint operations. Apply seam sealer as necessary before application of underbody sealer. Ensure that blanking plugs and grommets in the floor pan (except those used for wax injection) are fitted before underbody sealer application. Refit any heatfusible plugs which have been disturbed in repair with the aid of a hot air blower, or replace with rubber grommets.

Ensure that suspension units, wheels, tyres, power unit, exhaust and brakes (including all mounting points) are shielded prior to application of fresh underbody sealer.

Seam Sealers

A heat cured, PVC based sealant is applied to specific joint seams during factory assembly. This material is not suitable for service use and, during repair, should be substituted by an approved Seam Sealer.

Apply seam sealers after the application of primer and before the application of surfacer and top coat. The seam sealer must form a continuous bead, with the profile of the bead dependant on the type of seam. If seam sealer is applied with a brush, take particular care to maintain the required coverage of the seam. Where shaping of the seam sealer is required, use a cloth soaked with solvent such as white spirit to achieve the required finish.

Ensure that ALL accessible repair seams are sealed following a repair. Damage to a vehicle often flexes areas of the body remote from the impact. As a result, the seam sealer in these areas may be disturbed by subsequent straightening and repair operations. Check all seams in the vicinity of the area undergoing repair for evidence of cracked seam sealer, then clean out as required and apply fresh seam sealer using the following procedure:

Clean the affected seam and re-treat any exposed metal areas with a suitable etching primer.

Apply appropriate seam sealer as necessary.

Treat affected area with an acid-etch primer (and underbody sealer as applicable).

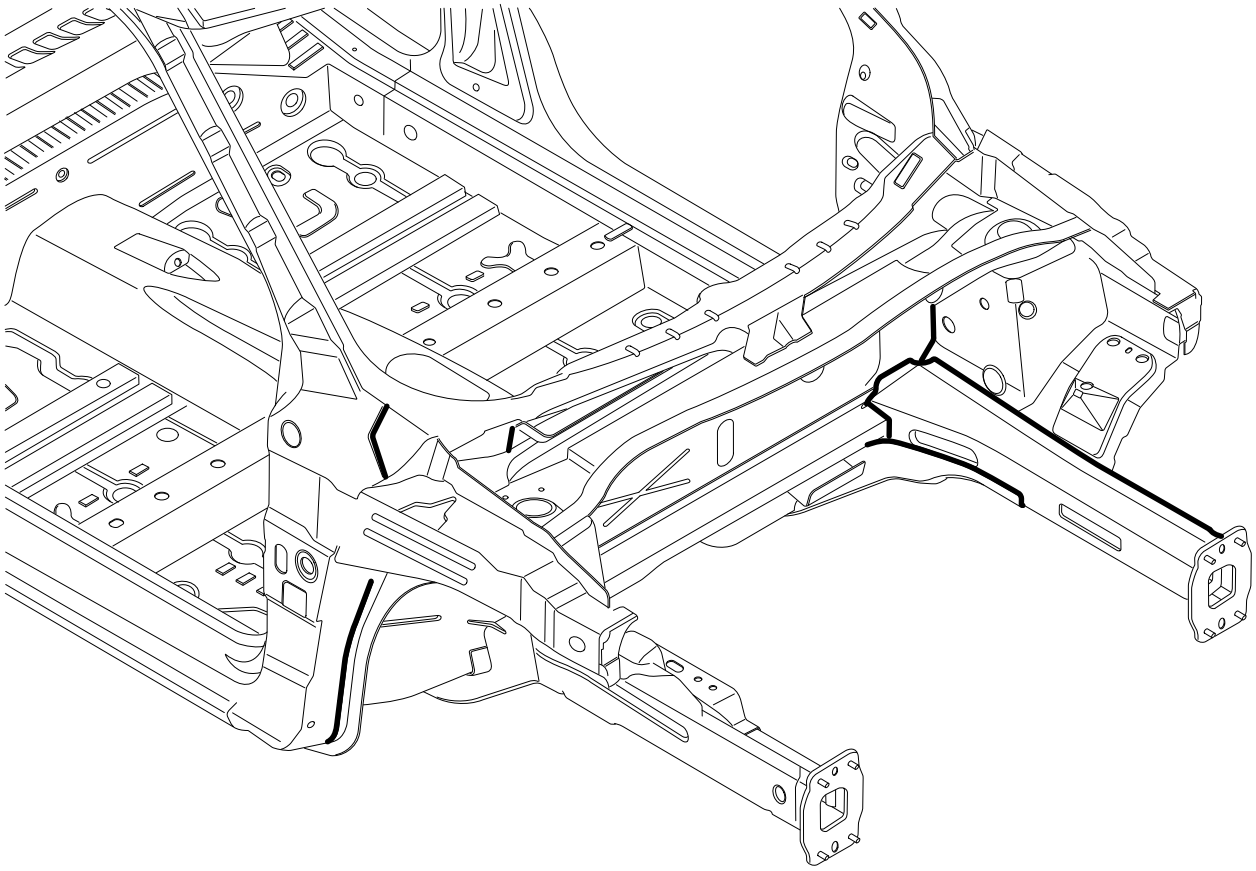
Apply appropriate colour coat.

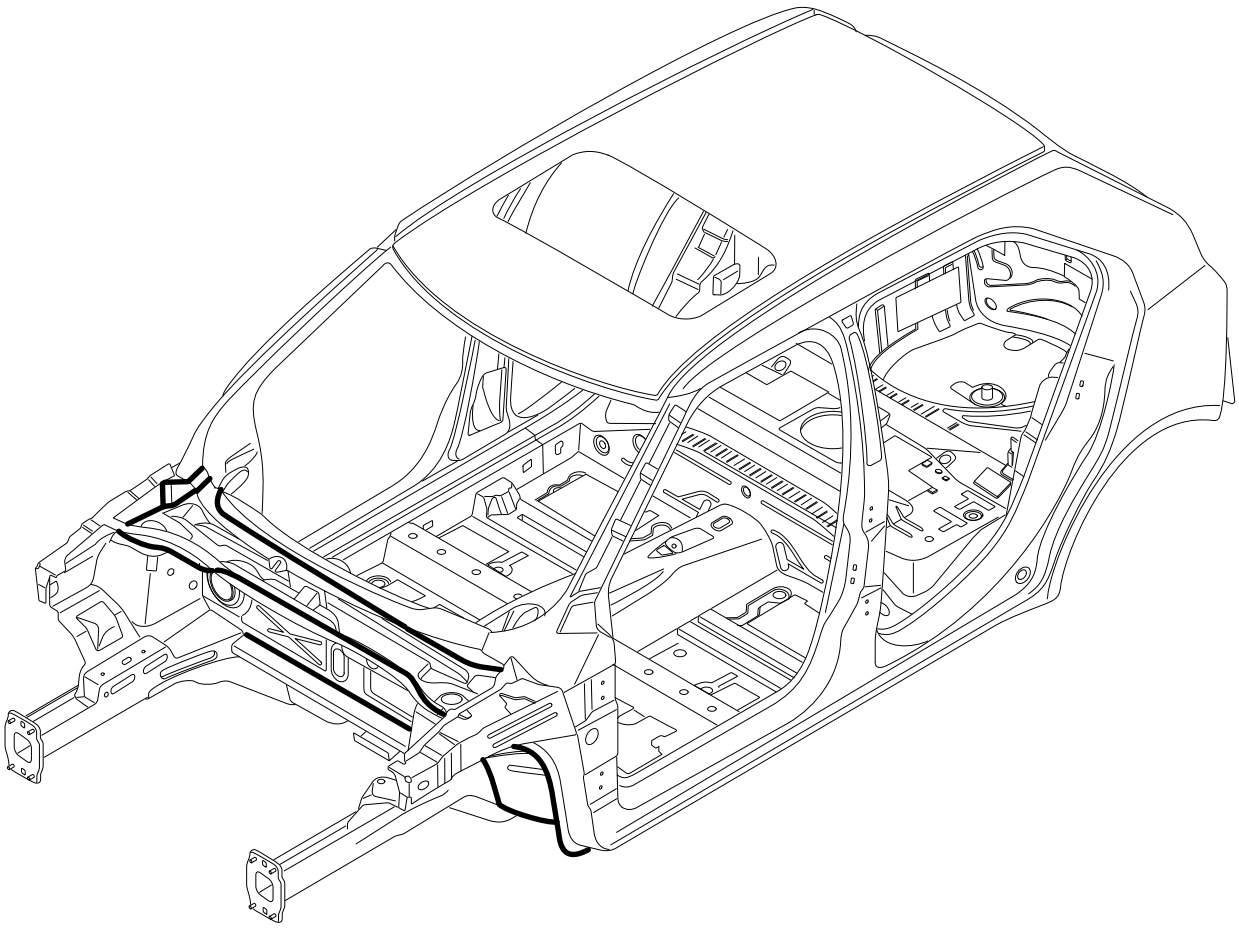
Where seams are inaccessible following the reassembly or fitting of components, ensure that a paste-type seam sealer is applied to such seams. Certain seams also become inaccessible after the completion of panel repairs. In such instances apply seam sealer and paint before final assembly. Provided access is adequate, apply seam sealer to both sides of a repair joint. Where access is limited to one side only (e.g. box sections), treat the affected box member with cavity wax. Seams to which seam sealer is applied during factory assembly are detailed in the following illustrations.

Note: *Thoroughly inspect all joints around vicinity of repair. If necessary seal all areas that have been joined, repaired or replaced. Leave no area open to wet /damp contamination. Sealing will help eliminate: water ingress and wind noise etc. Always carry out a final quality check on all sealed areas.*

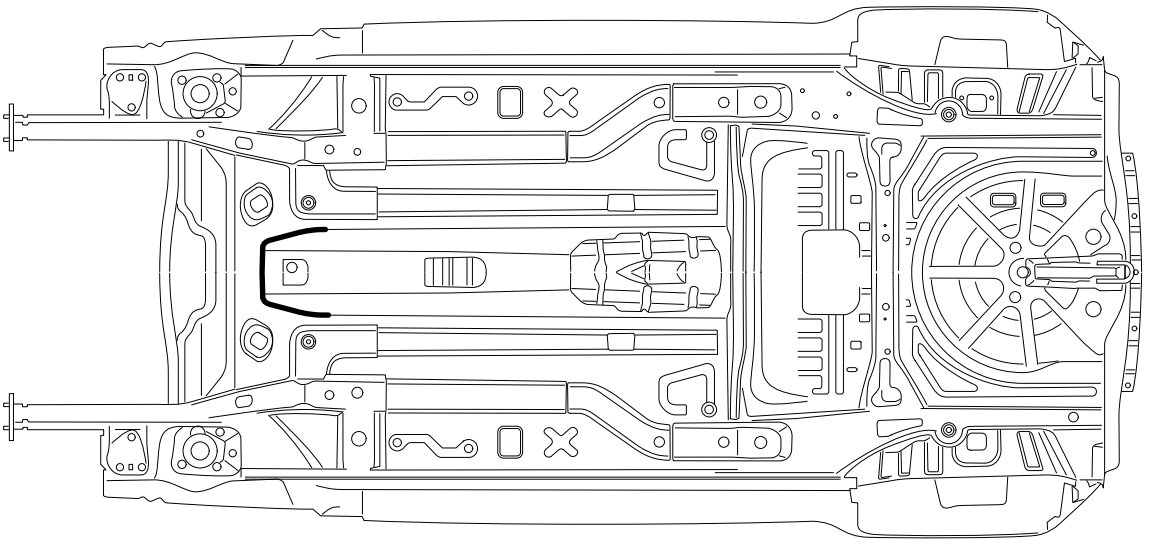
PVC Coat Application Area

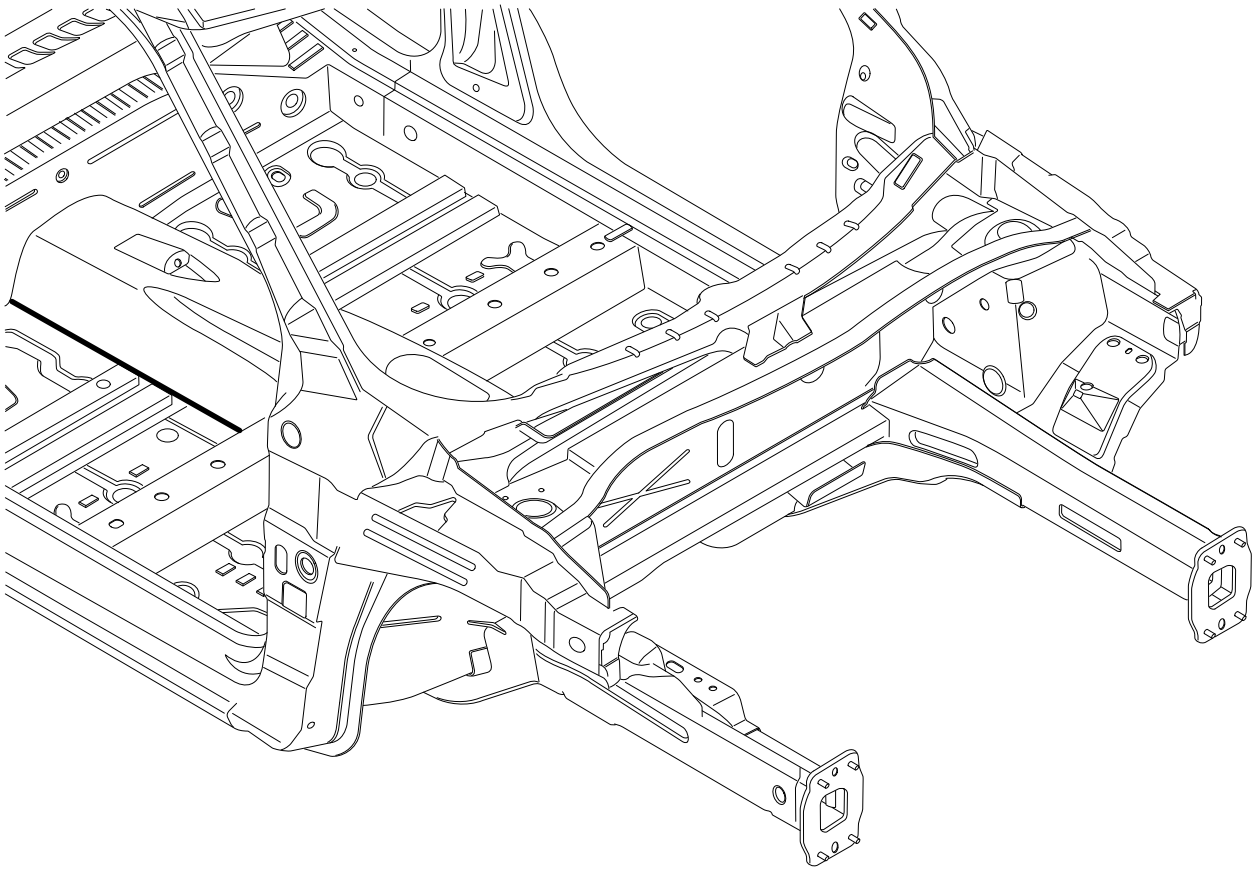
Engine Compartment Area

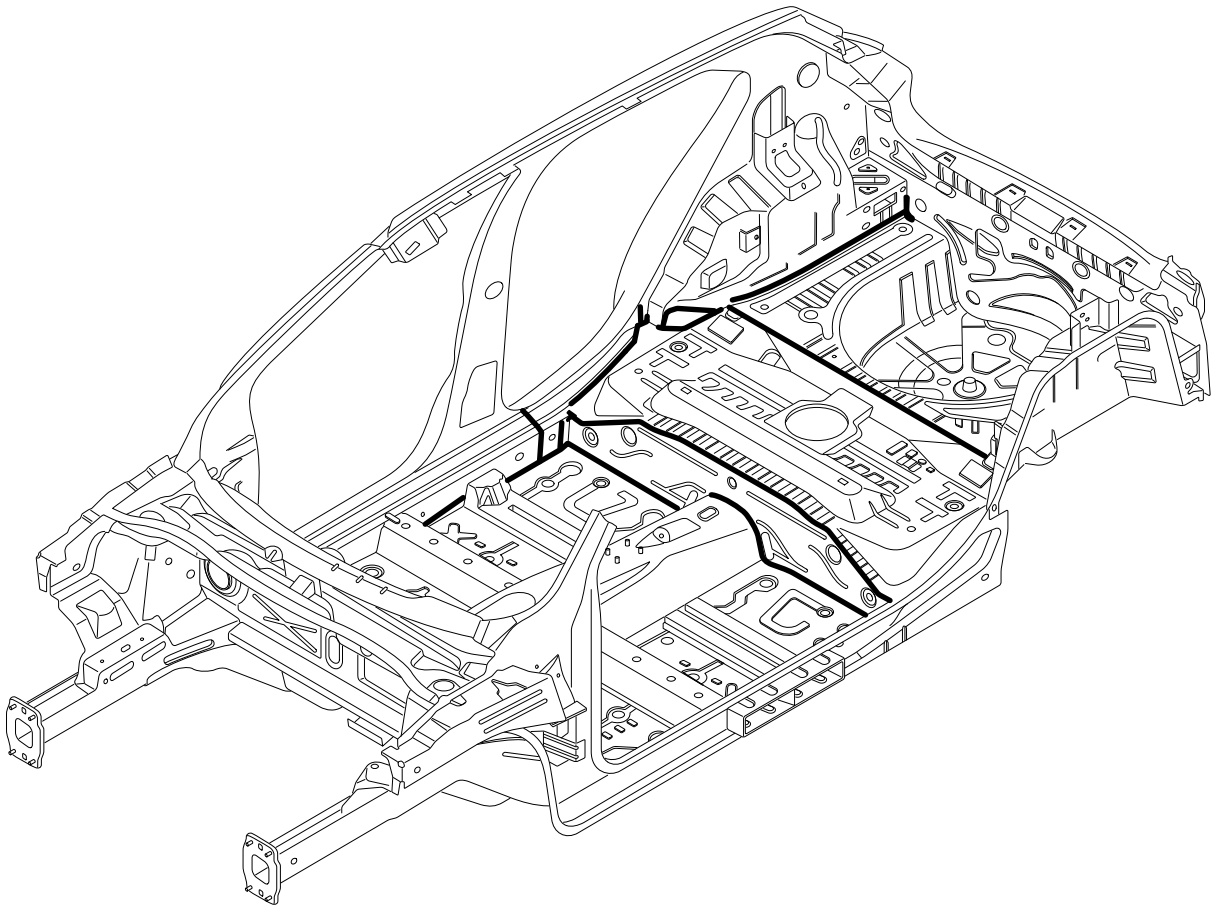


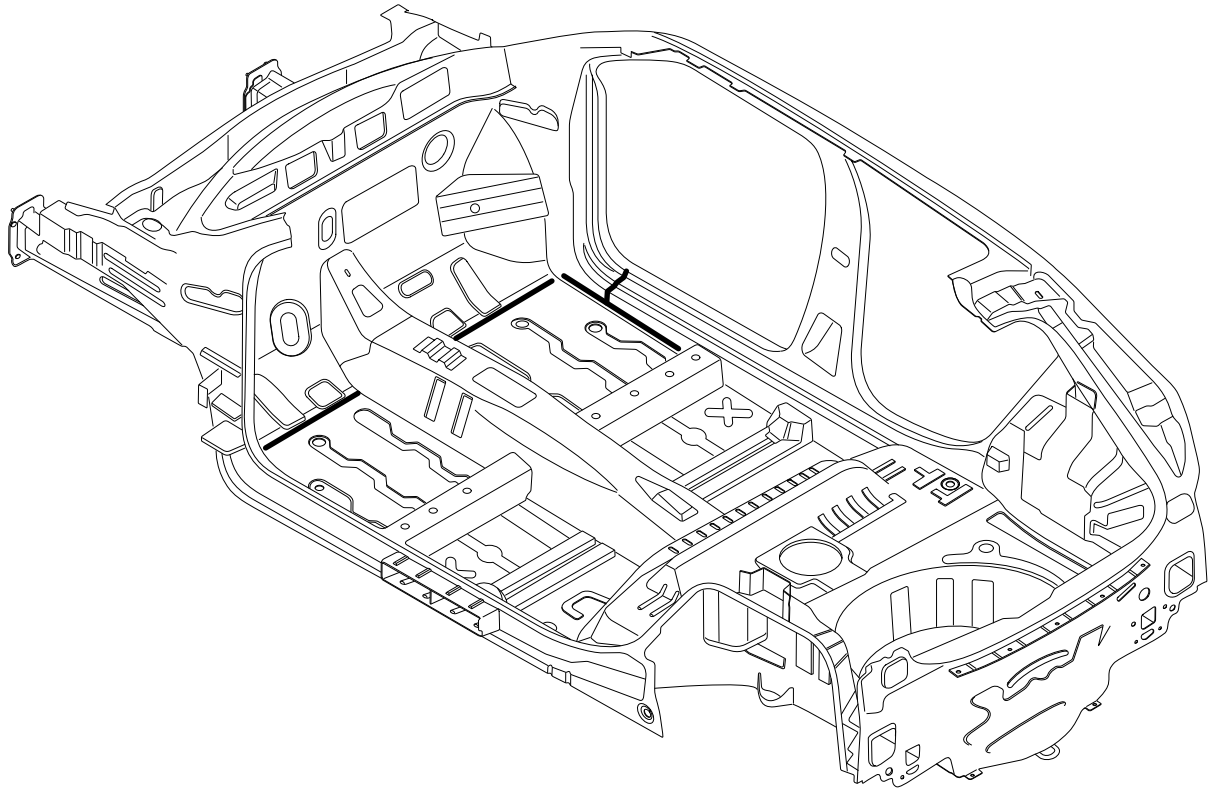


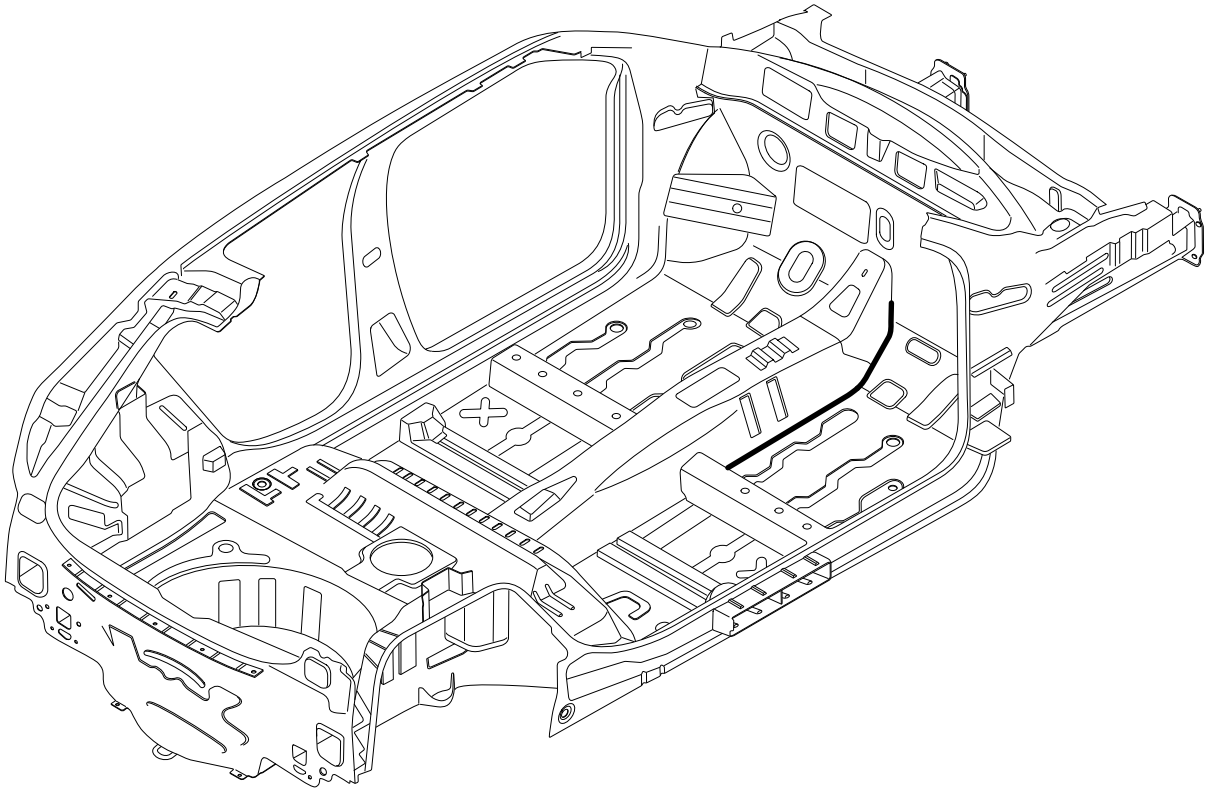
Front Floor Area



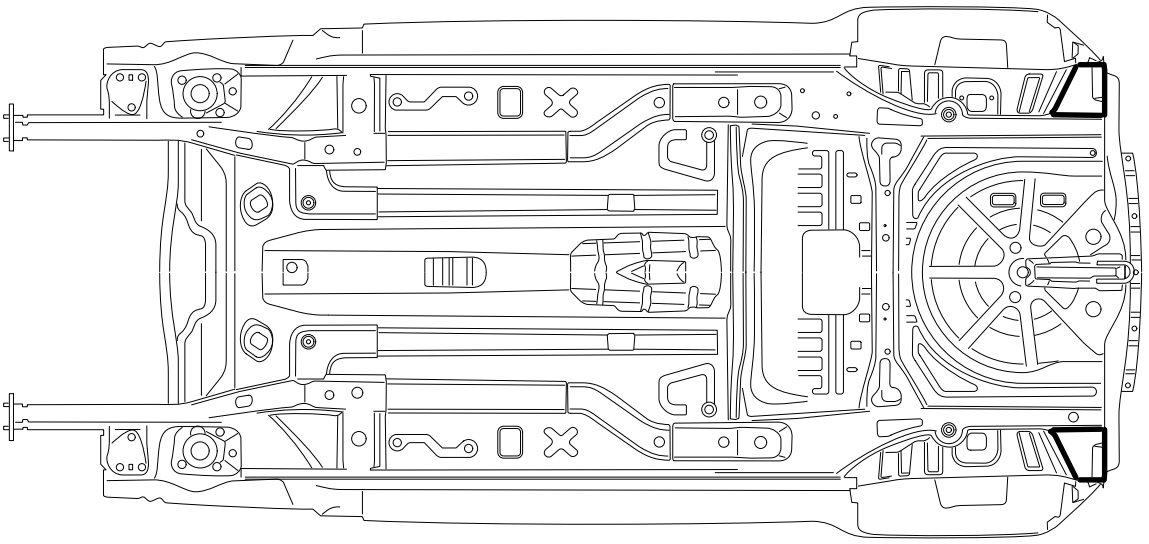


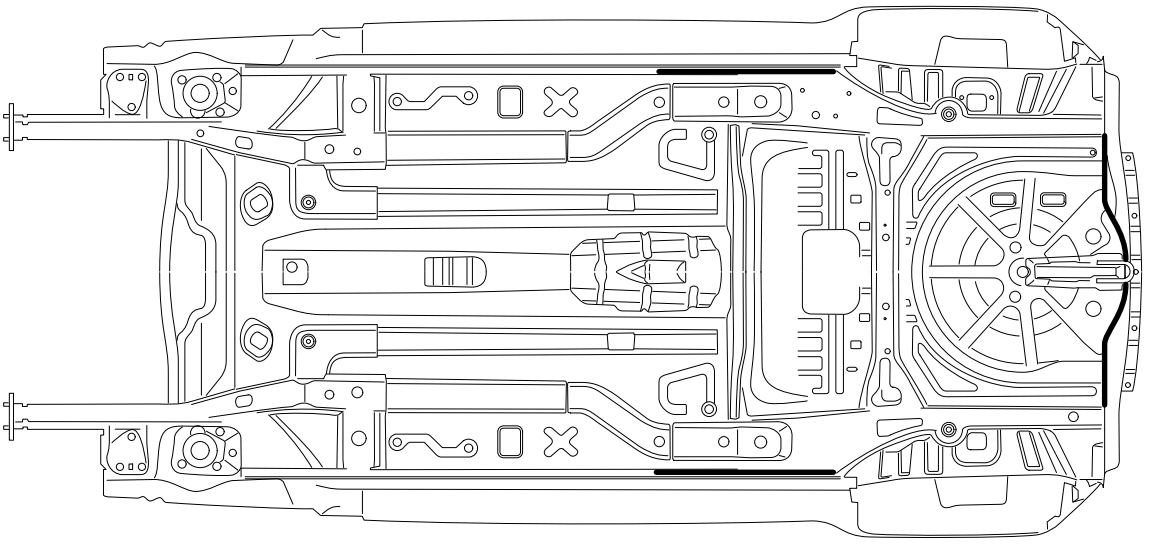




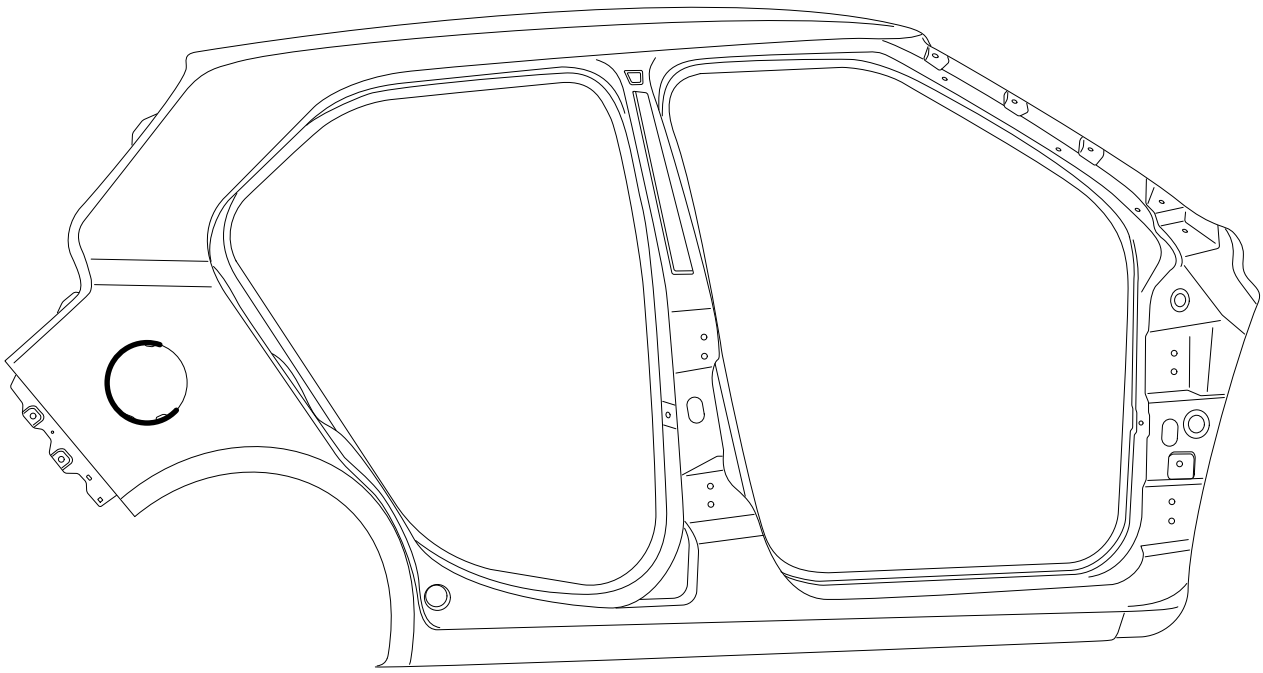


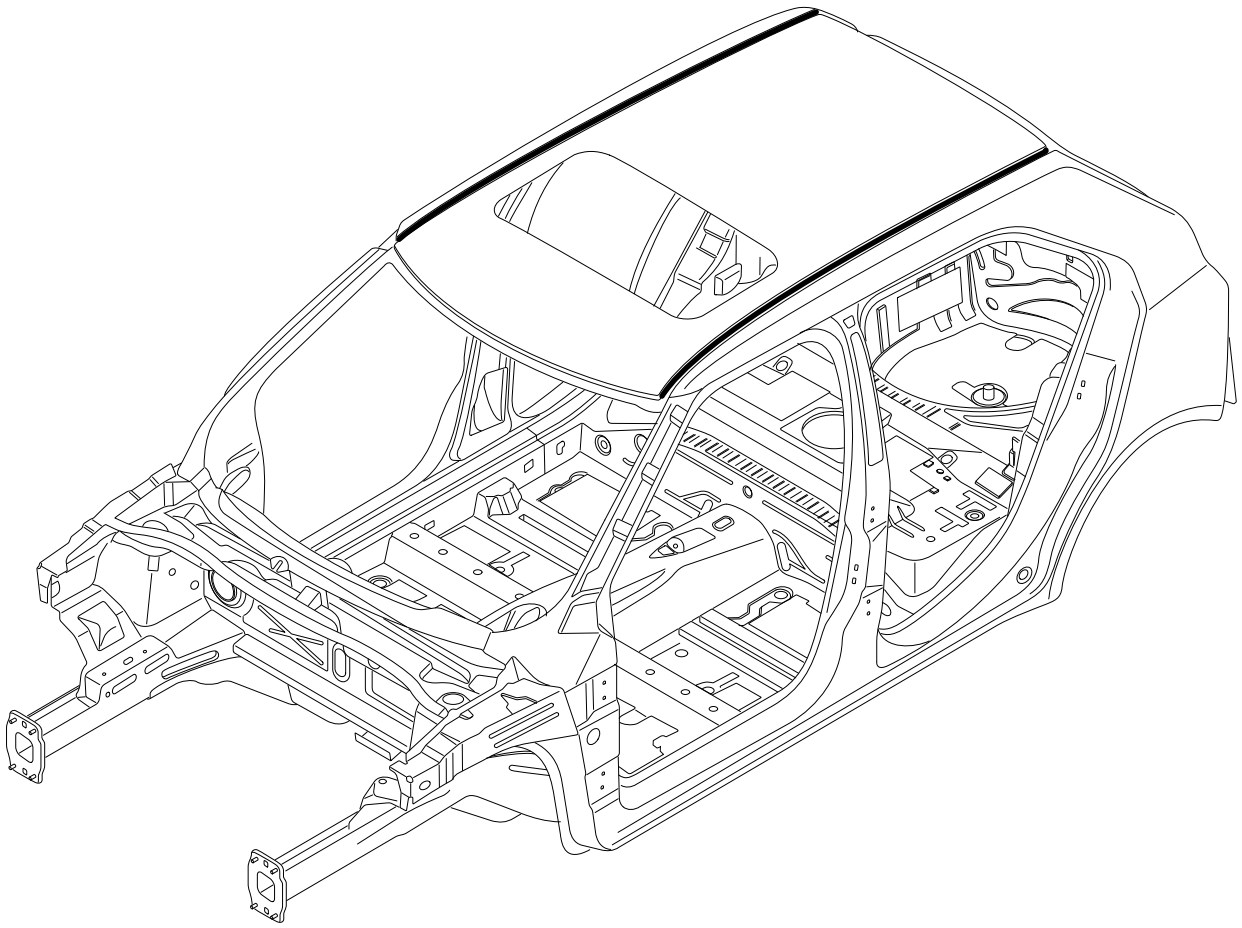
Rear Floor Area

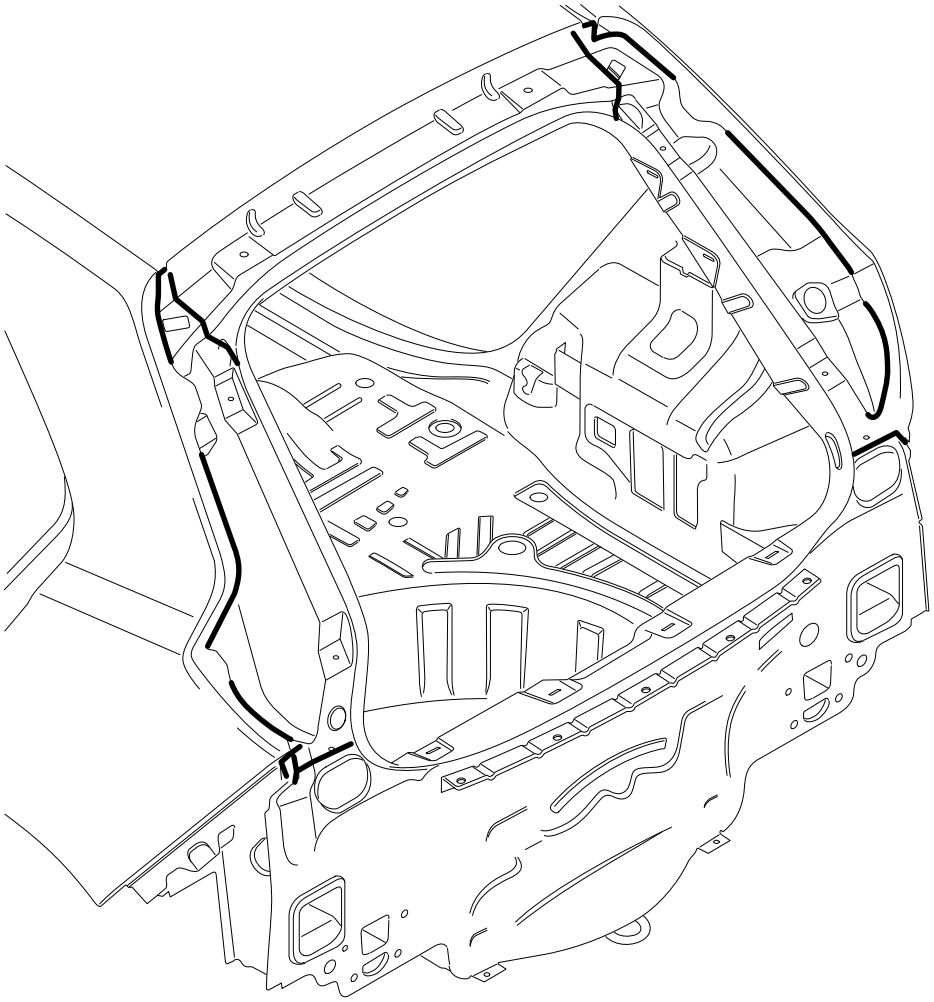


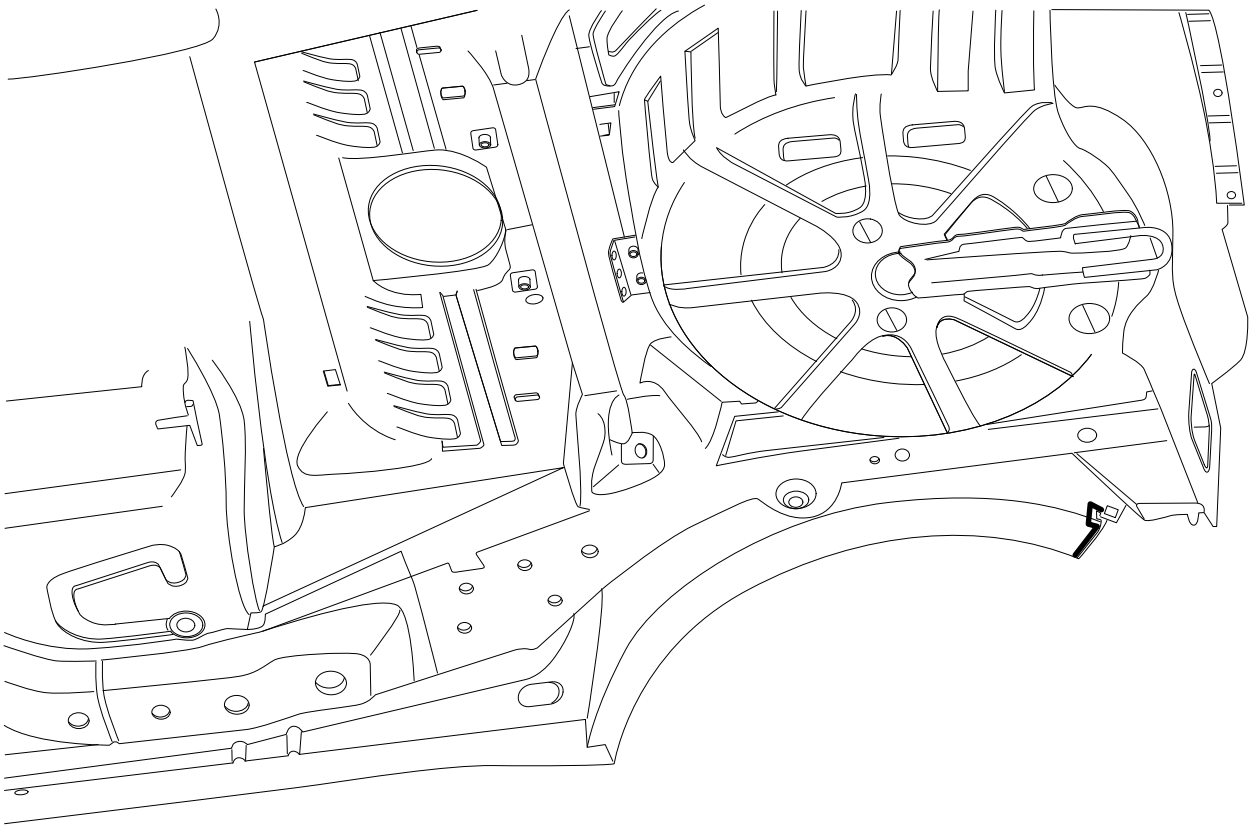


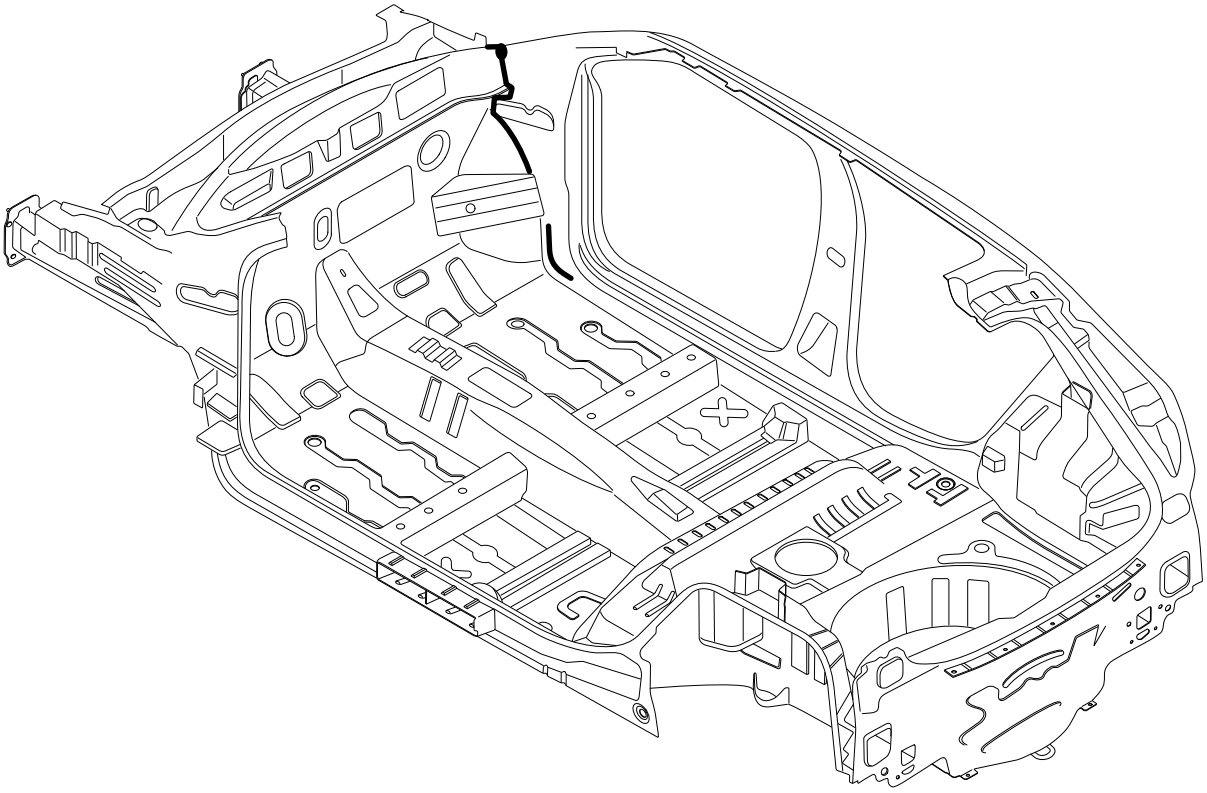
Bodyside Panel Area



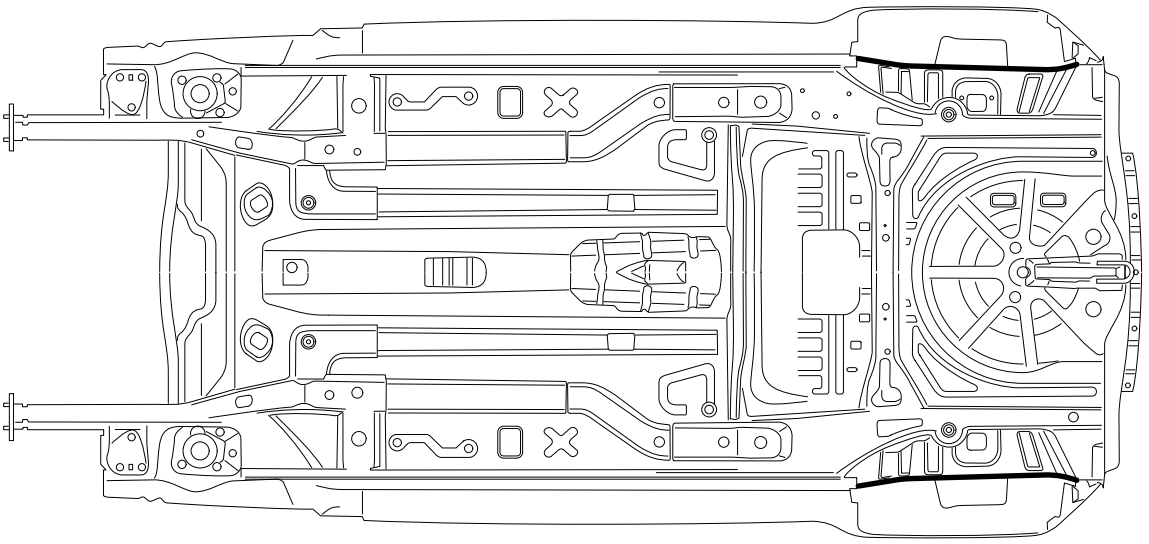


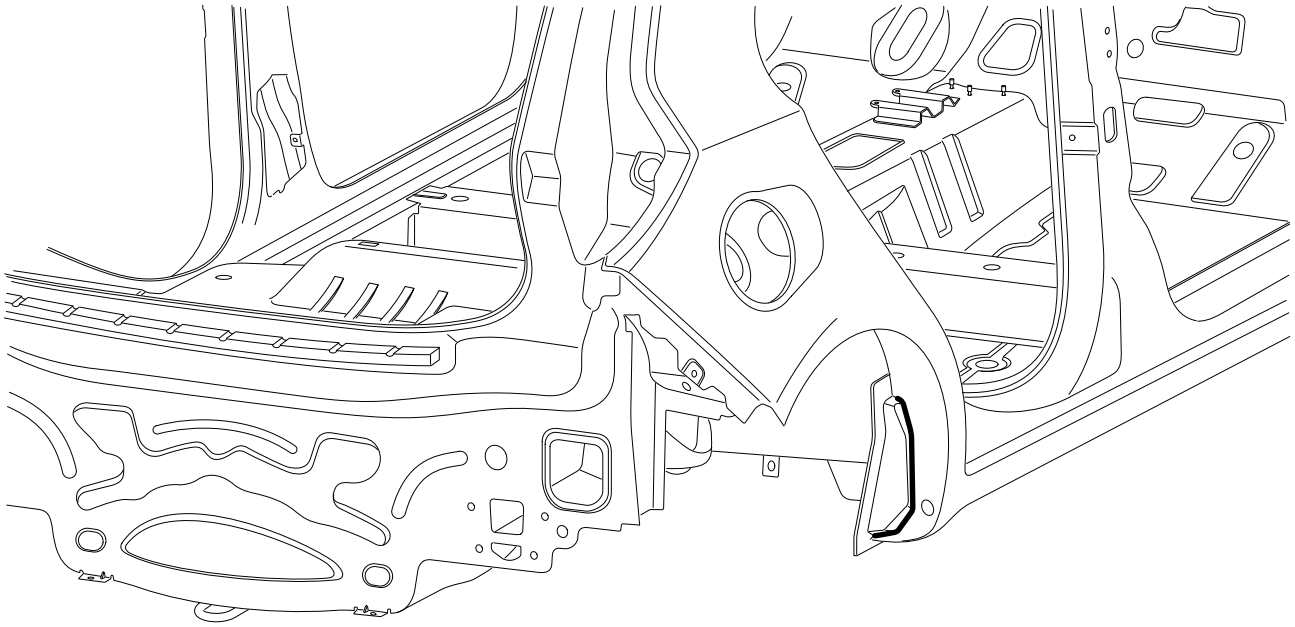


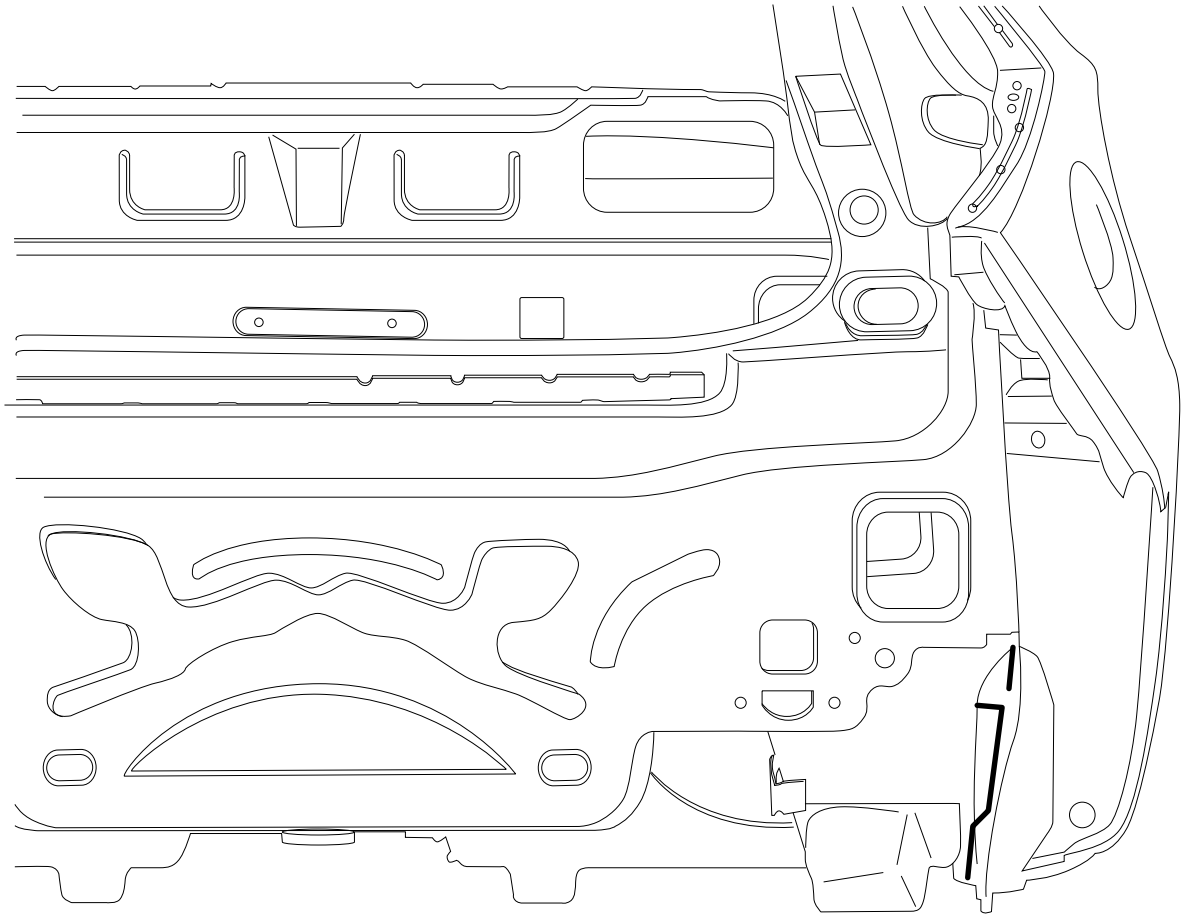


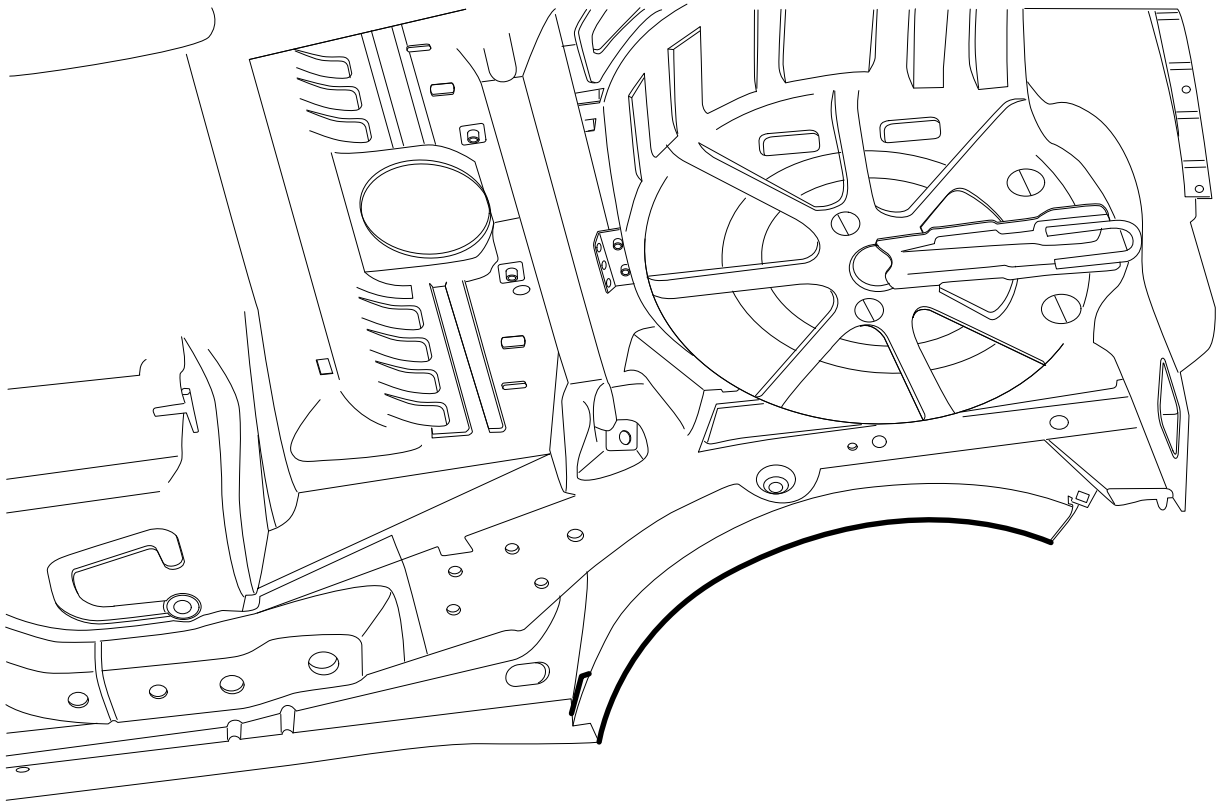


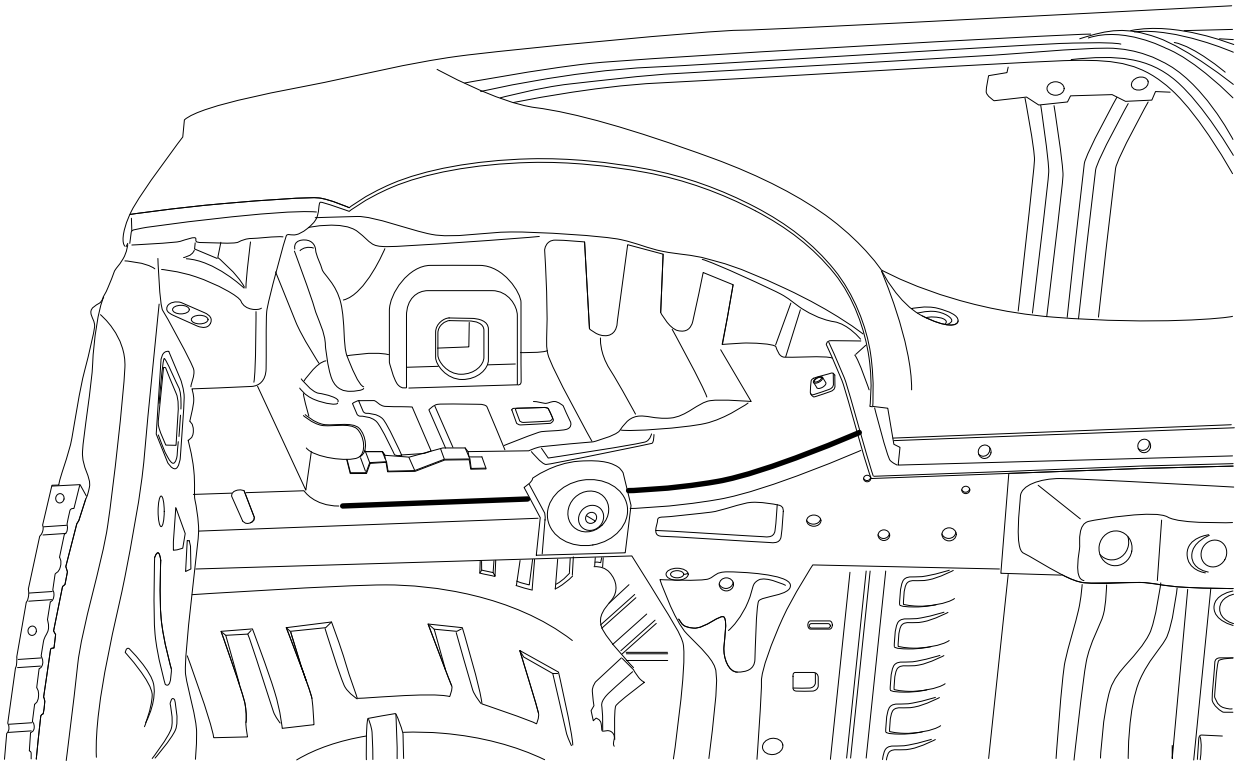
Wheel House Panel Area



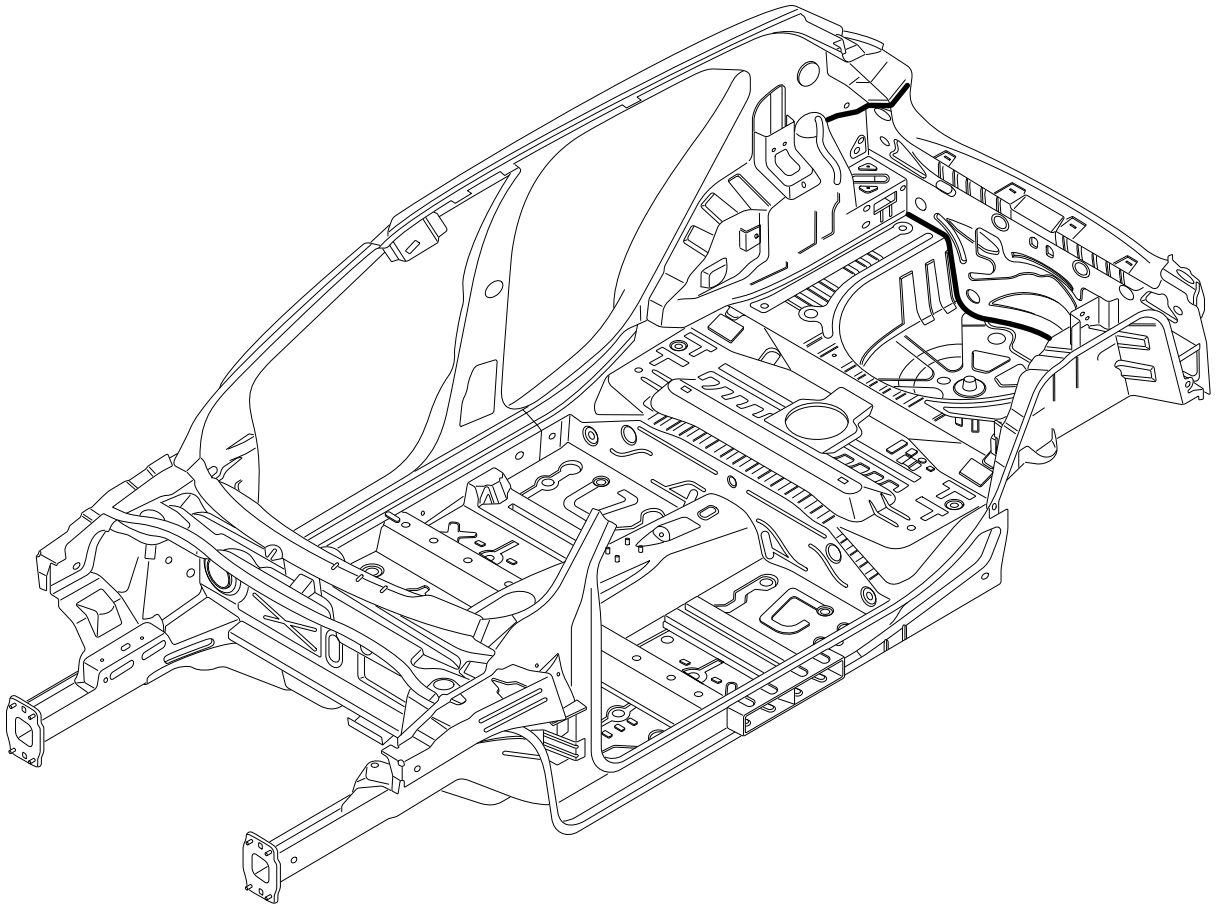


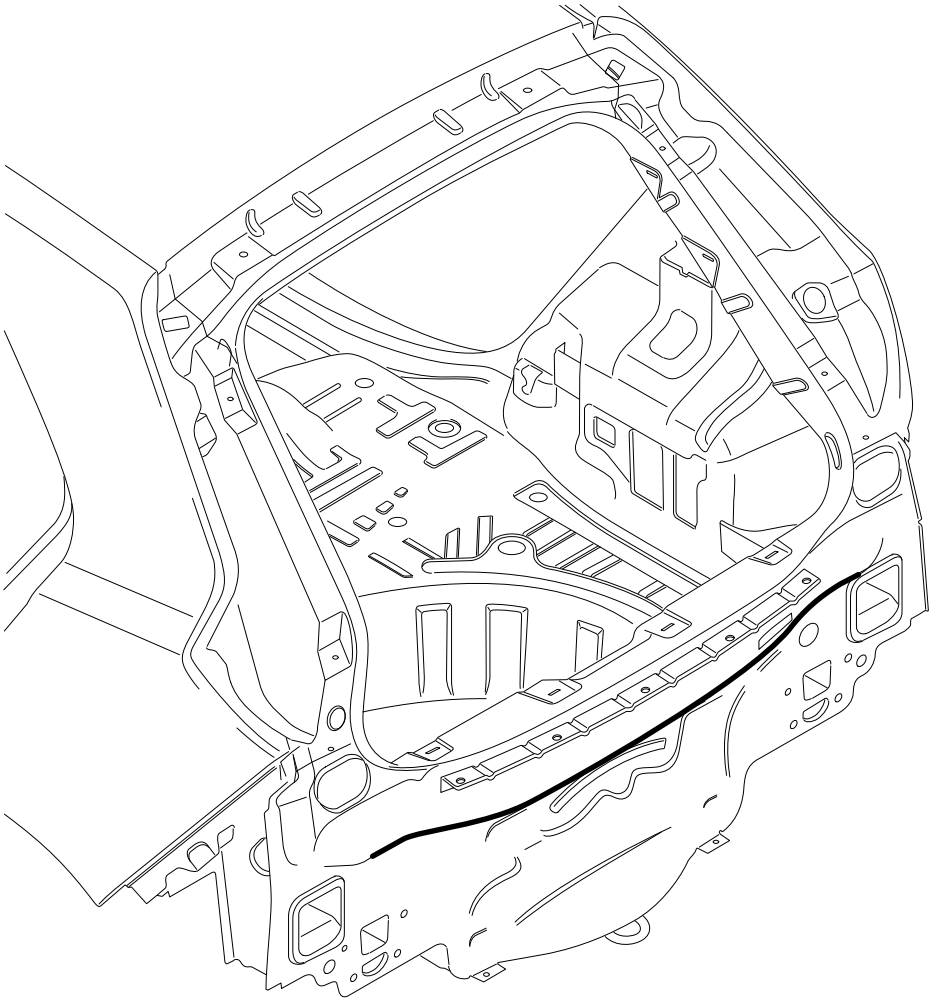


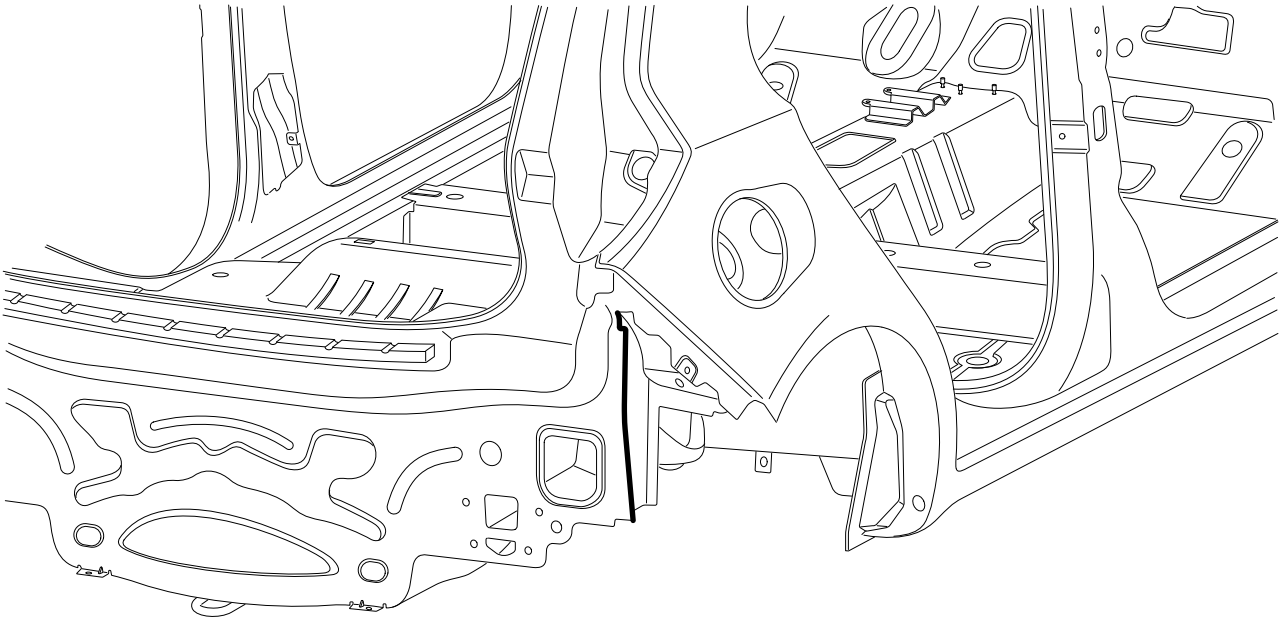


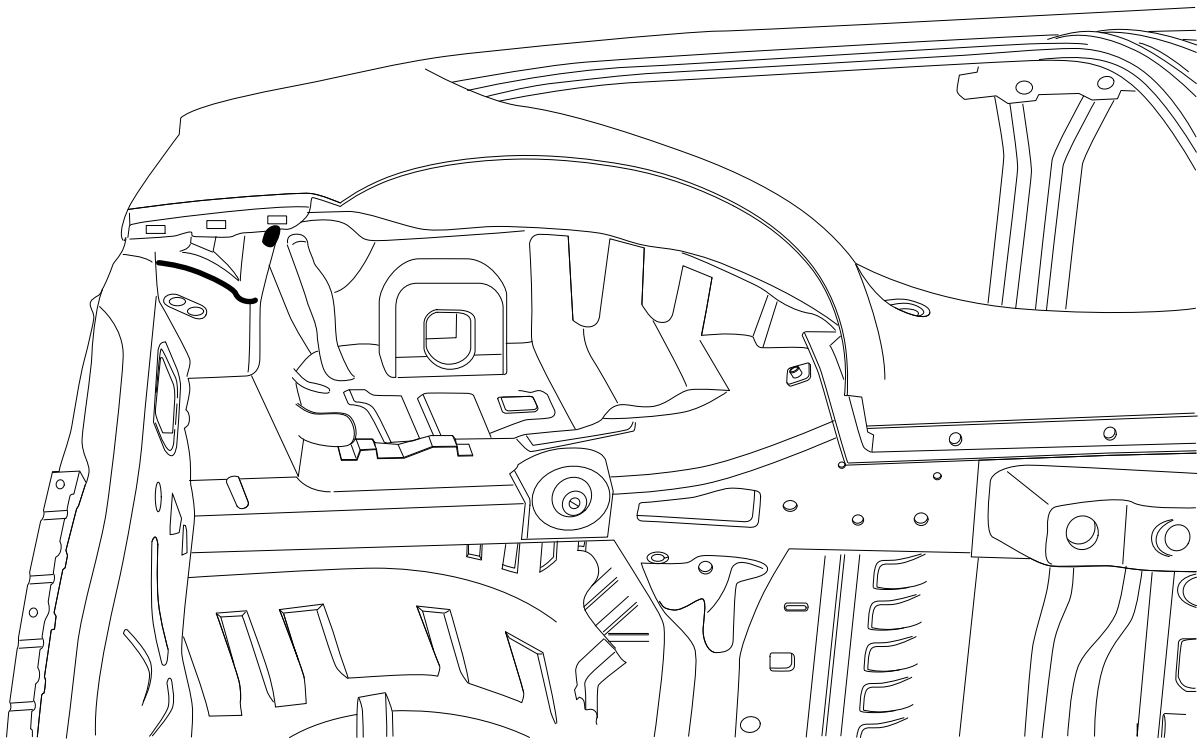


Rear End Panel Area

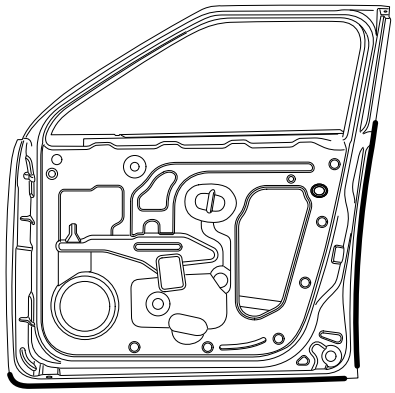




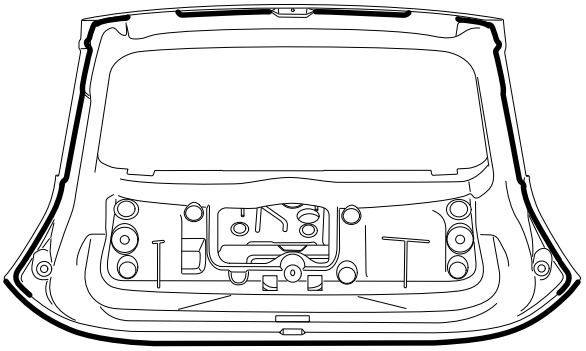




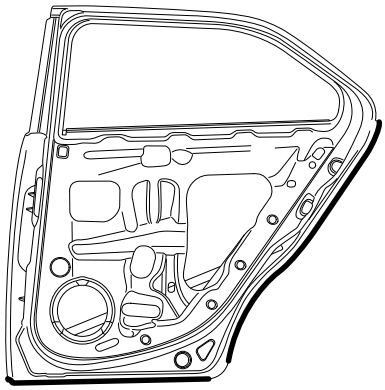
Front Door Area



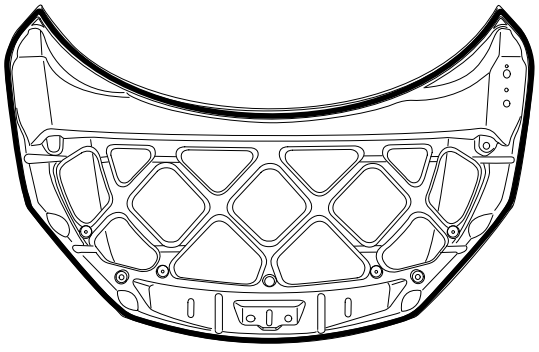
Tailgate Area



Rear DoorArea

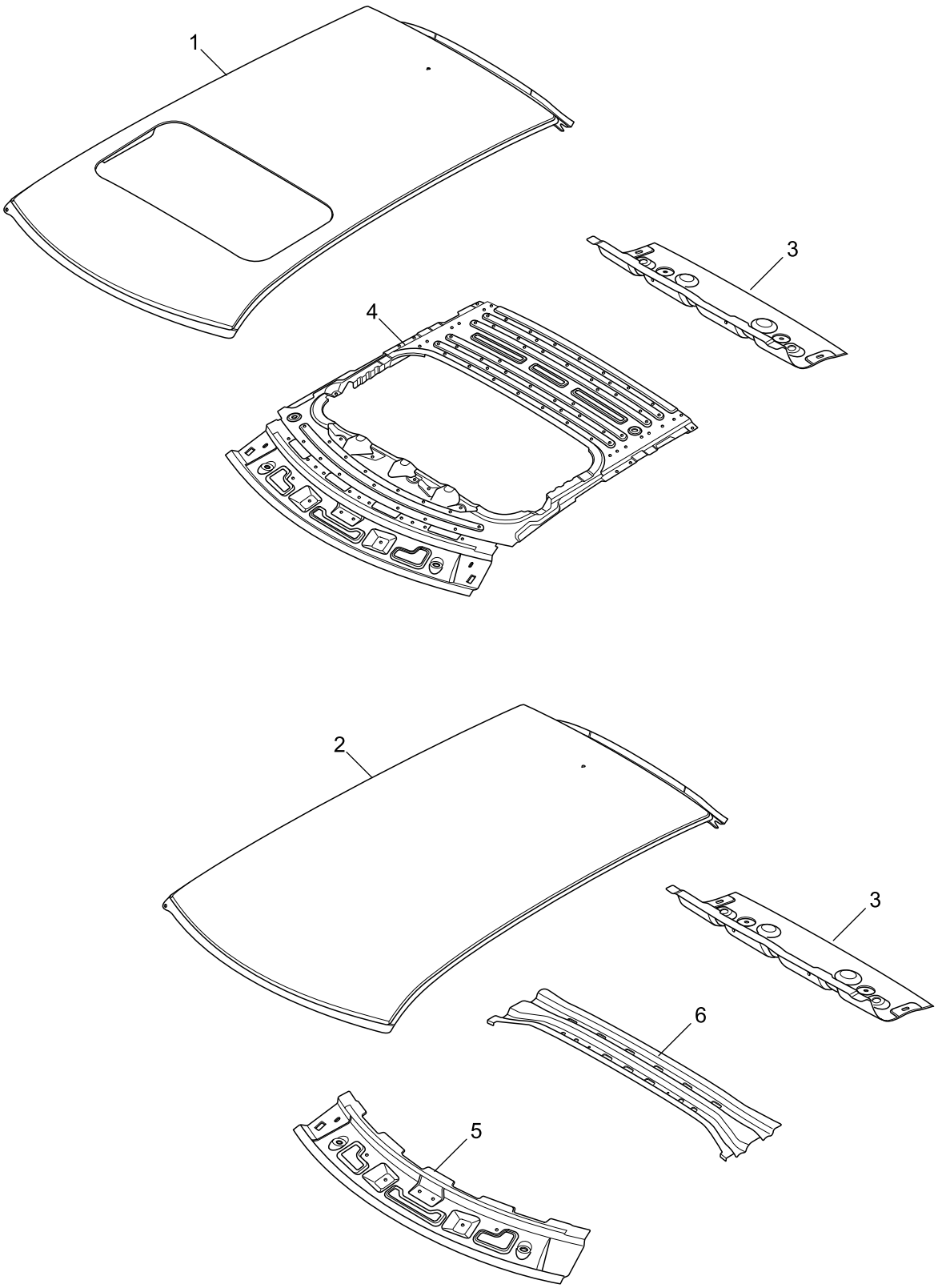


Bonnet Area



Repair Panel Infomation

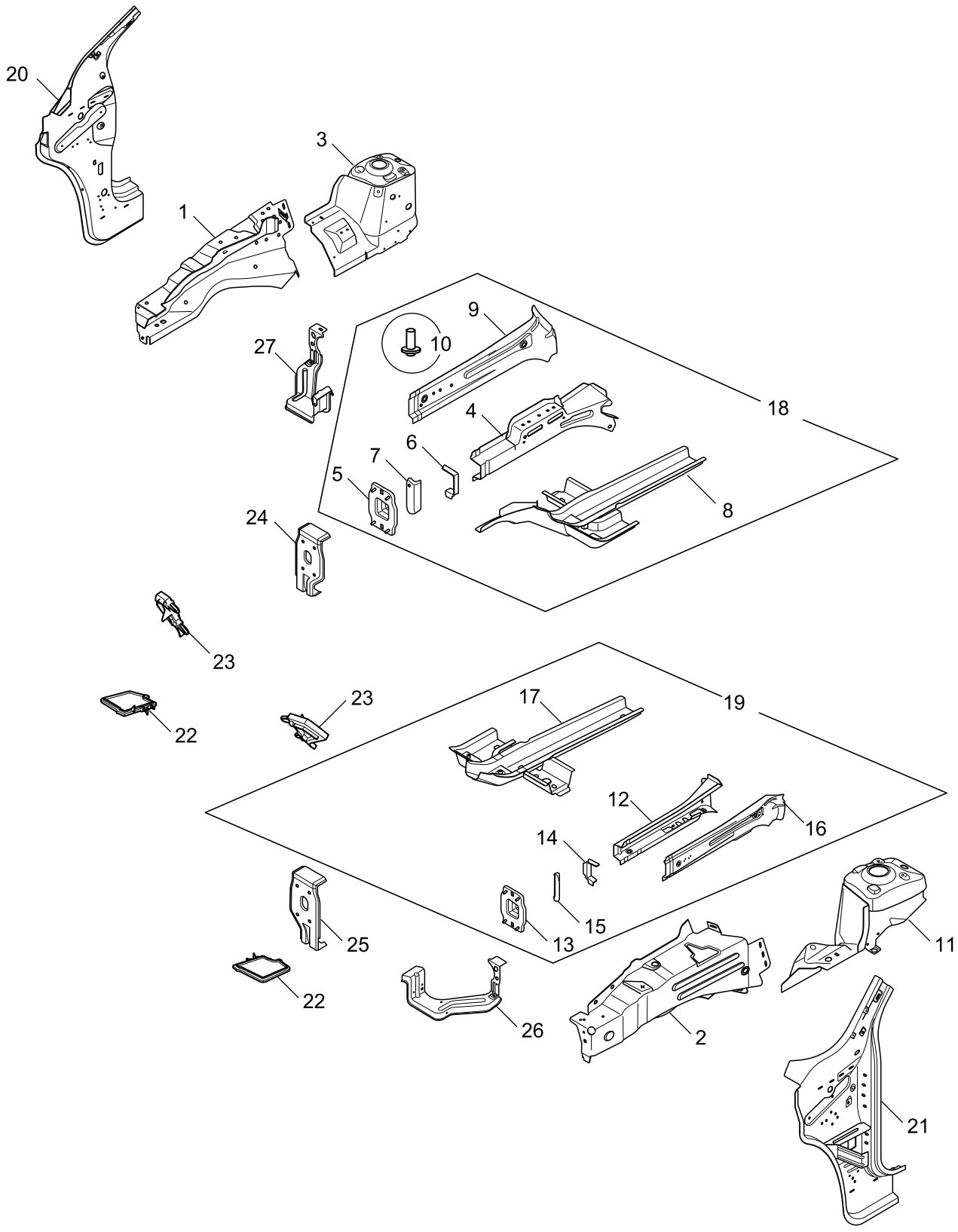
Roof Panel



1. Roof cover panel - sunroof
2. Roof cover panel
3. Rear header
4. Sunroof reinforcement assembly

5. Front header assembly
6. Centre roof header

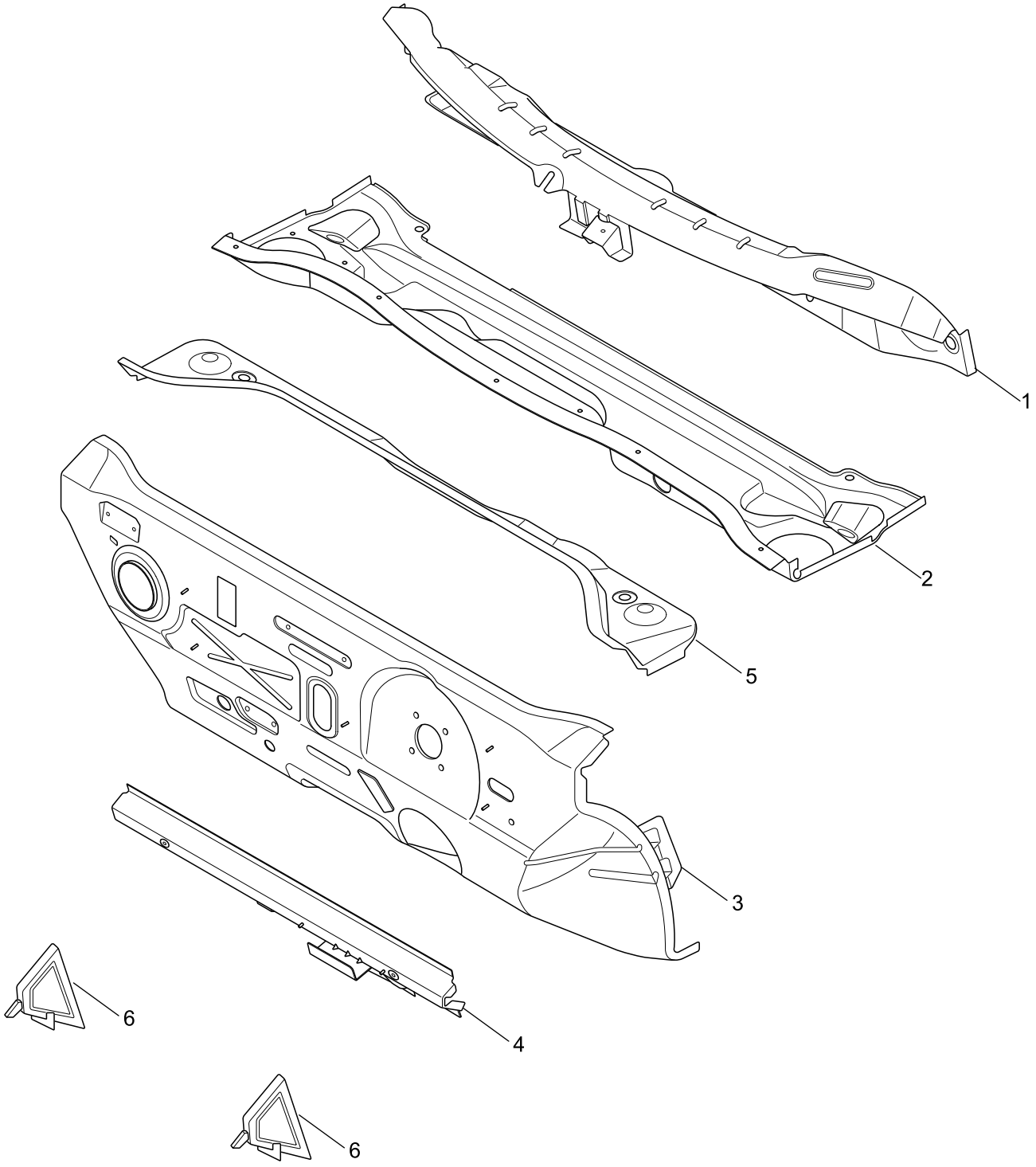
Engine Compartment Panel



1. Right side frame assembly
2. Left side frame assembly
3. Right side tower assembly
4. Right side sidemember inner assembly
5. Right side front bumper mounting bracket assembly

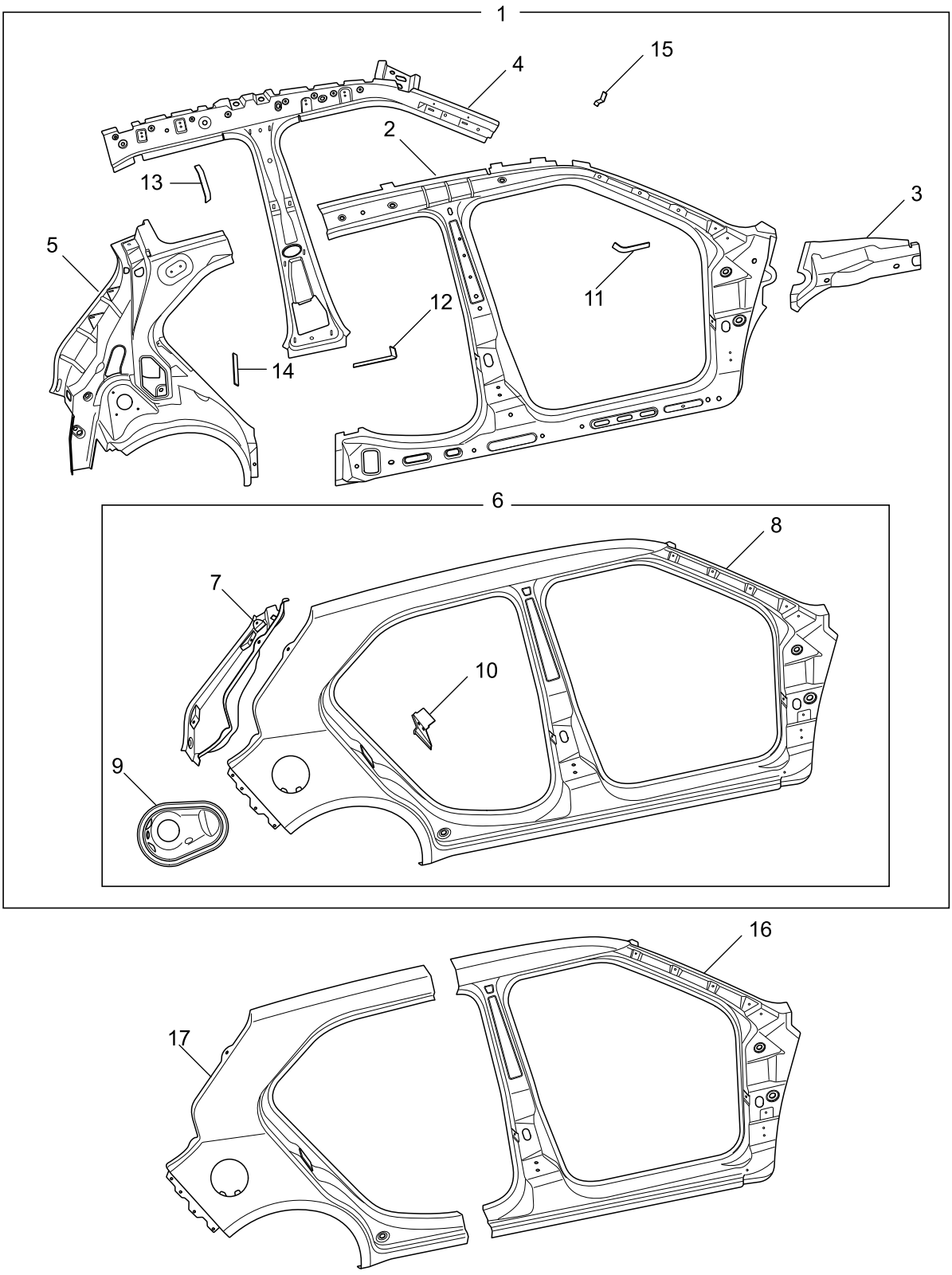
6. Right side front bumper mounting bracket reinforcement panel
7. Right side front bumper mounting bracket reinforcement panel
8. Right side dash longitudinal assembly
9. Right side sidemember outer assembly
10. Welding pin - front rail inner panel
11. Left side tower assembly
12. Left side sidemember inner assembly
13. Left side front bumper mounting bracket assembly
14. Left side front bumper mounting bracket reinforcement panel
15. Left side front bumper mounting bracket reinforcement panel
16. Left side sidemember outer assembly
17. Left side dash longitudinal assembly
18. Right side front rail assembly
19. Left side front rail assembly
20. Right side panel dash side assembly
21. Left side panel dash side assembly
22. A post lower panel NVH block
23. A post upper panel NVH block
24. Right side tank upper tie bar bracket assembly
25. Left side tank upper tie bar bracket assembly
26. Left side front bumper headlight refit panel assembly
27. Right side front bumper headlight refit panel assembly

Dash Panel



1. Dash upper assembly
2. Plenum assembly
3. Dash lower assembly
4. Crossmember dash lower center assembly
5. Crossmember dash lower upper center
6. Block

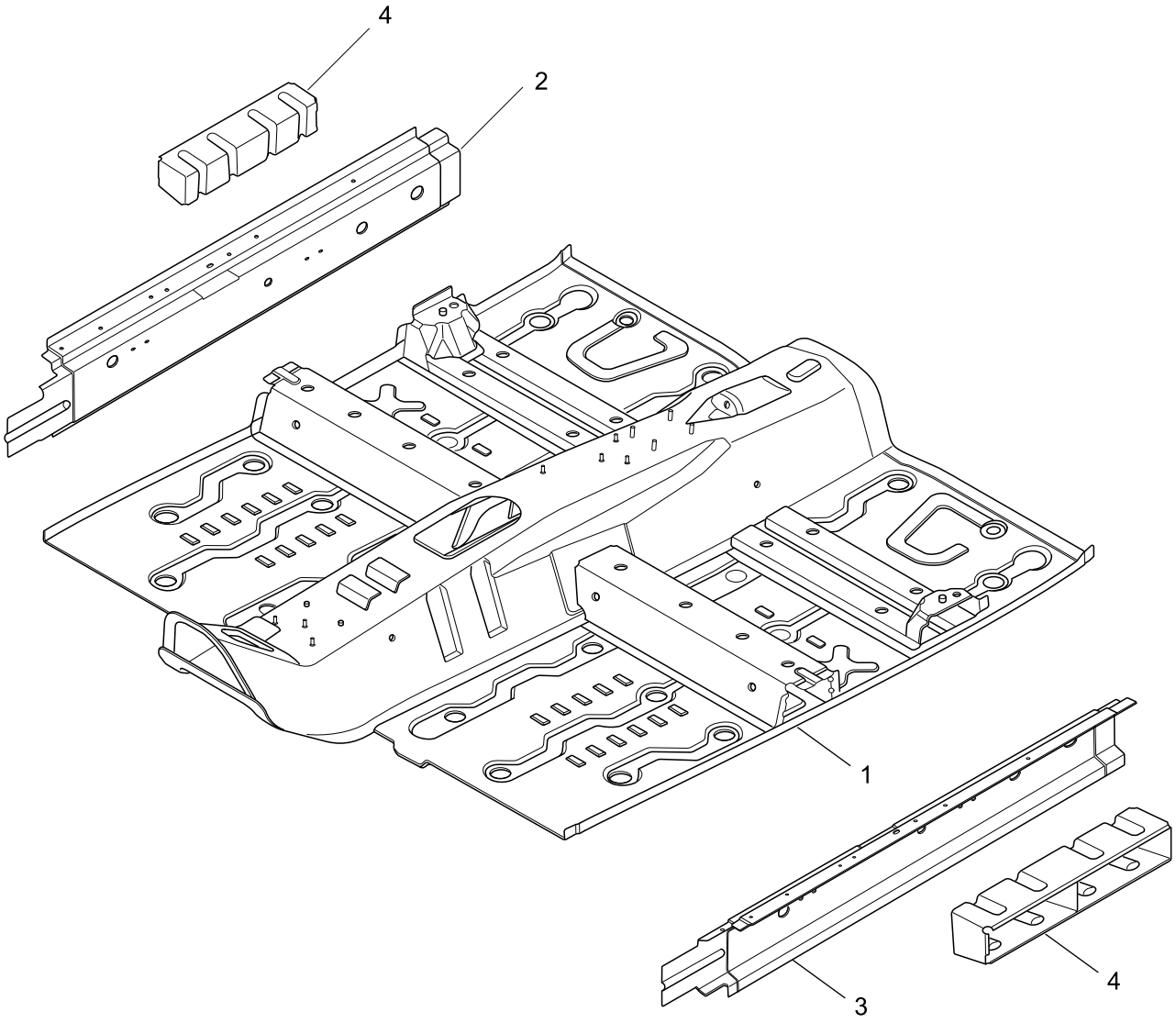
Bodyside Panel



1. Bodyside assembly
2. Front door frame reinforcement assembly
3. Valance inner panel
4. Bodyside closing assembly
5. Quarter rear inner panel assembly
6. Bodyside outer panel assembly

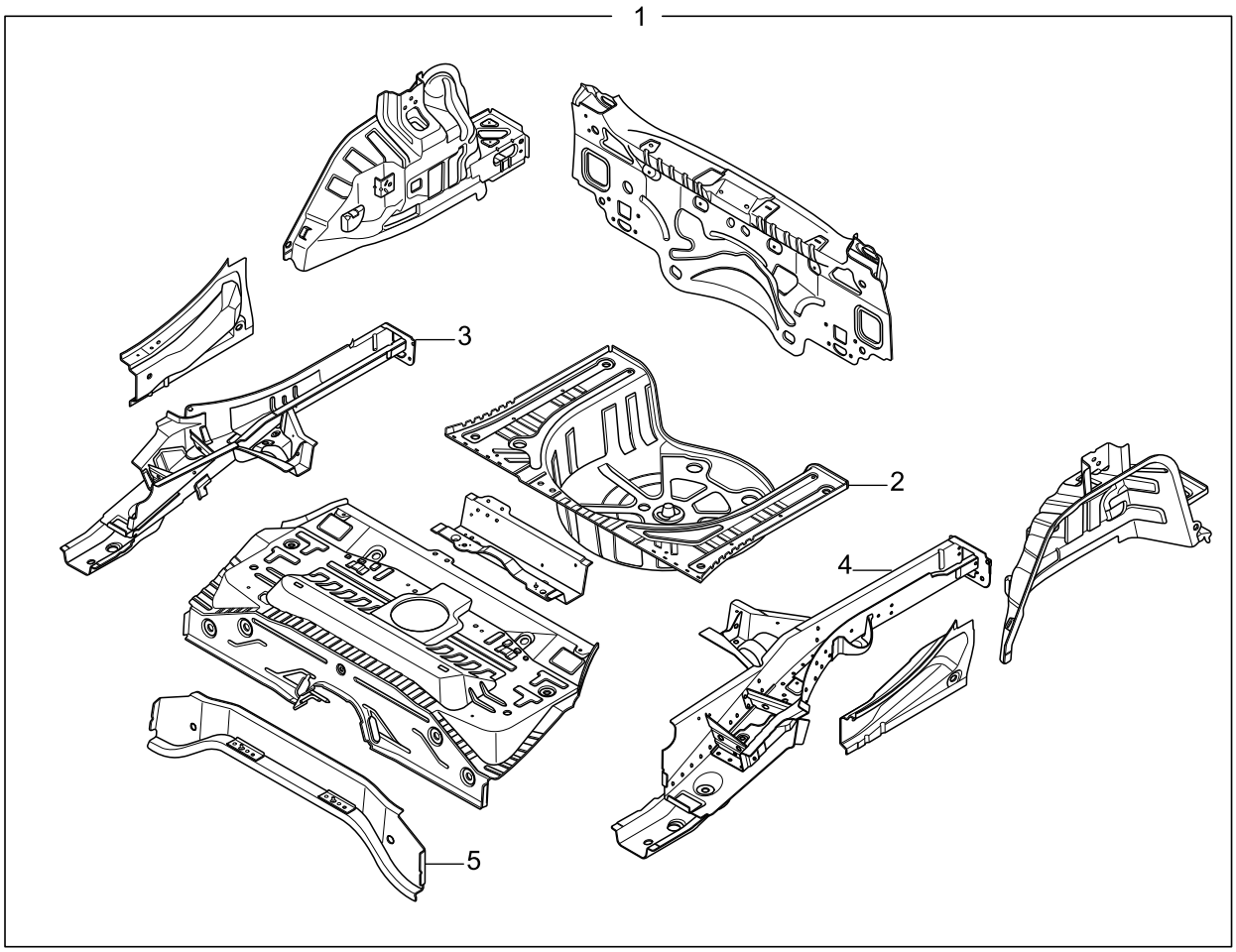
7. Rear lamp pocket assembly
8. Bodyside outer panel
9. Fuel filler shield assembly
10. D post striking plate stiffening plate assembly
11. A post outer panel NVH block
12. B post outer panel NVH block
13. Rear wall outer panel NVH block
14. C post lower NVH block
15. A post outer panel NVH block

Front Floor



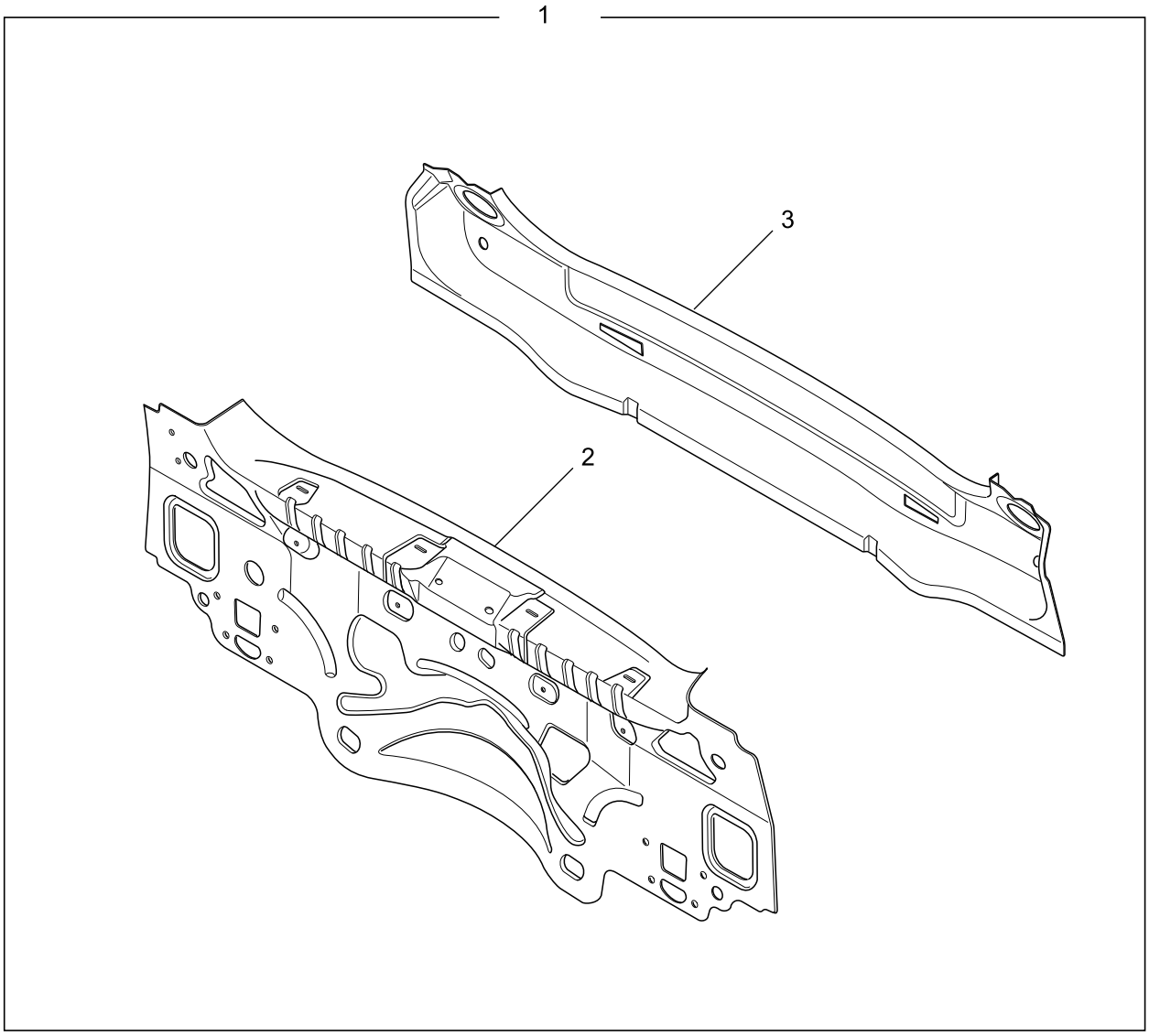
1. Front floor panel assembly
2. Right inner sill assembly
3. Left inner sill assembly
4. Sill inner reinforcement assembly

Rear Floor



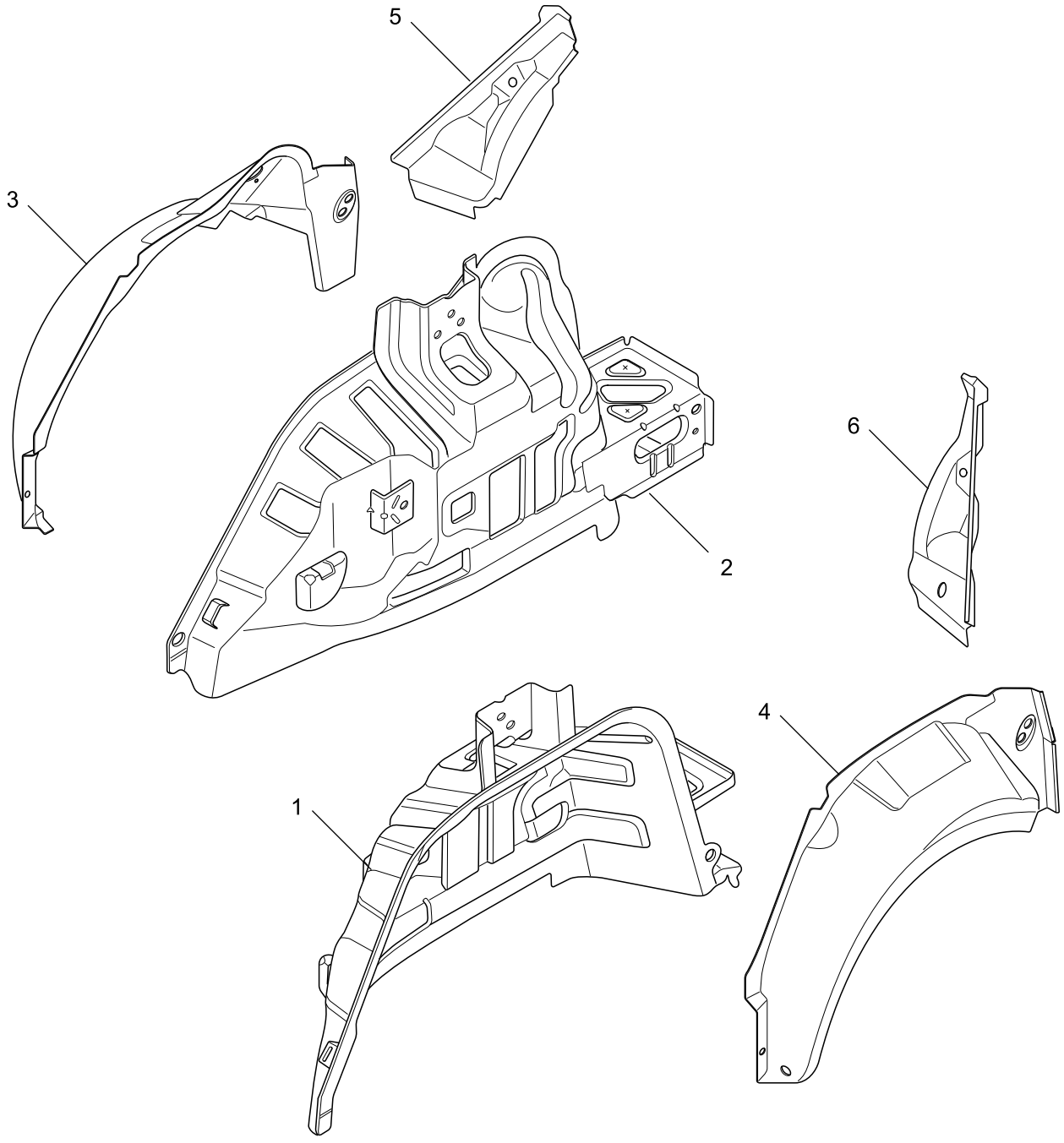
1. Rear floor panel assembly
2. Spare wheel stowage assembly
3. Right longitudinal rear assembly
4. Left longitudinal rear assembly
5. Crossmember heelboard assembly

Rear End Panel



1. Rear end panel assembly
2. Rear end panel striker assembly
3. Reinforcement rear end panel strikermember assembly

Wheel House Panel

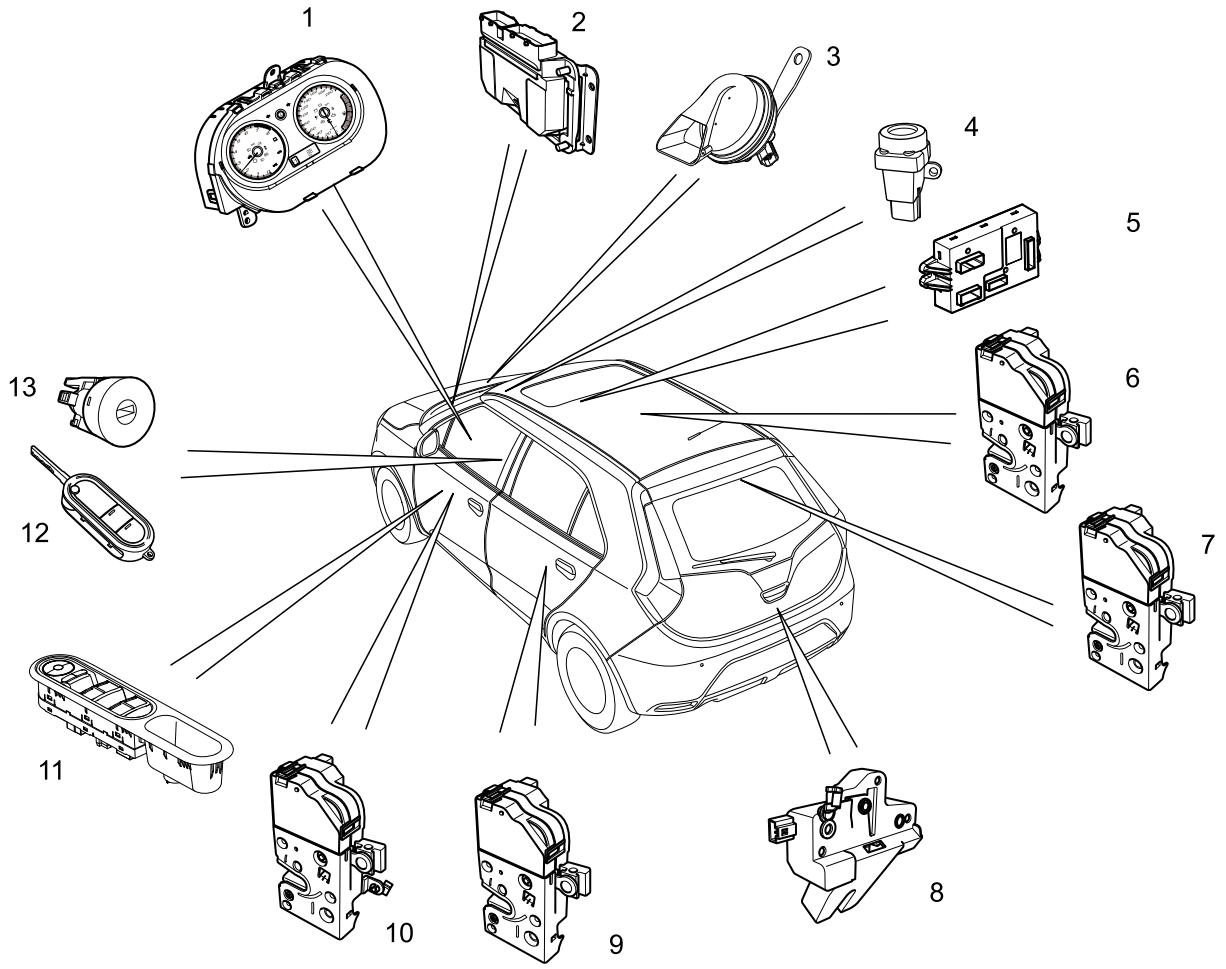


1. Left side wheelarch inner assembly
2. Right side wheelarch inner assembly
3. Right side wheelarch outer assembly
4. Left side wheelarch outer assembly
5. Right body side rear extension
6. Left body side rear extension

Vehicle Access

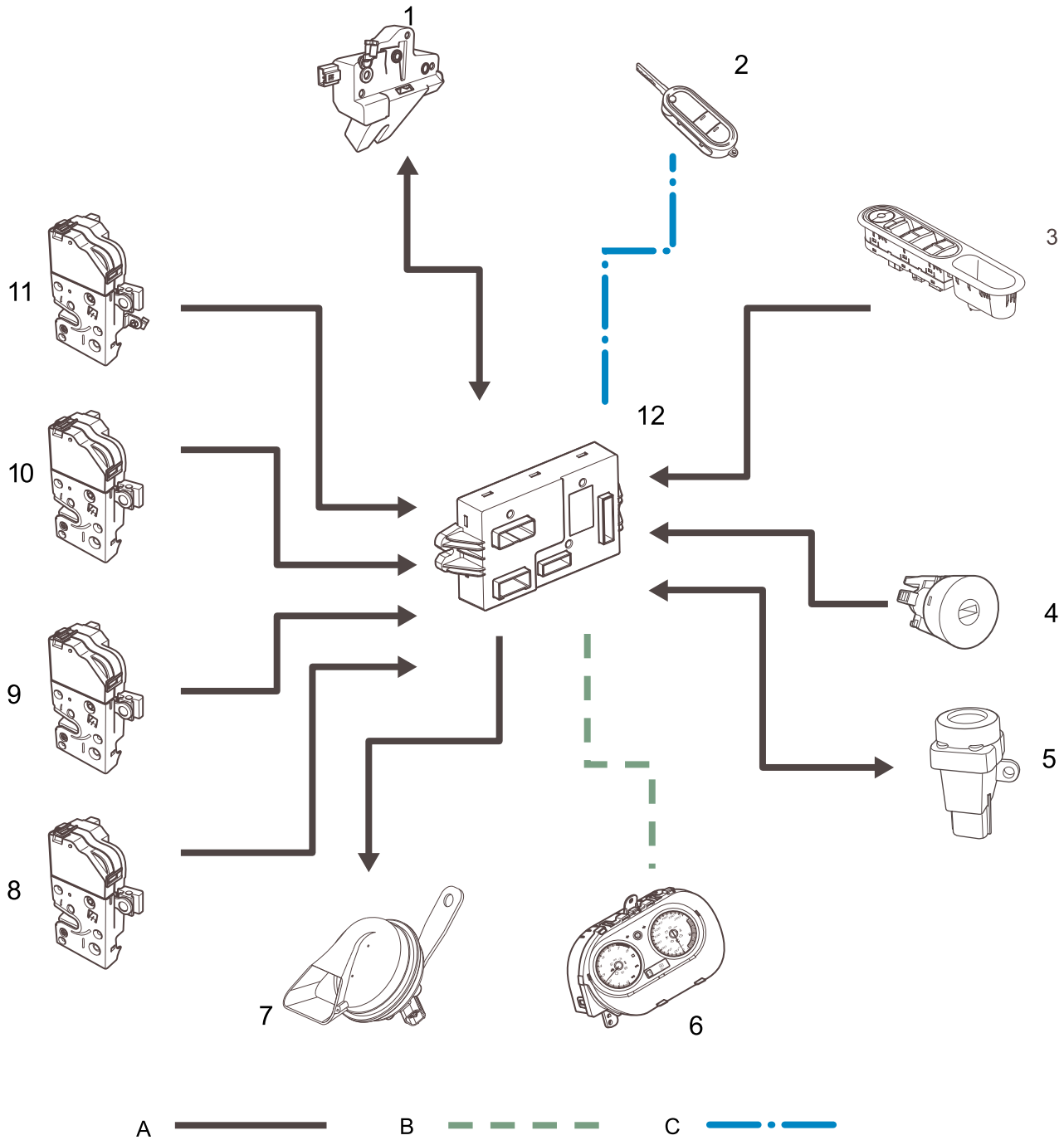
Description and Operation

System Component Layout



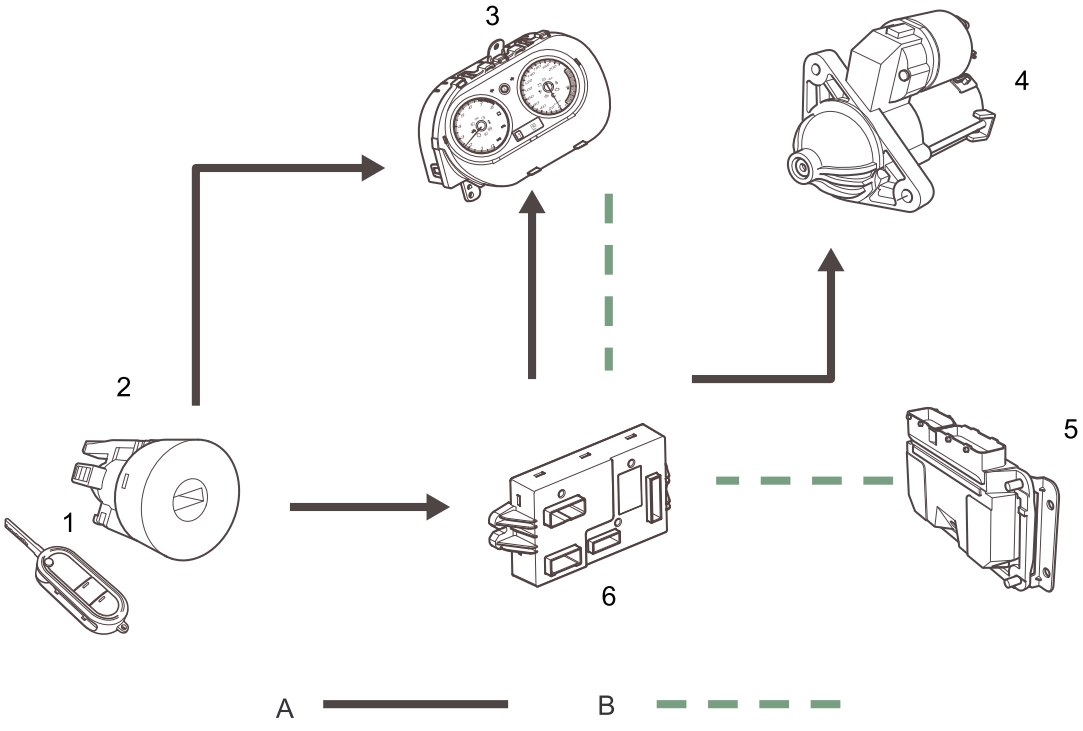
1. Instrument Pack
2. Engine Control Module
3. Horn
4. Inertia Switch
5. Body Control Module
6. Passenger's Door Switch and Lock
7. Rear Door Switch and Lock (RH)
8. Tailgate Switch and Lock
9. Rear Door Switch and Lock (LH)
10. Driver's Door Switch and Lock
11. Driver Side Door Switch Package
12. Remote Key
13. Ignition Switch

System Control Diagram



A = Hardwire; B = HS CAN Bus; C = RF Signal

1. Tailgate Switch and Lock
2. Remote Key
3. Driver Side Door Switch Package
4. Ignition Switch
5. Inertia Switch
6. Instrument Pack
7. Horn
8. Rear Door Switch and Lock (LH)
9. Rear Door Switch and Lock (RH)
10. Passenger's Door Switch and Lock
11. Driver's Door Switch and Lock
12. Body Control Module



A = Hardwire; B = HS CAN Bus

1. Remote Key
2. Ignition Lock
3. Instrument Pack
4. Starter Motor
5. Engine Control Module
6. Body Control Module

Description

Security and Locking System

The primary function of the security and locking system is to prevent unauthorized access to the vehicle. When the ignition switch is in the 'AUX' position, the transponder built into the remote key will mobilize the engine. The cipher is read by the coil around the ignition switch, the coil sends data to the remote key in a certain frequency . The security and locking system includes:

- Door Switch
- Tailgate Switch
- Hazard Warning Light
- Hazard Warning Light Button
- Remote Key
- Ignition Switch
- Body Control Module (BCM)
- RF Receiver

Door Switch

Each door latch mechanism contains an integral microswitch to inform the**BCM** of the status of the door. When the door is open the microswitch contacts are closed completing an earth path to the **BCM**. When the door is closed, the earth path is removed and the connection becomes open circuit.

Tailgate Switch

The tailgate lock motor contains an integral microswitch to inform the**BCM** of the status of the tailgate. When the tailgate is closed the microswitch contacts are open, creating an open circuit to the **BCM**. When the tailgate is opened, the switch closes completing the earth path to the **BCM**.

Operation

Locking or Unlocking by Remote Key

- Pressing the unlocking button on the remote key, the doors will be unlocked, simultaneously the direction lights will flash once for 2 seconds to indicate that the doors are unlocked successfully.
- Pressing the locking button on the remote key, the doors will be locked, simultaneously the direction lights flash for three times to indicate that the vehicle is locked firmly, meanwhile, the locking indicator in the instrument panel will flash. If pressing the locking button twice in one second, the super-lock will be active , that is the doors are unable to be opened with the internal handles, and the locking indicator in the instrument panel will flash at the same time. (the super-lock function is optional.)

Locking or Unlocking by Mechanical Key

When unlocking the door by mechanical key, insert the key into the driver door lock switch, and turn it to the On position for less than 2 seconds, to make all doors unlocked, simultaneously the direction lights flashing once to indicate the door locks are unlocked successfully . Alternatively, insert the key into the driver door lock switch, and turn it to the Off position for less than 2 seconds, to make all doors locked, simultaneously the direction lights flashing for three times and the locking indicator in the instrument panel flashing continuously.

Locking or Unlocking by Internal Lock Switch

- If the driver door is closed , but the inertia switch is inactive or the collision sensor is untriggered, pressing the internal lock switch to lock all doors. Then the locking indicator in the instrument pack is flashing. But the internal lock switch can not start the super-lock function. (the super-lock function is optional)
- Being the internal lock enable status, pressing the unlocking button on the central lock can open the locking doors.
- When collision occurs, with the inertia switch or collision sensor triggered, the locking doors will unlock automatically. Within the current ignition cycle, the door can not be relocked by pressing the internal lock switch.
- Under the condition of external lock or super-lock enable, the internal lock switch does not work. (the super-lock function is optional)

Unlocking by Inertia Switch or Collision Sensor

- When the ignition switch is on and the vehicle is not locked externally, doors can be unlocked automatically by triggering the inertia switch.
- When the collision sensor receives a collision signal, the doors will be unlocked automatically, except for the external locking condition.

Auto-relocking

If the vehicle is unlocked using the remote key, but no opening panels are operated within 30 seconds or the remote key is inserted, the vehicle will relock automatically.

If it is in the auto-relocking status, turn on the ignition switch to the "AUX" position, the auto-relocking function will be cancelled.

Automatic Unlocking

Turn the ignition switch off when the vehicle is in internal lock status, the vehicle will be unlocked automatically.

Bathrobe locking

It is possible to use the remote key to lock the vehicle while then engine is running and the vehicle is stationary. The vehicle's security system, however, will not be used.

Speed Related Locking

The BCM controls a speed-related locking function using a speed signal originated from the ABS system. The speed related locking function is set to off by default, but can be configured by the dealer.

Mislock Alarm

When the vehicle is locked from the outside by the remote key or the mechanism key in the following conditions, the BCM will active the horn alarm to indicate the mislock occurred:

- Any door is opened.
- When the ignition switch is in the position 1, position 2 or position 3.
- The engine is running (all the doors are well closed and the bathrobe locking function is activated, the security system function will be inactive).

Operation Condition of Security System

In the following conditions, the BCM makes the security system operate completely:

- All doors are closed.
- Remove the remote key.
- Receive the request for effective lock of the remote key.

At this time, the direction lights flashes three times to confirm the vehicle is active.

Note: If the driver door is opened, the BCM receives the locking request, the BCM will not active the security system.

If the security system is in active state but there is any door not closed, the BCM will make the security system to be in partial active.

In the following conditions, the BCM makes the security system does not work at all:

- Receive the unlocking request from the remote key.
- Insert the genuine key.

The direction lights flashes once for 2 seconds to confirm that the vehicle is inactive.

The remote key can be used to disalarm.

Seat Belts

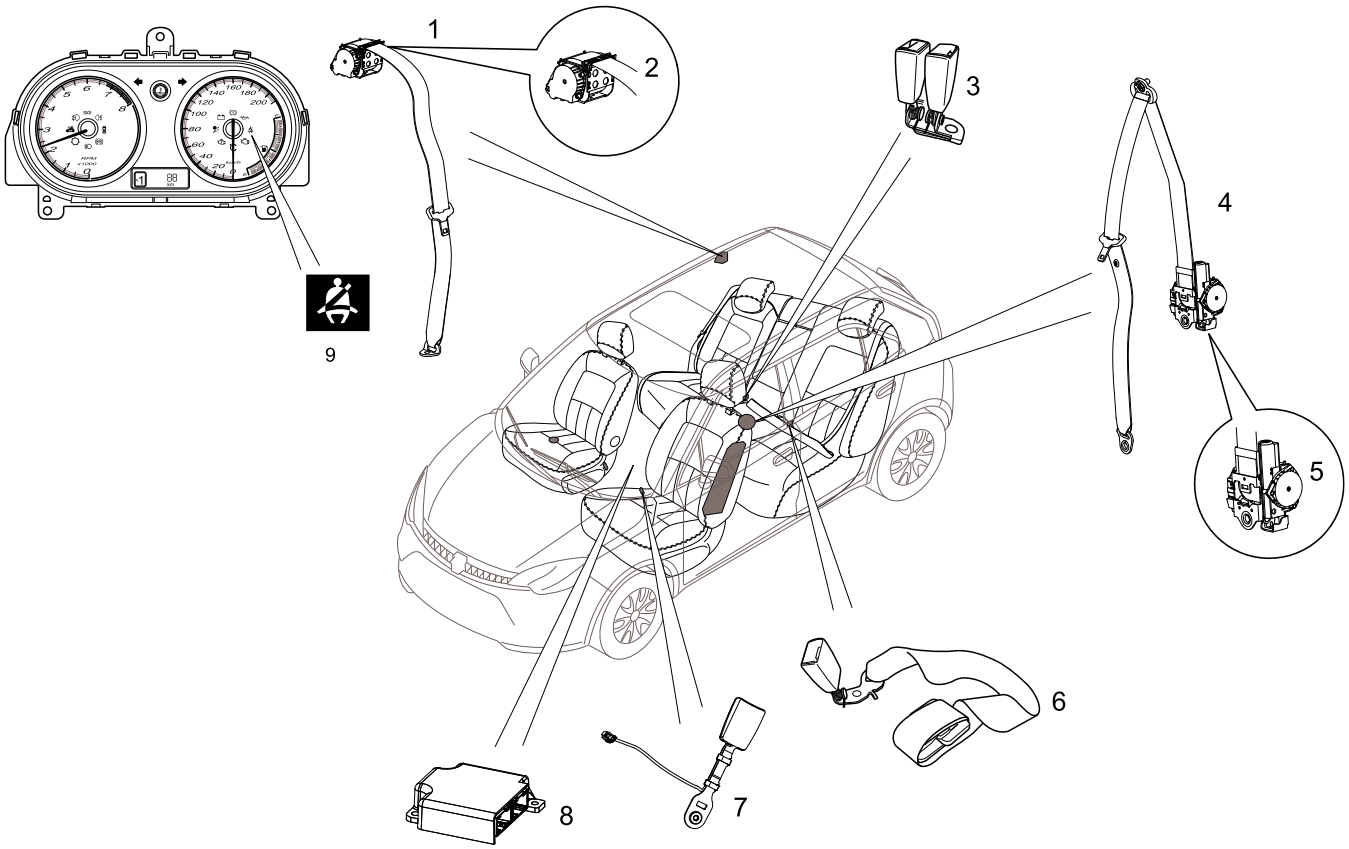
Specifications

Torque

Description	Value
Bolt - front seat belt retractor to 'BC' post	30–35Nm
Bolt - front seat belt to upper 'BC' post	30–35Nm
Bolt - front seat belt to body	30–35Nm
Bolt - front seat belt buckle	43–53Nm
Bolt - rear seat belt retractor to rear inner wheelarch	30–35Nm
Bolt - rear seat belt to upper 'D' post	30–35Nm
Bolt - rear seat middle lap belt	30–35Nm
Bolt - rear seat belt double buckle	30–35Nm
Bolt - rear seat belt to lower 'D' post	30–35Nm

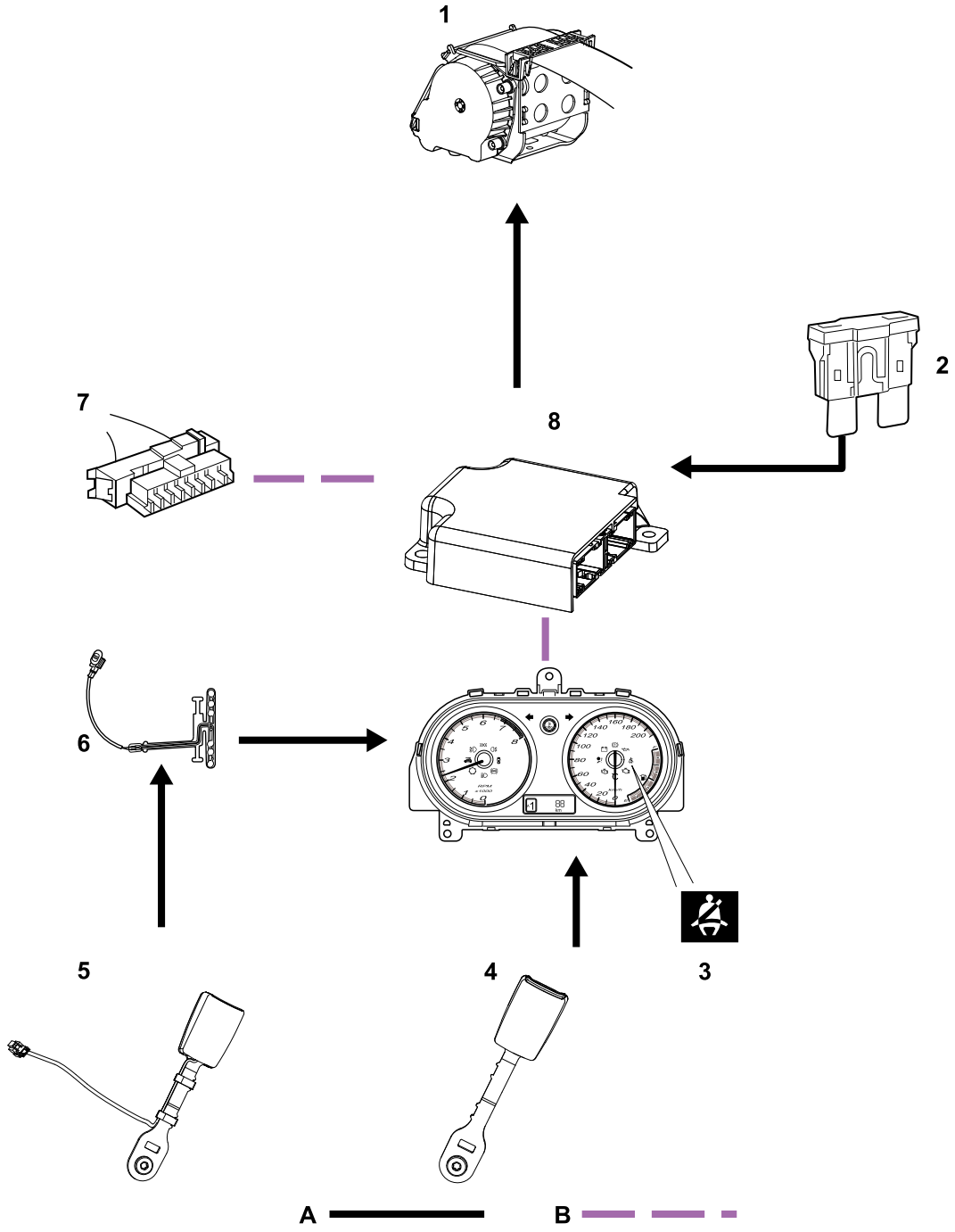
Description and Operation

System Component Layout



1. Rear Seat Belt Assembly
2. Rear Seat Belt Retractor
3. Rear Seat Belt Double Buckle
4. Front Seat Belt Assembly
5. Front Seat Belt Retractor with Pretensioner
6. Rear Seat Middle Belt and Buckle
7. Driver Seat Belt Buckle (with warming function)
8. Airbag Control Diagnostic Unit
9. Seat Belt Unfastened Warning Light

System Control Diagram

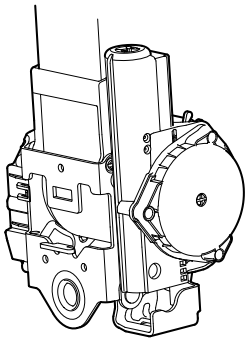


A = Hardwire B = High-speed CAN Bus

1. Seat Belt Retractor
2. Passenger Compartment Fuse F8
3. Seat Belt Unfastened Warning Light
4. Seat Belt Buckle
5. Seat Belt Buckle (with Warning)
6. Passenger Seat Occupancy Sensor (if fit)
7. Diagnostic Socket
8. Airbag Control Diagnostic Unit

Description

Front Seat Belt Pretensioner



S925002

When collision occurs, the front seat belt pretensioner unit will retract to ensure the occupants are firmly kept on their own positions. The seat belt pretensioner unit is secured on the seat belt retractor assembly of the B and C posts by bolts. The connector of the seat belt pretensioner unit is a 2-pin connector that is connected to the body harness.

When collision occurs, the seat belt pretensioner unit controls through the signal delivered from**SRS ECU**. The securing and operation methods of the two pretensioner units are the same. Each pretensioner unit is equipped with an initiator and a propellant generator, which act on the rotor of the seat belt reel.

Warning: Once the pre-tensioner has been operated, it cannot be reset. The gas generator will be exhausted. The unit must be replaced.

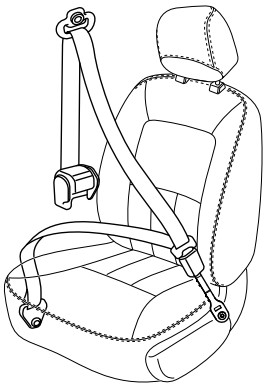
Seat Belts

Seat belt provides the basic protection for all occupants. The supplemental restraint system also provides a further protection for the front seat occupants by using the airbag module and the pretensioner seat belt. The front seats are equipped with the appropriate retractor and three-point seat belt. The retractor of the vehicle is emergency locking retractor (**ELR**).

The retractor appends to an additional lock-up mechanism with webbing sensor and auto sensor. If the webbing is pulled suddenly, the webbing sensor activates the lock-up mechanism immediately. If the vehicle decelerates suddenly or has a large-angle tilting, the auto sensor will activate the lock-up mechanism.

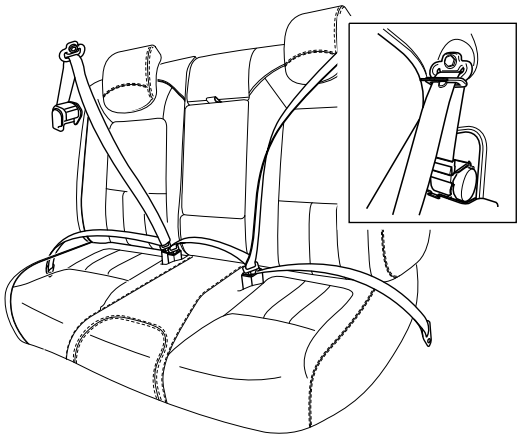
As the retractor locks when collision occurs, front seat belt retractor is equipped with a load limiter. If the limited load is more than the critical level, the load limiter makes the webbing loose, so the load acting on the occupants decreases.

Front Seat Belt



The retractor of the front seat belt is fit on the body, it is located in the cavity of the bottom of the BC post lower trim panel. Extend the webbing from the retractor and fix it on the mounting point on the bottom of B and C posts.

Rear Seat Belt

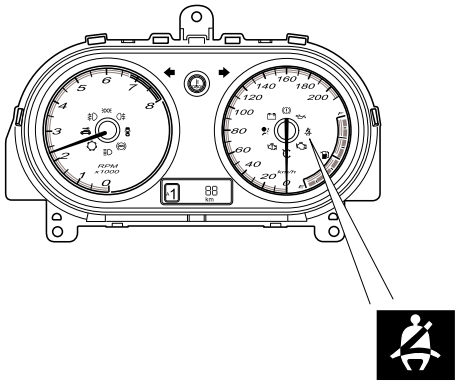


The rear seat belt retractor is mounted on the retaining panel of the rear wheel housing inner panel by bolts. One end of the webbing is fixed on the upper end of C post, the other end is fixed on the mounting point on the body floor, and the middle seat belt is fixed on the lower part of the rear seat.

The buckle of the right rear seat belt and the middle seat belt buckle are secured on the same point. The left rear seat belt buckle is located on the right coxa of the occupants.

The rear seat right belt buckle and the middle seat belt buckle are an assembly, and it is secured between the right rear seat and the middle seat by a bolt. The seat belt of the centre seat passenger is connected to the striker of right coxa through left coxa.

Seat Belt Alarm Indication



The front seat belt buckle integrates with the seat belt not fasten alarm switch, and it connects to the instrument pack by the**SRS ECU**. If the vehicle moves with the seat belt not fastened, then the seat belt alarm will be triggered. The warning message includes a sound alarm and a warning light that flashes on the instrument panel. For some vehicle specifications, to avoid causing the unnecessary alarm without passenger, a pressure sensor is fitted inside the passenger seat. If there is a passenger, but the pressure sensor is not activated, then the seat belt alarm will not be triggered even if the seat belt is not fastened.

Operation

SRSECU triggers the operation of the pretensioner seat belt:

- For the front seat belt, the initiator and the propellant generator inside the seat mounting buckle assembly act on the rotor of the seat belt inertia reel, the seat belt is tightened and the tension is increased to ensure the occupants are limited in their positions after a collision.

Service Procedures

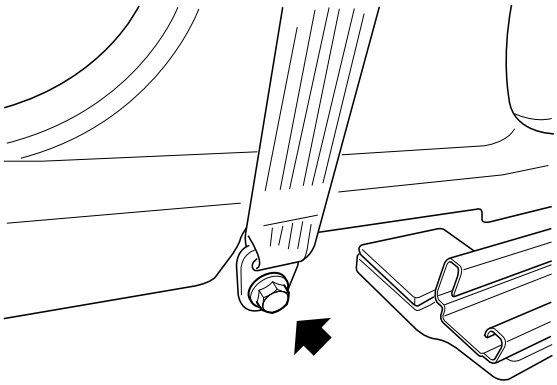
Front Seat Belt Assembly

Remove

1. Remove handset from docking station, disconnect battery leads, earth first and wait 10 minutes for the**SRS** back-up power circuit to discharge before commencing work.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

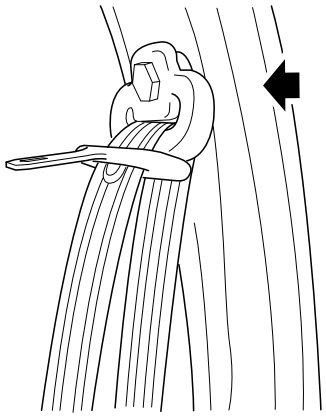
2. Remove the bolt securing the front seat belt to the lower end of the B post.



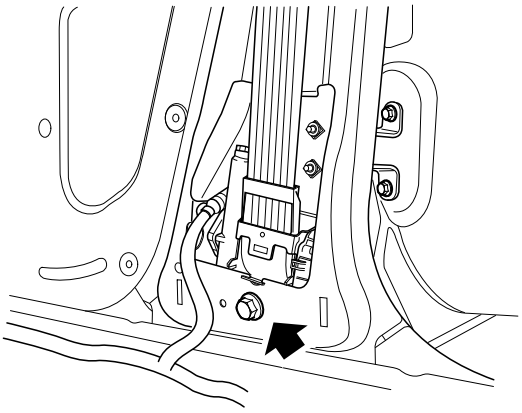
3. Remove the B post upper trim panel.

☞**B Post Upper Trim Panel Remove**

4. Remove the bolt securing the front seat belt guide ring to the upper end of the B post.



5. Disconnect the front seat belt connector.
6. Remove the bolt securing the front seat belt retractor to the lower end of the B post.



7. Remove the front seat belt assembly.

Refit

1. Secure the front seat belt retractor on the lower end of the B post, fit the bolt and tighten it to **30–35Nm**.
2. Connect the front seat belt connector.
3. Secure the front seat belt guide ring on the upper end of the B post, fit the bolt and tighten it to **30–35Nm**.
4. Fit the B post upper trim panel.

☞**B Post Upper Trim Panel Refit**

5. Secure the front seat belt on the lower end of the B post, fit the bolt and tighten it to **30–35Nm**.
6. Connect the battery earth lead.
7. Perform system inspection, turn the ignition switch, check if the**SRS** warning light illuminates for six seconds, and then turns off.

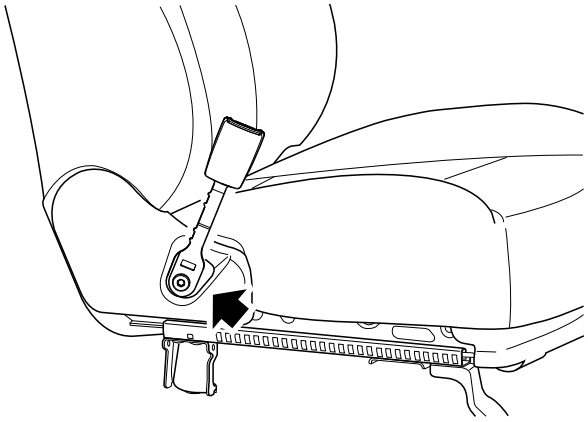
Front Seat Belt Buckle

Remove

1. Remove the front seat.

☞Front Seat Remove

2. Remove a bolt securing the front seat belt buckle to the seat.



3. Remove the front seat belt buckle.

Refit

1. Secure the front seat belt buckle to the seat, fit the bolt and tighten to **43–53Nm**.
2. Fit the front seat.

☞Front Seat Refit

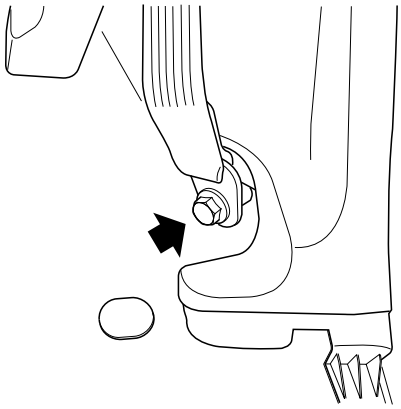
Rear Seat Belt Assembly

Remove

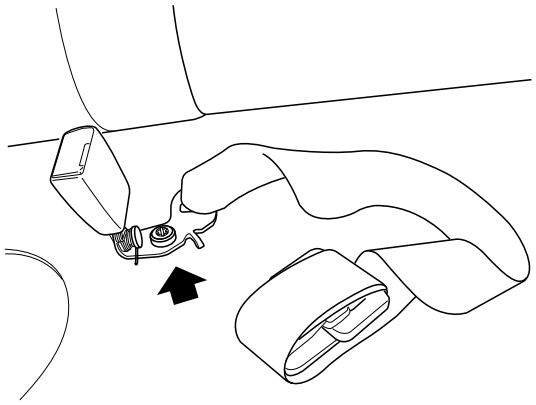
1. Remove the rear seat cushion.

☞Rear Seat Cushion Remove

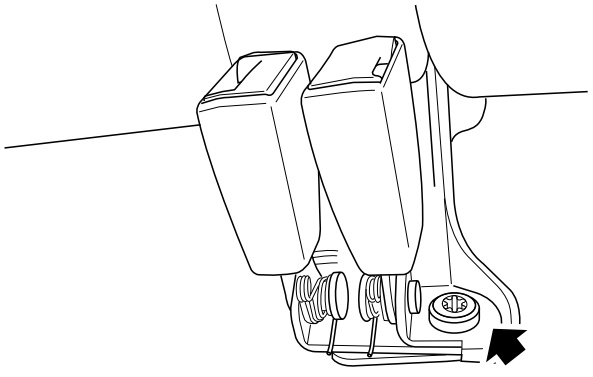
2. Remove one bolt securing the rear seat belt to the lower end of C post.



3. Remove one bolt securing the rear seat centre belt to the body, and remove the rear seat centre belt.



4. Remove one bolt securing the rear seat belt buckle to the body, and remove the rear seat belt buckle.



5. Remove the rear seat back.

☞Rear Seat Back Remove

6. Remove upper trim panel of C post.

☞**Upper Trim Panel of C Post Remove**

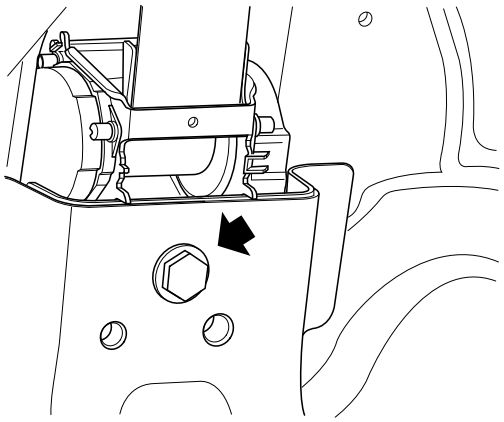
7. Remove lower trim panel of C post.

☞**Lower Trim Panel of C Post Remove**

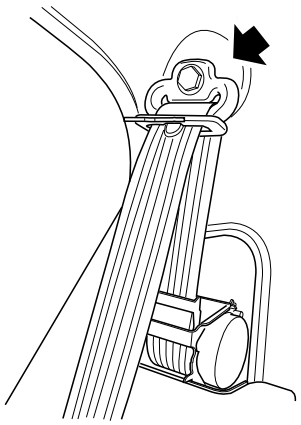
8. Remove the rear compartment trim panel.

☞**Rear Compartment Side Trim Panel Remove**

9. Remove one bolt securing the rear seat belt to the upper end of C post.



10. Remove one bolt securing the rear seat belt retractor to the rear wheelhouse inner panel.



11. Remove the rear seat belt assembly.

Refit

1. Position the rear seat belt retractor to the rear wheelhouse inner panel, fit the bolt and tighten to **30–35Nm**.
2. Secure the rear seat belt to the upper end of C post, fit the bolt and tighten to **30–35Nm**.
3. Fit the rear compartment side trim panel.

☞**Rear Compartment Side Trim Panel Refit**

4. Fit the lower trim panel of C post.

☞**Lower Trim Panel of C Post Refit**

5. Fit the upper trim panel of C post.

☞**Upper and Lower Trim Panels of C Post Refit**

6. Fit the rear seat back.

☞**Rear Seat Back Refit**

7. Position the rear seat cetre belt to the body, fit the bolt and tighten to **30–35Nm**.
8. Position the rear seat belt buckle to the body, fit the bolt and tighten to **30–35Nm**.
9. Secure the lower end of rear seat belt to the lower end of C post, fit the bolt and tighten to **30–35Nm**.
10. Fit the rear seat cushion.

☞**Rear Seat Cushion Refit**

Supplemental Inflatable Restraints

Specifications

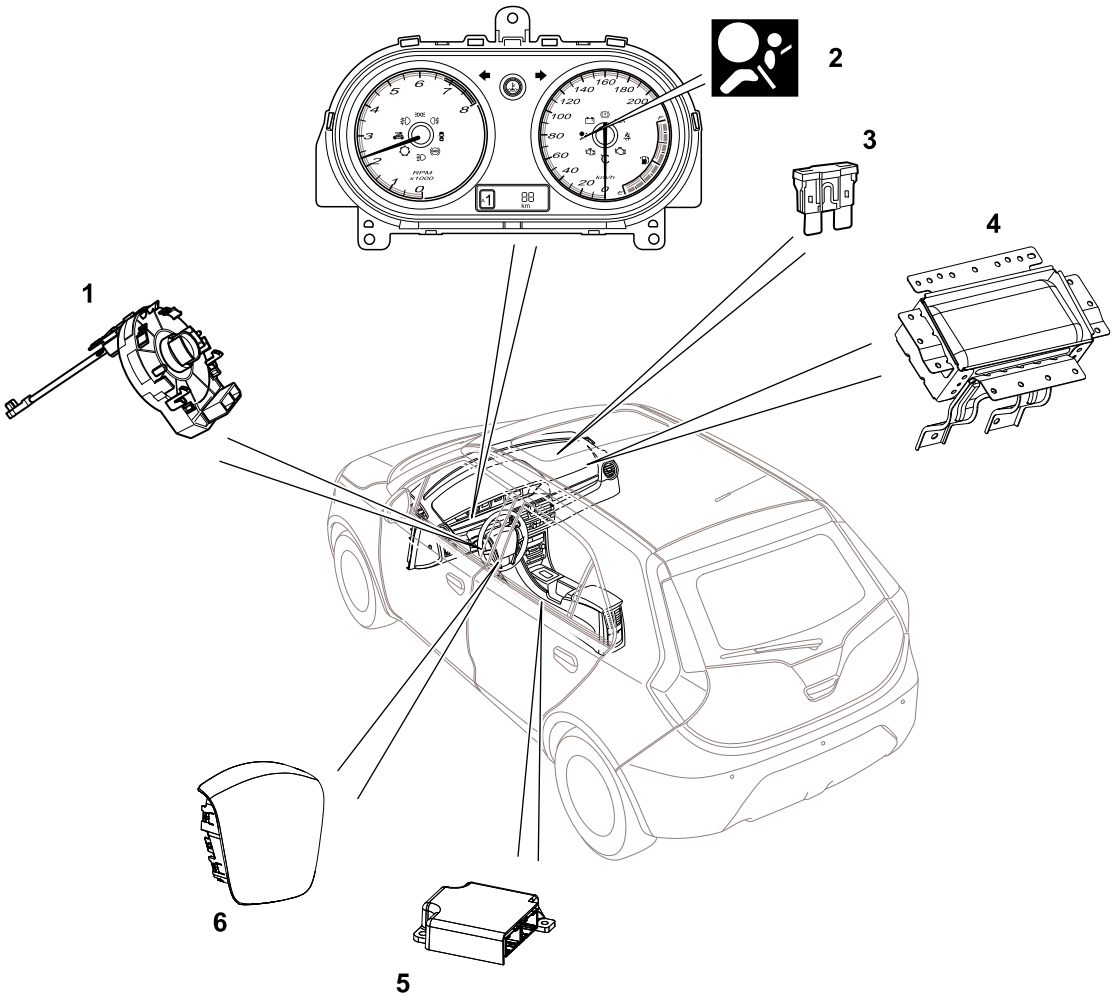
Torque

Description	Value
Bolt - driver airbag	10–13Nm
Bolt - passenger airbag	4–5Nm
Bolt - passenger airbag to “CBB” post	6–8Nm
Bolt - SRS ECU	7–10Nm

Description and Operation

System Layout

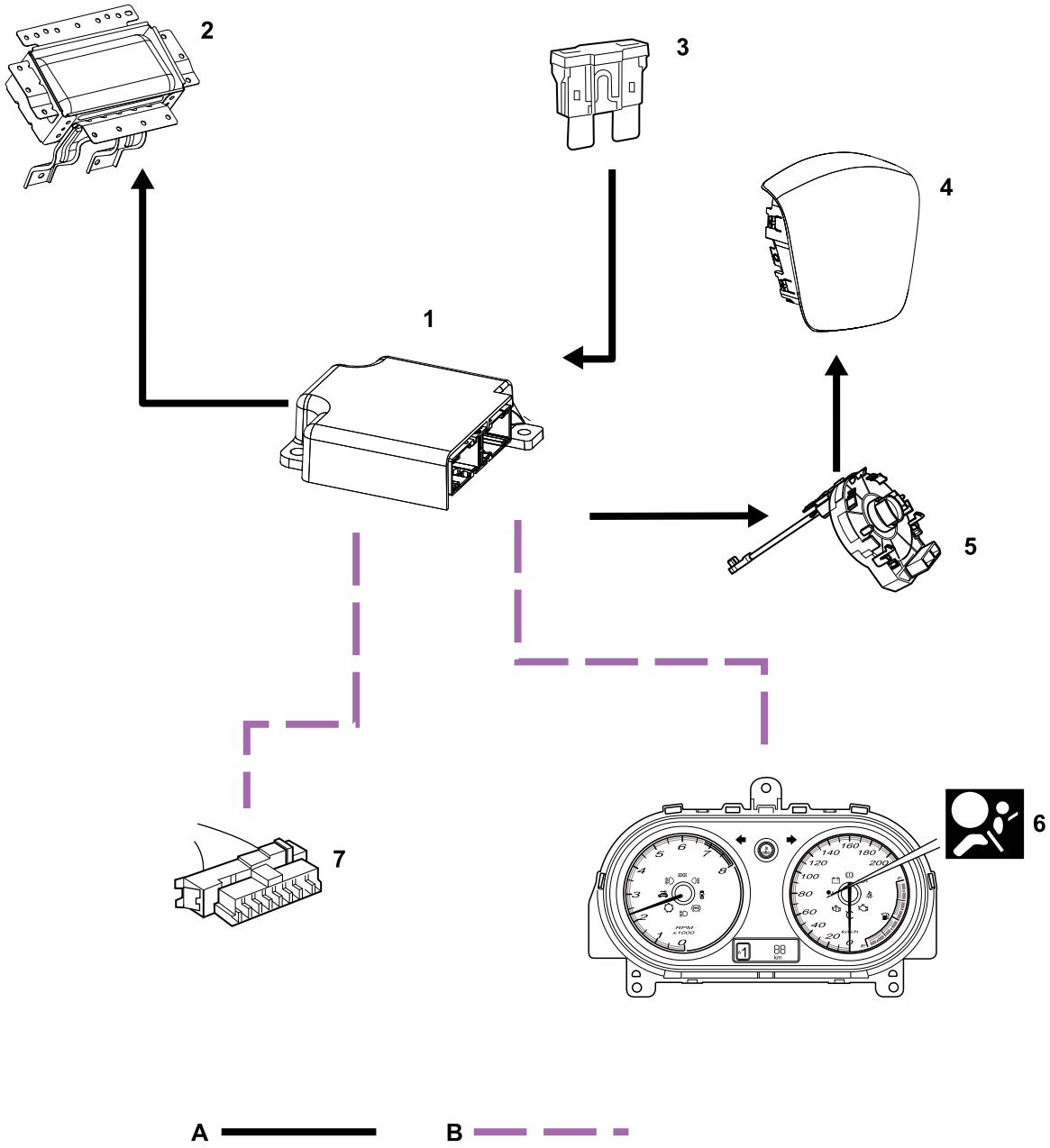
Airbag Layout



1. Rotary Coupler
2. Airbag Warning Lamp
3. Passenger Compartment Fuse F8
4. Passenger Airbag
5. Airbag Control Diagnostic Unit
6. Driver Airbag

System Control Diagram

Airbag Control Diagram



A = Hard Wire B = High-speed CAN Bus

1. Airbag Control Diagnostic Unit
2. Passenger Airbag
3. Passenger Compartment Fuse F8
4. Driver Airbag
5. Rotary Coupler
6. Airbag Warning Light
7. Diagnosis Socket

Description

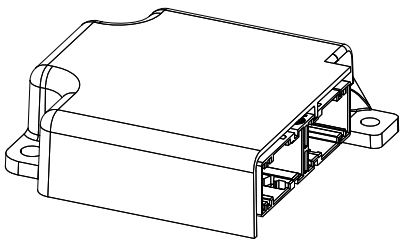
General Description

The Supplementary restraint system (**SRS**) can enhance the passive protection for vehicle passengers in case of serious collision. This device is normally used on the basis of that a standard protection system, such as the seat belt, has been used. The reason to consider this system as a passive protection system is that the system works automatically, for which previous communication with passengers within the vehicle is not required.

The**SRS** includes the following components:

- Supplementary Restraint System Diagnostic and Control Unit (**SRSECU**)
- Driver-side Front Airbag Module
- Front Passenger-side Front Airbag Module
- Pre-tensioned Front Seat Belt (RH)
- Pre-tensioned Front Seat Belt (LH)
- Rear Seat Belt (RH)
- Rear Seat Belt (LH)
- Alarming Switch for Untied Driver-side Belt (if fit)
- Rotary Coupler
- **SRS** Warning Light (within the instrument pack)

Supplementary Restraint System Diagnostic and Control Unit (SRSECU)



SRSECU can determine the collision manner and the range of influence by using the internal and external impact monitoring sensors (if fit), so as to control the operation of the supplementary restraint system. The sensors can transmit the side impact signal to**SRS ECU**. If the impact degree is higher than the preset value, the side airbag module corresponding to the impact side and all pretensioners will be triggered.**SRSECU** is fit on the centre gangway under the center console, and secured by three bolts.

SRSECU monitors collision condition of surrounding vehicles through the internal accelerometer and collision sensors.**SRSECU** can use these input data to distinguish serious collisions from slight ones or impacts due to uneven roads, so as to ensure the effective operation of airbags.

If the monitoring result shows that the front collision severity is higher than the preset trigger values,**SRSECU** will sent a signal to trigger the front airbag module and belt pretensioner.

The main sensor is integrated into**SRS ECU**. When the impact extent is beyond the preset trigger value, each airbag trigger device and seat belt pretensioner will be triggered.

Caution: It is important that the SRS ECU is correctly mounted and is fitted in the designated location and orientation to ensure correct operation.

The main sensor refers to the deceleration monitoring device which includes**SRS ECU**.

If the monitoring result shows that the front collision severity is higher than the preset trigger values,**SRSECU** will sent a signal to control and trigger the corresponding front airbag module and belt pretensioner.

For the rear collision,**SRSECU** monitors the rear collision severity through the main sensor. If the severity exceeds the preset threshold value, the seat belt pretensioner will be triggered.

ECU Monitoring

Warning: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS system components. It may cause accidental deployment and personal injury.

When powered on,**SRSECU** will monitor the preparation condition of the supplementary restraint system module and continuous monitoring will be carried out when it is started.**SRSECU** can detect system short, battery short/leakage and open-circuit conditions.**SRSECU** can monitor the conditions of the following modules:

- **SRSECU** Internal Accelerometer
- **SRSECU** Internal Safe Sensor
- **SRSECU** Microprocessor
- Front Airbag
- Seat Belt Pretensioner
- Diagnosis Count

If system or component malfunction has been monitored,**SRS** warning light will be illuminated to warn the driver.**SRSECU** tests the current of airbag and pretensioner trigger device, and examines the continuity of relevant circuits.

The recommended diagnostic equipment can be used for querying**SRS** system malfunction condition. The read out diagnostic information includes the current malfunction

information, malfunction frequency as well as the duration of each malfunction.

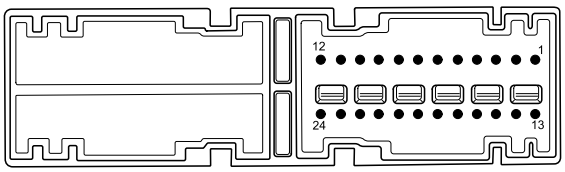
Power Supply and Backup Condition

The ignition power supply provides a forward voltage to**SRSECU** through a dedicated system fuse equipped on the passenger compartment.

The power supply provides power source to**SRS** warning light through the fuse 8 located in the passenger compartment fuse box. If power-supply malfunction occurs, inspect the connection condition of the fuses and wiring harnesses in the passenger-side fuse box and**SRS ECU**. After the engine start, the supplementary restraint system will be activated.

SRSECU includes a capacitor, which can store sufficient electric quality, to ensure that the corresponding trigger device and ignition circuit can still work after a collision occurs or when regular power supply is cut off.

SRSECU Connector End View



Connector Pin Detailed Information Chart

Pin No.	Description
1	High-speed CAN
2	Low-speed CAN
3	Ground
4	No Connection
5	No Connection
6	No Connection
7	No Connection
8	No Connection
9	Collision Output
10	No Connection
11	No Connection
12	Ignition
13	Low Voltage of Driver-side Airbag
14	High Voltage of Driver-side Airbag
15	High Voltage of Passenger-side Airbag
16	Low Voltage of Passenger-side Airbag
17	No Connection
18	No Connection
19	No Connection
20	No Connection
21	Low Voltage of Passenger-side Pretensioner
22	High Voltage of Passenger-side Pretensioner
23	High Voltage of Driver-side Pretensioner
24	Low Voltage of Driver-side Pretensioner

Warning: Do not use a multimeter or other general purpose test equipment on SRS system components or accidental deployment may occur. Only use the recommended diagnostic equipment to diagnose system faults.

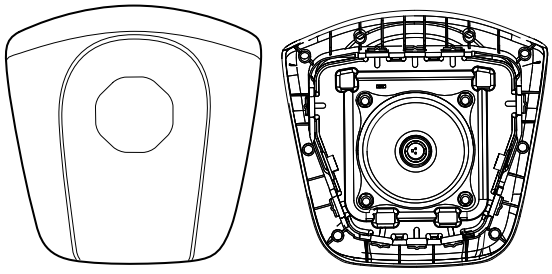
Driver Side Airbag Module

The driver-side airbag module is fit onto the steering wheel with two bolts. The electrical connection to**ECU** is carried out through a rotary coupler.

If a collision occurs, the sensor will transmit the collision signal to **ECU**, and then**ECU** will determine whether to trigger the supplementary restraint system according to the collision severity.

ECU is triggered by a control signal. A folded airbag, inflator and trigger device are equipped within the module.

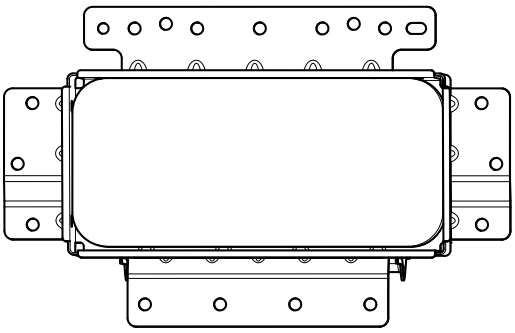
When**ECU** has monitored a serious collision, the electronic switch will be closed. Thus a small current will be generated and flow to the trigger device. The trigger device will be triggered, and generate heat and gas continuously, to allow the airbag inflate rapidly.



Passenger-side Front Airbag Module

Warning: After replacing the vehicle windscreen the Passenger Restraint System may not be capable of normal operation for 24 hours.

The passenger-side front airbag module is fit on the glove box within the instrument panel, directly in front of the passenger-side seat. The airbag module is fixed onto the instrument panel with bolts. The passenger-side front airbag module is triggered by the control signal from**SRS ECU**. A folded airbag and inflator module are equipped within the module. When**SRSECU** has monitored a serious front collision, the inflator will be triggered, to allow the nylon bag inflate rapidly.



Operation

General Description

When the remote key is inserted, the protector system will be activated. When the ignition switch is turned on,**SRS** warning light will keep on for about 6 seconds, and then turn off, which means that the system is normal.

Front Impact

If the front impact is serious enough, and exceeds the threshold value set within**SRS ECU**, the front airbag module and pretensioned front seat belt will function.

When the accelerometer and safety sensor within the**SRS** electronic control unit have perceived the impact, the electronic control unit will generate current to trigger the front airbag module:

- the driver-side front airbag module will be activated to expand the airbag.
- The passenger-side front airbag module will be activated to expand the airbag.

After the front airbag is entirely inflated, the airbag will immediately release gas through the vent port to provide a gradual deceleration to the moving forward passengers, so as to reduce the risk of personal injury.

The pretensioner of seat belt is equipped with a safe sensor, and its function time is shorter than the front airbag. Thus, before the airbag is entirely inflated, the passenger will have been secured in place.

SRSECU can determine if the collision is caused by the uneven road or the occurrence of a front collision impact. If the front impact monitored by the sensor is serious enough,**SRSECU** will send an ignition signal to the airbag module and seat belt pretensioner.

Front Impact with Angle

When a front impact with angle occurs, whether the airbag and seat belt pretensioner function depends on the collision speed and angle. The following conditions exist:

- When the impact is lower than the threshold value of**SRSECU** impact sensor, no airbag or seat belt pretensioner will be activated.
- When the collision speed and angle are over the trigger threshold values of the front impact sensor, the driver-side and passenger-side front airbag and seat belt pretensioner will be activated (side airbag detonation may also occur).

Inspection of Warning Light

When switching on the ignition switch,**SRS** warning light shall be illuminated, so as to conduct lamp inspection. If**SRS** has no malfunction, the warning light shall be turned off after 6 seconds, which will be used to monitor the follow-up ignition cycle. The system inspection includes**SRSECU** and**SRS** wiring harness conditions.

System Continuity Malfunction

With the ignition switch ON, if any of the following malfunctions has occurred to the system,**SRS** warning light will illuminate, and will keep on in the follow-up ignition cycle.

- **ECU** and**SRS** Malfunction
- Wiring Harness Malfunction
- Ground Connection Malfunction
- Open Circuit Malfunction
- Airbag Module Malfunction
- Seat Belt Pretensioner Malfunction

If the system has monitored a malfunction in the case of driving, the warning light will also be illuminated to demonstrate that**SRS** system is with a malfunction. If a collision occurs when the warning light is illuminated,**SRS** will not function.

When switching on the ignition switch, the diagnostic function of**SRSECU** is to monitor **SRS**. If any malfunction has been monitored,**SRSECU** will save a relevant malfunction code into the nonvolatile memory, and send out a signal to illuminate**SRS** warning light. The use of a diagnostic tool can help to read out the malfunction information within the memory.

Too Low Voltage Malfunction

When the voltage supply is not within the prescribed range, the malfunction light will be illuminated. The malfunction code will be saved into the memory.

Intermittent Malfunction

The warning light will be illuminated at this time, and keep on in the following driving cycle. Unless this malfunction occurs again during the next ignition, the warning light will not be illuminated then, but the malfunction code is still saved in the**SRSECU** memory.

Permanent Malfunction

For permanent malfunctions,**SRS** warning light will be illuminated during the start-up test, and keep on in each follow-up ignition cycle, until the reason causing malfunctions is resolved. Furthermore, the diagnostic system will also record the information of the occurring malfunctions.

After a malfunction has been found out, the system will remain some operation functions:

- If the outside circuit of**SRSECU** has been examined at fault,**SRSECU** will also trigger the airbag and seat belt pretensioner modules.

- When malfunctions occurring to**SRSECU** or power supply have been monitored, the overall system will not function.
- If the circuit of**SRS** warning light is with a malfunction, the light will not be illuminated when the ignition switch is switched on for original inspection. Provided that the system is with no other malfunction, all functions can still be available when a collision occurs.

The extra information able to be obtained by the use of "diagnostic tool" through a diagnostic socket:

- **SRSECU** Malfunction Code
- Version Levels of Hardware and Software
- Collision Mode and Status
- Vehicle Identification Number (**VIN**) Information

SRSECU records the malfunction information in the memory, which is read out by the diagnostic socket of diagnostic tool connected to the lower end of the sealed driver-side instrument panel.

Service Procedures

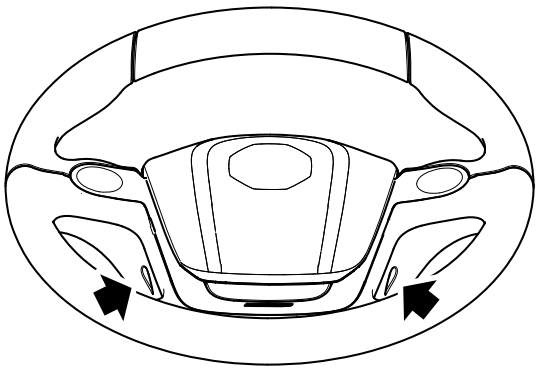
Driver-side Airbag

Remove

1. Remove handset from docking station, disconnect battery leads, earth first and wait 10 minutes for the**SRS** back-up power circuit to discharge before commencing work.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

2. Remove 2 screws securing the front airbag module to the steering wheel.



3. Disconnect the connector from the airbag module.
4. Remove the driver-side front airbag module.

Warning: Store the airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with enough force to cause serious injury.

Refit

1. Connect the driver-side airbag connector.
2. Secure the driver-side airbag to the steering wheel, fit the screw and tighten to **10–13Nm**.
3. Connect battery earth lead.
4. Perform system inspection, turn the ignition switch, check if the**SRS** warning light illuminates for 6 seconds, and then turns off.

Passenger Side Front Airbag

Remove

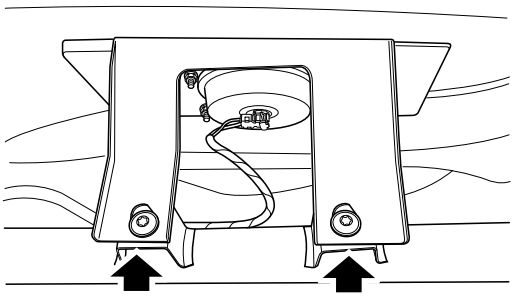
1. Remove handset from docking station, disconnect battery leads, earth first and wait 10 minutes for the**SRS** back-up power circuit to discharge before commencing work.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

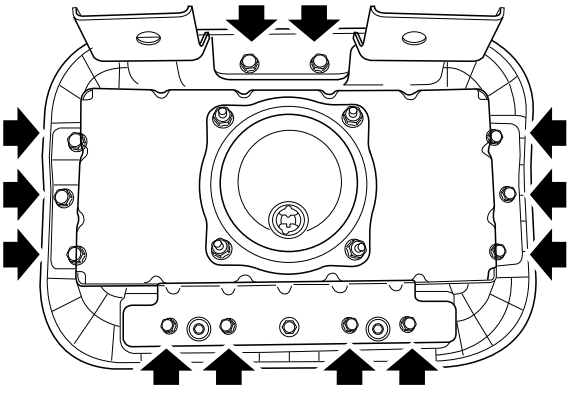
2. Remove the instrument panel assembly.

☞ **Instrument Panel Assembly Remove**

3. Disconnect the passenger side front airbag module connector.
4. Remove 2 bolts securing the front passenger side front airbag module to the instrument panel tie bar.



5. Remove 15 bolts securing the passenger side front airbag module to the instrument panel, remove the airbag module.



Warning: Store the airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with enough force to cause serious injury.

Refit

1. Secure the front passenger-side airbag module to the instrument panel, fit 15 bolts and tighten to **4–5Nm**.

2. Secure the passenger-side airbag to the instrument panel tie bar, fit 2 screws and tighten to **6–8Nm**.
3. Connect the front passenger-side airbag connector.
4. Fit the instrument panel assembly.

☞ **Instrument Panel Assembly Refit**

5. Connect battery earth lead.
6. Turn on the ignition switch and inspect if **SRS** warning light turns on for 6 seconds, and then turns off.

Supplemental Restraint System Diagnostic and Control Unit

Remove

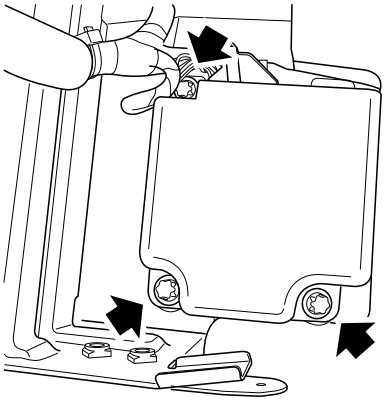
1. Remove handset from docking station, disconnect battery leads, earth first and wait 10 minutes for the **SRS** back-up power circuit to discharge before commencing work.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

2. Remove the centre console.

☞ **Centre Console Remove**

3. Disconnect the supplemental restraint system diagnostic and control unit connector.
4. Remove 3 bolts securing the supplemental restraint system diagnostic and control unit to the body.



5. Remove the supplemental restraint system diagnostic and control unit.

Refit

1. Secure the supplemental restraint system diagnostic and control unit to the body, fit the nut and tighten to **7–10Nm**.
2. Connect the supplemental restraint system diagnostic and control unit connector.
3. Fit the centre console.

☞ **Centre Console Refit**

4. Perform system inspection, turn the ignition switch, check if the **SRS** warning light illuminates for 6 seconds, and then turns off.

Park Assistant System

Specifications

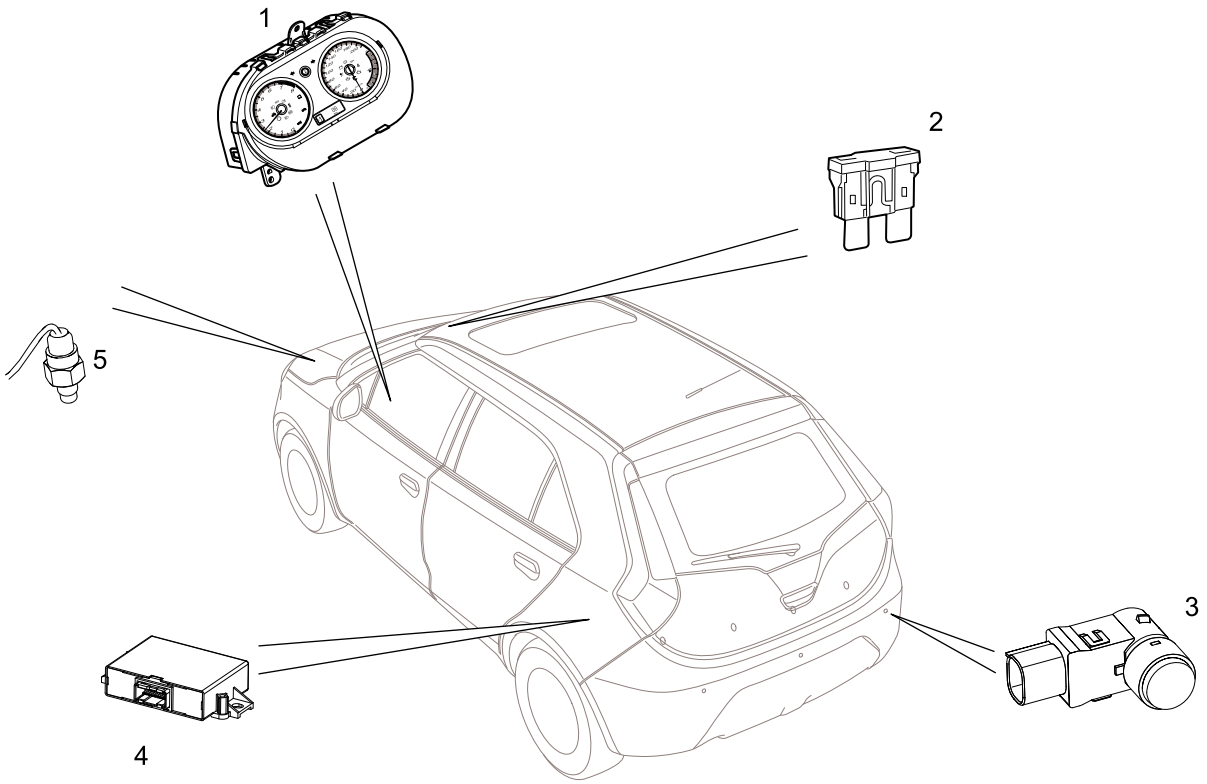
Torque

Description	Value
Screw - parking aid controller	3–4Nm

Description and Operation

System Component Layout

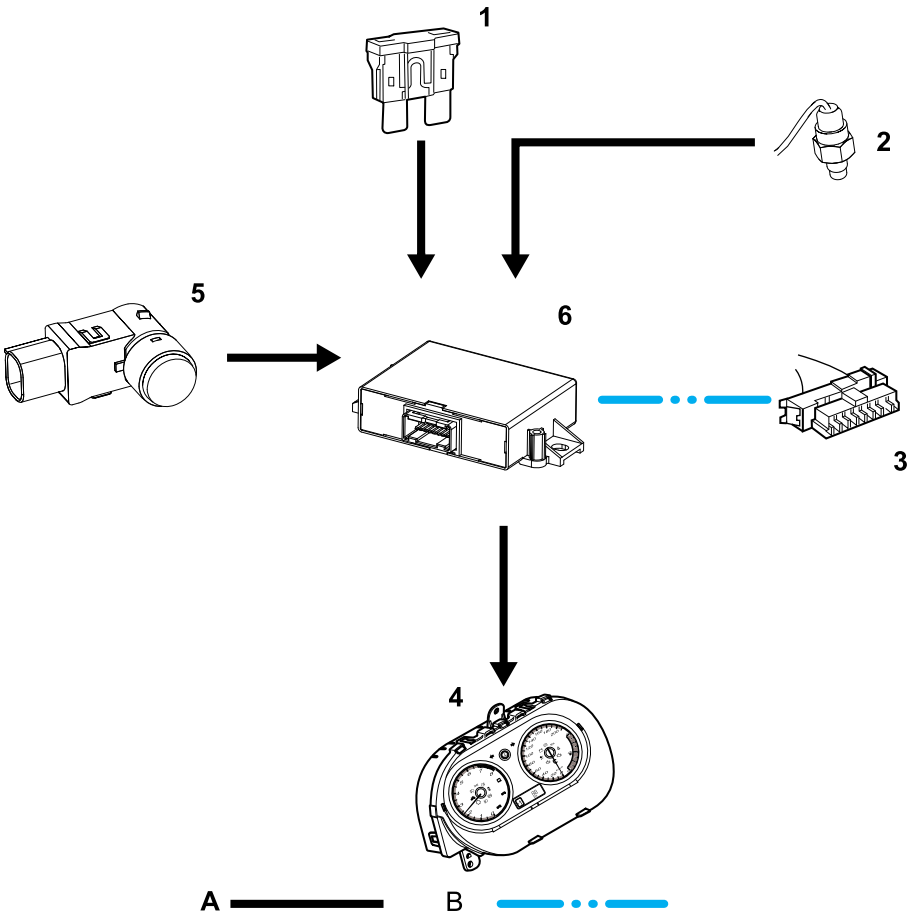
Parking Assist System Component Layout



1. Instrument Pack (With a sound warning device)
2. Passenger Compartment Fuse F6
3. Rear Ultrasonic Sensor
4. Parking Distance Control Unit
5. Reverse Light Switch

System Control Diagram

Parking Assist System Control Diagram



A = Hardwire B= K Line

1. Passenger Compartment Fuse F6
2. Reverse Light Switch
3. Diagnostic Socket
4. Instrument Pack (With a sound warning device)
5. Rear Ultrasonic Sensor
6. Parking Distance Control Unit

Description

General Description

In the process of reversing the vehicle, if there is an obstacle on the road where the vehicle need to go through, the parking distance control system will issue warning to the driver. The system consists of the following components: the three ultrasonic sensors fit on the rear bumper,**PDCECU** and the audible alarm device in the instrument pack. When the vehicle is engaged in reverse,**PDCECU** uses ultrasonic sensors to monitor the area around the rear bumper, if any object is detected within the monitoring area, the sound alarm device in the instrument component will produce a warning noise. The system can detect hard, solid objects, and at the same time, it can detect objects like wire fence.

Ultrasonic Sensors

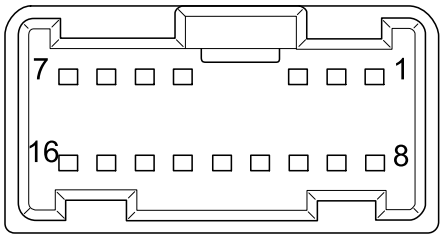
The ultrasonic sensors are fixed on the rear bumper. All the three sensors have the same structure, and the color match the main body color.

The detection range of the middle sensor is an area 1200 mm from behind the vehicle bumper, the detection range of two side sensors is an area 500 mm from the corner of the bumper.

Parking Distance Control Unit (PDC ECU)

PDCECU provides an automatic control function to the system, without the need for driver intervention.**ECU** is positioned behind the trim panel on the right-side boot. Between**ECU** and the vehicle wiring harness, there is a connector. The power of**ECU** is supplied by passenger compartment fuse. When the system is active,**ECU** outputs modulated signals to the ultrasonic sensor and the speaker, and receives the distance reading input information from the sensor.

ECU Wiring Harness Connector End Views



Connector Pin Detailed Information Chart

Pin No.	Description
1	No Connection
2	Signals received from the middle-rear sensor
3	Signals received from the right-rear sensor
4	Diagnostic Signal
5	No Connection
6	Reverse Signal
7	Ignition
8	Signals received from the left-rear sensor
9	Sensor Grounding
10	Sensor Power Supply
11	No Connection
12	Buzzer Signal
13	No Connection
14	No Connection
15	No Connection
16	Grounding

Audible Alarm Device

The audible alarm device in the instrument pack can emit an alarm sound to notify the driver of the system state and the presence of obstacles within the monitoring area.

Parking Assist System Precautions

When reversing, observe whether there are people or animals around. Special attention should be paid to children. If the situation can not be confirmed inside the vehicle, you should get off to confirm.

1. Parking assist system is only an auxiliary system for driver convenience.
2. Drivers should be vigilant to all phenomenons that may occur.
3. Sensors within the bumper are susceptible to damage when under impact or large pressure, and when impacted by high-pressure water in car washing operations.
4. In the normal state of the system, turn the ignition switch on and place the transmission lever into "R" position, the system will produce a short "beep" sound.

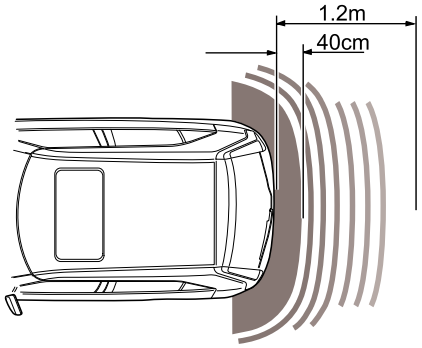
Operation

General Description

When the ignition switch is in position II and the reverse is selected, the system operates.**ECU** activate the system with1 second delay after selecting the reverse position. When the automatic transmission gear**ECU** receives the reverse selection, it starts the ultrasonic sensor, and then output a signal to the speaker to make the speaker produce a single alarm sound that can be heard ("beep beep" sound), indicating that the system is active. Then,**ECU** receives the distance reading information from the ultrasonic sensor and determine whether there are any objects within the detection range. If there are no objects within the detection range, it will not issue an audible alarm sound, but if any object is detected, the**ECU** sensor will output a signal to the speaker, making it produce a repetitive and audible alarm sound. From the edge of detection range to approximately 1200 mm from the rear of the vehicle, the alarm frequency increases with the shortening distance between detected objects and the vehicle, until within a distance of about 400 mm away from the vehicle, the audible alarm sound changes into a continuous alarm sound. when an object is detected, if the distance between the object and the vehicle is not reduced, for example the vehicle stops, or a rear corner of the vehicle moves in a direction parallel with the object, then the alarm will stop after about 3 seconds.

If a draw bar is fit,**ECU** can detect the draw hook/draw ball joint by using the input informations from the sensor, to compensate for draw hook/draw ball joint on the vehicle, and when the selector lever moves between the drive and the park, the delay activation system can avoid sending invalid alarm.

Detection Area



The relationship between the alarm sound and the distance to obstacles can be expressed as follows:

Stage	Distance (mm)	Alarm cycle (msec)
1	0-400	OFF / ON
2	400-500	OFF / ON: 75, 50, 75, 50, 75, 50, 75, 50, 75, 50, 75, 50, 75
3	500-600	OFF / ON: 75, 75, 75, 75, 75, 75, 75, 75, 75, 75, 75
4	600-700	OFF / ON: 75, 100, 75, 100, 75, 100, 75, 100, 75, 100, 75
5	700-800	OFF / ON: 75, 125, 75, 125, 75, 125, 75
6	800-900	OFF / ON: 75, 150, 75, 150, 75, 150, 75
7	900-1000	OFF / ON: 75, 175, 75, 175, 75, 175, 75
8	1000-1100	OFF / ON: 75, 200, 75, 200, 75, 200, 75
9	1100-1200	OFF / ON: 75, 225, 75, 225, 75, 225, 75

Caution: Blind spots, areas where the sensor cannot detect obstructions, may occur if obstructions are present at distances of around 300 mm from the sensors.

Self Diagnosis

Each time the system is activated,**PDCECU** and the sensor performs the self-test procedure.**PDCECU** also performs the short-circuit or open-circuit check on the system circuit. If a failure is detected and persists for more than 3 seconds, a related fault code in the**PDCECU** EEPROM and the system is disabled. To alert the driver to a fault, a higher frequency 3 second audible warning tone is produced, in place of the normal short tone, when the system first becomes active.

Service Procedures

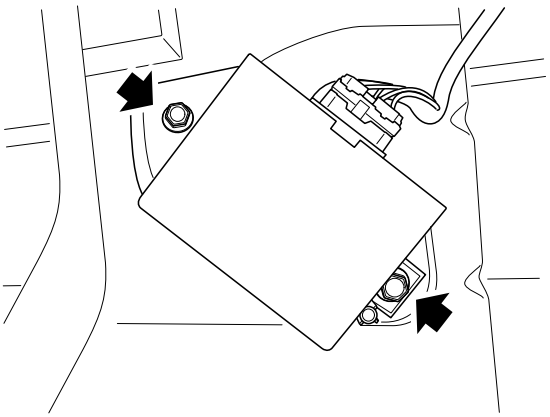
Parking Assist Unit

Remove

1. Remove the right boot trim panel.

☞**Boot Side Trim Panel Remove**

2. Disconnect the parking assist unit upper connector.
3. Remove 2 bolts securing the parking assist unit to the body, remove the parking assist unit.



Refit

1. Secure the parking assist unit to the body, fit 2 bolts and tighten to **3–4Nm**.
2. Connect the connector of the parking assist unit.
3. Fit the right boot trim panel.

☞**Boot Side Trim Panel Refit**

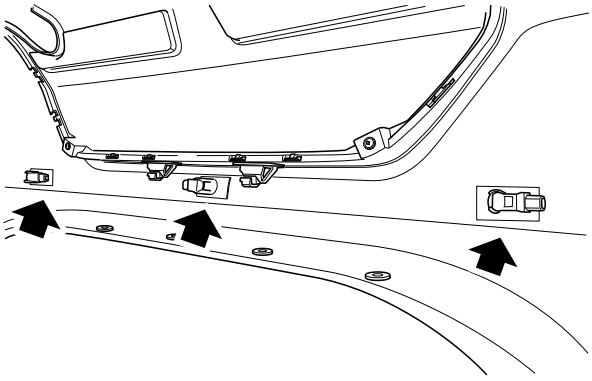
Ultrasonic Sensor

Remove

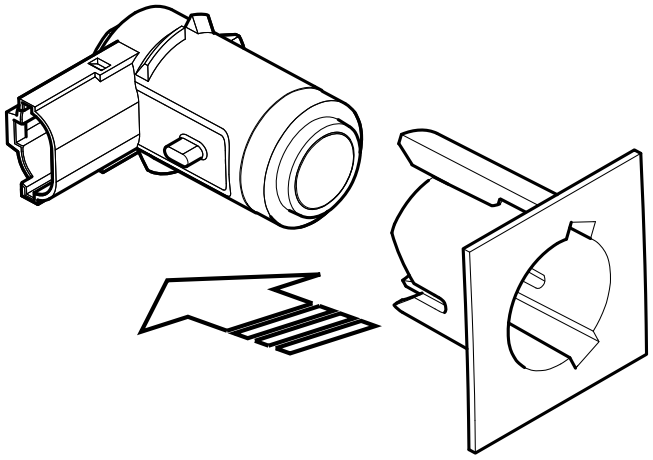
1. Remove the rear bumper.

☞**Rear Bumper Remove**

2. Disconnect the connector on the ultrasonic sensor.



3. Remove 3 ultrasonic sensors from ultrasonic sensor mounting brackets.



Refit

1. Secure the ultrasonic sensor to the ultrasonic sensor support.
2. Connect the ultrasonic sensor connector.
3. Fit the rear bumper.

☞**Rear Bumper Refit**

Entertainment and Navigation

Specifications

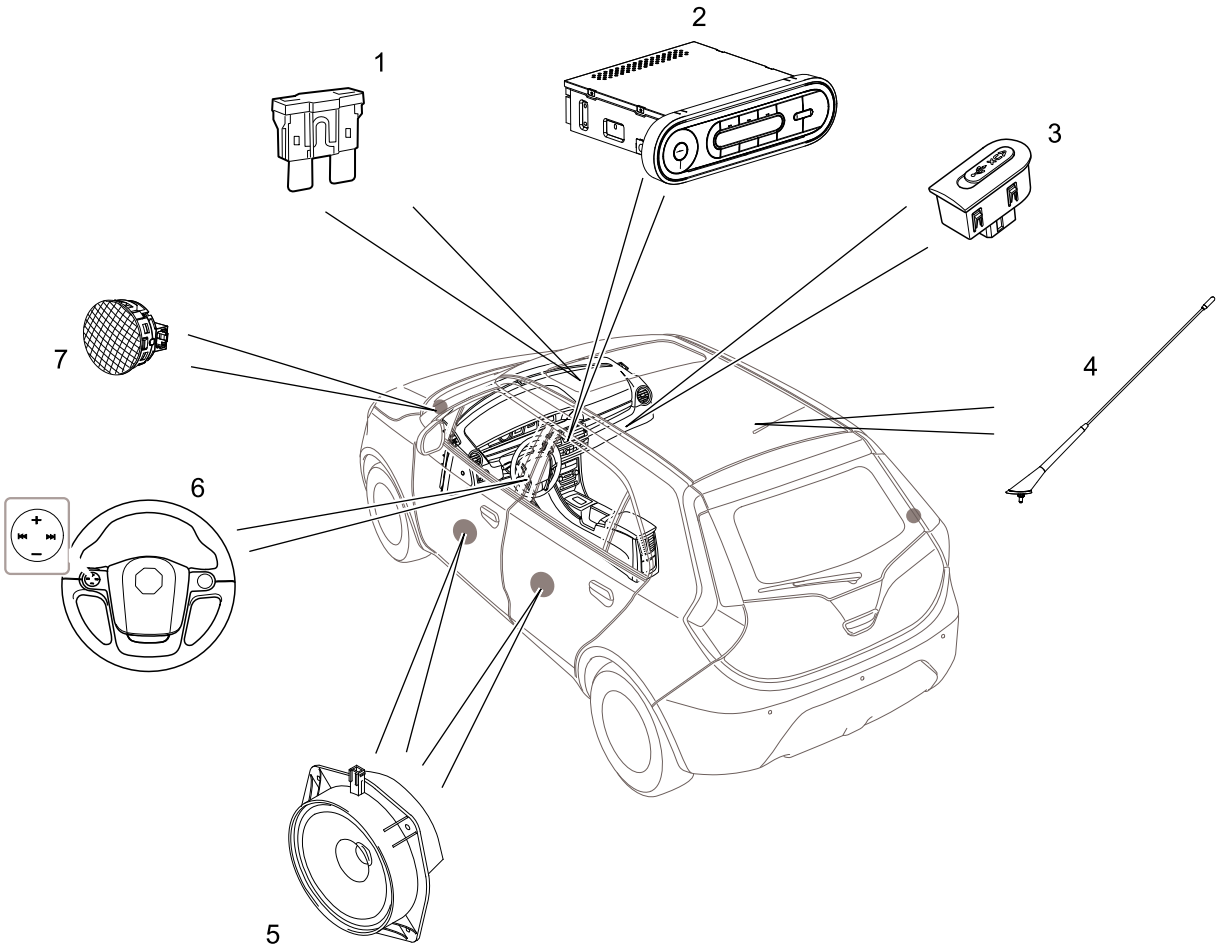
Torque

Description	Value
Nut - antenna	3–4Nm
Screw - front door speaker	0.8–1.2Nm
Screw - rear door speaker	0.8–1.2Nm

Description and Operation

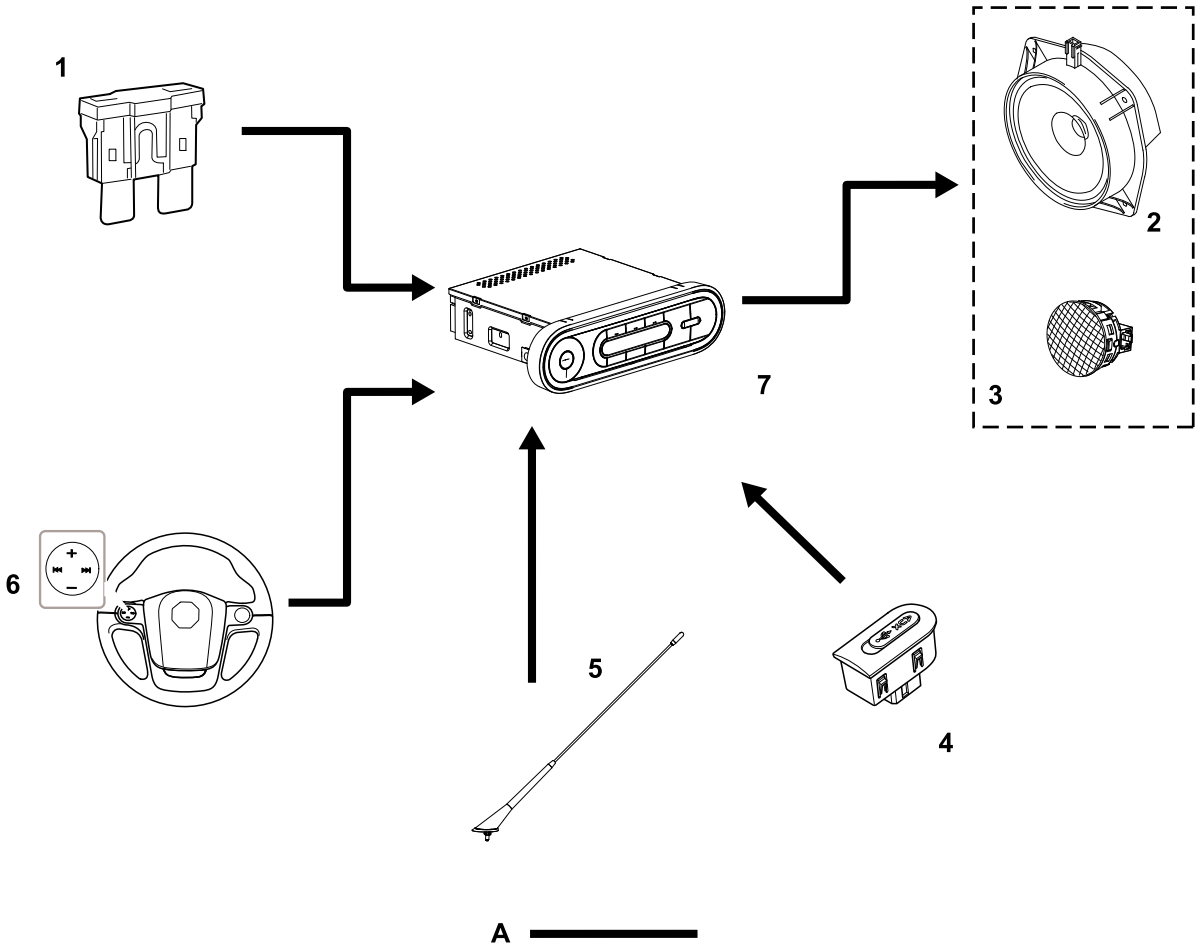
System Component Layout

Player Component Layout



1. Passenger Compartment Fuse F3/F18
2. Player
3. USB/AUX Ports (if fit)
4. Radio Antenna
5. Woofer
6. Steering Wheel Entertainment Control Switch (if fit)
7. Tweeter

System Control Diagram
CD Player Control Diagram



A = Handwire

1. Passenger Compartment Fuse F3/F18
2. Woofer
3. Tweeter
4. Audio/Audio Ports (if fit)
5. Radio Antenna
6. Steering Wheel Entertainment Control Switch (if fit)
7. Player

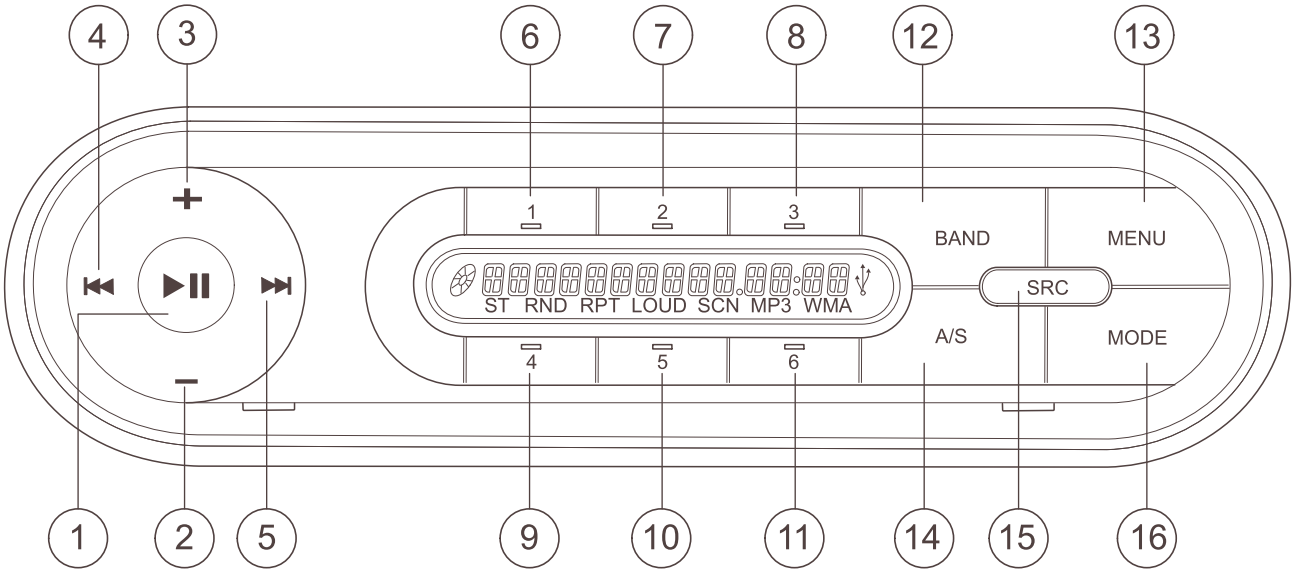
Description

General Description

Based on the vehicle configuration, two kinds of audio head units are available for refit:

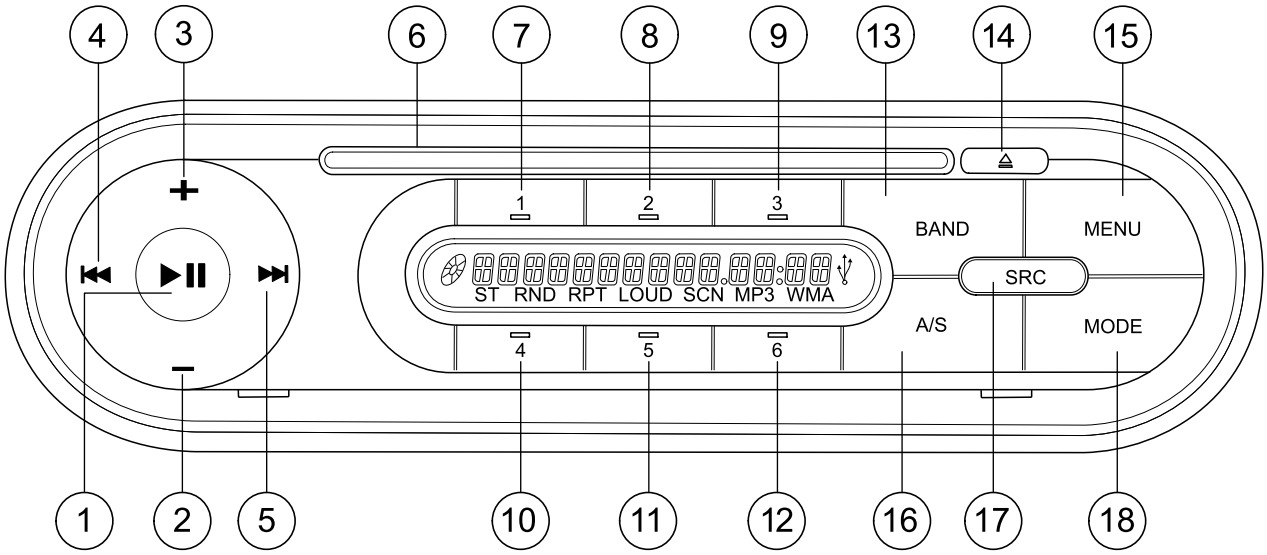
1. radio, USB/**AUX** port.
2. CD player, USB/**AUX** port.

Radio



1. Power / Play (Pause) / Mute Button
2. Volume Down Button
3. Volume Up Button
4. Radio Automatic (Manual) Tuning / CD \ MP3 \ USB Backward Selections / CD \ MP3 Rewind
5. Radio Automatic (Manual) Tuning / CD \ MP3 \ USB Forward Selections / CD \ MP3 Fast Forward
6. Number Button 1
7. Number Button 2
8. Number Button 3
9. Number Button 4
10. Number Button 5
11. Number Button 6
12. Radio Band Selection
13. Menu Button
14. Automatical Radio Station Save/ CD \ MP3 \ USB Track Scanning
15. Sound Source Selection
16. Play Mode Selection

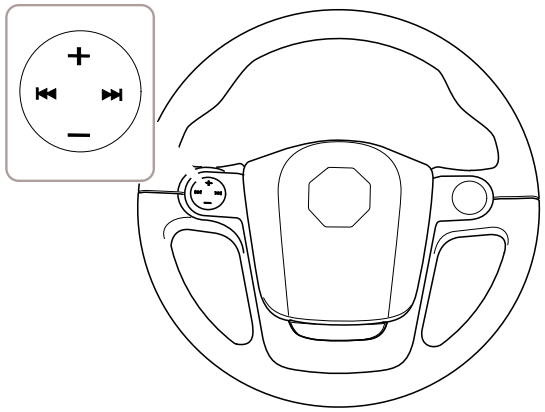
CD player



1. Power / Play (Pause) / Mute Button
2. Volume Down Button
3. Volume Up Button
4. Radio Automatic (Manual) Tuning / CD \ MP3 \ USB Backward Selections / CD \ MP3 Rewind
5. Radio Automatic (Manual) Tuning / CD \ MP3 \ USB Forward Selections / CD \ MP3 Fast Forward
6. CD Slot
7. Number Button 1
8. Number Button 2
9. Number Button 3
10. Number Button 4
11. Number Button 5
12. Number Button 6
13. Radio Band Selection
14. Disc Eject Button
15. Menu Button
16. Automatical Radio Station Save/ CD \ MP3 \ USB Track Scanning
17. Sound Source Selection
18. Play Mode Selection

Steering Wheel Audio Controller

The audio device can be controlled by the remote switch fitted on the steering wheel. These buttons are more convenient for the use of the most common function in the**ICE** system.

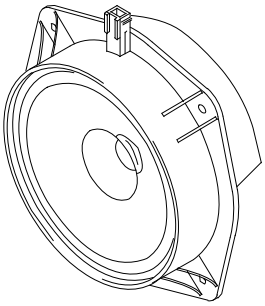


Display

The audio information and related informations are displayed on the screen.

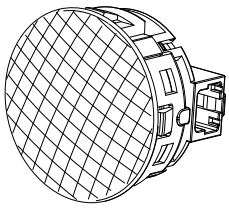
Woofer

Woofers are fit in the four doors (some models are without rear door woofer). and secured with 3 screws on the door panel.



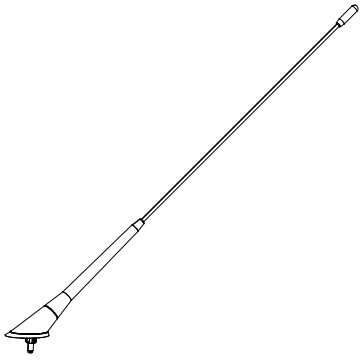
Tweeter

Tweeters are fit on the A post upper trim panel.



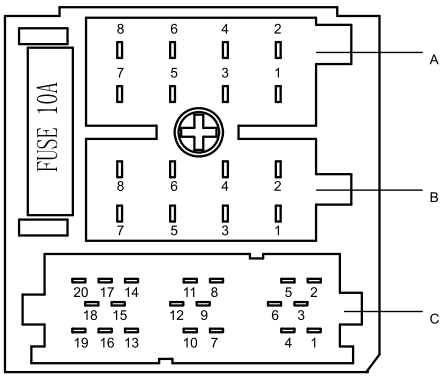
Radio Antenna

Antenna is located in a central location on the rear roof.



Entertainment System Harness Connector

Player Connector End Views



Connector Pin Detailed Information Chart

Pin No.	Description
A1	No Connection
A2	No Connection
A3	No Connection
A4	Ignition Switch (ACC)
A5	No Connection
A6	Backlight Illumination
A7	Power
A8	Power Ground
B1	RH Rear Speaker Positive
B2	RH Rear Speaker Negative
B3	RH Front Speaker Positive
B4	RH Front Speaker Negative
B5	LH Front Speaker Positive
B6	LH Front Speaker Negative
B7	LH Rear Speaker Positive
B8	LH Rear Speaker Negative
C1	No Connection
C2	No Connection
C3	No Connection
C4	No Connection
C5	Steering Switch Related Radio Frequency
C6	Steering Switch
C7	AUX Connected with Tester Probe
C8	No Connection
C9	No Connection
C10	RH AUX Sound Track
C11	AUX Ground

C12	LH AUX Sound Track
C13	No Connection
C14	No Connection
C15	USB Shield Twisted Pair Ground
C16	No Connection

C17	USB Power Supply (+5V)
C18	USB Ground
C19	USB Data Input
C20	USB Data Output

Operation

The entertainment system can be operated only when the wireless key is inserted or the ignition switch is turned on.

For more information about the entertainment system operation, refer to the Owner's Manual.

The following USB products are recommended, some of the other products may not play.

USB brand and capacity	Model
Verbatim 8GB (Number of nested folders: 10)	
SanDisk 512M	
SanDisk 4GB (Number of nested folders: 10)	
SanDisk 2GB	SDCZ36, SDCZ50-002G
SanDisk 4GB	SDCZ50
SanDisk 8GB (Number of nested folders: 10)	
SanDisk 16GB (Number of nested folders: 10)	
Toshiba 4GB	
Toshiba 8GB (Number of nested folders: 10)	SMART U3
Toshiba 16GB (Number of nested folders: 10)	SMART U3
Toshiba 16GB	
Kingston 1GB	
Kingston 2GB	DTI
Kingston 4GB	DTI101G2, DTI101C/4G
Kingston 8GB	DTIG2/8G
Kingston 16GB	DT1G3/16G
Sony 4G	
Sony 128MB	
Kingmax 32MB	
Kingmax 64MB	
Kingmax 2G	

USB brand and capacity	Model
Kingmax 4G	U204G
Teclast 2GB (With antivirus disk)	
Teclast 4GB (Number of nested folders: 9, including an empty folder)	CoolFlash
Teclast 8GB (Number of nested folders: 10)	
Netac 2GB	U186
Newman flash drive 256MB	V
Newman flash drive 2GB	V2
Thunis 2GB	
Thunis 4GB	Chuangqi Z-307
Thunis 512MB	
HP 4GB	V165w
SSK 1GB	U disk
SSK 4GB	
SSK 2GB	
Aigo 2GB	miniking usb
Aigo 4GB	L8203
PNY 2GB	
PNY 4GB	
Apacer 4GB	
Lenovo 8G	
Lenovo 4G	
Samsung 128M	V88
A-data 2G	
A-data 4G	C802
Transcend 16G	JF V60
Transcend 4G	
HEDY Digital Card Reader 1G	
Hyundai Snow 4G	

Service Procedures

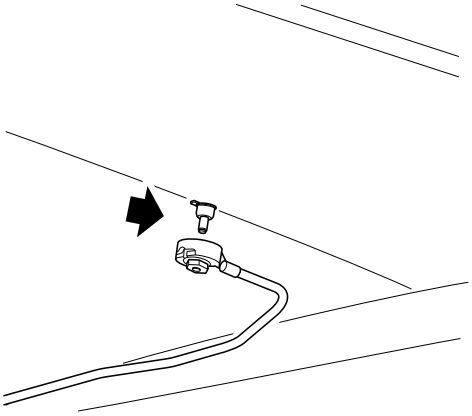
Radio Antenna

Remove

1. Remove the roof inner garnish.

☞**Roof Inner Garnish Remove**

2. Remove the antenna nut.



3. Remove the radio antenna from the roof.

Refit

1. Fit the radio antenna on the central rear roof, ensure that the antenna tilt angle is in an rearward direction.
2. Thread the nut of the antenna feeder terminal into the antenna stud and tighten to **3–4Nm**.
3. Fit the roof interior trim.

☞**Roof Interior Trim Refit**

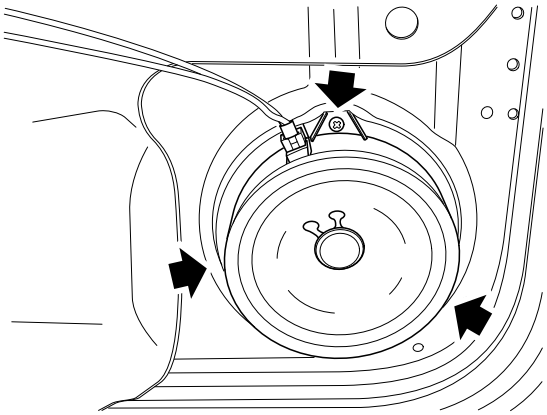
Front Door Woofer

Remove

1. Remove the front door interior trim panel.

☞**Front Door Interior Trim Remove**

2. Loosen the front door woofer connector.
3. Remove 3 screws securing the woofer to the front door and remove the woofer.



Refit

1. Secure the woofer to the front door, fit 3 screws and tighten to **0.8–1.2Nm**.
2. Connect the woofer connector.
3. Fit the front door interior trim.

☞**Front Door Interior Trim Refit**

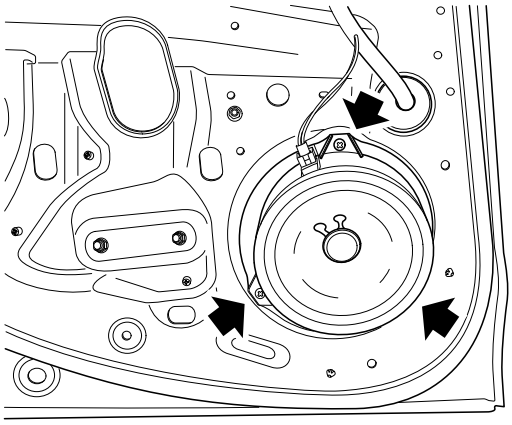
Rear Door Woofer

Remove

1. Remove the rear door interior trim panel.

☞**Rear Door Interior Trim Remove**

2. Loosen the rear door woofer connector.
3. Remove 3 screws securing the woofer to the rear door and remove the woofer.



Refit

1. Secure the woofer to the rear door, fit 3 screws and tighten to **0.8–1.2Nm**.
2. Connect the woofer connector.
3. Fit the rear door interior trim panel.

☞**Rear Door Interior Trim Refit**

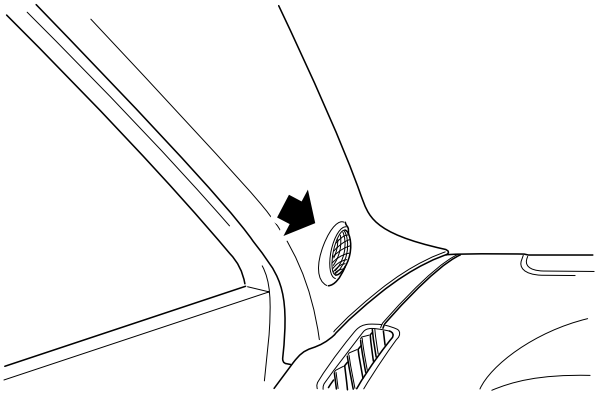
Tweeter

Refit

1. Remove the tweeter from the A post upper trim panel.
2. Disconnect the electrical connector.

Remove

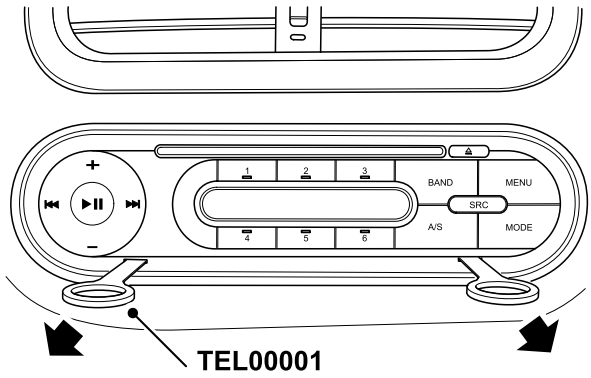
1. Connect the tweeter connector.
2. Engage the tweeter into the post A upper trim panel.



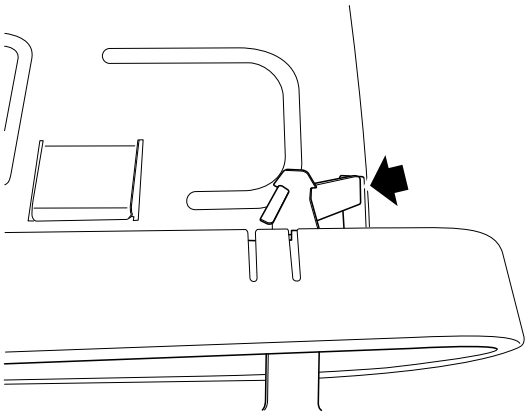
Player

Remove

1. Disconnect battery earth lead.
2. Insert**TEL00001** into the player slot, and pull out the player.



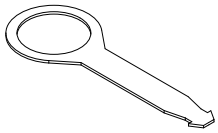
3. Disconnect the player connector and remove the player.
4. Press the spring plates on both sides of the player and remove **TEL00001**.



Refit

1. Connect the player connector.
2. Push the player into the instrument panel.
3. Connect battery earth lead.

Special Tools

Tool Number	Description	Picture
TEL00001	CD player Keys	

Displays and Gauges

Specifications

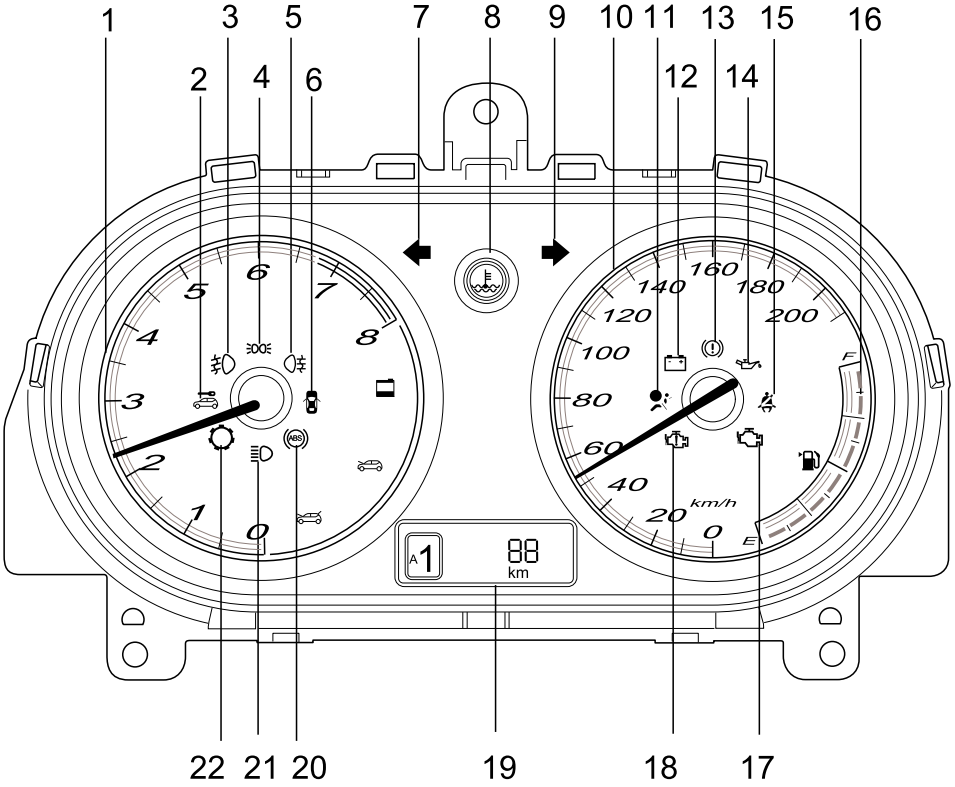
Torque

Description	Value
Screw - instrument cluster to fascia	1.3–1.9Nm

Description and Operation

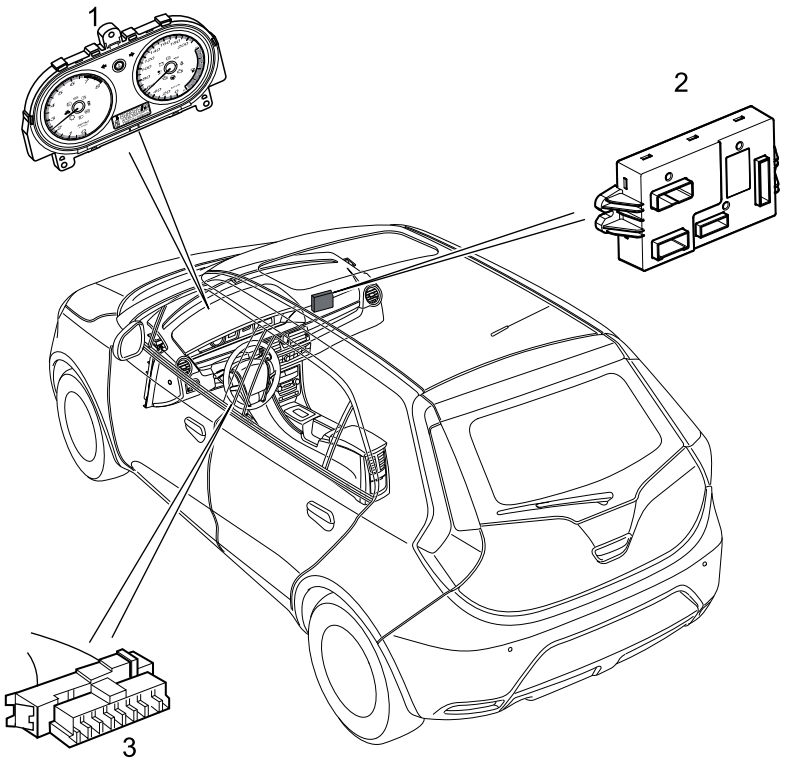
System Layout

Instrument Pack Layout



1. Tachometer
2. Engine Immobilizer System Warning Light
3. Front Fog Lamp Indicator
4. Side Light Indicator
5. Rear Fog Lamp Indicator
6. Liftgate Warning Light
7. Left Direction Indicator
8. Engine Coolant Temperature Warning Light
9. Right Direction Indicator
10. Speedometer
11. Airbag Warning Light
12. Alternator Charge Warning Light
13. Brake System Malfunction Warning Light
14. Low Oil Pressure Warning Light
15. Seat Belt Unfastened Warning Light
16. Fuel Gauge
17. Engine Emission Malfunction Warning Light
18. Engine Malfunction Warning Light
19. Message Centre
20. ABS Warning Light
21. Main Beam Indicator
22. Automatic Transmission Malfunction Warning Light

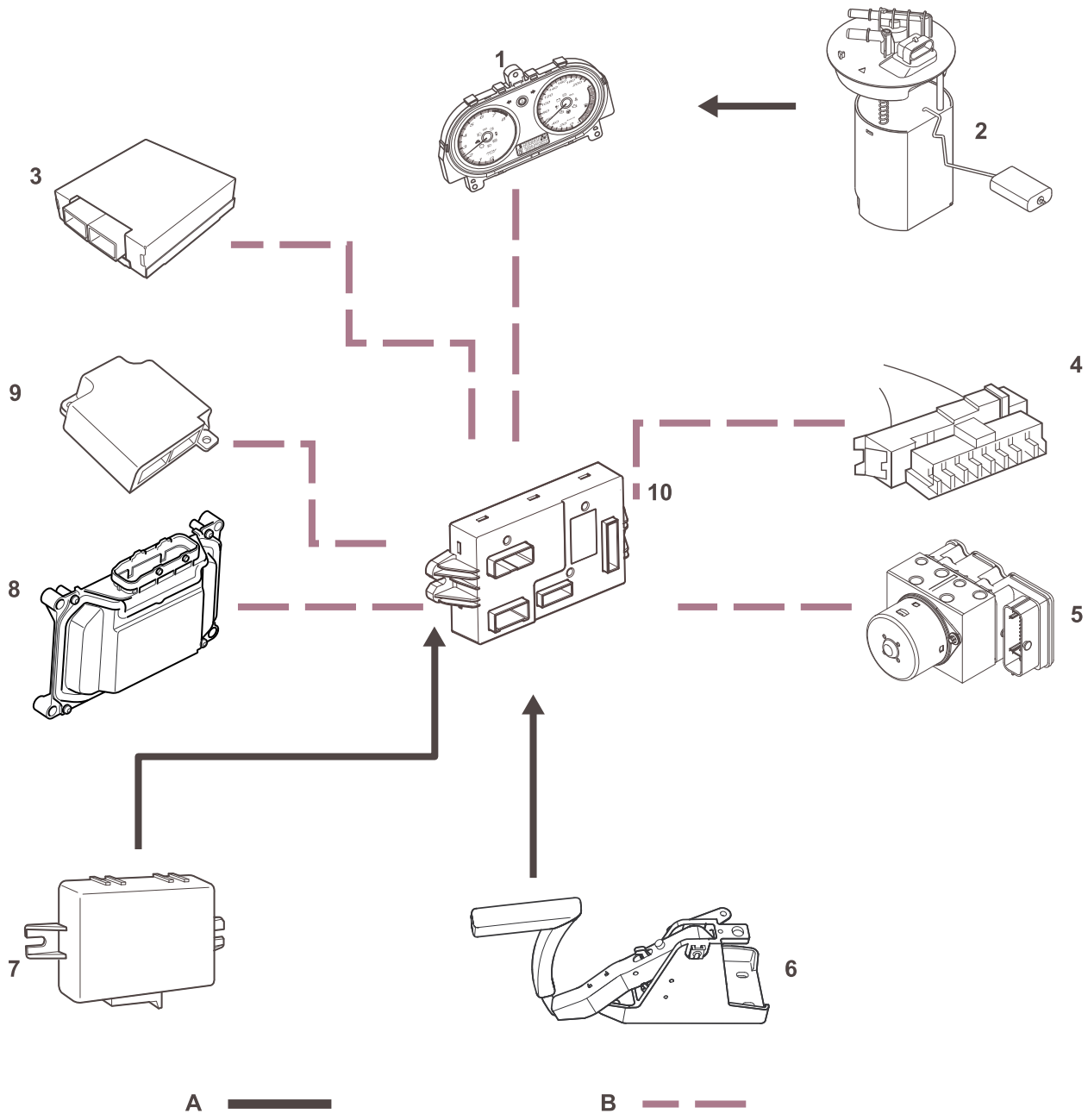
Meter Unit Component Layout



1. Instrument Pack
2. Body Control Module (BCM)
3. Diagnostic Socket

System Control Diagram

Meter unit system control Diagram



S742020

1. Instrument Pack
2. Fuel Level Sensor
3. Automatic Transmission Controller
4. Diagnostic Socket
5. ABS Controller
6. Park Brake Handle
7. Parking Distance Control Unit
8. Engine Control Module
9. Airbag Control Module
10. Body Control Module (BCM)

Description

General Description

The instrument pack is connected to the body harness through a connector terminal, and fixed on the instrument panel assembly by three screws.

The instrument pack is an enclosed (integrated) component and can not be split. We can switch the interface of the message centre and reset the single trip A, single trip B, average fuel consumption and average speed by a trip computer switch on the combination switch.Refer to the trip computer switch section for specific operation.

Caution: *After each routine maintenance, the dealer must reset the maintenance interval with a authorized diagnostic tool.*

Displayed Information

The instrument pack provides the parameters related to the status of the vehicle, such as the speed, engine coolant temperature, fuel level, and displays to the driver through LCD, warning light, analog type dial and segment digital type fuel gauge.

The displayed information mainly consists of the following components:

- tachometer
- Speedometer
- Fuel gauge - LED. When the fuel level is low, the warning will be activated.
- Direction Indicator and Warning Light
- Message Centre. It shows the odometer, gear position information, trip distance (single trip A, single trip B), fuel range to empty, average fuel consumption, average speed, instantaneous fuel consumption, next service, overdrive alarm (only for the Arab market.)

When the key is turned to IGN position, all warning lights will turn on at the same time to conduct self-check, tachometer, speedometer, fuel gauge and engine coolant temperature warning light will scan for self-check.

Communication Signal

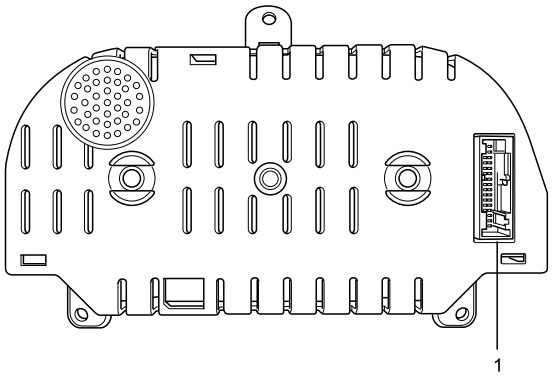
The instrument pack mainly receives the information through the high speed CAN. High-speed CAN nodes include the instrument pack, body control unit, airbag control unit, automatic transmission control unit, engine control unit and ABS control unit. The instrument pack receives and sends signals through the high speed CAN bus line. Signals sent and received by the instrument pack are as shown below.

Signal Name	Transmitting Component	Receiving Component
ABS Warning Light	ABS Control Module	Instrument Pack
Airbag Malfunction	SRS ECU	Instrument Pack
Alternator Malfunction	Hard Wire	Instrument Pack
Brake Fluid Level	Hard Wire	Instrument Pack
Doors	BCM	Instrument Pack
Engine Coolant Temperature	EMS	Instrument Pack
Engine Malfunction Indicator Light (MIL)	EMS	Instrument Pack
Low Oil Pressure	Hard Wire	Instrument Pack
Engine Speed	EMS	Instrument Pack
Fuel Gauge	Hard Wire	Instrument Pack
Transmission Case Gear Position Information	TCU	Instrument Pack
Transmission Case Malfunction	TCU	Instrument Pack
Hand Brake On	Hard Wire	Instrument Pack
Ignition Switch Status	Hard Wire	Instrument Pack
Parking Distance Control	Hard Wire	Instrument Pack
Side Belt Reminder	Hard Wire	Instrument Pack
Theft Deterrent Alert	BCM	Instrument Pack
Remote Key Voltage Low	BCM	Instrument Pack
Vehicle Speed	ABS Control Module	Instrument Pack
Vehicle Identification Code (VIN Code)	BCM	Instrument Pack
Wheel Speed Pulse Signal	ABS Control Module	Instrument Pack
Electric Brakeforce Distribution (EBD) Warning	ABS Control Module	Instrument Pack
Engine Failure (DBW) Warning	EMS	Instrument Pack
Left/Right Direction Indicator	Hard Wire	Instrument Pack
Main Beam Indicator	Hard Wire	Instrument Pack
Front Fog Indicator	Hard Wire	Instrument Pack

Rear Fog Indicator	BCM	Instrument Pack
Side Light Indicator	BCM (KL15 ON)/Hard Wire (KL15 OFF)	Instrument Pack

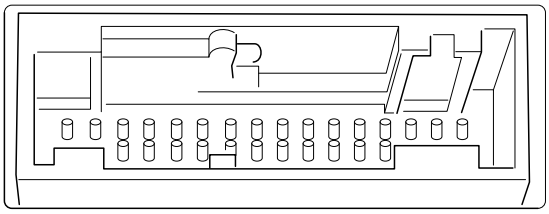
Harness Connector

Instrument Pack Harness Connector Position Schematic Diagram



1. Instrument Harness Connector

Instrument Pack Harness Connector End Views

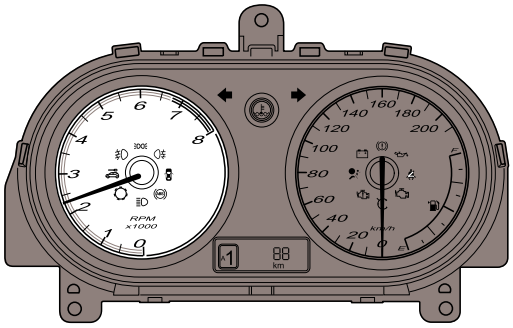


Instrument Pack Harness Connector Pin Detailed Information Chart

Pin No.	Description
1	KL.30
2	Not in Use
3	Ignition Switch + Transponder Coil -
4	Ignition Switch + Transponder Coil +
5	Theft Deterrrent (Communication) Clock (Line)
6	Theft Deterrent Data
7	Not in Use
8	Earth Lead KL.31
9	Not in Use
10	BCM audible Requst
11	Not in Use
12	Brake Fluid
13	Seat Belt
14	Side Light
15	Hand Brake
16	Fuel Oil Level -
17	KL.15Ignition
18	KL.RAuxiliary
19	Not in Use
20	Left Direction Indicator
21	Alternator
22	Oil Pressure
23	Driver Side Door Open
24	Mileage Reset/Trip Computer Switch
25	Right Direction Indicator
26	High Speed CAN
27	High Speed CAN
28	Front Fog Lamp
29	Headlamp
30	PDC Audible Alarm
31	Fuel Level+
32	Engine Coolant Level

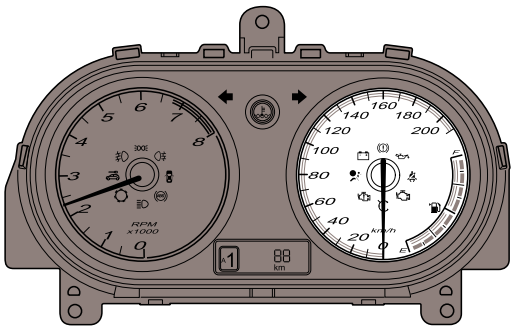
Main Display Functions for the Instrument Pack can be expressed as follows

Tachometer



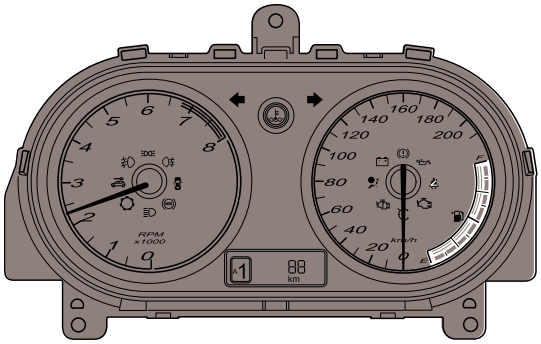
The tachometer indicates the engine speed with the number of the turns per minute. The red area at the high speed end of the tachometer scale range is used to warn the driver that if the engine speed is high, the engine may be damaged. When the ignition switch is in IGN position, The instrument pack receives the vehicle speed signal through the high speed CAN bus line from the EMS.

Speedometer



The speedometer adopts pointer display. ABS calculates the vehicle speed by collecting the wheel speed pulse signal. The instrument pack receives the vehicle speed signal through the high speed CAN bus line from the ABS module, and displays the vehicle speed signal after it has been corrected and calculated.

Fuel Gauge



Fuel gauge is located on the right side of the instrument pack, with the display of the 8 LED bar codes, and the instrument is directly connected with the fuel sensor through hard line. When pressing the trip computer switch with the instrument pack under the wake state, the fuel gauge lights up and displays the current fuel status. When the ignition key is turned to IGN position, the fuel gauge starts to work, when the fuel level is at normal status, the bottom segment is in white color; when the bottom segment illuminates in red color, it indicates the oil is low, as oil continues to decrease, the red LED segment will flash accompanied by alarm.

Caution: *During the operation of the vehicle, if the meter detects that the fuel sensor signal is outside the valid range (which may be caused by the open fuel sensor circuit resulting from the debris inside the fuel), the instrument will use previously recorded valid fuel levels and injection signals received from the ECM to calculate the remaining fuel until the end of the ignition cycle. when turning the ignition on for the next time, if the fuel sensor signal value detected is still out of valid range, then the fuel gauge will not display. But this will not affect the normal operation of the vehicle, when the fuel signal is back to normal, the gauge will return to normal display.*

Warning Display

Direction Indicator (Left, Right)

The left and right direction indicators are indicated by the green arrows located on the top of the instrument pack. Whenever the direction indicators operate, the left or right direction indicator will flash. If the hazard warning light operates, the left and right direction indicators will flash simultaneously.

Engine Coolant Temperature Warning Light

The warning light has two colors with blue and red. If the light illuminates in blue, then the engine coolant temperature is low. If the light illuminates in red, then the engine coolant temperature is high, when the coolant temperature continues to rise, the warning light will flash accompanied by alarm sound, then continuous running will lead to engine damage, the vehicle operations should be stopped as soon as possible.

ABS Warning Light

This warning light is yellow. After finishing the self-check, if the ABS warning light illuminates, it indicates a fault in the ABS system is found, and the emergency measures should be taken. Although the ABS system is malfunctioning, the brake function can be performed normally.

Parking Brake and Brake System Warning Light

This red warning light is used to inform the driver: 1. ABS detects a fault in the electronic brake distribution (EBD); 2. low brake fluid level; 3. hand brake does not released. After self-check, if there is a problem with EBD or low brake fluid level, warning lights will illuminate, accompanied by alarm.

When the speed is greater than 5 km/h, if the hand brake is not released, warning lights start flashing, accompanied by repeated alarm that last for 30 seconds.

If, after turning off the vehicle, the hand brake is not pulled, when the drive door is opened, (under any gear position) the instrument activates the alarm, warning light flashing with associated alarm sound.

Engine Malfunction Warning Light

This warning light is yellow. This indicator is used to indicate the malfunction greatly affecting the engine performance

(except the emission malfunction), which is detected by the engine management system. When the ignition switch is turned to IGN position, the self-check starts, and the warning light will go off after finishing the self-check. If the warning light does not go off or during driving illuminates, accompanied by the alarm sound, it indicates that the EMS has a malfunction which has greatly affected the engine performance, causing the engine limp back home, for example, malfunctions of the electronic throttle, accelerator pedal and ECU reference voltage.

Engine Emission Malfunction Warning Light

This warning light is yellow. This warning light is used to indicate the malfunction affecting the engine performance and the emission, which is detected by the engine management system. When the ignition switch is turned to IGN position, the self-check starts, and the warning light still remain ON after finishing the self-check. After starting the engine, if there is no malfunction, the lights will go off; If the lights illuminates after starting the engine, accompanied by the alarm sound, it indicates there is a fault affecting the engine performance and the emission.

Alternator Charge Warning Light

This warning light is red. The signals will be sent to the instrument through the hard wire. When the ignition key is turned to IGN position, if no electricity is generated, this warning light will come on. If the engine does not start and the ignition key is turned to IGN position, it is normal that the warning light comes on. After starting the engine, if the alternator does not generate electricity normally, this warning light will come on with the warning sound.

Seat Belt Unfastened Warning Light

This warning light is red. After finishing the self-check, if this warning light comes on, it indicates that the driver or front passenger seat belt is unfastened. After starting the engine, the warning light comes on with one warning sound. When the vehicle speed exceeds 5 km/h, if the seat belt is still unfastened, the warning light will flash with repeated warning sound until it is fastened or stop warning after 90 seconds.

Airbag Warning Light

This warning light is red. After self-test, if the light comes on, it indicates that the airbag control unit detects a failure.

Main Beam Indicator

This warning light is blue. The signal will be sent to the instrument through the hard wire. When the main beam lamp comes on, this indicator is illuminated. It informs the driver that the main beam lamp has been illuminated.

Front Fog Lamp Indicator

The front fog lamp indicator is green. When the ignition key is turned to IGN position and the front fog lamp is turned on, this signal indicator will be illuminated.

Rear Fog Lamp Indicator

The rear fog lamp indicator is yellow. When the ignition key is turned to IGN position and the rear fog lamp is turned on, this signal indicator will be illuminated.

Side Light Indicator

The side light indicator is green. When the position light is turned on, this signal indicator will come on.

Low Oil Pressure Warning Light

The red warning light is illuminated when a low engine oil pressure is detected. If the warning light does not go off after starting the engine or comes on during driving, it will be accompanied by an audible alarm to alert the driver. Pay attention to the malfunction, and handle it immediately if possible. Otherwise, the engine will be damaged.

Engine Immobilizer System Warning Light

This warning light is red. When the key is turned to IGN position, the starter cannot be started if the immobilizer system verification fails, and the warning light comes on at this time. If the key battery is at low voltage, the warning light will flash with one warning sound. If the immobilizer system verification fails and the key battery voltage is low, these will cause the warning light to remain on.

Door Open Warning Light

This warning light is red. It is used to notify the driver that the doors or tailgate have not closed, when the ignition switch is turned on, the warning light come on for 4 seconds to perform the system check. If the doors or tailgate have not closed, the warning light does not go off. When the speed is greater than 5 km/h, if there is still an unclosed door exists, the warning light will flash, accompanied by alarm sound until the door is closed or stop after 30 seconds.

Automatic Transmission Malfunction Warning Light

This warning light is yellow. It is used to notify the driver that the automatic transmission controller fails. When the self-check is completed, if the light continues to come on, it indicates a faulty automatic transmission and will be accompanied by alarm sound.

Audible Alarm

Keys Forgotten to Pull Out and Vehicle Lights Forgotten to Turn Off

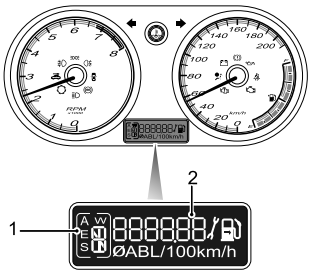
When the ignition key comes off, and the driver's door is opened, if the lamp is not closed, or the key is not out, the

instrument will activate an audible alarm until the headlights are off and the keys are pulled out, or stop after 30 seconds.

Parking Distance Control (PDC) Warning

It applies only to the vehicles with back up radar. In reversing gear position, when detecting the obstacles, audible alarm will be activated by PDC, alarm sound frequency changes with the distance from the obstacles, the closer to the obstacles, the higher the repetition rate of alarm sound.

Message Centre



Trip Computer

The trip computer displays the following information on the LCD:

1. Gear position information and operation mode information
2. Single trip A, single trip B, fuel range to empty, average fuel consumption, average speed, instantaneous fuel consumption, next service and overdrive alarm (only for the Arab market).

Gear position information and operation mode

As shown below, in the case of AMT automatic mode, LCD displays gear position information on the left with 12345 and displays operation mode information next to the number: E-Economy, M-Manual, S-sport Mode, W-winter, A-Automatic. Under the AMT manual mode, no operation mode will be displayed.

Odometer

It records the odometer of the vehicle.

Fuel Range to Empty

As shown below, it displays the fuel range to empty. It indicates range that the vehicle can drive with the remaining fuel in the tank, and it is calculated according to the fuel consumption during traveling, and changes in the unit of 1 km. After filling up the fuel, the fuel range to empty will be re-calculated.

'Fuel range to empty' is calculated based on a recent trip average fuel consumption and fuel tank remaining fuel. If the fuel consumption decreases and increases evidently because of the change of the driving pattern or road condition, the decrease or increase of the fuel range to empty can be seen.

Instantaneous Fuel Consumption

The function displays the current instantaneous fuel consumption in L/100km.

Average Fuel Consumption

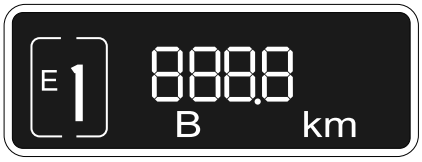
Displays the calculation result of the average fuel consumption from the last reset to the current trip in L/100km. Average fuel consumption can be calculated after starting the engine. Average consumption is related to driving habits, road condition, load, tyre pressure, the quality of oil, etc.

Average Speed

It is the calculation result of the average vehicle speed in km/h after starting the engine.

trip A and trip B

The trip distance displays in km.



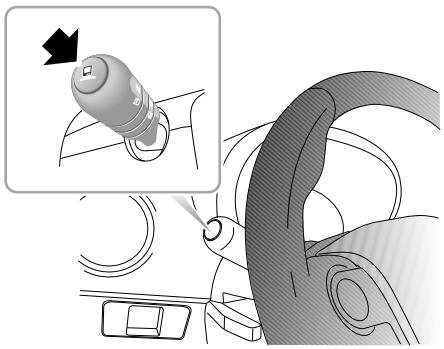
Next Service

Displays the maintenance symbols and the left mileage before the next maintenance.

Overdrive Alarm (Only for the Arab Market)

According to regulations in overseas markets, when the vehicle speed exceeds the specified value, LCD will display specified speed and the speed units begin to flash, accompanied by the alarm sound.

Trip Computer Switch



When repeat pressing (less than 2 seconds) the buttons briefly at the lever end (as shown by arrows), the following informations will be cyclically displayed: odometer ® trip A ® trip B ® fuel range to empty ® instantaneous fuel consumption ® Average fuel consumption ® average speed ® next service.

When the pages you select to display are trip A, trip B, average fuel consumption or average speed, pressing and holding (more than 2 seconds) the buttons at the lever end can reset the selected display.

Operation

Operation Mode

The functionality of the instrument pack features available at any particular time is dependent on the position of the ignition switch.

Ignition Switch OFF

When the ignition switch is turned off, if the vehicle battery remains being connected, the instrument pack will stay in the 'standby mode'.

Ignition Switch "ON"

With the ignition switch turned on, the instrument pack starts the inspection before driving, and CAN bus line enters the activation status. The following warning lights always remain ON after performing self-check for 4 seconds:

- Low Oil Pressure Warning Light
- Engine Emission Malfunction Warning Light
- Battery Charge Warning Light

Airbag Warning Light performs self-check for 6 seconds.

Ignition Switch 'Start'

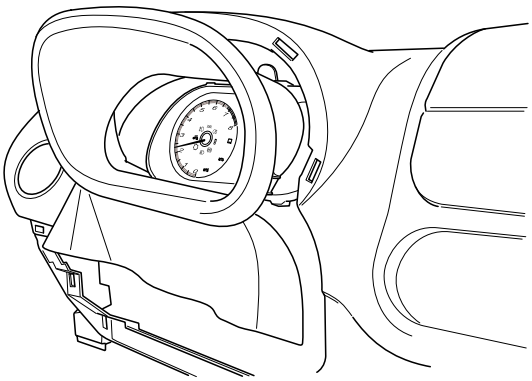
After the engine starts, all lights will be extinguished. If there is any warning light remaining on, it indicates that there is a fault existing in the corresponding system.

Service Procedures

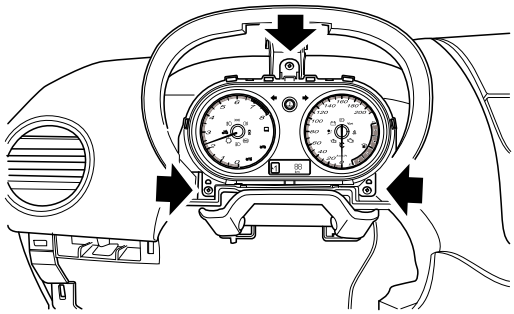
Instrument Pack

Remove

1. Disconnect battery earth lead.
2. Pull out the instrument luster assembly, and remove it together with the steering column upper boot.



3. Remove 3 self-tapping screws fixing the instrument pack to the upper part of the instrument panel.



4. Disconnect the electric coupler.
5. Remove the instrument pack.

Refit

1. Connect the electric coupler.
2. Secure the instrument pack to the upper instrument panel. Fit screws and tighten to **1.3–1.9Nm**.
3. Fit the instrument luster assembly and the steering column upper boot.
4. Connect battery earth lead.

Glossary List

Name	Description
A/C	Air Conditioning
ABS	Anti-lock braking system
AUX	Auxiliary
BCM	Body Controller Module
CAN	Controller area network
CHMSL	Centre High Mounted Stop Lamp
CKP	Crankshaft Position
CMP	Camshaft Position
CO	Carbon Monoxide
CO2	Carbon Dioxide
DDSP	Driver's Door Switch Pack
DSC	Dynamic Stability Control
EBD	Electronic Braking-force Distribution
ECM	Engine Control Module
ECT	Engine Coolant Temperature
ECU	Electronic Control Unit
EEPROM	Electronic Erasable Programmable Read Only Memory
ELR	Emergency Locking Retractor
EMS	Engine Management System
ESCL	Electronic steering column lock
ETC	Electronic Temperature Control
HC	Hydro Carbons
HO2S	Heated Oxygen Sensor
HRW	Heated Rear Window
ICE	In Car Entertainment
ICS	Inflatable Curtain Structure
ISO	International Organization for Standardization
K	Pink
LED	Light Emitting Diode
LIN	Local Interconnect Network

Name	Description
MIL	Malfunction Indicator Lamp
MLS	Master Light Switch
NOx	Oxides of Nitrogen
NTC	Negative Temperature Coefficient
OAT	Organic Acid Technology
PAS	Power Assisted Steering
PDC	Parking Distance Control
PWM	Pulse Width Modulation
RON	Research Octane Number
SBR	Side Belt Reminder
SRS	Supplementary Restraint System
TCM	Transmission Control Module
TMAP	Temperature, Manifold Absolute Pressure
TP	Throttle Position
TWC	Three-way Catalyst
TXV	Thermostatic Expansion Valve
V	Volt
VIN	Vehicle Identification Number