TABLE OF CONTENTS

04 – DRIVE SYSTEM AND BRAKE **31**
DRIVE AND DRIVEN PULLEYS 31
DRIVE BELT 33
MECHANICAL BRAKE 35
HYDRAULIC BRAKE 35
TRACK 36
GEARBOX 36
CHAINCASE 37
05 – ELECTRICAL SYSTEM **39**
IGNITION SYSTEM 39
CHARGING SYSTEM 40
STARTING SYSTEM 40
ROTAX ELECTRONIC REVERSE (RER) 42
LIGHTS, INSTRUMENTS AND ACCESSORIES 43
06 – STEERING SYSTEM **47**
HANDLEBAR 47
SKI 47
07 – SUSPENSION **49**

03 ENGINE (443 AND 552)
01 – ENGINE REMOVAL AND INSTALLATION **51**
GENERAL 54
PROCEDURES 54
02 – ENGINE LEAK TEST **55**
PREPARATION 55
PROCEDURES 55
ENGINE LEAK VERIFICATION FLOW CHART 57
03 – AIR INTAKE SYSTEM **59**
PROCEDURES **61**
AIR FILTER 61
AIR INTAKE SILENCER 61
04 – EXHAUST SYSTEM **63**
GENERAL **66**
PROCEDURES **66**
TUNED PIPE 66
MANIFOLD 66
05 – OIL INJECTION SYSTEM **67**
GENERAL **72**
RECOMMENDED OIL TYPE 72
INSPECTION **72**
OIL SYSTEM LEAK TEST 72
PROCEDURES **73**
OIL RESERVOIR 73
OIL LEVEL SENSOR 73
OIL FILTER 74
OIL PUMP 74
CHECK VALVE 79
INJECTION NOZZLE 79
06 – REWIND STARTER **81**
GENERAL **83**
PROCEDURES **83**
STARTER HANDLE 83
REWIND STARTER 83
ROPE 86
07 – AXIAL FAN **89**
GENERAL **90**

PROCEDURES 90
CYLINDER COWL 90
AXIAL FAN 90
FAN BELT 91
AXIAL FAN BEARING 93
08 – MAGNETO SYSTEM 95
GENERAL 97
PROCEDURES 97
MAGNETO FLYWHEEL 97
STATOR 99
TRIGGER COIL 99
09 – TOP END 101
GENERAL 105
PROCEDURES 105
CYLINDER COWL 105
CYLINDER HEAD 105
CYLINDER 106
PISTON 107
REED VALVE 111
10 – BOTTOM END 113
GENERAL 116
PROCEDURES 116
CRANKCASE 116
CRANKSHAFT 117
CRANKSHAFT BEARINGS 118
11 – ENGINE MEASUREMENT 123
CYLINDER HEAD WARPAGE 123
COMBUSTION CHAMBER VOLUME MEASUREMENT 123
CYLINDER TAPER 124
CYLINDER OUT OF ROUND 124
CYLINDER/PISTON CLEARANCE 125
RING/PISTON GROOVE CLEARANCE 126
RING END GAP 127
CRANKSHAFT DEFLECTION 127
CONNECTING ROD BIG END AXIAL PLAY 127
CRANKSHAFT ALIGNMENT 127
CHECKING SURFACE FLATNESS 128

04 ENGINE (593)
01 – ENGINE REMOVAL AND INSTALLATION 129
GENERAL 132
PROCEDURES 132
02 – ENGINE LEAK TEST 137
GENERAL 137
PROCEDURES 137
ENGINE LEAK VERIFICATION FLOW CHART 140
03 – AIR INTAKE SYSTEM 141
PROCEDURES 143
AIR FILTER 143
AIR INTAKE SILENCER 144
04 – EXHAUST SYSTEM 145
GENERAL 147
PROCEDURES 147
TUNED PIPE 147
MANIFOLD 148
MUFFLER 148

ABLE OF CONTENTS

EXHAUST GAS TEMPERATURE SENSOR (EGTS) 149
05 – COOLING SYSTEM 151
GENERAL 154
INSPECTION 154
COOLING SYSTEM LEAK TEST 154
MAINTENANCE 154
COOLANT REPLACEMENT 154
PROCEDURES 155
THERMOSTAT 155
RADIATOR CAP 156
FRONT RADIATOR 156
REAR RADIATOR 157
COOLANT TANK 157
WATER PUMP 157
COOLANT TEMPERATURE SENSOR (CTS) 157
06 – OIL INJECTION SYSTEM 159
GENERAL 163
RECOMMENDED OIL TYPE 163
INSPECTION 163
OIL SYSTEM LEAK TEST 163
PROCEDURES 164
OIL RESERVOIR 164
OIL LEVEL SENSOR 165
OIL FILTER 165
OIL PUMP 165
INJECTION NOZZLE 168
07 – REWIND STARTER 171
GENERAL 173
PROCEDURES 173
STARTER HANDLE 173
REWIND STARTER 173
ROPE 176
08 – MAGNETO SYSTEM 179
GENERAL 182
PROCEDURES 182
MAGNETO FLYWHEEL 182
STATOR 184
TRIGGER COIL 185
CRANKSHAFT POSITION SENSOR (CPS) 185
09 – TOP END 187
GENERAL 190
PROCEDURES 190
REED VALVE 190
RAVE VALVE 191
CYLINDER HEAD COVER 194
CYLINDER HEAD 195
CYLINDER 195
PISTON 196
10 – BOTTOM END 201
GENERAL 204
PROCEDURES 204
WATER PUMP 204
BEARING HOUSING 204
WATER/OIL PUMP SHAFT 208
CRANKCASE 208
CRANKSHAFT 209

CRANKSHAFT BEARINGS 211
11 – ENGINE MEASUREMENT 215
CYLINDER HEAD WARPAGE 215
COMBUSTION CHAMBER VOLUME MEASUREMENT 215
CYLINDER TAPER 216
CYLINDER OUT OF ROUND 216
PISTON/CYLINDER CLEARANCE 217
RING/PISTON GROOVE CLEARANCE 218
RING END GAP 219
CRANKSHAFT DEFLECTION 219
CONNECTING ROD BIG END AXIAL PLAY 219
CRANKSHAFT ALIGNMENT 219

05 ENGINE (810)
01 – ENGINE REMOVAL AND INSTALLATION 221
GENERAL 222
PROCEDURES 222
ENGINE REMOVAL 222
ENGINE INSTALLATION 224
02 – ENGINE LEAK TEST 227
GENERAL 227
PROCEDURES 227
PREPARATION 227
LEAK TEST 229
REASSEMBLY 229
03 – AIR INTAKE SYSTEM 231
GENERAL 233
PROCEDURES 233
AIR INTAKE SILENCER 233
INTAKE MANIFOLD 233
04 – EXHAUST SYSTEM 235
GENERAL 237
PROCEDURES 237
EXHAUST PIPE 237
MUFFLER 237
05 – LUBRICATION SYSTEM 239
ENGINE LUBRICATION 241
GENERAL 242
MAINTENANCE 242
OIL LEVEL VERIFICATION 242
OIL CHANGE 242
OIL FILTER 242
INSPECTION 243
ENGINE OIL PRESSURE 243
PROCEDURES 244
OIL PRESSURE SWITCH 244
ENGINE OIL PRESSURE REGULATOR 244
OIL PUMP 245
ENGINE OIL STRAINER 247
REED VALVE 248
06 – COOLING SYSTEM 249
GENERAL 252
INSPECTION 252
COOLING SYSTEM LEAK TEST 252
MAINTENANCE 253
COOLANT REPLACEMENT 253

TABLE OF CONTENTS

PROCEDURES 255
COOLANT TANK CAP 255
FRONT RADIATOR 255
RADIATOR FAN 255
RELAY R3 256
REAR RADIATOR 257
COOLANT TANK 257
COOLANT TEMPERATURE SENSOR (CTS) 258
THERMOSTAT 258
WATER PUMP HOUSING 258
WATER PUMP IMPELLER 258
WATER PUMP SHAFT AND SEALS 259
07 – MAGNETO SYSTEM 263
GENERAL 265
PROCEDURES 265
MAGNETO COVER 265
STATOR 266
ROTOR 267
SPRAG CLUTCH 268
SPRAG CLUTCH GEAR 269
STARTER DRIVE GEARS 269
08 – CYLINDER AND HEAD 271
GENERAL 275
MAINTENANCE 275
VALVE CLEARANCE ADJUSTMENT 275
PROCEDURES 276
VALVE COVER 276
TIMING CHAIN TENSIONER 276
CAMSHAFT TIMING GEAR 278
ROCKER ARM 279
TIMING CHAIN 281
CYLINDER HEAD 281
CAMSHAFT 283
VALVE SPRING 287
VALVE 288
VALVE GUIDE 291
CYLINDER 292
PISTON 293
PISTON RINGS 297
09 – BOTTOM END 299
GENERAL 302
PROCEDURES 302
PTO COVER OIL SEAL 302
PTO COVER 302
DRIVE GEARS 305
TIMING CHAIN 306
TIMING CHAIN GUIDE 307
CRANKCASE 307
CRANKSHAFT 311

5 FUEL SYSTEM
01 – FUEL TANK AND FUEL PUMP (440F, 550F AND 600) 319
INSPECTION 322
FUEL SYSTEM LEAK TEST 322
PROCEDURES 322
DIAPHRAGM FUEL PUMP 322

IN-TANK FUEL STRAINER 322
FUEL FILTER 322
FUEL TANK 322
02 – FUEL TANK AND FUEL PUMP (600 HO SDI) 324
INSPECTION 325
FUEL SYSTEM LEAK TEST 327
FUEL PRESSURE TEST 327
PROCEDURES 327
OETIKER CLAMPS 328
FUEL PUMP 328
IN-TANK FUEL STRAINER 329
FUEL FILTER 330
FUEL TANK 330
TROUBLESHOOTING 330
FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART 331
03 – FUEL TANK AND FUEL PUMP (V800) 333
INSPECTION 333
FUEL SYSTEM LEAK TEST 333
FUEL PRESSURE TEST 333
TROUBLESHOOTING 333
FUEL SYSTEM DIAGNOSTIC FLOW CHART 334
PROCEDURES 334
FUEL FILTER 334
FUEL PUMP 334
FUEL TANK 334
04 – VM CARBURETORS (440F, 550F AND 600) 336
CARBURETOR 336
THROTTLE CABLE 336
CHOKE CABLE 336

07 ENGINE MANAGEMENT (SDI)
01 – OVERVIEW 3
GENERAL 3
OPERATING PRINCIPLE 3
AIR INDUCTION 3
FUEL DELIVERY SYSTEM 3
ELECTRICAL SYSTEM 3
ENGINE MANAGEMENT SYSTEM (EMS) 3
FUEL INJECTION 3
IGNITION SYSTEM 3
E-RAVE 3
ENGINE MODES OF OPERATION 3
MONITORING SYSTEM 3
DIAGNOSTIC MODE 3
ENGINE MANAGEMENT SYSTEM FUNCTIONS 3
02 – EMS DIAGNOSTIC AND COMMUNICATION TOOLS 3
DIAGNOSTIC 3
GENERAL 3
EMS FAULT CODE TABLES 3
EMS FAULT CODES SUPPLEMENTAL INFORMATION 3
COMMUNICATION TOOLS 3
MPI (MULTI-PURPOSE INTERFACE) 3
MPI-2 (MULTI-PURPOSE INTERFACE) 3
B.U.D.S. SOFTWARE 3
03 – ADJUSTMENT AND REPAIR PROCEDURES 3
GENERAL 3

TABLE OF CONTENTS

FUEL SYSTEM 375
ELECTRICAL SYSTEM 376
BASIC ADJUSTMENTS 380
IDLE SPEED 380
CLOSED THROTTLE RESET 380
THROTTLE CABLE 381
IGNITION TIMING 382
REPAIR PROCEDURES 382
FUEL INJECTORS 382
ENGINE CONTROL MODULE (ECM) 385
THROTTLE BODY 386
THROTTLE POSITION SENSOR (TPS) 387
CRANKSHAFT POSITION SENSOR (CPS) 388
AIR TEMPERATURE SENSOR (ATS) 389
COOLANT TEMPERATURE SENSOR (CTS) 390
AIR PRESSURE SENSOR (APS) 391
EXHAUST GAS TEMPERATURE SENSOR (EGTS) 391
KNOCK SENSOR (KS) 392
E-RAVE SOLENOID 393

08 ENGINE MANAGEMENT (V800)

01 – OVERVIEW 395
OPERATING PRINCIPLE 396
AIR INDUCTION 396
FUEL SYSTEM 396
ELECTRICAL SYSTEM 397
ENGINE MANAGEMENT SYSTEM 399
ELECTRONIC FUEL INJECTION 399
IGNITION 399
ENGINE MODES OF OPERATION 400
MONITORING SYSTEM 400
02 – EMS DIAGNOSTIC AND COMMUNICATION TOOLS 403
GENERAL 403
COMMUNICATION TOOLS 403
MULTI-PURPOSE INTERFACE (MPI) 403
MULTI-PURPOSE INTERFACE-2 (MPI-2) 405
B.U.D.S. SOFTWARE 408
DIAGNOSTIC 410
MONITORING SYSTEM 410
FAULT CODES 410
FAULT CODE TABLE 411
03 – ADJUSTMENT AND REPAIR PROCEDURES 417
GENERAL 417
FUEL SYSTEM 417
ELECTRICAL SYSTEM 418
BASIC ADJUSTMENTS 420
IDLE SPEED 420
THROTTLE CABLE 420
CLOSED THROTTLE AND IDLE ACTUATOR RESET 421
IGNITION TIMING 422
REPAIR PROCEDURES 422
ENGINE CONTROL MODULE (ECM) 422
FUEL INJECTOR 424
FUEL RAIL 427
THROTTLE BODY 428
THROTTLE POSITION SENSOR (TPS) 431

IDLE BYPASS VALVE 433
CRANKSHAFT POSITION SENSOR (CPS) 434
CAMSHAFT POSITION SENSOR (CAPS) 436
MANIFOLD AIR PRESSURE AND TEMPERATURE SENSOR (MAPTS) 437
COOLANT TEMPERATURE SENSOR (CTS) 439
OIL PRESSURE SWITCH (OPS) 440

09 ELECTRICAL SYSTEM

01 – COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE (600 MODELS) 443
COMMUNICATION TOOLS 443
MULTI-PURPOSE INTERFACE (MPI) 443
MULTI-PURPOSE INTERFACE MPI-2 446
B.U.D.S. SOFTWARE 447

02 – IGNITION SYSTEM (440F/550F) 449
GENERAL 451
IGNITION SYSTEM TESTING SEQUENCE 451
PROCEDURES 452
SPARK PLUG 452
IGNITION SWITCH 452
TETHER CUT-OUT SWITCH 453
ENGINE CUT-OUT SWITCH 454
WIRING HARNESS 454
IGNITION COIL 454
IGNITION GENERATOR COIL 455
TRIGGER COIL 456
MPEM 457
ADJUSTMENT 457
IGNITION TIMING 457

03 – IGNITION SYSTEM (600) 461
GENERAL 461
IGNITION SYSTEM TESTING SEQUENCE 461
PROCEDURES 462
SPARK PLUG 462
ELECTRICAL CONNECTOR 462
DESS POST 462
ENGINE CUT-OUT SWITCH 462
WIRING HARNESS 463
IGNITION COIL 463
TRIGGER COIL 464
MULTI-PURPOSE ELECTRONIC MODULE (MPEM) 464
ADJUSTMENT 464
IGNITION TIMING 464

04 – IGNITION SYSTEM (V800) 467
GENERAL 467
PROCEDURES 467
DESS SWITCH 467
ENGINE CUT-OUT SWITCH 467
IGNITION COIL 468
IGNITION TIMING 470
SPARK PLUG 470

05 – CHARGING SYSTEM 471
GENERAL 471
PROCEDURES 472
CHARGING FUSE 472
VOLTAGE REGULATOR 473
STATOR 475

TABLE OF CONTENTS

BATTERY 476
BATTERY (VRLA) 480
06 – STARTING SYSTEM 483
GENERAL 489
PROCEDURES 489
FUSES 489
BATTERY 490
REVERSE SWITCH 490
IGNITION SWITCH 490
DESS SWITCH 490
ENGINE CUT-OUT SWITCH 490
START SWITCH 490
STARTING SOLENOID (440F/550F/600) 491
STARTING SOLENOID (600 HO SDI) 492
STARTING SOLENOID (V800) 494
ELECTRIC STARTER 497
07 – DIGITALLY ENCODED SECURITY SYSTEM (DESS) 501
GENERAL 501
KEY PROGRAMMING 501
TROUBLESHOOTING 502
08 – ROTAX ELECTRONIC REVERSE (440F) 505
GENERAL 505
TROUBLESHOOTING 505
TESTING PROCEDURES 505
RER SWITCH 505
RER TRIGGER COIL 506
09 – LIGHTS, INSTRUMENTS AND ACCESSORIES 509
GENERAL 509
RELAY LOCATION 510
CURRENT TYPE (AC AND DC) 510
POWER DISTRIBUTION 511
DIAGNOSTIC 512
LIGHTING AND ACCESSORIES SYSTEM TESTING 512
PROCEDURES 513
FUSES 513
RELAY R1 514
RELAY R2 515
RELAY R4 515
HEADLAMP 515
TAILLIGHT 517
ELECTRONIC SPEEDOMETER 517
SPEED SENSOR 522
TACHOMETER 523
ENGINE TEMPERATURE GAUGE 524
HEATING ELEMENTS 525
12-VOLT POWER OUTLET 527
12-VOLT REAR POWER OUTLET 527
BEEPER 527

10 DRIVE SYSTEM AND BRAKE
01 – DRIVE BELT 529
APPLICATION CHART 529
DRIVE BELT 529
02 – DRIVE PULLEY (COMET® 102) 533
GENERAL 535
PROCEDURES 535

FIXED AND SLIDING SHEAVES 535
RAMPS 538
RING GEAR 539
03 – DRIVE PULLEY (BOMBARDIER LITE) 541
GENERAL 543
PROCEDURES 543
FIXED AND SLIDING SHEAVES 543
GOVERNOR CUP 544
CENTRIFUGAL WEIGHT 545
SPRING 546
RING GEAR 548
04 – DRIVE PULLEY (TRA III) 549
GENERAL 551
PROCEDURES 551
CALIBRATION SCREWS 551
FIXED AND SLIDING SHEAVES 552
GOVERNOR CUP 554
RAMPS 555
SPRING 556
CENTRIFUGAL LEVERS 557
BUSHINGS 558
05 – DRIVE PULLEY (TRA IV) 561
GENERAL 563
PROCEDURES 563
CALIBRATION SCREWS 563
FIXED AND SLIDING SHEAVES 564
GOVERNOR CUP 566
RAMPS 567
SPRING 568
CENTRIFUGAL LEVERS 569
BUSHINGS 569
06 – DRIVEN PULLEY(IBC 5100 AND IBC VSA 6000) 573
GENERAL 575
PROCEDURES 575
DRIVEN PULLEY 575
07 – DRIVEN PULLEY (LPV 27) 579
GENERAL 581
PROCEDURES 581
DRIVEN PULLEY 581
08 – PULLEY ALIGNMENT 587
GENERAL 587
PULLEY ALIGNMENT SPECIFICATIONS 587
PROCEDURES 588
09 – BRAKE (WT/SWT/SUV/TUV) 591
GENERAL 593
PROCEDURES 593
BRAKE FLUID 593
BRAKE PADS 593
BRAKE DISC 595
CALIPER 595
MASTER CYLINDER 596
BRAKE LIGHT SWITCH 596
10 – COUNTERSHAFT AND BRAKE (LT 440F) 599
GENERAL 600
PROCEDURES 600
BRAKE PADS 600

TABLE OF CONTENTS

CALIPER 601
BRAKE CABLE 601
BRAKE DISC 601
BRAKE LIGHT SWITCH 602
COUNTERSHAFT 602
COUNTERSHAFT BEARING 602
11 – CHAINCASE (LT 440F) 603
GENERAL 605
MAINTENANCE 605
CHAINCASE OIL 605
DRIVE CHAIN ADJUSTMENT 605
PROCEDURES 606
CHAINCASE 606
CHAIN TENSIONER 607
CHAIN TENSIONER ROLLER BEARING 607
12 – GEARBOX (WT/SWT/SUV/TUV) 609
GENERAL 614
MAINTENANCE 614
GEARBOX OIL 614
PROCEDURES 615
GEARBOX 615
13 – DRIVE AXLE 627
GENERAL 631
PROCEDURES 631
DRIVE AXLE 631
DRIVE AXLE BEARING 632
SPROCKETS 633
14 – TRACK 635
TRACK 635

11 SUSPENSION
01 – FRONT SUSPENSION (LT/WT/SWT) 639
GENERAL 640
PROCEDURES 640
SHOCK ABSORBER AND SPRING 640
02 – FRONT SUSPENSION (SUV/TUV) 643
GENERAL 644
PROCEDURES 644
SHOCK ABSORBER 644
SWING ARM 644
SKI LEG 645
UPPER AND LOWER ARMS 645
03 – REAR SUSPENSION (LT/WT/SWT) 647
GENERAL 649
PROCEDURES 649
REAR AXLE 649
EXTENSION ARM 649
REAR SHOCK ABSORBER 650
REAR SPRING 650
REAR ARM 651
FRONT SHOCK ABSORBER 651
FRONT SPRING 651
SUPPORT PLATE 652
SLIDER SHOE 652
SUSPENSION ASSEMBLY 653

TABLE OF CONTENTS

04 – REAR SUSPENSION (SUV/TUV) **655**
SUSPENSION REMOVAL 656
SUSPENSION DISASSEMBLY AND ASSEMBLY 656
SUSPENSION INSTALLATION 657
SUSPENSION LUBRICATION 658
05 – SHOCK ABSORBER INSPECTION AND SERVICING **659**
SHOCK ABSORBER 659

12 STEERING
01 – STEERING AND HANDLEBAR **661**
GENERAL 667
PROCEDURES 667
HANDLEBAR GRIP 667
HANDLEBAR 668
HANDLEBAR EXTENSION 668
TIE-ROD 668
STEERING ARM 669
STEERING COLUMN 670
02 – SKIS AND STEERING ALIGNMENT **671**
GENERAL 672
ADJUSTMENT 672
STEERING ALIGNMENT 672
PROCEDURES 674
SKI RUNNER 674
SKI 674

13 BODY/FRAME
01 – BODY **677**
PARTS REPLACEMENT 677
DECAL 677
HOOD 677
FRONT BUMPER 678
BOTTOM PAN 678
WINDSHIELD 678
CONSOLE 679
SEAT 679
BACKREST 679
CLEANING 679
SEAT 679
PLASTIC 680
REPAIR 680
REPAIR PROCEDURE FOR R.R.I.M. 683
02 – FRAME **683**
PROCEDURES 683
SELF-PIERCING RIVETS 683
POP RIVETS 683
FRAME 683

TABLE OF CONTENTS

14 TECHNICAL SPECIFICATIONS

01 – 440F AND 550F MODELS 685
02 – 600 MODELS 693
03 – 600 HO SDI MODELS 697
04 – V800 MODELS 701

15 ELECTRICAL CONNECTORS AND WIRING DIAGRAMS

01 – ELECTRICAL CONNECTORS 707
PROCEDURES 709
TAB AND RECEPTACLE CONNECTORS 709
SUMITOMO CONNECTOR 710
DEUTSCH CONNECTORS 710
PACKARD CONNECTOR 711
PACKARD 24-CIRCUIT AND 32-CIRCUIT CONNECTOR 711
AMP MULTILOCK CONNECTOR 712
AMP 8-CIRCUIT CONNECTOR 713
KOSTAL ECM CONNECTOR "A" AND "B" 713
BATTERY CABLE TERMINAL 717
02 – WIRING DIAGRAMS 719
WIRE COLORS 719

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2007 Ski-Doo snowmobiles. See model list on next page.

This edition was primarily published to be used by snowmobile mechanic technicians who are already familiar with all service procedures relating to Bombardier Recreational Products Inc. (BRP) made snowmobiles. Mechanic technicians should attend continuous training courses given by B.R.P.T.I.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This manual uses technical terms which may be slightly different from the ones used in the *PARTS CATALOG*.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. Service and Warranty Bulletins may be published to update the content of this manual. Make sure to read and understand them. It does not included dealer modifications, whether authorized or not by BRP, after manufacturing the product.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

⚠ WARNING

Unless otherwise specified, engine should be turned OFF and cold for all maintenance and repair procedures.

This manual emphasizes particular information denoted by the wording and symbols:

⚠ WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of information will promote its correct use. Always use common shop safety practice.

This information relates to the preparation and use of BRP snowmobile and has been utilized safely effectively by BRP. However, Bombardier Recreational Products Inc. (BRP) disclaims liability for all ages and/or injuries resulting from the improper use of the contents. We strongly recommend that services be carried out and/or verified by a highly skilled professional mechanic. It is understood certain modifications may render use of the vehicle illegal under existing federal, provincial and state ulations.

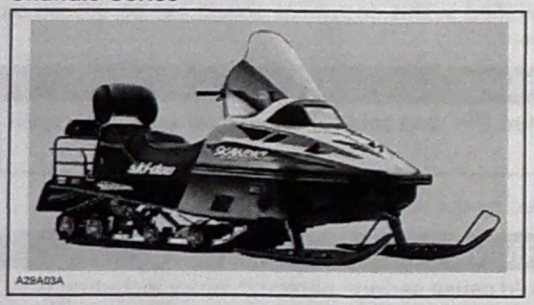
INTRODUCTION

GENERAL INFORMATIONS

This shop manual covers the following BRP made 2007 Skandic and Expedition TUV models:

MODEL	ENGINE TYPE
Expedition TUV 600 HO SDI	593 HO SDI
Expedition TUV V800	V810
Skandic LT 440F	443
Skandic SUV 550F	552
Skandic SUV 600	593
Skandic SWT 550F	552
Skandic SWT V800	V810
Skandic WT 550F	552
Skandic WT 600	593

Skandic Series



TYPICAL

Expedition TUV



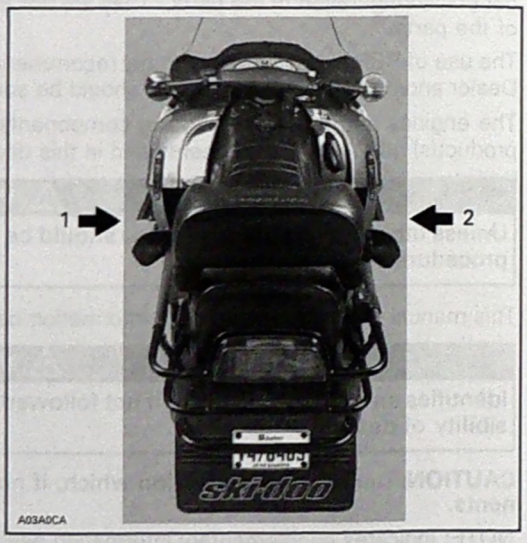
TYPICAL

The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

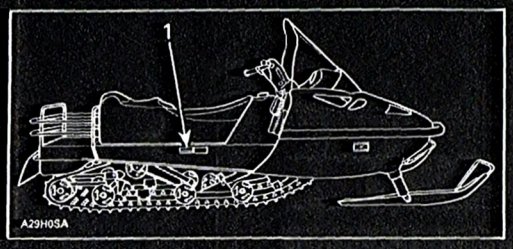
The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on vehicle).



TYPICAL
1. Left
2. Right

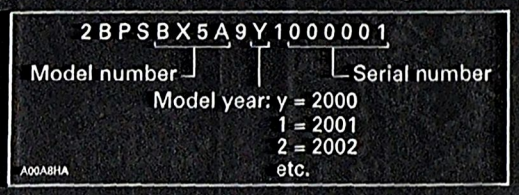
VEHICLE IDENTIFICATION NUMBER

Vehicle Identification Number Location



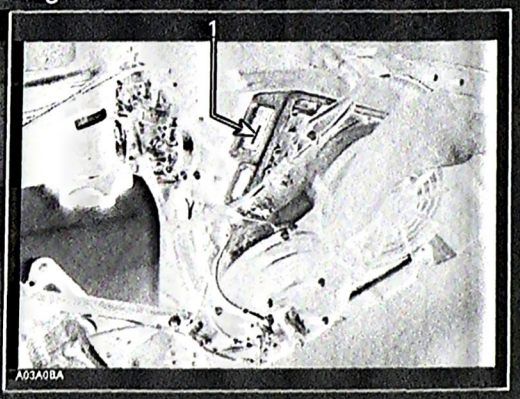
TYPICAL
1. Vehicle identification number

Identification Number Meaning

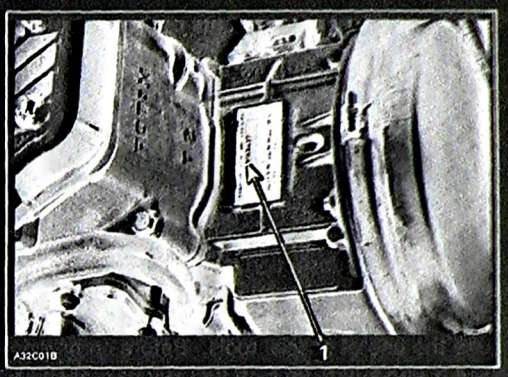


ENGINE SERIAL NUMBER

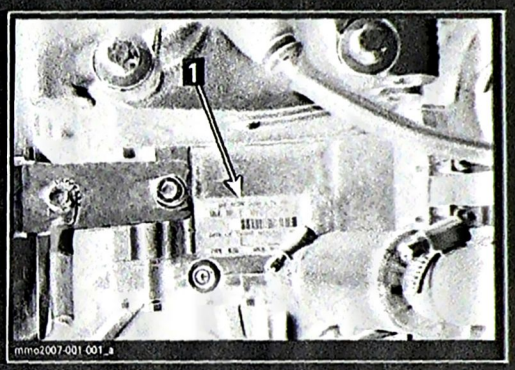
Engine Serial Number Location



TYPICAL — 2-STROKE FAN COOLED ENGINES
1. Engine serial number



TYPICAL — 2-STROKE LIQUID COOLED ENGINES
1. Engine serial number



TYPICAL — V800
1. Engine serial number

ARRANGEMENT OF THIS MANUAL, ILLUSTRATIONS AND PROCEDURES

The manual is divided into many major sections as you can see in the main table of contents at the beginning of the manual.

Each section is divided in various subsections, and again, each subsection has one or more division.

Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE

Page heading indicates section and subsection detailed.

Subsection title indicates beginning of the subsection.

Italic subtitle above exploded view indicates pertaining models.

Exploded view assists you in identifying parts and related positions.

Drop represents a service product to be applied to a surface. In this case Loctite 271 to screw threads.

Bold face number indicates special procedure concerning this part.

Illustration number for publishing process.

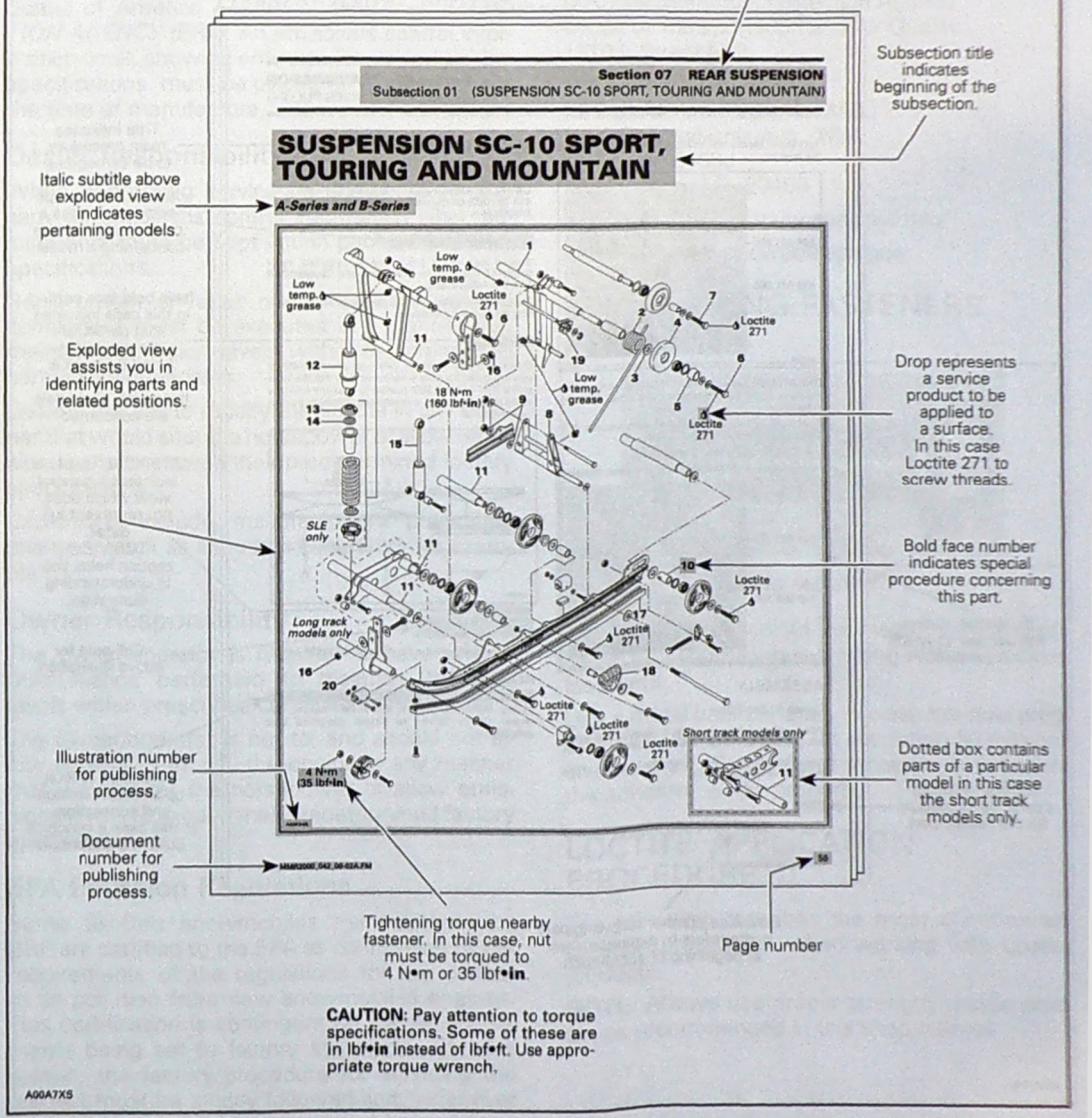
Document number for publishing process.

Dotted box contains parts of a particular model in this case the short track models only.

Tightening torque nearby fastener. In this case, nut must be torqued to 4 N•m or 35 lbf•**in**.

Page number

CAUTION: Pay attention to torque specifications. Some of these are in lbf•**in** instead of lbf•ft. Use appropriate torque wrench.



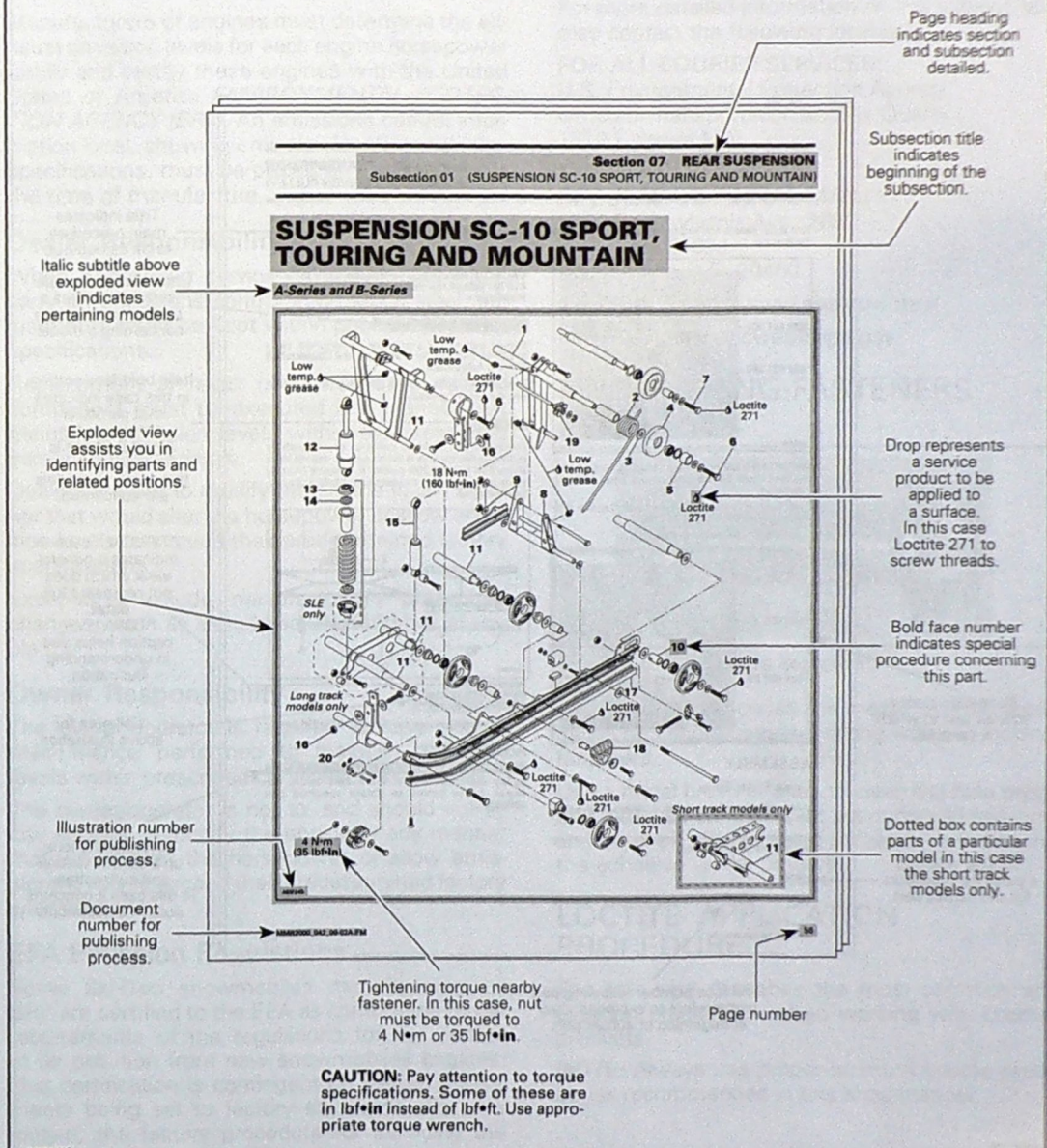
CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

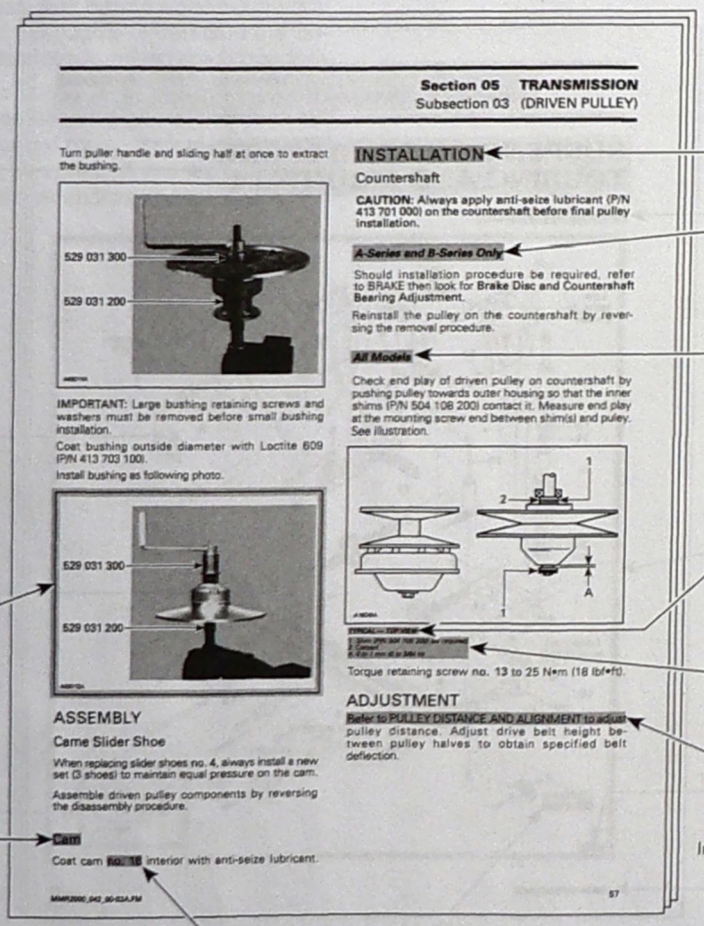
TYPICAL PAGE



CAUTION: Pay attention to torque specifications. Some of these are in lbf•**in** instead of lbf•ft. Use appropriate torque wrench.

A00A7X5

TYPICAL PAGE



Section 05 TRANSMISSION
Subsection 03 (DRIVEN PULLEY)

Turn puller handle and sliding half at once to extract the bushing.

529 031 300
529 031 200

IMPORTANT: Large bushing retaining screws and washers must be removed before small bushing installation.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Install bushing as following photo.

529 031 300
529 031 200

ASSEMBLY

Came Slider Shoe

When replacing slider shoes no. 4, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 18** interior with anti-seize lubricant.

MMR2000_042_00-03A.FM

57

INSTALLATION

Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

A-Series and B-Series Only

Should installation procedure be required, refer to BRAKE then look for **Brake Disc and Countershaft Bearing Adjustment.**

Reinstall the pulley on the countershaft by reversing the removal procedure.

All Models

Check end play of driven pulley on countershaft by pushing pulley towards outer housing so that the inner shims (P/N 504 108 200) contact it. Measure end play at the mounting screw end between shim(s) and puley. See illustration.

1
2
A
1

TYPICAL — TOP VIEW

1 Shim (P/N 504 108 200) as required
2 Cement
3 0 to 1 mm (0 to 3/64 in)

Torque retaining screw no. 13 to 25 N•m (18 lbf•ft).

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height between pulley halves to obtain specified belt deflection.

Title indicates main procedure to be carried-out.

Italic bold face type setting indicates a particular procedure concerning a model.

Italic bold face setting in this case indicates that particular procedure for A and B-Series is finished, so from this point, all models are concerned.

"TYPICAL" caption indicates a general view which does not represent full detail. "TOP VIEW" caption helps you in understanding illustration.

Call-outs for above illustration.

Reference to look up a certain section and subsection. In this case it concerns pulleys adjustment.

Illustration always follows text to which it pertains.

Subtitle indicates a particular procedure for the named part.

Bold face number following part name refers to exploded view at beginning of subsection.

A00A7YS

ENGINE EMISSIONS INFORMATION

Manufacturer's Responsibility

Manufacturers of engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States of America *ENVIRONMENTAL PROTECTION AGENCY (EPA).* An emissions control information label, showing emission levels and engine specifications, must be placed on each vehicle at the time of manufacture.

Dealer Responsibility

When performing service on snowmobiles that carry an emissions control information label, adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are not to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturer's prescribed changes, such as altitude adjustments for example.

Owner Responsibility

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is not to, and should not allow anyone to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

EPA Emission Regulations

Some Ski-Doo snowmobiles manufactured by BRP are certified to the EPA as conforming to the requirements of the regulations for the control of air pollution from new snowmobiles engines. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA requirements on exhaust emissions for snowmobiles products. For more detailed information on this subject, you may contact the following locations:

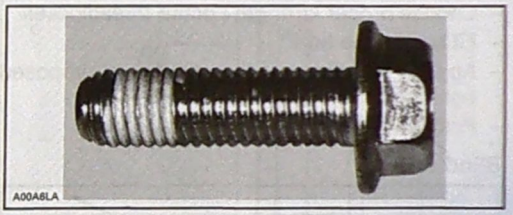
FOR ALL COURIER SERVICES:
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
1310 L Street NW
Washington D.C. 20005

REGULAR US POSTAL MAIL:
1200 Pennsylvania Ave. NW
Mail Code 6403J
Washington D.C. 20460

INTERNET: http://www.epa.gov/otaq/

E-MAIL: otaqpublicweb@epa.gov

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a tap to clean the hole properly then use a solvent, let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

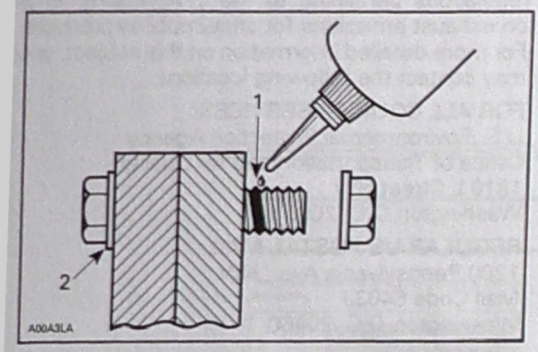
LOCTITE APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this shop manual.

Threadlocker

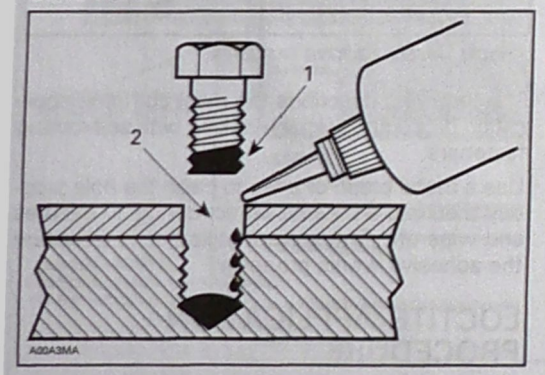
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

- Clean threads (bolt and nut) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
- Choose proper strength Loctite threadlocker.
- Fit bolt in the hole.
- Apply a few drops of threadlocker at proposed tightened nut engagement area.
- Position nut and tighten as required.

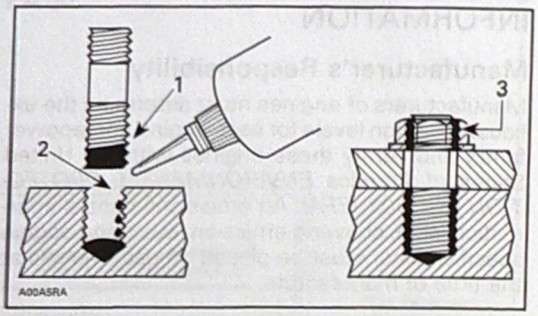
Blind Holes



1. On threads
2. On threads and at the bottom of hole

- Clean threads (bolt and hole) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
- Choose proper strength Loctite threadlocker.
- Apply several drops along the threaded hole and at the bottom of the hole.
- Apply several drops on bolt threads.
- Tighten as required.

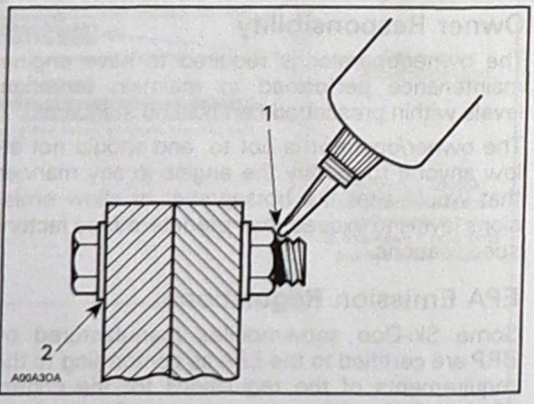
Stud in Blind Holes



1. On threads
2. On threads and in the hole
3. Onto nut threads

- Clean threads (stud and hole) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
- Put several drops of proper strength Loctite threadlocker on female threads and in hole.
- Apply several drops of proper strength Loctite on stud threads.
- Install stud.
- Install cover, etc.
- Apply drops of proper strength Loctite on uncovered threads.
- Tighten nuts as required.

Pre-Assembled Parts

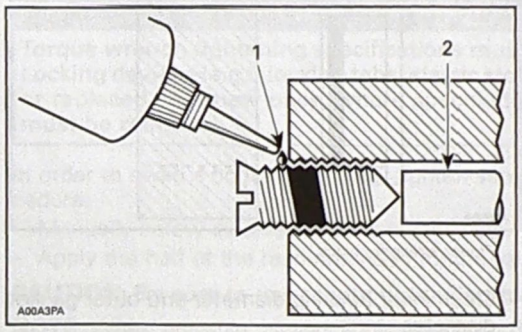


1. Apply here
2. Do not apply

- Clean bolts and nuts with solvent.
- Assemble components.
- Tighten nuts.
- Apply drops of proper strength Loctite on bolt/nut contact surfaces.
- Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw

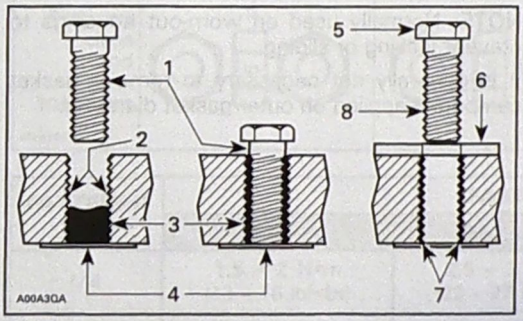


1. Apply here
2. Plunger

- Adjust screw to proper setting.
- Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
- Avoid touching metal with tip of flask.

NOTE: if it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

Stripped Thread Repair



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tapes
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

- Follow instructions on Loctite FORM-A-THREAD 81668 package.
- If a plate is used to align bolt:

a. Apply release agent on mating surfaces.

b. Put waxed paper or similar film on the surfaces.

- Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

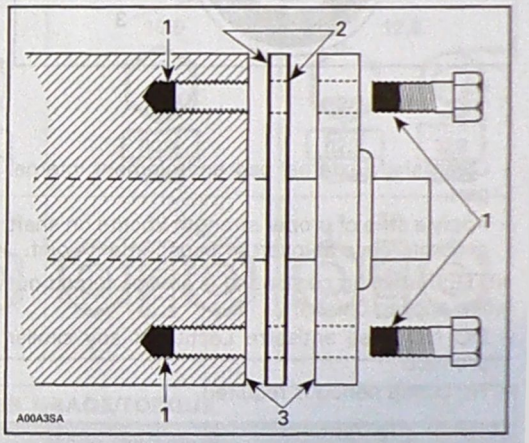
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

- Use a stud or thread on desired length.
- DO NOT apply release agent on stud.
- Do a STANDARD THREAD REPAIR.
- Allow to cure for 30 minutes.
- Assemble.

Gasket Compound



1. Proper strength Loctite
2. Loctite Primer N (P/N 293 800 041) and Gasket Eliminator 518 (P/N 293 800 038) on both sides of gasket
3. Loctite Primer N only

- Remove old gasket and other contaminants with Loctite Chisel remover (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

- Clean both mating surfaces with solvent.
- Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
- Apply GASKET ELIMINATOR 518 (P/N 293 800 038) on both sides of gasket, using a clean applicator.

– Place gasket on mating surfaces and assemble immediately.

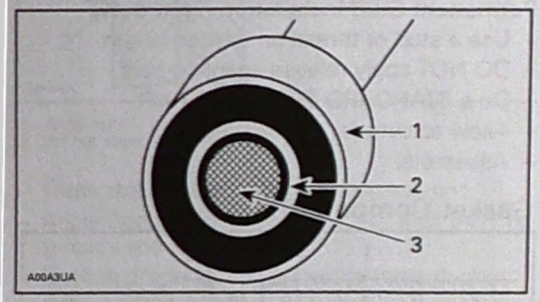
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

If holes are sunken, apply proper strength Loctite on bolt threads.

– Tighten as usual.

Mounting on Shaft

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

– Clean shaft external part and element internal part.
– Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

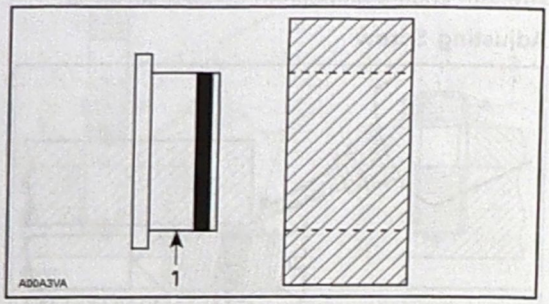
– DO NOT use antiseize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

1. Apply retaining compound on internal element bore.
2. Continue to assemble as shown above.

Case-In Components

Metallic Gaskets



1. Proper strength Loctite

– Clean inner housing diameter and outer gasket diameter.
– Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
– Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

– Install according to standard procedure.
– Wipe off surplus.
– Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table. The table also gives the metric conversion.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following procedure:

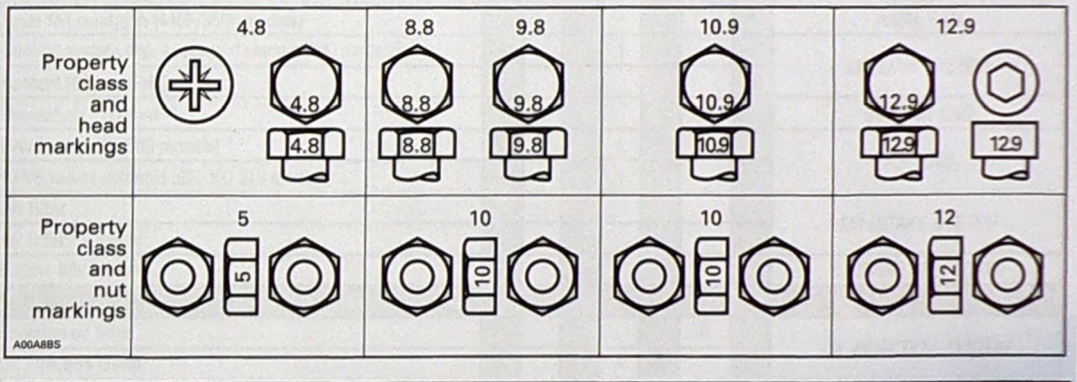
- Manually screw all screws, bolts and/or nuts.
- Apply the half of the recommended torque value.

CAUTION: Be sure to use proper tightening torque for the proper strength grade.

NOTE: When possible, always apply torque on the nut.

- Torque at the recommended torque value.

NOTE: Always torque screws, bolts and/or nuts in a criss-cross sequence.



FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	**8.8** Grade	**10.9** Grade	**12.9** Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•**in**)	4 – 5 N•m (35 – 44 lbf•**in**)
M5	3 – 3.5 N•m (27 – 31 lbf•**in**)	4.5 – 5.5 N•m (40 – 47 lbf•**in**)	7 – 8.5 N•m (62 – 75 lbf•**in**)	8 – 10 N•m (71 – 89 lbf•**in**)
M6	6.5 – 8.5 N•m (58 – 75 lbf•**in**)	8 – 12 N•m (71 – 106 lbf•**in**)	10.5 – 15 N•m (93 – 133 lbf•**in**)	16 N•m (142 lbf•**in**)
M8	15 N•m (11 lbf•ft)	24.5 N•m (18 lbf•ft)	31.5 N•m (23 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	72.5 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	127.5 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

MAINTENANCE CHART (440F/550F/600)

A: ADJUST
I: INSPECT
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION [1]	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	EVERY 2 YEARS OR 6000 KM (3700 mi)	STORAGE [1]	PRESEASON PREPARATION [1]	REFER TO SUBSECTION
ENGINE								
Rewind starter							I, L, C	REWIND STARTER
Engine support	I			I		I		ENGINE REMOVAL AND INSTALLATION
Exhaust system	I		I			I		EXHAUST SYSTEM
Exhaust manifold screws	I						I	
Axial fan condition (440F/550F models)							I	AXIAL FAN
Cooling system cap, hoses and clamps (600 models)	I			I			I	COOLING SYSTEM
Coolant (600 models)	I				R			
Crankshaft PTO seal [2]						I		BOTTOM END
RAVE valves [2] (600 models)				C				TOP END
RAVE valves solenoid (600 HO SDI models)				I				
Air filter			C				C	AIR INTAKE SYSTEM
Air intake silencer							I, C	
Engine lubrication						T		STORAGE PROCEDURE
LUBRICATION SYSTEM								
Injection oil filter			I			R		OIL INJECTION SYSTEM
Oil injection pump	A			A			A	
FUEL SYSTEM								
Add fuel stabilizer						T		STORAGE PROCEDURE
Fuel filter					R			FUEL TANK AND FUEL PUMP
Fuel lines, fuel rail and connections	I						I	
Carburetor (440F/550F/600 models)	A			A			A,C	VM CARBURETORS
Throttle cable	I			I			I	
Throttle body [2] (600 HO SDI models)							C	ENGINE MANAGEMENT
ELECTRICAL SYSTEM								
EMS fault codes [2] (600 HO SDI models)	I					I		ENGINE MANAGEMENT
Spark plugs [2] [4]	I		I				R	IGNITION SYSTEM
Battery (if so equipped)	I		I			I	I	CHARGING SYSTEM
Wiring harnesses and cables [2]	I		I			I		ELECTRICAL CONNECTORS
Operation of lighting system (HI/LO beam, taillight and brake light)	I	I				I		LIGHTS, INSTRUMENTS AND ACCESSORIES
Headlamp beam aiming				A				
Engine cut-out switch and tether cut-out switch operation test	I	I				I		IGNITION SYSTEM

A: ADJUST
I: INSPECT
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (1)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	EVERY 2 YEARS OR 6000 KM (3700 mi)	STORAGE (1)	PRESEASON PREPARATION (1)	REFER TO SUBSECTION
DRIVE SYSTEM								
Drive belt condition	I	I					I	DRIVE BELT
Drive belt height adjustment	EVERY BELT REPLACEMENT							
Drive and driven pulley	I		I	C		I	C	DRIVE PULLEY and DRIVEN PULLEY
Tightening torque of drive pulley screw	I			I			I	DRIVE PULLEY
Driven pulley preload	I			I		I		
Ramp pivot nut tightening	I							DRIVE PULLEY (COMET 102)
Ramp bushing				R				
Drive chain tension						I		CHAINCASE or GEARBOX
Chaincase or gearbox oil	I		I			R	I	
Drive axle end bearing (3)	L		L			L		DRIVE AXLE
Countershaft lubrication (3)	L		L			L		COUNTERSHAFT AND BRAKE
Track	I		I			I		TRACK
Track tension and alignment	A	AS REQUIRED						
BRAKE SYSTEM								
Brake fluid	I	I			R		I	BRAKE
Brake hose, pads and disk	I	I					I	
SUSPENSION								
Front suspension arms (3)	A, I,L		A, I	L		A, I,L		FRONT SUSPENSION
Rear suspension (3)	I		I,L			I,L		REAR SUSPENSION
Suspension stopper strap				I		I		
STEERING SYSTEM								
Steering (3)	I,L		I	L		I,L		STEERING AND HANDLEBAR
Wear and condition of skis and runners	I	I				I		SKIS AND STEERING ALIGNMENT
VEHICLE								
Vehicle cleaning and protection	T		T			T		STORAGE PROCEDURE

(1) To be performed by an authorized Ski-Doo dealer.

(2) Emission-related.

(3) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

(4) Before installing new spark plugs at preseason preparation, it is suggested to burn excess storage oil by starting the engine with the old spark plugs. Only perform this operation in a well-ventilated area.

MAINTENANCE CHART (V800)

A: ADJUST
I: INSPECT
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION [1]	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	EVERY 2 YEARS OR 6000 KM (3700 mi)	STORAGE [1]	PRESEASON PREPARATION [1]	REFER TO SUBSECTION
ENGINE								
Engine and oil filter	R			R				*LUBRICATION SYSTEM*
Valve adjustment	I, A			I, A				*CYLINDER AND HEAD*
Engine seals							I	*ENGINE*
Engine motor mounts	I			I		I		*ENGINE REMOVAL AND INSTALLATION*
Exhaust system	I		I			I		*EXHAUST SYSTEM*
Air filter			C				C	*AIR INTAKE SYSTEM*
Air intake silencer							I, C	
Cooling system cap, hoses and clamps	I			I			I	*COOLING SYSTEM*
Coolant	I				R			
Engine lubrication						T		*STORAGE PROCEDURE*
FUEL SYSTEM								
Add fuel stabilizer						T		*STORAGE PROCEDURE*
Fuel filter					R			*FUEL TANK AND FUEL PUMP*
Fuel lines and connections	I						I	*ENGINE MANAGEMENT*
Throttle body							C	
Throttle cable	I			I			I	
ELECTRICAL SYSTEM								
EMS fault codes	I					I		*ENGINE MANAGEMENT*
Spark plugs	I				R			*IGNITION SYSTEM*
Battery	I		I			I	I	*CHARGING SYSTEM*
Wiring harnesses and cables	I		I			I		*ELECTRICAL SYSTEM*
Headlamp beam aiming				A				*LIGHTS, INSTRUMENTS AND ACCESSORIES*
Operation of lighting system (HI/LO beam, taillight and brake light)	I	I				I		
Engine cut-out switch and tether cut-out switch operation test	I	I				I		

A: ADJUST
I: INSPECT
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (1)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	EVERY 2 YEARS OR 6000 KM (3700 mi)	STORAGE (1)	PRESEASON PREPARATION (1)	REFER TO SUBSECTION
DRIVE SYSTEM								
Drive belt	I	I					I	*DRIVE BELT*
Drive belt height adjustment	EACH BELT REPLACEMENT							
Drive and driven pulley	I		I	C		I	C	*DRIVE PULLEY* and *DRIVEN PULLEY*
Tightening torque of drive pulley screw	I			I			I	*DRIVE PULLEY*
Driven pulley preload	I			I			I	*DRIVEN PULLEY*
Gearbox oil	I		I			R	I	*CHAINCASE*
Drive axle end bearing (2)	L		L			L		*DRIVE AXLE*
Track	I	I				I		*TRACK*
Track tension and alignment	A	AS REQUIRED						
BRAKE SYSTEM								
Brake fluid	I	I			R		I	*BRAKE*
Brake hose, pads and disk	I	I					I	
SUSPENSION								
Front and rear suspensions	I		I,L			I, L		*FRONT SUSPENSION* and *REAR SUSPENSION*
Rear suspension stopper strap				I		I		
STEERING SYSTEM								
Steering mechanism (2)	I,L		I	L		I,L		*STEERING AND HANDLEBAR*
Wear and condition of skis and runners	I	I				I		*SKIS AND STEERING ALIGNMENT*
VEHICLE								
Vehicle cleaning and protection	T		T			T		*STORAGE PROCEDURE*

(1) To be performed by an authorized Ski-Doo dealer.

(2) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

STORAGE PROCEDURE (440F/550F/600)

SERVICE PRODUCTS

Description	Part Number	Page
fuel stabilizer	413 408 600	6
heavy duty cleaner	293 110 001	7
plastic & vinyl cleaner	413 711 200	7
scratch remover kit	861 774 800	7
storage oil (Canada)	413 711 600	6
storage oil (USA)	413 711 900	6
suspension grease	293 550 033	6–7
XP-S Lube	293 600 016	6–7

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from *MAINTENANCE CHART* jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts must be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle first.

ENGINE SYSTEM

Rewind Starter

For inspection, cleaning and lubrication, refer to *REWIND STARTER* section.

Engine Support

Check if engine support is cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mounts on engine support. Replace them if brittle, cracked or otherwise damaged.

Exhaust System

Check and replace if necessary:

- Tuned pipe shields and deflectors for damages.
- Tuned pipe ends for cracks or damages.
- Manifold for cracks or damages.

Engine

PTO Crankshaft Seal

Check PTO crankshaft seal for leak. Replace seals if required.

Engine Lubrication

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period.

NOTE: Be sure to add fuel stabilizer to a full tank of fuel before starting the engine (see details further in *FUEL SYSTEM*).

Proceed as follows:

- Place the vehicle in a well ventilated area and start the engine.

⚠ WARNING

Ensure the track is free of particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

- Allow engine to run at idle speed until it reached its operating temperature.
- Stop the engine.
- Remove the primary air intake silencer. Refer to *AIR INTAKE SYSTEM* for the removal procedure.
- Restart engine and run at idle speed.

- Inject storage oil into each carburetor/throttle body until the engine stalls or until a sufficient quantity of oil has entered the engine (approximately half a can).
- With the engine stopped, remove the spark plugs and spray storage oil (Canada) (P/N 413 711 600) or storage oil (USA) (P/N 413 711 900) into each cylinder.
- Crank slowly 2 or 3 revolutions to lubricate cylinders.
- Reinstall the spark plugs and primary air intake silencer.

LUBRICATION SYSTEM

Injection Oil Filter

Replace injection oil filter, refer to *OIL INJECTION SYSTEM* section.

FUEL SYSTEM

Fuel Stabilizer

It is critical to use the fuel stabilizer (P/N 413 408 600) (250 mL) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank prior to starting engine for internal parts lubrication so that stabilizer flows everywhere in fuel system. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system (if so equipped).

Do not drain fuel system.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure carburetor protection against varnish deposit.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. Never use an open flame to check fuel level. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle. Periodically inspect fuel system.

DRIVE SYSTEM

Drive and Driven Pulleys

After inspection and interior cleaning of pulleys, spray XP-S Lube (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

Skandic WT, SWT, SUV and Expedition TUV

Check the driven pulley preload. Refer to *DRIVEN PULLEY*.

Chaincase

Skandic LT 440F

Check drive chain tension and adjust if necessary. Replace chaincase oil. Refer to *CHAINCASE* section.

Gearbox Oil

Skandic WT, SWT, SUV and Expedition TUV

Replace gearbox oil, refer to *GEARBOX* section.

Drive Axle End Bearing

Lubricate end housing bearing with suspension grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.

Track

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

Replace damaged or missing cleats by new ones.

If track is damaged or rods are broken, replace track.

NOTE: Do not release track tension.

STEERING SYSTEM

Steering Mechanism

Lubricate the steering mechanism if needed. **Inspect all components for tightness.**

Skis and Runners

Inspect skis and runners for wear, deterioration or damage.

SUSPENSION

Front Suspension

Inspect the front suspension arms for wear or damages, replace if necessary. Refer to *FRONT SUSPENSION*.

Lubricate front suspension arms.

Rear Suspension

Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace if necessary.

Lubricate front and rear arms at grease fittings using suspension grease (P/N 293 550 033).

ELECTRICAL SYSTEM

EMS Fault Codes

600 HO SDI Models

Using B.U.D.S., verify if fault codes appear in the EMS. Repair or replace defective parts.

Battery (if so equipped)

Remove battery, clean its tray and surrounding area with water and baking soda.

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casing is damaged, replace battery.

Charge battery as explained in *CHARGING SYSTEM* section.

Wiring Harnesses, Cables and Connectors

Inspect for wear, deterioration or damage, replace defective parts if necessary.

Lighting System and Switches

Check operation of lighting system (HI/LO beam, brake light, etc.).

Check if engine and tether cord cutout switches work properly.

VEHICLE

Vehicle Cleaning

Clean the engine compartment. Remove grass, twigs, cloth, etc. These are combustible under certain conditions.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid further damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (P/N 293 110 001).

CAUTION: Do not use heavy duty cleaner on decals or vinyl.

For vinyl and plastic parts use plastic & vinyl cleaner (P/N 413 711 200).

To remove scratches on windshield use scratch remover kit (P/N 861 774 800) or any good extra-fine rubbing compound and wax product.

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched or worn off.

Spray all bare metal parts including shock rods with XP-S Lube (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection. Use a non-abrasive wax such as silicone wax.

NOTE: Apply non-abrasive wax on glossy finish only.

Vehicle Protection

Block air intake and muffler with clean rags.

Protect the vehicle with an approved cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

STORAGE PROCEDURE (V800)

SERVICE PRODUCTS

Description	Part Number	Page
BRP fuel stabilizer	413 408 600	10
heavy duty cleaner	293 110 001	11
plastic & vinyl cleaner	413 711 200	11
scratch remover	861 774 800	11
suspension grease	293 550 033	10
XP-S Lube	293 600 016	10–11
XP-S storage oil (USA)	413 711 900	9
XP-S storage oil	413 711 600	9

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from *MAINTENANCE CHART* jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts should be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle first.

PROCEDURES

ENGINE

Engine Support

Check if engine support is cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mounts on engine support. Replace them if brittle, cracked or otherwise damaged.

Exhaust System

Check and replace if necessary:

- Tuned pipe shield for damages.
- Tuned pipe ends for cracks or damages.
- Manifold for cracks or damages.

Engine

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period.

NOTE: Be sure to add fuel stabilizer before starting the engine.

Proceed as follows:

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

Stop the engine.

Change engine oil and filter. Refer to *LUBRICATION SYSTEM.*

With the engine stopped, remove spark plugs and spray XP-S storage oil (P/N 413 711 600) into each cylinder.

NOTE: For US citizens, use the XP-S storage oil (USA) (P/N 413 711 900) only.

CAUTION: Do not inject storage oil into throttle body bore to avoid blocking idle bypass valve.

Press start button, 1 or 2 seconds maximum, to lubricate cylinder.

Reinstall the spark plugs.

⚠ WARNING

This procedure must only be performed in a well-ventilated area. Do not run engine during storage period.

FUEL SYSTEM

Fuel Stabilizer

It is critical to use the BRP fuel stabilizer (P/N 413 408 600) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank **prior to starting engine** for internal parts lubrication so that stabilizer flows everywhere in fuel system. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

Do not drain fuel system.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle.

ELECTRICAL SYSTEM

EMS Fault Codes

Using B.U.D.S., verify if fault codes appear in the EMS. Repair or replace defective parts.

Lighting System and Switches

Check operation of lighting system (HI/LO beam, brake light, etc.).

Check if engine cutout switch and tether cord cutout switch work properly.

Battery

Remove battery, clean its tray and close area with water and baking soda.

Inspect, clean and charge battery as explained in *CHARGING SYSTEM.*

Wiring Harnesses, Cables and Connectors

Inspect for wear, deterioration or damage, replace defective parts if necessary.

DRIVE SYSTEM

Drive and Driven Pulleys

After inspection and interior cleaning of pulleys, spray XP-S Lube (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

Gearbox

Replace gearbox oil, refer to *DRIVE SYSTEM* section.

Drive Axle End Bearing

Lubricate end housing bearing with suspension grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on end cap.

Track

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

Replace damaged or missing cleats by new ones.

If track is damaged or rods are broken, replace track.

NOTE: Do not release track tension.

SUSPENSION

Front Suspension

Inspect front suspension components for tightness, wear, deterioration or damage, replace defective parts if necessary.

Lubricate ski legs if needed with suspension grease (P/N 293 550 033).

Rear Suspension

Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.

Lubricate front and rear arms at grease fittings using suspension grease (P/N 293 550 033).

Suspension Stopper Strap

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace if necessary.

STEERING

Steering Mechanism

Lubricate the steering mechanism if needed. **Inspect all components for tightness.**

Skis and Runners

Inspect skis and runners for wear, deterioration or damage.

VEHICLE

Vehicle Cleaning

Clean the engine compartment. Remove grass, twigs, cloth, etc. These are combustible under certain conditions.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid further damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (P/N 293 110 001).

CAUTION: Do not use this product on decals or vinyl.

For vinyl and plastic parts use plastic & vinyl cleaner (P/N 413 711 200).

To remove scratches on windshield or hood use scratch remover (P/N 861 774 800).

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched off.

Spray all bare metal parts including shock chromed rods with XP-S Lube (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection. Use a non-abrasive wax such as silicone wax.

NOTE: Apply non-abrasive wax on glossy finish only.

Vehicle Protection

Block air intake and exhaust system using clean rags.

Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

PRESEASON PREPARATION

SERVICE PRODUCTS

Description	Part Number	Page
pulley flange cleaner	413 711 809	14
XP-S chaincase oil	413 801 900	14
XP-S synthetic chaincase oil	413 803 300	14

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than one month.

Refer to preseason preparation column from *MAINTENANCE CHART* jointly with the present preseason preparation procedure in order to cover each and every aspect of the snowmobile preseason preparation procedure.

Any worn, broken or damaged parts found during the storage procedure should have been replaced. If not, proceed with the replacement.

⚠ WARNING

Unless otherwise specified, engine should be turned off for preparation procedure.

ENGINE

Rewind Starter

440F, 550F and 600 Models

Check if rope is fraying.

When pulling starter grip, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

Exhaust Manifold

Check exhaust manifold screws for looseness. Re-torque if necessary.

Muffler

Remove rags that were installed during storage preparation.

Axial Fan

440F and 550F Models

Inspect fan belt, adjust or replace if required.

Cooling System

600 and V800 Models

Inspect cooling system for leaks, to perform a cooling system leak test, refer to *COOLING SYSTEM*.

Check coolant level in coolant reservoir. Add coolant if necessary.

If engine is cold, refill up to 15 mm (5/8 in) over COLD level line.

If engine is hot, refill up to 25 mm (1 in) over COLD level line. Use caution when opening pressurized coolant reservoir cap. Place a rag over cap and turn it slowly to release pressure.

Engine Seals

V800 Models

Make sure there is no oil coming out from engine seals.

Air Filter and Air Intake Silencer

Remove rags that were installed for storage.

Check that inside of air silencer is clean and dry then properly reinstall the filter.

CAUTION: These snowmobiles have been calibrated with the filter installed. Operating the snowmobile without it, may cause engine damage.

LUBRICATION SYSTEM

440F, 550F and 600 Models

Oil Injection Pump

Make sure oil injection pump is properly adjusted, refer to *OIL INJECTION PUMP*.

FUEL SYSTEM

Fuel Lines, Fuel Rails and Connections

Inspect fuel system for leaks. Perform a fuel system leak test, refer to *FUEL TANK AND FUEL PUMP*.

Carburetors

440F, 550F and 600 Models

Disassemble carburetors in order to clean all internal parts. Do not hesitate to replace any jets having gum or varnish on their surfaces.

Make sure carburetors are properly adjusted, refer to *VM CARBURETORS (440F, 550F AND 600)*.

Throttle Body

600 HO SDI and V800 Models

Using the pulley flange cleaner (P/N 413 711 809), clean the throttle plates and throttle body bores.

NOTE: To ease cleaning, throttle body should be partially pulled from engine, without disconnecting throttle cable or coolant hose.

CAUTION: Ensure the cleaner does not enter engine intake.

Throttle Cable

Verify adjustment and make sure that cable operates freely. Refer to *VM CARBURETORS (440F, 550F AND 600)* or *ENGINE MANAGEMENT*.

Choke Cable

440F, 550F and 600 Models

Verify adjustment and make sure that cable operates freely. Refer to *VM CARBURETORS (440F, 550F AND 600)*.

DRIVE SYSTEM

Drive Belt

Inspect belt for cracks, fraying or abnormal wear. Replace if necessary.

Make sure to install the proper belt with arrow printed on belt pointing front of vehicle.

Drive and Driven Pulleys

Clean drive and driven pulleys sheaves with pulley flange cleaner (P/N 413 711 809).

Check if the drive pulley screw is properly torqued. Refer to *DRIVE PULLEY* for torquing procedure.

Brake

Brake Fluid

Check brake fluid in reservoir for proper level. Add fluid (DOT 4) as required.

CAUTION: Use only (DOT 4) brake fluid from a sealed container. Do not store or use a started bottle of brake fluid.

Brake Hose, Pads and Disk

Inspect brake hose for wear, deterioration or damage, replace if necessary.

Inspect brake pads for proper thickness. Refer to *BRAKE*.

Remove any rust built-up on braking surfaces. Clean brake disk braking surfaces with pulley flange cleaner (P/N 413 711 809).

Chaincase

440F Models

Check oil for proper level. Add recommended chaincase oil as required.

MODEL	CHAINCASE OIL
440F	XP-S chaincase oil (P/N 413 801 900)

Gearbox

550F, 600 and V800 Models

Check oil for proper level. Add recommended gearbox oil as required.

MODEL	CHAINCASE OIL
550F	XP-S chaincase oil (P/N 413 801 900)
600 AND V800	XP-S synthetic chaincase oil (P/N 413 803 300)

Track

Verify track tension and alignment, refer to *TRACK*.

NOTE: Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

ELECTRICAL SYSTEM

Battery (if so equipped)

Verify that battery is fully charged, if not, refer to the appropriate charging procedure in *CHARGING SYSTEM*.

Spark Plugs

440F, 550F and 600 Models

Once preseason preparation is done, start engine with the old spark plugs to burn excess storage oil. Then, install new properly gapped spark plugs.

NOTE: Ensure to replace with recommended spark plugs.

ENGINE (443/552/593)

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For **600 HO SDI** engine, refer also to *ENGINE MANAGEMENT (SDI).*

ENGINE GENERAL

Symptom: **ENGINE BACKFIRES.**

1. **Check spark plugs.**
   - *Carbon accumulation caused by defective spark plug(s). Clean carbon accumulation from piston and cylinder head and install dry properly gapped spark plug(s).*
2. **Check ignition timing.**
   - *Timing is too advanced. Set timing according to specifications (refer to IGNITION SYSTEM).*
3. **Check for erratic sparks.**
   - *Poor electrical connections. Repair.*
   - *Faulty stator. Replace defective parts.*
4. **Check carburetor.**
   - *Fuel passages obstructed. Clean carburetor and install new strainer or filter.*
   - *Fuel level too low. Adjust float level according to specifications.*
5. **Check axial fan (443/552 engines)**
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN).*
   - *Dirty cooling fins or blocked air ducts. Clean.*
6. **Check cooling system (593 Engine).**
   - *Low antifreeze level. Adjust antifreeze level. Proceed with a leakage test (refer to COOLING SYSTEM) and repair as required.*
   - *Defective tank cap. Replace cap.*
   - *Defective thermostat. Replace thermostat.*
   - *Air in system. Bleed system.*

Symptom: **ENGINE SUDDENLY TURNS OFF AT HIGH RPM AND/OR WITH LIGHT LOAD.**

1. **Check spark plugs.**
   - *Non-resistor type spark plugs installed.*
2. **Check that ground wires are well connected.**
   - *Loose or corroded ground.*

Symptom: **ENGINE SUDDENLY TURNS OFF.**

1. **Check if engine is leaking.**
   - *Damaged gasket and/or seal. Refer to ENGINE LEAK TEST. Replace defective parts.*
2. **"Four-corner" seizure of piston(s).**
   - *High acceleration when engine is cold. Piston expands faster than cylinder. Replace piston(s). Ask driver to refer to the WARM-UP PROCEDURE in the OPERATOR'S GUIDE.*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

3. **Piston(s) seizure on exhaust side (color on piston dome is correct).**
   - *Kinked fuel tank vent tube. Relocate fuel tank vent tube.*
   - *Leaks at fuel line connections or damaged fuel lines. Replace defective lines.*
   - *Fuel does not flow through carburetor(s) (foreign particles in needle area and/or varnish formation in carburetor(s)). Clean carburetor(s) and install new strainer or filter.*
   - *Spark plug heat range is too warm. Install spark plugs with appropriate heat range (refer to TECHNICAL SPECIFICATIONS).*
   - *Improper ignition timing. Adjust according to specifications (refer to IGNITION TIMING).*
   - *Restriction in exhaust system. Replace.*
   - *Compression ratio is too high. Install genuine parts.*
   - *Too low fuel octane number. Use proper fuel octane number.*
   - *Carburetor calibration is too lean. Adjust according to specifications (refer to VM CARBURETORS).*
   - *Improper reed valve adjustment or damage. Adjust according to specifications (refer to appropriate ENGINE subsection) and/or install BRPs recommended reed valve.*
   - *Poor quality oil. Use proper BRP's XP-S injection oil.*
   - *Leaks at air intake silencer. Replace air intake silencer grommets.*
   - *Excessive wear of piston rings. Replace piston rings.*
4. **Melted and/or perforated piston dome; melted section at ring end gap.**
   - *When piston reaches TDC, mixture is ignited by heated areas in combustion chamber. This is due to an incomplete combustion of a poor quality oil. Clean residue accumulation in combustion chamber and replace piston(s). Use proper BRP's XP-S injection oil.*
   - *Spark plug heat range is too high. Install recommended dry properly gapped spark plugs (refer to TECHNICAL SPECIFICATIONS).*
   - *Ignition timing is too advanced. Adjust according to specifications (refer to IGNITION SYSTEM).*
   - *Inadequate fuel quality. Use appropriate fuel.*
   - *Carburetion is too lean. Adjust according to specifications (refer to VM CARBURETORS).*
5. **Seized piston all around the circumference (dry surface).**
   - *Lack of oil, damaged oil line or defective injection pump. Replace defective part(s).*
6. **Grooves on intake side of piston only.**
   - *Oil film eliminated by water (snow infiltration in engine). This can also be caused by running engine on choke for too long. Excessive fuel will remove the oil film on the piston and make marks. Replace piston(s) and check if intake system leaks.*
7. **Piston color is dark due to seizure on intake and exhaust sides.**
   - *Loose fan belt. Adjust its tension and/or replace.*
   - *Cooling system leaks and lowers coolant level. Proceed with a leakage test (refer to COOLING SYSTEM) and repair as required. Add coolant in cooling system until appropriate level is reached.*
   - *Accumulation of foreign particles in needle valve and/or main jet area. Clean carburetor(s).*
8. **Cracked or broken piston(s).**
   - *Cracked or broken piston(s) due to excessive piston/cylinder clearance or engine over-revving. Check piston/cylinder clearance (refer to TOP END). Replace piston(s).*

ymptom: **PISTON RING AND CYLINDER SURFACES ARE SCRATCHED.**

1. **Check oil quality.**
   - *Poor quality oil. Use proper BRP's XP-S injection oil.*
2. **Check injection pump and its hoses.**
   - *Inadequate injection pump adjustment and/or defective hoses. Adjust pump according to specifications (refer to OIL INJECTION SYSTEM) and/or replace hoses.*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. **Check spark plug condition and gap.**
   - *Fouled spark plugs or wrong spark plug gap. Replace or readjust gap.*
2. **Check if there is water in fuel.**
   - *There is water in fuel. Drain fuel system, then fill with appropriate fuel.*
3. **Check proper operation of RAVE valves (RAVE equipped engines).**
   - *Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER). Repair.*
4. **Check items listed in *ENGINE RUNS OUT OF FUEL* (refer to *FUEL AND OIL SYSTEMS* subsection).**
5. **Check carburetor adjustments and cleanliness.**
   - *Inadequate carburetor adjustments or dirt accumulation. Clean and adjust according to specifications (refer to VM CARBURETORS).*
6. **Check drive belt.**
   - *Worn belt. Replace belt if width is 3 mm (1/8 in) less than nominal dimension (refer to DRIVE BELT).*
7. **Check track adjustment.**
   - *Too much tension and/or improper alignment. Align track and adjust its tension to specifications (refer to TRACK).*
8. **Check drive pulley.**
   - *Improper calibration screw adjustments (TRA pulley) and/or worn bushing(s). Adjust according to specifications (refer to DRIVE PULLEY) and/or replace bushing(s).*
9. **Check driven pulley.**
   - *Worn bushing and/or spring tension. Replace spring and/or adjust its tension according to specifications (refer to DRIVEN PULLEY).*
10. **Check exhaust system.**
    - *Restriction or exhaust system leakage. Replace or reseal with Loctite 5920 RTV high temperature sealant (P/N 293 800 090).*
11. **Check ignition timing.**
    - *Decrease in power due to delayed ignition. Adjust according to specifications (refer to IGNITION SYSTEM).*
12. **Check engine compression.**
    - *Worn piston(s) and ring(s). Replace.*
13. **Check if engine overheats.**
    - *Improper fan belt tension. Adjust fan belt (refer to AXIAL FAN).*
    - *Coolant level is low, cap fails to pressurize system or air circulates through lines. Adjust level, replace cap or bleed cooling system.*
14. **Check reed valve.**
    - *Improper tightness and/or opening. Replace or adjust. (Refer to proper ENGINE subsection).*

Symptom: **ENGINE DETONATION AT MAXIMUM RPM.**

1. **Check which type of fuel is used.**
   - *Octane number is too low and/or alcohol level is too high. Use recommended fuel type.*
2. **Check spark plug type.**
   - *Improper spark plug heat range. Install recommended spark plugs (refer to TECHNICAL SPECIFICATIONS).*

Symptom: **ENGINE DETONATION AT MAXIMUM RPM.** (cont'd)

3. **Check exhaust system.**
   - *Too much restriction. Replace.*
4. **Check ignition timing.**
   - *Timing is too advanced. Adjust according to specifications (refer to IGNITION SYSTEM).*
5. **Check if engine is overheating. (Refer to *HIGH ENGINE OPERATING TEMPERATURE*).**
6. **Check carburetion.**
   - *Fouled and/or improper carburetor components. Clean or replace according to specifications (refer to VM CARBURETORS).*
7. **Check compression ratio and combustion chamber volume.**
   - *Compression ratio is too high. Install genuine parts.*

Symptom: **ENGINE TURNS OVER BUT FAILS TO START.**

1. **Check switches.**
   - *Ignition switch, emergency cut-out switch or tether switch is OFF. Place all switches in the RUN or ON position. If it still does not work, connect DESS switch WH/GN and WH/BK wires together (harness side).*
2. **Check fuel level.**
   - *Mixture too lean to start cold engine. Check fuel tank level and use choke.*
3. **Check spark plug.**
   - *Defective spark plug (no spark) or wrong spark plug gap. Replace spark plugs or readjust gap.*
   - *Flooded engine (spark plug wet when removed). Do not overprime or overchoke. Remove wet spark plugs, turn ignition switch to OFF and crank engine several times. Install clean dry properly gapped spark plugs. Start engine following usual starting procedure.*
4. **Check fuel lines.**
   - *No fuel to the engine (spark plugs dry when removed). Check fuel tank level; turn fuel valve on if applicable; check fuel filter and strainer, replace if clogged; check condition of fuel and impulse lines and their connections.*
5. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s) (e.g.: piston(s), ring(s), etc.).*

Symptom: **IRREGULAR ENGINE IDLE (normal use after engine warm up).**

1. **Check choke.**
   - *Choke plunger may be partially opened. Readjust.*
2. **Check carburetor adapter.**
   - *Air enters through a crack. Replace.*
3. **Check air screw position.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
4. **Check dimension of pilot jet.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
5. **Check reed valve.**
   - *Improper tightness and/or opening. Replace or adjust. Refer to proper ENGINE subsection.*
6. **Check if engine is leaking.**
   - *Leaking gaskets allow air to enter in engine. Refer to ENGINE LEAK TEST. Replace defective parts.*

Symptom: **IRREGULAR ENGINE IDLE (normal use after engine warm up).** (cont'd)

7. **On models with carburetors, check throttle slide height.**
   - *Incorrect throttle slide height. Readjust according to specifications.*
8. **On SDI models, check cleanness of throttle body.**
   - *Deposits inside throttle body. Clean throttle body bores and plates.*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (fan cooled engines).**

1. **Check condition and heat range of spark plugs.**
   - *Melted spark plug tip or inadequate heat range. Replace.*
2. **Check fan belt and axial fan.**
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN).*
   - *Dirty cooling fins or blocked air ducts. Clean.*
3. **Check if there are leak at air intake silencer and/or engine crankcase.**
   - *Leak(s). Repair or replace.*
4. **Check carburetion.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS) or replace inadequate component(s).*
5. **Check ignition timing.**
   - *Ignition timing is too advanced. Adjust according to specifications (refer to IGNITION SYSTEM).*
6. **Check cylinder O-rings.**
   - *Worn O-rings. Replace.*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (liquid cooled engines).**

1. **Check coolant level and check if there is air infiltration in the system or if there are leaks in gasket areas.**
   - *Low coolant level or air in system. Add coolant until recommended level is reached, bleed system and/or tighten clamps.*
2. **Check temperature gauge sensor.**
   - *False reading. Check terminal connections. If problem persists, replace sensor.*
3. **Check if heat exchangers are clean.**
   - *Dirty heat exchangers. Clean heat exchangers.*
4. **Check if coolant flows through system properly.**
   - *Foreign particles and/or broken coolant pump impeller. Clean cooling system and/or replace coolant pump impeller.*
5. **Check antifreeze concentration.**
   - *Antifreeze concentration is too high. Adjust concentration according to BRP's recommendations.*
6. **Check thermostat.**
   - *Thermostat reacts slowly or not at all. Replace.*
7. **Check coolant tank cap.**
   - *Cap does not hold pressure. Replace.*
8. **Check condition and heat range of spark plugs.**
   - *Melted spark plug tip or inadequate heat range. Replace.*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (liquid cooled engines).** (cont'd)

9. **Check carburation.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS) or replace inadequate component(s).*
10. **Check ignition timing.**
   - *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
11. **Check if there are leaks at air intake silencer and/or engine crankcase.**
   - *Leak(s). Repair or replace.*

Symptom: **ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 to 1000 RPM slower).**

1. **Check RAVE valve pistons.**
   - *Valve piston(s) is (are) not screwed to the bottom. Screw valve piston(s) to bottom.*
2. **Check that valve moves freely.**
   - *Valve stuck in closed position. Clean.*
3. **Check RAVE valve stems.**
   - *Bent RAVE valve stem(s). Replace.*
4. **Check clamps or sleeves.**
   - *Damaged clamp(s) or sleeve(s). Replace.*
5. **Check RAVE valve hoses.**
   - *Hose leakage. Repair.*
6. **Check RAVE valve solenoid.**
   - *Defective solenoid. Check and replace.*

Symptom: **ENGINE EQUIPPED WITH RAVE. ENGINE HESITATES AT LOW OR MID-SPEED AND REACHES MAXIMUM PERFORMANCE ONLY AFTER A WHILE.**

1. **Check RAVE valve spring(s).**
   - *Spring tension is too low or spring(s) is (are) broken. Replace.*
2. **Check RAVE valve movement.**
   - *Valve(s) is (are) stuck in open position. Clean.*
3. **Check RAVE valve solenoid.**
   - *Defective solenoid. Check and replace.*

Symptom: **ENGINE PINGING.**

1. **Check for proper fuel octane number according to engine type.**
   - *Too low fuel octane number. Use appropriate fuel octane number (Refer to TECHNICAL SPECIFICATIONS).*
2. **Check fuel lines.**
   - *Bent fuel lines (preventing fuel from flowing through). Relocate or replace fuel lines.*
3. **Check if carburetor(s) is (are) clean.**
   - *Dirt prevents fuel from flowing through. Clean.*
4. **Check ignition timing.**
   - *Timing is too advanced. Adjust according to specifications (refer to IGNITION SYSTEM).*

Symptom: **ENGINE PINGING.** (cont'd)

5. **Check compression ratio.**
   - *Compression ratio is too high. Replace inadequate part(s) to obtain manufacturer's recommended compression ratio or use a higher grade fuel.*
6. **Check for carbon accumulation in combustion chamber and/or on piston dome.**
   - *Carbon accumulation. Remove carbon accumulation.*

Symptom: **ENGINE GENERATES A LOT OF VIBRATIONS.**

1. **Check engine supports and stopper.**
   - *Loose and/or broken supports or interference between support(s) and chassis. Retighten to specification (refer to ENGINE REMOVAL AND INSTALLATION) or replace.*
2. **Check drive pulley (refer to *VIBRATIONS ORIGINATING FROM DRIVE PULLEY*).**
3. **Check carburetor synchronization.**
   - *Throttle slide height is not the same on each carburetor and/or throttle slides opening is not synchronized. Adjust throttle slide heights and throttle cable.*
4. **Check for crankshaft and bearings.**
   - *Loose crankshaft bearings or uneven crankshaft. Retighten or replace the parts.*

REWIND STARTER

Symptom: **REWIND STARTER ROPE DOES NOT REWIND.**

1. **Check rewind spring.**
   - *Broken spring. Replace spring.*

Symptom: **REWIND STARTER PAWL DOES NOT ENGAGE.**

1. **Check stopper spring.**
   - *Broken stopper spring. Replace.*
2. **Check pawl and pawl lock.**
   - *Pawl and pawl lock have stuck together because of heat. Replace.*
3. **Check pawl and rope sheave.**
   - *Pawl and rope sheave have stuck together because of heat. Replace.*

ENGINE (810)

COOLING SYSTEM

Symptom: **HIGH ENGINE OPERATING TEMPERATURE.**

1. **Check coolant level.**
   - *Coolant level lower than recommended. Check for leakage and refill.*
   - *Coolant leaking from leak indicator hole means a damaged water pump rotary seal. Replace rotary seal (refer to COOLING SYSTEM).*
   - *Cylinder head or cylinder base. Gasket is causing coolant leakage. Replace.*
   - *Gasket on water pump housing leaks. Retighten screws and/or replace gasket.*
   - *Coolant leaking from drain plug on water pump housing. Retighten screw and/or replace copper ring.*
   - *Hose clamps are loose. Retighten clamps.*
   - *Hoses are brittle and/or hard. Replace.*
2. **Check radiator condition.**
   - *Radiator cracked or deformed. Replace radiator.*
3. **Check for air bubbles in cooling system.**
   - *Air in cooling system. Refill and bleed cooling system (refer to COOLING SYSTEM).*
4. **Check temperature sensor for electrical/mechanical failure.**
   - *Temperature sensor defective. Replace.*
5. **Check thermostat.**
   - *Thermostat defective (does not open when engine gets hot). Replace (refer to COOLING SYSTEM).*
6. **Check condition of water pump impeller.**
   - *Impeller fins broken and/or impeller threads are damaged. Replace.*
7. **Check intermediate gears behind PTO cover.**
   - *Worn out and/or broken gear(s) is/are causing a loss of coolant flow. Replace worn out and/or broken gear(s), refer to BOTTOM END.*
8. **Check if water pump shaft is seized.**
   - *Water pump shaft does not turn. Replace defective part(s).*

LUBRICATION SYSTEM

Symptom: **LOW OR NO OIL PRESSURE.**

1. **Check oil level and search for leakage on crankcase and/or sealing parts.**
   - *Oil drain plug on engine bottom is loosed and/or sealing ring is missing. Retighten the plug and/or place sealing ring.*
   - *Oil leaking from leak indicator hole means a damaged oil seal on water pump shaft. Replace oil seal (refer to COOLING SYSTEM).*
   - *Sealing rings, O-rings and/or gaskets are brittle and/or hard or damaged. Replace damaged parts.*
   - *Crankcase is leaking due to loose screws. Retighten screws with recommended torque.*
   - *Crankcase is leaking due to damage. Rebuild engine with new crankcase and gasket parts. Use recommended oil (refer to LUBRICATION SYSTEM).*
2. **Check oil quality and viscosity used.**
   - *Incorrect oil being used. Use recommend oil (refer to LUBRICATION SYSTEM).*

Symptom: **LOW OR NO OIL PRESSURE.** (cont'd)

3. **Check oil filter for contamination.**
   - *Oil filter clogged. Replace oil and oil filter at the same time. Use recommend oil (refer to LUBRICATION SYSTEM).*
4. **Check oil pressure switch function.**
   - *Oil pressure switch damaged. Replace oil pressure switch.*
5. **Check oil orifice(s) on the oil pump suction side.**
   - *Oil orifice(s) is(are) clogged. Clean from contamination. Replace oil and oil filter if necessary (refer to LUBRICATION SYSTEM).*
6. **Check oil pump function.**
   - *Oil pump rotor is out of wear limit. Replace oil pump shaft (refer to LUBRICATION SYSTEM).*
   - *Oil pump seized due to oil leakage and/or air inclusion. Replace oil pump (refer to LUBRICATION SYSTEM).*
   - *Gears driving oil pump are broken or otherwise damaged. Replace gears.*
7. **Check oil pressure regulator valve (spring) function.**
   - *Valve spring damaged (valve always open). Replace spring.*
   - *Valve piston is stuck in oil pump housing. Repair valve piston.*
8. **Check plain bearings in crankcase for heavy wear.**
   - *Plain bearings out of specification (increased clearance). Replace plain bearings.*
9. **Check engine oil strainer in crankcase.**
   - *Oil strainer is clogged due to contamination. Clean or replace strainer and diagnose causes of contamination. Replace possible damaged parts (refer to BOTTOM END).*

Symptom: **HIGH OIL CONSUMPTION.**

1. **Check for oil leakage.**
   - *Oil drain plug on engine bottom is loosed and/or sealing ring is missing. Retighten the plug and/or place sealing ring.*
   - *Oil leaking from leak indicator hole means a damaged oil seal on water pump shaft. Replace oil seal (refer to COOLING SYSTEM).*
   - *Sealing rings, O-rings and/or gaskets are brittle and/or hard or damaged. Replace damaged parts.*
   - *Crankcase is leaking due to loose screws. Retighten screws with recommended torque.*
   - *Crankcase is leaking due to damage. Rebuild engine with new crankcase and gasket parts. Use recommended oil (refer to LUBRICATION SYSTEM).*
2. **Check engine condition.**
   - *Piston rings worn out (blue coloured engine exhaust emission). Replace piston rings (refer to CYLINDER AND HEAD).*
   - *Piston rings are broken (low compression). Replace piston rings (refer to CYLINDER AND HEAD).*
   - *Valve stem seal damaged and/or sealing lip is hard and/or brittle. Replace all valve stem seals.*
   - *Valve piston is stuck in oil pump housing. Repair valve piston (refer to LUBRICATION SYSTEM).*

mptom: **OIL CONTAMINATION (white appearance).**

1. **Check both leak indicator holes (front of engine and on PTO side) if water and/or oil leaks.**
   - *Leakage of oil/water mixture from the front leak indicator hole means damaged water pump seal ring and rotary seal. Replace (refer to COOLING SYSTEM).*
   - *Leakage of oil from the leak indicator hole on PTO side means damaged oil seal. Replace (refer to LUBRICATION SYSTEM).*

Symptom: **OIL CONTAMINATION (white appearance).** (cont'd)

2. **Check cylinder head and/or cylinder base gasket.**
   - *Gasket damaged or leaking. Retighten cylinder head with recommended torque and/or replace gasket.*
3. **Check tightening torque of cylinder head screws.**
   - *Screws not properly tightened. Retighten screws to recommended torque and replace oil.*
4. **Check oil for particles (may indicate possible engine internal damages).**
   - *Oil contamination due to metal or plastic particles. Replace possibly damaged part(s) including oil and oil filter. Use recommended oil (refer to TECHNICAL SPECIFICATIONS).*

CYLINDER AND HEAD

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from cylinder head area.**
   - *Improper valve clearance adjustment. Adjust valve clearance.*
   - *Rocker arms are worn out. Replace rocker arms.*
   - *Rocker arm screws not tightened. Replace screws and perform the torque procedure (refer to CYLINDER AND HEAD).*
   - *Faulty chain tensioner. Replace spring and/or mechanism.*
   - *Chain guide worn out. Replace chain guide.*
   - *Stretched timing chain and/or worn out sprockets. Replace timing chain and sprockets.*
   - *Sprocket screws got loose. Retighten screws with recommended torque.*
   - *Incorrect camshaft timing adjustment. Replace damaged components and readjust camshaft timing (refer to CYLINDER AND HEAD).*

Symptom: **OIL LEAKAGE FROM CYLINDER AND/OR CYLINDER HEAD.**

1. **Check screws for torque.**
   - *Loose screws. Retighten screws with recommended torque.*
   - *Gaskets are brittle, hard, worn out or otherwise damaged. Replace damaged gaskets, O-rings or the V-ring on breather.*
2. **Spark plug tube seal condition.**
   - *Contact area between spark plug and ignition coils fouled by oil. Clean spark plug area and replace spark plug tube.*

CRANKSHAFT

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from crankshaft area.**
   - *Crankshaft plain bearings are damaged. Replace the crankshaft plain bearings. (refer to BOTTOM END).*
   - *Connecting rod plain bearings are damaged. Replace the connecting rod plain bearings (refer to BOTTOM END).*
2. **Check if magneto screw is loosen.**
   - *Magneto rotor got loose. Replace damaged components and retighten rotor retaining screw with recommended torque.*

ENGINE GENERAL

Symptom: ENGINE BACKFIRES.

1. **Check spark plug.**
   - *Carbon accumulation caused by defective spark plugs. Clean carbon accumulation and replace spark plugs.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to ENGINE MANAGEMENT).*
3. **Check leakage on intake manifold.**
   - *Air leak on intake system. Retighten screws and/or replace intake manifold gasket.*
4. **Check exhaust air leaking.**
   - *Exhaust gasket is leaking. Retighten screws and/or replace exhaust gasket.*
5. **Check intake valve(s) for leaking.**
   - *Intake valve(s) is(are) leaking. Repair or replace valve(s).*
6. **Check if fuel supply is sufficient at high RPM.**
   - *Fuel line is contaminated and/or bent (engine gets lean). Clean and/or replace defective part(s).*
   - *Defective fuel pump. Check fuel pressure.*
7. **Check engine ground.**
   - *Poor engine ground. Clean and tighten.*

Symptom: ENGINE SUDDENLY TURNS OFF.

1. **Check spark plug condition and/or gap.**
   - *Fouled spark plug or wrong spark plug gap. Readjust gap and clean spark plug or replace pistons.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to ENGINE MANAGEMENT).*
3. **Check if fuel supply is sufficient at high RPM.**
   - *Clogged fuel filter or fuel injectors.*
   - *Defective fuel pump. Check fuel pressure.*
   - *Fuel line is contaminated and/or bent. Clean and/or replace defective part(s).*
4. **Engine leakage.**
   - *Damaged head gasket and/or seal and/or leaking inlet/exhaust valve(s). Perform an engine leak test to diagnose problem. Refer to ENGINE LEAK TEST.*
5. **Melted and/or perforated piston dome; melted section at ring end gap.**
   - *Spark plug heat range is too hot. Install recommended spark plug (refer to TECHNICAL SPECIFICATIONS).*
   - *Coolant less than recommended level (engine gets too hot). Repair cooling circuit and/or refill with recommended liquid.*
   - *Poor quality and/or wrong fuel. Clean from contamination and use appropriate fuel (refer to TECHNICAL SPECIFICATIONS).*
6. **Piston color is dark due to seizure on intake and exhaust sides.**
   - *Cooling system leaks and lowers coolant level. Tighten clamps or replace defective parts. Add antifreeze in cooling system until appropriate level is reached. Replace damaged parts.*
7. **Cracked or broken piston.**
   - *Cracked or broken piston due to excessive piston/cylinder clearance or engine overreving. Replace piston. Check piston/cylinder clearance (refer to CYLINDER AND HEAD).*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

8. **Check piston rings and cylinder surface for grooves.**
   - *Poor oil quality. Use recommended oil.*
   - *Contamination through engine intake. Replace defective part(s) and use new air filter.*
9. **Check valve springs exhaust/intake.**
   - *Broken valve spring damages the cylinder head, valve(s), rocker arm(s), piston, piston rings and connecting rod. Replace defective part(s).*
10. **Check crankshaft, rocker arms movement.**
    - *Oil pump failure due to lack of oil. Repair and replace defective parts and use recommended oil.*
    - *Oil contamination due to clogged oil filter/oil strainer. Replace oil and oil filter at the same time, replace defective part(s) (refer to LUBRICATION SYSTEM).*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. **Check spark plug condition and/or gap.**
   - *Fouled spark plug or wrong spark plug gap. Readjust gap or replace.*
2. **Check spark plug type.**
   - *Improper spark plug heat range. Install recommended spark plug (refer to TECHNICAL SPECIFICATIONS).*
3. **Check fault codes in B.U.D.S system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to ENGINE MANAGEMENT).*
4. **Perform an engine leak test.**
   - *Damaged head gasket, piston, seal or valves. Repair or replace defective part(s).*
5. **Check for water in fuel (wrong fuel).**
   - *There is water in fuel or wrong fuel. Drain fuel system, search for leakage and refill it with appropriate fuel.*
6. **Check fuel pressure.**
   - *Low fuel pressure. Perform fuel pressure test (refer to FUEL TANK AND FUEL PUMP).*
7. **Check air intake system.**
   - *Air filter is clogged due to contamination. Replace air filter.*
8. **Check drive belt.**
   - *Drive belt width is less than specified (refer to DRIVE BELT). Replace.*

Symptom: **ENGINE CRANKS BUT FAILS TO START.**

1. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to ENGINE MANAGEMENT).*
2. **Check if ignition coils are properly installed on spark plugs.**
3. **Check spark plugs.**
   - *Define spark plugs (no spark) or wrong spark plug gap. Readjust gap and clean spark plugs or replace.*
   - *Flooded engine (spark plugs wet when removed). Activate engine drowned mode and crank engine with rags over the spark plug holes (refer to ENGINE MANAGEMENT).*
4. **Check engine compression.**
   - *Perform an engine leak test. Insufficient engine compression. Replace defective part(s) (e.g.: piston, ring(s), etc.).*

Symptom: **ENGINE CRANKS BUT FAILS TO START.** (cont'd)

5. **Check fuel level in fuel tank and fuel pressure.**
   - *Low or no fuel pressure. Replace defective part(s).*
   - *Make sure fuel pump was not disabled with B.U.D.S.*
6. **Check fuel injectors.**
   - *Plugged or faulty injector(s). Replace defective part(s).*
7. **Check idle bypass valve.**
   - *Bypass valve stuck or defective. Replace.*
8. **Check trigger wheel.**
   - *Bent tooth. Refer to MAGNETO SYSTEM.*

Symptom: **ENGINE HARD TO START.**

1. **Check idle bypass valve.**
   - *Stuck or defective. Refer to ENGINE MANAGEMENT.*
2. **Check closed throttle and idle actuator with B.U.D.S.**
   - *Wrong TPS zero setting or bypass valve reset. Refer to ENGINE MANAGEMENT.*
3. **Check throttle cable adjustment.**
   - *Wrong adjustment (likely to tight). Refer to ENGINE MANAGEMENT.*
4. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s).*
5. **Verify spark plug condition.**
   - *Defective, improper, worn out or fouled spark plugs. Identify the source of problem and correct. Replace spark plugs.*
6. **Check fuel level in fuel tank and fuel pressure.**
   - *Low or no fuel pressure. Replace defective part(s). Refer to FUEL TANK AND FUEL PUMP.*
7. **Check CAPS (Camshaft Position Sensor).**
   - *Defective sensor or wiring. Refer to ENGINE MANAGEMENT.*

FUEL AND OIL SYSTEMS (440F/550F/600)

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For 600 HO SDI models, also refer to *ENGINE MANAGEMENT (SDI)* section.

FUEL SYSTEM

Symptom: **HIGH FUEL CONSUMPTION OR RICH MIXTURE (models with carburetor only).**

1. **Check fuel tank.**
   - *Perforated fuel tank. Replace fuel tank.*
2. **Check fuel pump, reservoir and carburetor fittings.**
   - *Leaking fittings. Replace defective part.*
3. **Check choke adjustment.**
   - *Fuel flows through choke circuit while engine runs. Readjust choke.*
4. **Check float height in carburetor(s).**
   - *Fuel level is too high in float bowl(s). Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
5. **Check needle valve on each carburetor.**
   - *Foreign particles prevent needle valve from closing and/or pounded seating area. Clean or replace needle valve, then clean seating area.*

Symptom: **FUEL LEAKS IN ENGINE BASE WHEN ENGINE IS STOPPED (models with carburetor only).**

1. **Check items 3, 4 and 5 of *HIGH FUEL CONSUMPTION*.**
2. **Check fuel pump.**
   - *Cracked diaphragm. Replace.*

Symptom: **ENGINE LACKS POWER OR STALLS AT HIGH RPM (models with carburetor only).**

1. **Check fuel tank vent hose.**
   - *Kinked or clogged hose. Relocate or replace.*
2. **Check in-tank fuel strainer.**
   - *Clogged filter. Replace.*
3. **Check fuel lines.**
   - *Kinked or clogged lines. Relocate or replace.*
4. **Check fuel pump flow.**
   - *Check impulse hose. Replace.*
   - *Dried diaphragm. Replace.*
5. **Check if carburetor(s) is (are) clean.**
   - *Varnish. Clean.*
6. **Check carburetors calibration.**
   - *Wrong calibration. Refer to TECHNICAL SPECIFICATIONS.*

Symptom: **ENGINE LACKS FUEL (SDI models only).**

1. **Check in-tank strainer and in-line fuel filter.**
   - *Clogged strainer or filter. Replace fuel strainer or filter.*
2. **Check if lines are perforated, kinked, or if they leak at fittings.**
   - *Replace lines.*
3. **Check fuel pump pressure.**
   - *Electric fuel pump defective. Replace.*
   - *Regulator defective. Replace.*
4. **Check fuel injectors flow.**
   - *Dirty or defective injectors. Replace.*

OIL INJECTION SYSTEM

Symptom: **HIGH INJECTION OIL CONSUMPTION.**

1. **Check oil injection pump adjustment.**
   - *Oil injection pump adjusted too rich. Adjust.*
2. **Check injection pump identification.**
   - *Wrong pump. Replace with the appropriate pump. Refer to OIL INJECTION SYSTEM.*
3. **Check injection oil lines and their fitting.**
   - *Leaking lines and/or cover. Replace defective part(s).*
4. **Check injection pump cover gasket.**
   - *Broken gasket. Replace.*
5. **Check nipple check valve.**
   - *Check valve stuck open. Replace.*
6. **Check pump.**
   - *Defective pump. Replace pump or connecting cable.*
7. **Test pump shaft gear reservoir for leaks.**
   - *Leaking seal(s). Replace seal(s).*

DRIVE SYSTEM AND BRAKE

The following charts are provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

DRIVE AND DRIVEN PULLEYS

Symptom: **THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY FROM A STANDING START.**

1. **Check drive belt condition.**
   - *Belt is too narrow (drive belt engagement is higher in drive pulley). Replace belt if width is less than specified in DRIVE BELT.*
2. **Check distance between pulleys and/or drive belt deflection.**
   - *Distance is too small between pulleys or deflection is too high (drive belt engagement is higher in drive pulley). Adjust distance between pulleys and/or drive belt deflection according to specifications (refer to PULLEY ALIGNMENT).*
3. **Check driven pulley sliding sheave play.**
   - *Jammed sliding sheave. Replace.*
4. **Check spring tension of driven pulley sliding sheave.**
   - *Sliding sheave rotation is accelerated when spring tension is too weak. Adjust according to specifications (refer to DRIVEN PULLEY).*
5. **Refer to *VIBRATIONS ORIGINATING FROM DRIVE PULLEY* and *VIBRATIONS ORIGINATING FROM DRIVEN PULLEY* and check items listed.**
6. **Check drive pulley spring tension.**
   - *Spring tension is too weak. Replace.*

Symptom: **ENGINE MAXIMUM RPM IS TOO HIGH AND TOP SPEED IS NOT REACHED.**

1. **Check items 1, 2 and 3 of *THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY WHEN IT IS STOPPED*.**
2. **Check driven pulley spring tension.**
   - *Spring tension is too stiff. Adjust according to specifications (refer to DRIVEN PULLEY).*
3. **Check position of the calibration screws (TRA drive pulley).**
   - *Selected numbers are too high. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
4. **Refer to *VIBRATIONS ORIGINATING FROM DRIVEN PULLEY* and check items listed.**
5. **Check the driven pulley.**
   - *Driven pulley does not open completely. Clean, readjust or replace driven pulley.*
6. **Check if levers of drive pulley move freely.**
   - *Stuck levers. Replace lever bushings.*

Symptom: **LOOSENESS IS FELT IN DRIVE SYSTEM WHEN ACCELERATING/DECELERATING.**

1. **Check drive chain tension.**
   - *Drive chain is too loose. Adjust.*
2. **Check radial play of driven pulley.**
   - *Worn key, keyway or splines. Replace.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVE PULLEY.**

1. **Check drive belt.**
   - *Belt width is uneven at many places. Replace.*
2. **Check tightening torque of drive pulley screw.**
   - *Moving governor cup. Retighten screw.*
3. **Spring cover screws.**
   - *Spring cover moves and restrains sliding sheave movement. Retighten screws.*
4. **Check spring cover (TRA type) and/or sliding sheave bushings.**
   - *Excessive gap between bushings and fixed sheave shaft, thus restraining sliding sheave movements. Replace bushing(s).*
5. **Check governor cup splines.**
   - *Excessive radial play. Replace governor cup.*
6. **Check lever assembly.**
   - *Lever assembly is damaged (worn bushing, bent lever, etc.). Replace damaged part.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVEN PULLEY.**

1. **Check sliding sheave side play.**
   - *Sliding sheave bushing worn out. Replace sliding sheave bushing.*
2. **Check sliding sheave and fixed sheave straightness.**
   - *Sliding sheave/fixed sheave warped. Replace.*
3. **Check cam slider shoes.**
   - *One or two slider shoes out of three are broken. Replace.*

Symptom: **PULLEYS DO NOT DOWN SHIFT PROPERLY.**

1. **Check driven pulley spring tension.**
   - *Spring tension is too low. Adjust according to specifications (refer to DRIVEN PULLEY).*
2. **Refer to *VIBRATIONS COMING FROM DRIVEN PULLEY* and check items listed.**
3. **Check drive pulley bushings (cleanliness, wear, etc.).**
   - *Bushings stick to fixed sheave pulley shaft. Clean or replace.*

Symptom: **IN REVERSE ENGINE FAILS AND DRIVEN PULLEY OPENS TOO FAST (drive belt is low in driven pulley).**

1. **Check pulley distance and alignment.**
   - *Improper adjustment. Adjust according to specifications (refer to PULLEY ALIGNMENT) and make sure that torque rod is resting against engine. Check engine mounts.*
2. **Check for reverse sliding shoes.**
   - *Sliding shoes are worn or missing. Replace sliding shoes.*
3. **Check spring.**
   - *Spring is weak or insufficient tension. Replace spring.*

DRIVE BELT

Symptom: **UNEVEN BELT WEAR ON ONE SIDE ONLY.**

1. **Check tightening torque of engine mount bolts.**
   - *Loose engine mount. Tighten engine mount nuts/bolts equally.*
2. **Check pulley alignment.**
   - *Pulley misalignment. Align pulleys.*
3. **Check drive belt contact area on pulleys.**
   - *Rough or scratched pulley surfaces. Repair or replace pulley sheave.*
4. **Check driven pulley sliding sheave play.**
   - *Driven pulley bushing worn. Replace bushing.*

Symptom: **BELT GLAZED EXCESSIVELY OR HAVING BAKED APPEARANCE.**

1. **Check if drive pulley bushings are worn.**
   - *Slipping due to insufficient pressure on belt sides. Replace bushing.*
2. **Check condition of drive pulley fixed sheave shaft.**
   - *Slipping due to rusted drive or driven pulley shafts. Clean shaft with fine steel wool.*
3. **Check if pulley sheaves are clean.**
   - *Slipping due to oily pulley surfaces. Clean pulley sheaves.*
4. **Check pulley calibration.**
   - *Slipping due to improper pulley calibration. Calibrate according to specifications.*

Symptom: **BELT WORN EXCESSIVELY IN TOP WIDTH.**

1. **Check drive pulley.**
   - *Excessive slippage due to jammed of drive pulley. Inspect drive pulley.*
2. **Check drive belt identification number.**
   - *Improper belt angle. (wrong type of belt). Replace belt with an appropriate drive belt.*
3. **Check drive belt width.**
   - *Considerable use. Replace belt if width is less than specified in DRIVE BELT.*

Symptom: **BELT TOO NARROW ON ONE SECTION.**

1. **Check for frozen track.**
   - *Frozen track. Free track from ice.*
2. **Check parking brake.**
   - *Parking brake is engaged. Release parking brake.*
3. **Check track tension/alignment.**
   - *Track too tight. Adjust track tension and alignment.*
4. **Check drive pulley.**
   - *Drive pulley does not operate properly. Repair or replace drive pulley.*
5. **Check idle speed.**
   - *Engine idle speed is too high. Adjust according to specifications.*
6. **Check drive belt length.**
   - *Incorrect belt length. Replace with an appropriate drive belt (refer to TECHNICAL SPECIFICATIONS).*

Symptom: **BELT TOO NARROW ON ONE SECTION.** (cont'd)

7. **Check distance between pulleys.**
   - *Incorrect pulley distance. Readjust according to specifications.*
8. **Check belt height.**
   - *Belt height is incorrect. Adjust according to specifications.*

Symptom: **BELT SIDES WORN CONCAVE.**

1. **Check pulley sheave surfaces.**
   - *Rough or scratched pulley sheave surfaces. Repair or replace.*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace belt with an appropriate drive belt (refer to TECHNICAL SPECIFICATIONS).*

Symptom: **BELT DISINTEGRATION.**

1. **Check drive belt identification number.**
   - *Excessive belt speed. Wrong type of belt. Replace belt with proper type of belt. (refer to TECHNICAL SPECIFICATIONS).*
2. **Check if pulley sheaves are clean.**
   - *Oil on pulley surfaces. Clean pulley surfaces with fine emery cloth and wipe clean using pulley flange cleaner (P/N 413 711 809) and a cloth.*

Symptom: **BELT CORD POPPED OUT.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to PULLEY ALIGNMENT).*

Symptom: **FATIGUE CRACKS BETWEEN COGS.**

1. **Check drive belt condition.**
   - *Belt considerably worn, worn out. Replace.*
   - *Distortion of natural belt shape due to improper storage. Store properly.*

Symptom: **TOOTH CHUNK OUT.**

1. **Check drive belt rotational direction.**
   - *Improper belt installation. Replace.*
2. **Check if drive belt rubs against components.**
   - *Belt rubs against fixed components. Relocate components.*
3. **Check drive pulley.**
   - *Violent engagement of drive pulley. Check drive pulley engagement speed, drive pulley bushings and components.*

ymptom: **BELT "FLIP-OVER" AT HIGH SPEED.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to PULLEY ALIGNMENT).*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace with an appropriate drive belt.*

MECHANICAL BRAKE

Symptom: **BRAKE DOES NOT ADJUST AUTOMATICALLY.**

1. **Check ratchet wheel spring.**
   - *Broken ratchet wheel spring tab. Replace.*
2. **Check mobile pad stud.**
   - *Stud rotates in pad. Replace.*

Symptom: **BRAKE HANDLE DOES NOT RETURN COMPLETELY.**

1. **Check brake return spring.**
   - *Broken return spring. Replace.*
2. **Check if brake cable moves freely in its housing.**
   - *Brake cable movement is limited due to oxidation or dirt accumulation. Replace.*
3. **Check distance between brake lever and caliper.**
   - *Distance is too wide. Adjust according to specifications (refer to COUNTERSHAFT AND BRAKE).*

Symptom: **BRAKE SYSTEM IS NOISY.**

1. **Check brake pad thickness.**
   - *Pads are worn up to wear indicator. Replace.*
2. **Check key/keyway or splines.**
   - *Key/keyway or splines are worn out. Replace parts.*

HYDRAULIC BRAKE

Symptom: **SPONGY BRAKE CONDITION.**

1. **Brake pads worn.**
   - *Replace brake pads.*
2. **Air in brake system.**
   - *Bleed system.*
3. **Contaminated brake fluid.**
   - *Replace brake fluid and bleed system. If the problem persists, replace master cylinder.*
4. **Check for damaged hose, master cylinder and caliper.**
   - *Replace part(s) and check for proper mounting.*

Symptom: **BRAKE FLUID LEAKAGE.**

1. **Check for loosen hose connectors.**
   - *Replace copper washers and retighten.*
2. **Check for damaged hose, master cylinder and caliper.**
   - *Replace part(s) and check for proper mounting.*

Symptom: **BRAKE SYSTEM IS NOISY.**

1. **Check brake pad thickness.**
   - *Pads are worn up to wear indicator. Replace.*
2. **Check key/keyway or splines.**
   - *Key/keyway or splines are worn out. Replace parts.*

TRACK

Symptom: **SLIDER SHOES WEAR OUT PREMATURELY OR TRACK CLEATS BECOME BLUE.**

1. **Check track tension.**
   - *Pressure is too great on slider shoes. Adjust according to specifications (refer to TRACK). Replace defective parts.*
2. **Check idler wheel condition.**
   - *Stuck bearing, flat spot on wheel or damaged wheel. Replace defective parts.*
3. **Check snow conditions or lack of snow.**
   - *Lack of lubrication of slider shoes. Ask driver to ride in appropriate snow condition (see OPERATOR'S GUIDE).*
4. **Check slider shoes and/or suspension retaining screws.**
   - *Twisted slider shoes or loose retaining screws. Replace defective parts and/or tighten loosen screws.*

Symptom: **DERAILING TRACK.**

1. **Check track tension.**
   - *Track is too loose. Adjust to recommended tension.*
2. **Check if track and slider shoes are properly aligned.**
   - *Improper alignment. Adjust.*

Symptom: **NOISE OR VIBRATION COMING FROM THE TRACK.**

1. **Check track tension.**
   - *Track is too loose. Adjust to recommended tension.*
2. **Check slide suspension retaining bolts.**
   - *Missing bolt(s), some components interfere with track rotation. Replace missing bolt(s).*
3. **Check condition of idler wheel(s).**
   - *Idler wheel rubber is damaged. Replace idler wheel.*
4. **Check guide cleats.**
   - *Top portion of guide cleat(s) is bent. Replace.*
5. **Check sprockets.**
   - *One or several teeth of drive shaft sprocket are broken. Replace sprocket(s).*
6. **Check track rods and/or internal traction teeth.**
   - *One or several track rods and/or teeth are broken. Replace track.*

GEARBOX

Symptom: **UNUSUAL GEARBOX NOISE AND/OR VIBRATION.**

1. **Check oil lever in gearbox.**
   - *Oil leakage from gearbox. Replace damaged gasket(s) and/or oil seal(s), torque screws and refill oil up to specified level (refer to GEARBOX).*
2. **Check bearings in gearbox for free movement.**
   - *Bearing(s) do(es) not move freely. Replace bearing(s).*
3. **Check for knocking noise.**
   - *Teeth of gears are damaged and/or worn. Replace defective gear(s).*

CHAINCASE

Symptom: **UNUSUAL CHAINCASE NOISE AND/OR VIBRATION.**

1. **Check oil lever in chaincase.**
   - *Oil leakage from chaincase. Replace damaged gasket(s) and/or oil seal(s), torque screws and refill oil up to specified level (refer to CHAINCASE).*
2. **Check drive chain adjustment.**
   - *Drive chain is too loose. Adjust drive chain in accordance with the procedure in CHAINCASE.*
3. **Check bearings in chaincase for free movement.**
   - *Bearing(s) do(es) not move freely. Replace bearing(s).*
4. **Check for knocking noise.**
   - *Teeth of gears are damaged and/or worn. Replace defective gear(s).*
   - *Chain tensioner is defective. Check roller and needle bearing. Replace defective parts.*
   - *Chain is stretched over service limit. Replace drive chain.*

ELECTRICAL SYSTEM

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

IGNITION SYSTEM

Symptom: **THE ECM AND/OR MPEM DOES NOT WORK.**

1. **Check that high tension coil wires do not touch any metal parts.**
   - *Short circuit. Isolate and reroute wires.*
2. **On liquid cooled models), check codes in B.U.D.S.**
   - *Defective connections or faulty ECM. Repair or replace.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG (riding on wet snow).**

1. **Check if spark plug wires and/or spark plug cap seals are sealing out moisture.**
   - *Defective wires and/or seals. Replace defective part.*
2. **Check if ignition system wiring harness connectors are in good condition and/or are sealing out moisture.**
   - *Loose connectors, corroded terminals or defective parts. Clean terminals and apply silicone dielectric grease. Replace defective parts.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG (riding in deep and thick snow).**

1. **Perform all verifications outlined under *ENGINE DOES NOT START — NO SPARK AT SPARK PLUG*.**
2. **Check spark plugs. Proceed with spark plug analysis in order to identify source of problem.**
   - *Defective and/or worn spark plug(s) and/or cable(s) and/or cap(s). Engine related problem. Replace defective part(s). Proceed with ignition system testing procedures. Perform engine analysis.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG (normal use).**

1. **Verify misfiring by observing flash of stroboscopic timing light; unplug connectors between magneto/generator and vehicle wiring harness to isolate problem. Check condition of connectors.**
   - *Defective spark plug(s) and/or cable(s)/cap(s). Defective electrical system wiring harness and/or accessories and ignition cut-out switches. Condition of connector terminals. Replace defective parts and/or repair damaged wires. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*

Symptom: **FOULED (BLACK) SPARK PLUG TIP.**

1. **Check carburetor.**
   - *Carburetion is too rich. Adjust according to specifications (refer to TECHNICAL SPECIFICATIONS).*
2. **Check injection oil consumption.**
   - *Injection pump flow is too high. Adjust according to specifications or replace.*
3. **Check oil quality.**
   - *Poor quality oil (creation of deposits). Use appropriate BRP's XP-S injection oil.*
4. **Check engine compression.**
   - *Leaking piston ring(s). Replace.*

Symptom: **SPARK PLUG TIP IS LIGHT GRAY.**

1. **Refer to *ENGINE SLOWS DOWN OR STOPS AT HIGH RPM* and check items listed.**
2. **Check spark plug heat range.**
   - *Spark plug heat range is too high. Replace by BRP's recommended spark plug (refer to TECHNICAL SPECIFICATIONS).*
3. **Check if air intake silencer leaks.**
   - *Air surplus coming from opening(s) located between halves. Seal.*
4. **Check carburetor adapter collars.**
   - *Loose collar(s). Tighten.*
5. **Check carburetor adapter(s).**
   - *Cracked or deformed adapter(s). Replace.*
6. **Check if primary compression leaks.**
   - *Primary compression leaks. Perform leak down test and repair as necessary.*

CHARGING SYSTEM

Symptom: **BATTERY NOT CHARGING OR CHARGING VOLTAGE INADEQUATE.**

1. **Check battery.**
   - *Battery shows less power. Reload battery.*
   - *Battery has electrical failure. Replace.*
2. **Check voltage regulator/rectifier.**
   - *Refer to CHARGING SYSTEM.*
3. **Check wiring harness for cracks or other damages.**
   - *Harness shows electrical failure and/or other damages. Replace/repair wiring harness.*
4. **Check magneto for damage and/or electrical failure.**
   - *Radial position of rotor wrong due to broken Woodruff key. Replace Woodruff key.*
   - *Coating on stator winding is damaged. Replace stator.*
   - *Resistance value is out of specification (refer to TECHNICAL SPECIFICATIONS). Replace magneto.*
   - *Connector on magneto is damaged and/or has electrical failure. Repair and clean contacts of connector.*

STARTING SYSTEM

Symptom: **STARTER DOES NOT TURN.**

1. **Check fuse.**
   - *Burnt fuse. Check wiring condition and replace fuse.*
2. **Check MPEM or ECM.**
   - *Defective ECM or MPEM. Using B.U.D.S. software, check faulty codes and diagnose all components. Repair defective part.*
3. **Check battery charge.**
   - *Discharged or disconnected battery. Recharge battery and check charging system and wires.*
4. **Check ground.**
   - *Poor, or corroded ground contacts. Check, clean and tighten.*

Symptom: **STARTER DOES NOT TURN.** (cont'd)

5. **Check continuity of start or ignition switch contact points.**
   - *Poor contact of start or ignition switch contact points. Replace switch.*
6. **On fan cooled models, check continuity between ignition switch and solenoid.**
   - *Open circuit. Repair.*
7. **On liquid cooled models, check continuity between start switch and ECM.**
   - *Open circuit. Repair.*
8. **On liquid cooled models, check continuity between ECM and solenoid switch.**
   - *Open circuit. Repair.*
9. **Check starter solenoid.**
   - *Inadequate connection (too much resistance) or defective solenoid. Clean, reconnect and/or replace.*
10. **Check starter.**
    - *Inadequate connection (too much resistance) or defective starter. Reconnect and/or replace.*
11. **Check engine problems.**
    - *Damaged engine. Check and repair.*

Symptom: **STARTER TURNS BUT DOES NOT CRANK THE ENGINE.**

1. **Check battery capacity.**
   - *Shorted battery cell(s). Replace.*
2. **Check battery charge.**
   - *Low battery. Recharge battery and check recharge system and wires.*
3. **Check wire connection.**
   - *Inadequate connection (too much resistance). Clean and reconnect.*
4. **Check solenoid switch contact disc.**
   - *Burnt or poor contact of solenoid switch contact disc. Replace solenoid switch.*
5. **Check starter.**
   - *Defective. Replace starter.*
6. **Check engine.**
   - *Engine seized. Overhaul the engine.*

Symptom: **STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.**

1. **Check clutch pinion gear.**
   - *Worn clutch pinion gear. Replace clutch.*
2. **Check clutch.**
   - *Defective clutch. Replace clutch.*
3. **Check brackets.**
   - *Worn or broken brackets. Replace brackets.*
4. **Check movement of clutch on splines.**
   - *Poor movement of clutch on splines. Clean and correct.*
5. **Check clutch bushing.**
   - *Worn clutch bushing. Replace clutch.*

Symptom: **STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.** (cont'd)

6. **Check ring gear.**
   - *Worn ring gear. Replace ring gear.*
7. **Check for proper starter rotation direction.**
   - *Starter turns in wrong direction, incorrectly installed brushes, wrong polarity or wrong starter. Replace starter or reconnect properly.*

Symptom: **ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.**

1. **Check clutch.**
   - *Jammed clutch pinion gear. Replace or clean.*
2. **Check movement of clutch on splines.**
   - *Clutch is stuck on splines. Clean.*
3. **Check starter brackets.**
   - *Broken bracket(s). Replace bracket(s).*
4. **Check starter solenoid.**
   - *Shorted starter solenoid winding(s). Replace starter solenoid.*
   - *Melted starter solenoid contacts. Replace starter solenoid.*
   - *Starter solenoid returns poorly. Replace starter solenoid.*
5. **Check start or ignition switch contacts.**
   - *Contacts shorted. Replace switch.*

Symptom: **NOISE OCCURRENCE WHEN STARTING ENGINE.**

1. **Check if ring gear is well-mounted to drive pulley fixed sheave.**
   - *Loose and/or broken bolts. Retighten bolts using thread locker or replace ring gear and drive pulley fixed sheave.*

Symptom: **ELECTRIC STARTER SOMETIMES DOES NOT WORK WHEN ACTIVATED.**

1. **Check battery cables and starter wires.**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*
2. **Check fuse.**
   - *Oxidized or burnt fuse. Clean or replace.*
3. **Check wiring harness connections.**
   - *Oxidized connections. Clean or replace defective terminals.*
4. **Check ignition switch or start switch.**
   - *Defective contacts in switch. Replace.*
   - *Moisture in switch. Clean switch.*
5. **Check solenoid of electric starter.**
   - *Shorted solenoid wiring harness or corroded contact washer. Replace.*

ROTAX ELECTRONIC REVERSE (RER)

Symptom: **RER DOES NOT WORK.**

1. **Check idle speed.**
   - *Wrong idle speed. Adjust according to specification (refer to TECHNICAL SPECIFICATIONS).*

Symptom: **RER DOES NOT WORK.** (cont'd)

2. **Check spark plugs.**
   - *Faulty spark plug(s). Replace.*
3. **Check engine compression.**
   - *Too low engine compression; engine stalls when pushing RER button. Rebuilt the engine.*
4. **Check drive belt height.**
   - *Wrong belt height. Adjust according to specification (refer to DRIVE BELT).*
5. **Check carburetor synchronization and air screw adjustment.**
   - *Wrong adjustment. Adjust according to specification (refer to TECHNICAL SPECIFICATIONS) and read VM CARBURETORS subsection.*
6. **Check RER switch and electrical connections.**
   - *Defective contacts in switch. Bad electrical connections or damaged wires. Replace or repair.*
7. **Check RER trigger coil.**
   - *Faulty RER trigger coil. Refer to ROTAX ELECTRONIC REVERSE (RER) section.*

Symptom: **RER SOMETIMES DOES NOT WORK WHEN ACTIVATED.**

1. **Check RER switch.**
   - *Defective contacts in switch. Replace.*
   - *Moisture in switch. Clean switch.*
2. **Check engine condition.**
   - *Low engine compression and/or defective piston. Replace defective parts.*

LIGHTS, INSTRUMENTS AND ACCESSORIES

Symptom: **HEADLAMP NOT LIGHTING (white bulb).**

1. **Check bulb.**
   - *Gas leak. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING (broken element).**

1. **Check for loose headlamp housing and bulb socket.**
   - *Vibration problem. Tighten headlamp mounting screws. Lock bulb in socket. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING (melted filament, ends of element holder and black bulb).**

1. **Check voltage at headlamp at different speeds. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*.**
   - *Excessive voltage in lighting circuit. Replace voltage regulator and ensure proper grounding. Retest.*
   NOTE: If quartz halogen bulb is involved, ensure that proper voltage regulator is installed.

Symptom: **HEADLAMP DIMMING.**

1. **Check voltage at headlamp at different speeds. It must be above 11 V. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES* section.**
   - *Insufficient voltage in lighting circuit. Replace voltage regulator and retest.*

Symptom: **HEADLAMP DIMMING.** (cont'd)

2. **Visually inspect wiring harness for damaged and/or melted wires and/or bad wire terminal crimping and/or connections.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Repair/replace damaged wires and/or terminals. Reroute harness where necessary.*
3. **On 440F, 550F and 600 models, verify if there is an interconnection between AC and DC current.**
   - *Faulty installation of optional equipment. Refer to LIGHTS, INSTRUMENTS AND ACCESSORIES section.*
4. **Check if optional electric accessories are overloading the magneto/generator.**
   - *Excessive electrical load to magneto/generator. Reduce the electrical load by removing excess accessories. Reconnect as recommended by manufacturer.*
5. **Heating grips: Verify if the return wires of the elements were grounded to the chassis by mistake.**
   - *Faulty installation of optional equipment. Reconnect as recommended by manufacturer.*

Symptom: **FALSE FUEL AND/OR TEMPERATURE GAUGE READINGS.**

1. **On 440F, 550F and 600 models, verify if gauge was connected on DC current by mistake (in case of optional installation).**
   - *Faulty installation of optional equipment. Refer to LIGHTS, INSTRUMENTS AND ACCESSORIES.*
2. **Verify sender unit for free movement and/or correct arm position.**
   - *Defective or damaged part. Correct or replace sender unit.*
3. **Verify sender unit/gauge wiring harness condition.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Replace or repair damaged wires. Reroute where necessary.*

Symptom: **NO ELECTRICAL ACCESSORIES WORK WHEN ENGINE IS ON IDLE.**

1. **Check idle speed.**
   - *Too low idle speed. Readjust to specifications.*
2. **Verify regulator.**
   - *Faulty regulator. Replace.*

Symptom: **BRAKE LIGHT REMAINS ON.**

1. **Check if bulb is properly installed.**
   - *Bulb is not installed correctly (contact elements are reversed). Install bulb correctly.*
2. **Check brake switch.**
   - *Switch contact remains closed. Replace brake switch.*
3. **Check wiring harness.**
   - *Shorted wiring harness. Replace or repair wiring harness.*

Symptom: **REAR LIGHT BULB FLASHES.**

1. **Check bulb tightness in housing.**
   - *Looseness at bulb contact elements. Install bulb correctly.*
2. **Check if rear light is properly connected.**
   - *Connector housing is partially connected. Install connector housing properly.*
3. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires.*

Symptom: **TACHOMETER DOES NOT WORK.**

1. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires.*
2. **Check tachometer signal or power supply and ground.**
   - *Check. Refer to LIGHTS, INSTRUMENTS AND ACCESSORIES.*

STEERING SYSTEM

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

HANDLEBAR

Symptom: **WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.**

1. **Check ski runner condition.**
   - *Worn ski runners. Replace.*
2. **Check ski spring preload.**
   - *Insufficient ski pressure on the ground. Increase spring preload.*
3. **Check if front arm stopper strap is too long (rear suspension).**
   - *Insufficient ski pressure on the ground. Shorten stopper strap.*
4. **Check front arm spring preload (rear suspension).**
   - *Insufficient ski pressure on the ground. Loosen spring tension.*

Symptom: **HANDLEBAR IS DIFFICULT TO TURN.**

1. **Check if the handlebar turns freely when skis are off the ground.**
   - *Ball joints corrosion restrains movement. Lubricate or replace the ball joint.*
   - *Component need proper lubrication. Lubricate. Refer to STEERING AND HANDLEBAR.*
   - *Bent parts. Replace parts.*
2. **Check ski spring preload.**
   - *Too much preload. Reduce ski spring preload.*
3. **Check position of front arm spring adjustment cam.**
   - *When spring tension is weak, more weight is transferred to the skis. Increase spring preload.*
4. **Check position of stopper strap (rear suspension).**
   - *Too much weight when stopper strap is short. Lengthen front arm stopper strap.*
5. **Check ski runners.**
   - *Wrong ski runners type. Replace.*

SKI

Symptom: **THE SNOWMOBILE ZIGZAGS.**

1. **Check ski runners.**
   - *Worn or bent ski runners. Replace ski runners.*
   - *Wrong ski runner type. Replace.*
2. **Check ski alignment.**
   - *Improper ski alignment. Align skis in order to obtain proper toe-out (opening), refer to SKIS AND STEERING ALIGNMENT.*
3. **Check if bushings are too loose in steering system.**
   - *Bushings are too loose. Replace.*
4. **Check ski pressure.**
   - *Too much pressure on skis. Increase center spring preload (rear suspension).*

SUSPENSION

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **SUSPENSION IS TOO LOW.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Installed springs are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
4. **Check condition of shock.**
   - *Shock frozen. Replace shock.*

Symptom: **REAR SUSPENSION BOTTOMS OUT.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Springs installed are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
4. **Check condition of the rear shock absorber.**
   - *Damaged rear shock absorber. Replace rear shock absorber.*

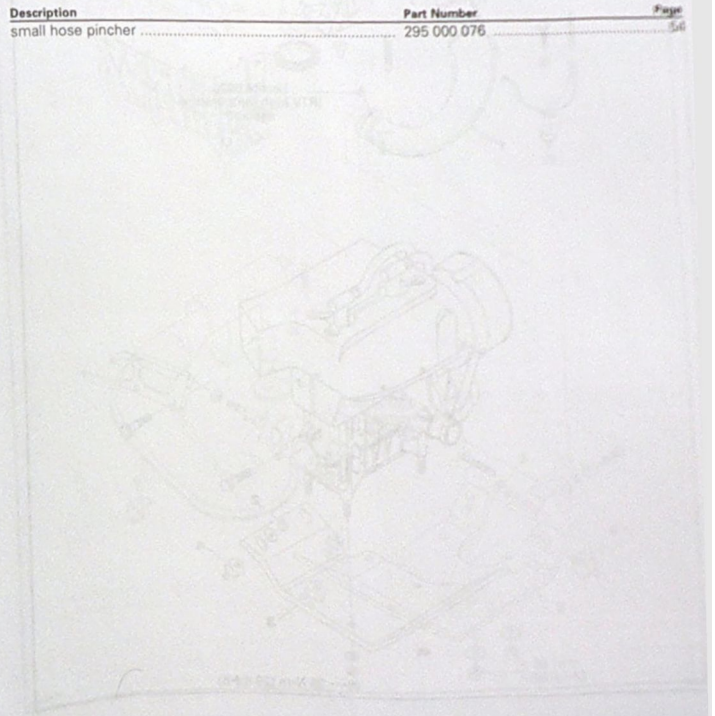
Symptom: **REAR SUSPENSION IS TOO STIFF.**

1. **Check rear spring preload.**
   - *Too much preload. Adjust to a softer position.*
2. **Check springs.**
   - *Springs installed are too stiff. Install optional softer springs.*
3. **Check track tension.**
   - *Track is too tight. Adjust.*
4. **Check if axles are properly lubricated.**
   - *Improper lubrication and/or contaminated grease (sticky oil sludge). Clean and/or lubricate.*
5. **Check condition of the rear shock absorber.**
   - *Damaged rear shock absorber. Replace rear shock absorber.*

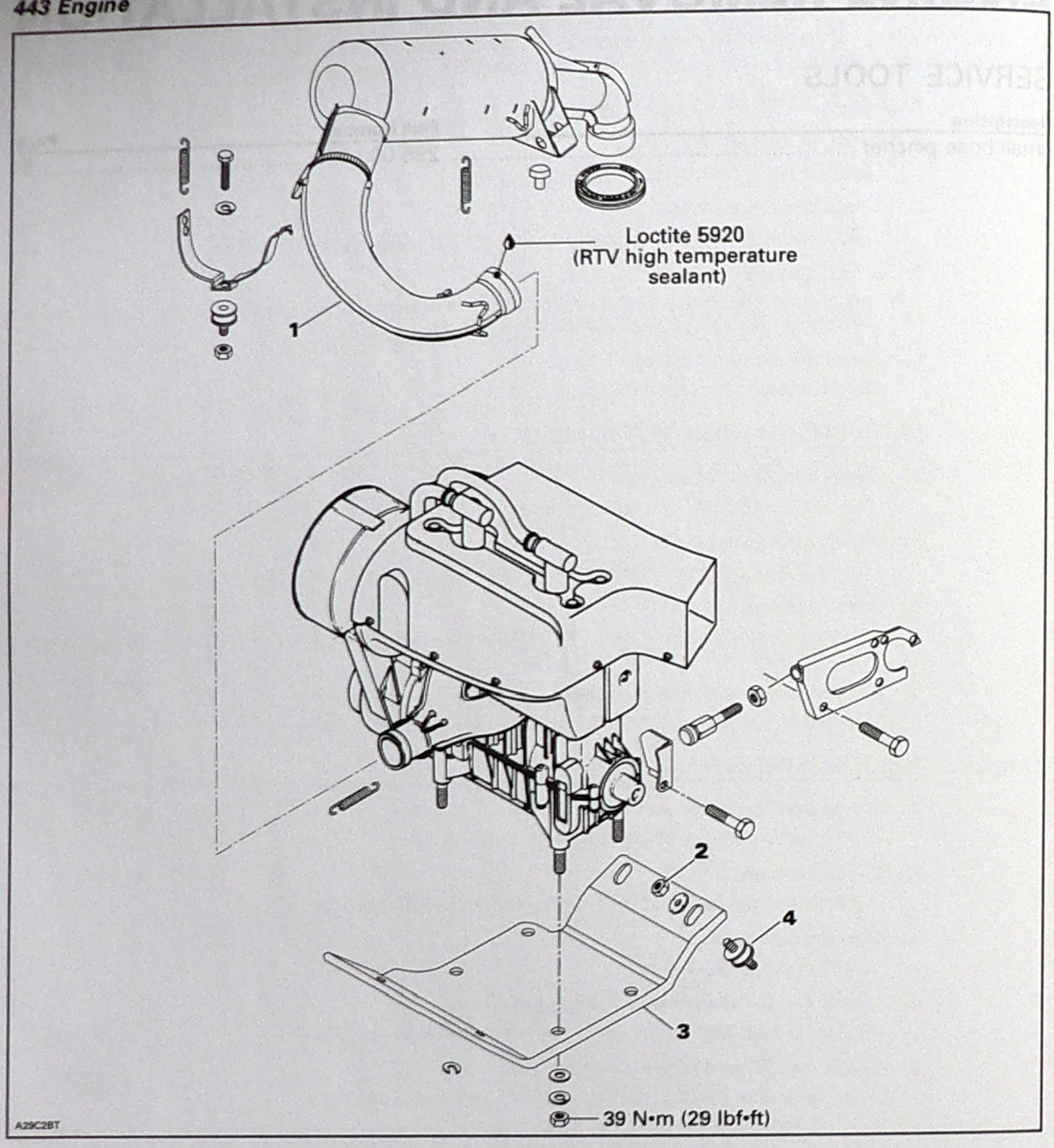
ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

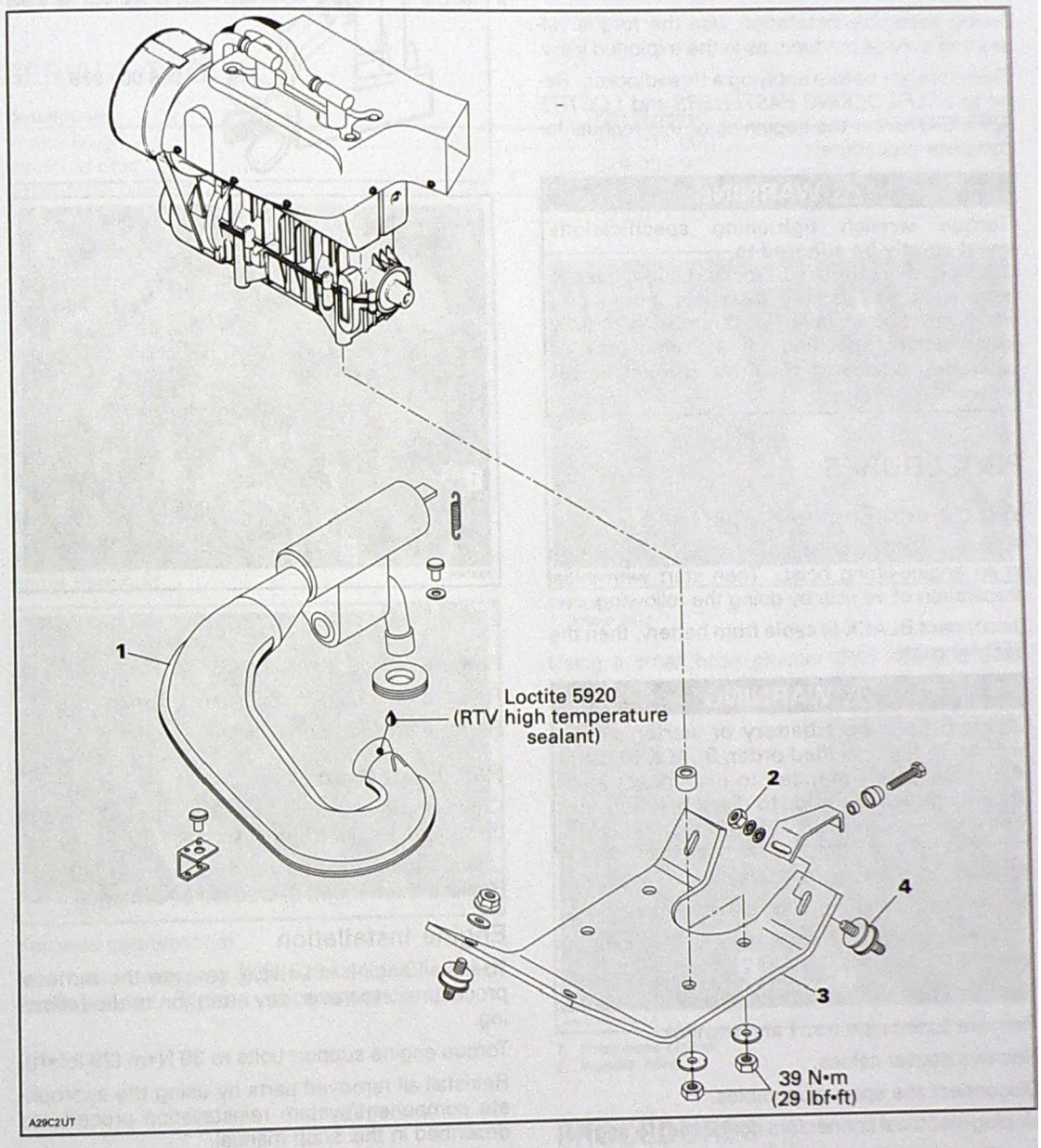
Description	Part Number	Page
small hose pincher	295 000 076	5-8



443 Engine


Loctite 5920
(RTV high temperature
sealant)
1
2
3
4
39 N•m (29 lbf•ft)
A29C2BT

552 Engine


1
Loctite 5920
(RTV high temperature
sealant)
2
4
3
39 N•m
(29 lbf•ft)
A29C2UT

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

Vehicle and Engine Preparation

Place vehicle at workstation that will have access to an engine-lifting hoist. Then start with initial preparation of vehicle by doing the following.

Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Remove drive and driven pulleys.

Release carburetor from air intake silencer.

Unscrew carburetor clamps then remove carburetors from intake adapters.

Remove impulse line from crankcase.

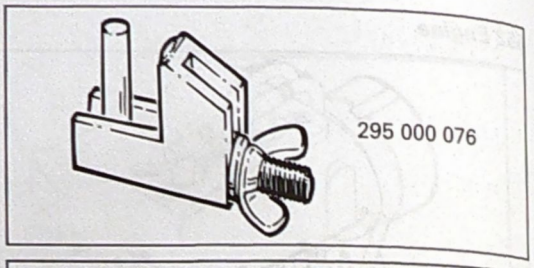
Remove tuned pipe **no. 1** and manifold.

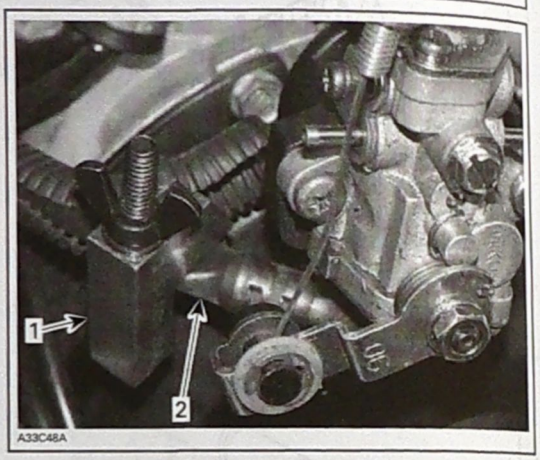
Remove starter cables.

Disconnect the spark plug cables.

Unplug electrical connectors connected to engine.

Install a small hose pincher (P/N 295 000 076) on the oil inlet hose and disconnect it from oil pump. Clean any spillage.





1. Hose pincher
2. Oil inlet hose

Remove rewind starter handle.

Remove the engine support nuts **no. 2**.

Remove engine from vehicle.

Part Inspection

Check if engine support **no. 3** is cracked, bent or damaged. Replace if necessary.

Check rubber mounts **no. 4** on engine support. Replace them if brittle, cracked or damaged.

Engine Installation

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

Torque engine support bolts to 39 N•m (29 lbf•ft).

Reinstall all removed parts by using the appropriate component/system reinstallation procedures described in this shop manual.

Perform engine and pulley alignment. Refer to *PULLEY ALIGNMENT*.

ENGINE LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
intake plug	529 011 000	55
manifold plug	529 035 961	55
small hose pincher	295 000 076	55
vacuum/pressure pump	529 021 800	55

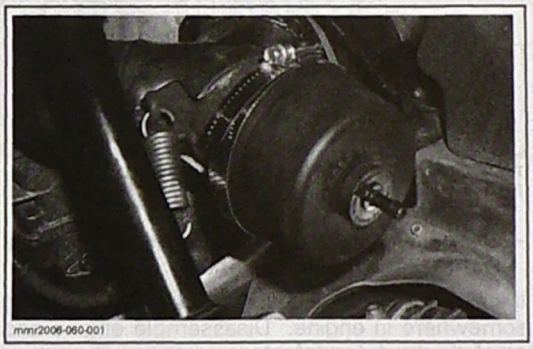
Prior to take apart an engine, it is important to proceed with a leak test to diagnose engine problems. Whenever the engine is disassembly, a leak test should be performed after reassembly.

Each cylinder cannot be verified individually due to intentional leakage from one cylinder to the other through labyrinth sleeve in center of crankshaft.

PREPARATION

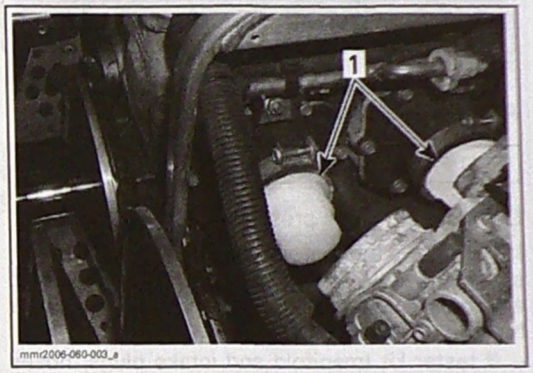
Remove tuned pipe.

Install manifold plug (P/N 529 035 961) over exhaust manifold.



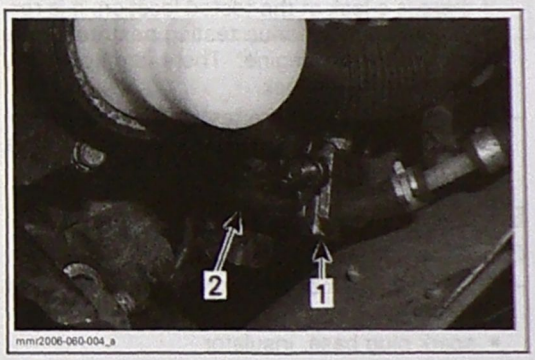
Remove carburetor(s).

Insert an intake plug (P/N 529 011 000) in each intake adaptor. Tighten with existing clamps.



TYPICAL
1. Intake plug

Using a small hose pincher (P/N 295 000 076), block impulse hose.

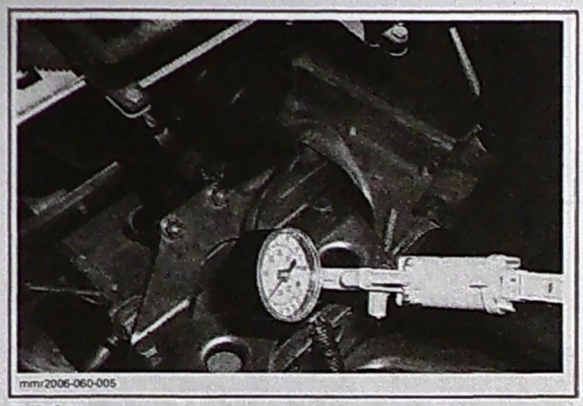


1. Small hose pincher
2. Impulse hose

PROCEDURES

NOTE: A flow chart has been prepared as a visual reference. See last page of this chapter.

Install vacuum/pressure pump (P/N 529 021 800) on manifold plug.



TYPICAL

Activate pump and pressurize engine

TEST PRESSURE: 34 kPa (5 PSI) for 3 minutes

Do not exceed this pressure.

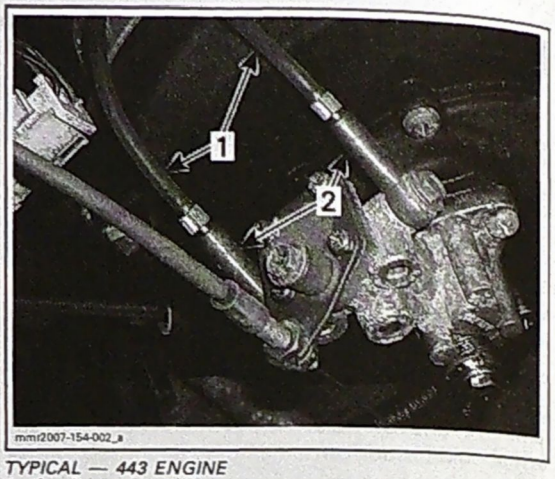
If pressure drops before the recommended time, spray a soapy solution on tester kit (manifold and intake plugs, vacuum/pressure pump and its hose).

- If tester kit (manifold and intake plugs, hoses and pump) is leaking, bubbles will indicate where leak comes from.
- If tester kit is not leaking, check engine, see below for procedure.
- If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.
- If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

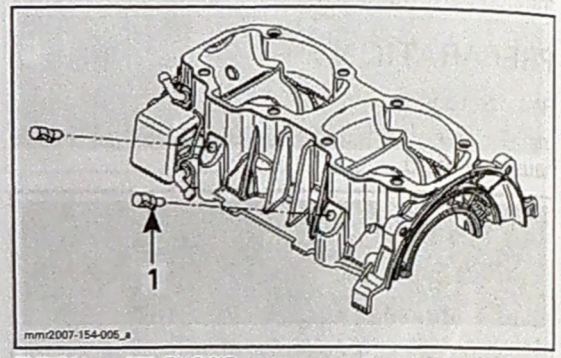
Engine

Check the following:

- All jointed surfaces and screw/stud threads of engine:
  - spark plug base, insulator
  - cylinder head
  - cylinder
  - crankcase halves (joint)
  - oil injection pump mounting flange (O-ring).
- Small injection oil lines coming from pump. Air bubbles or oil column going toward pump, indicates a defective check valve.



TYPICAL — 443 ENGINE
1. Small injection oil lines
2. Check valve inside banjo fittings

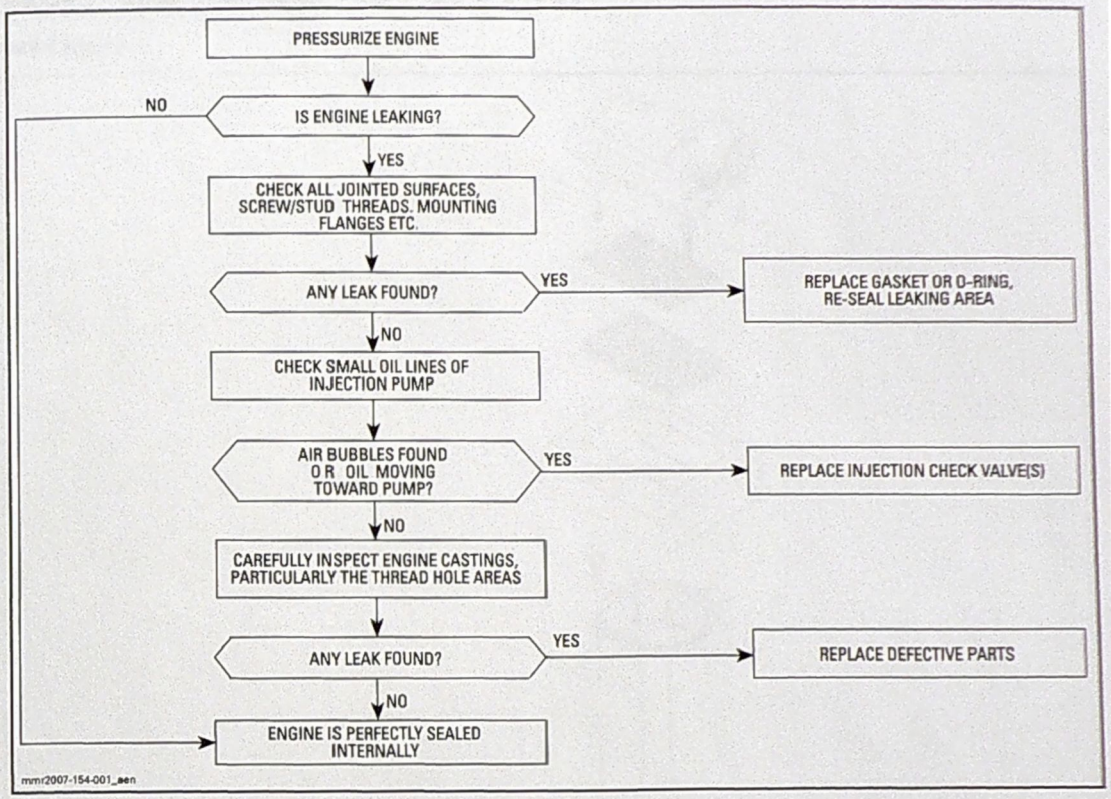


TYPICAL — 552 ENGINE
1. Check valve inside injector nozzle

- Crankshaft outer seals. One behind drive pulley and the other behind magneto.

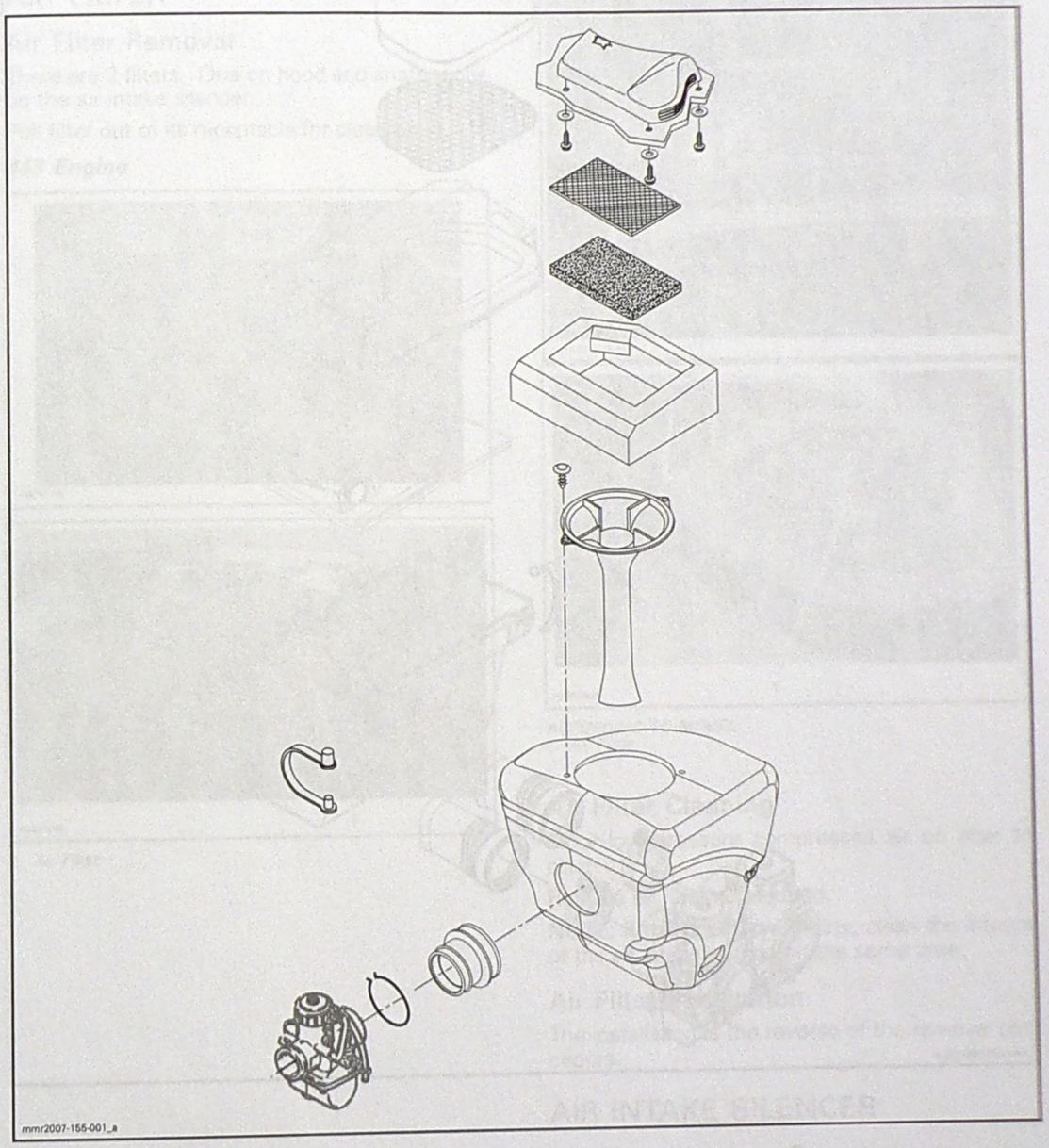
If leak still persists, it indicates a defective casting somewhere in engine. Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

ENGINE LEAK VERIFICATION FLOW CHART



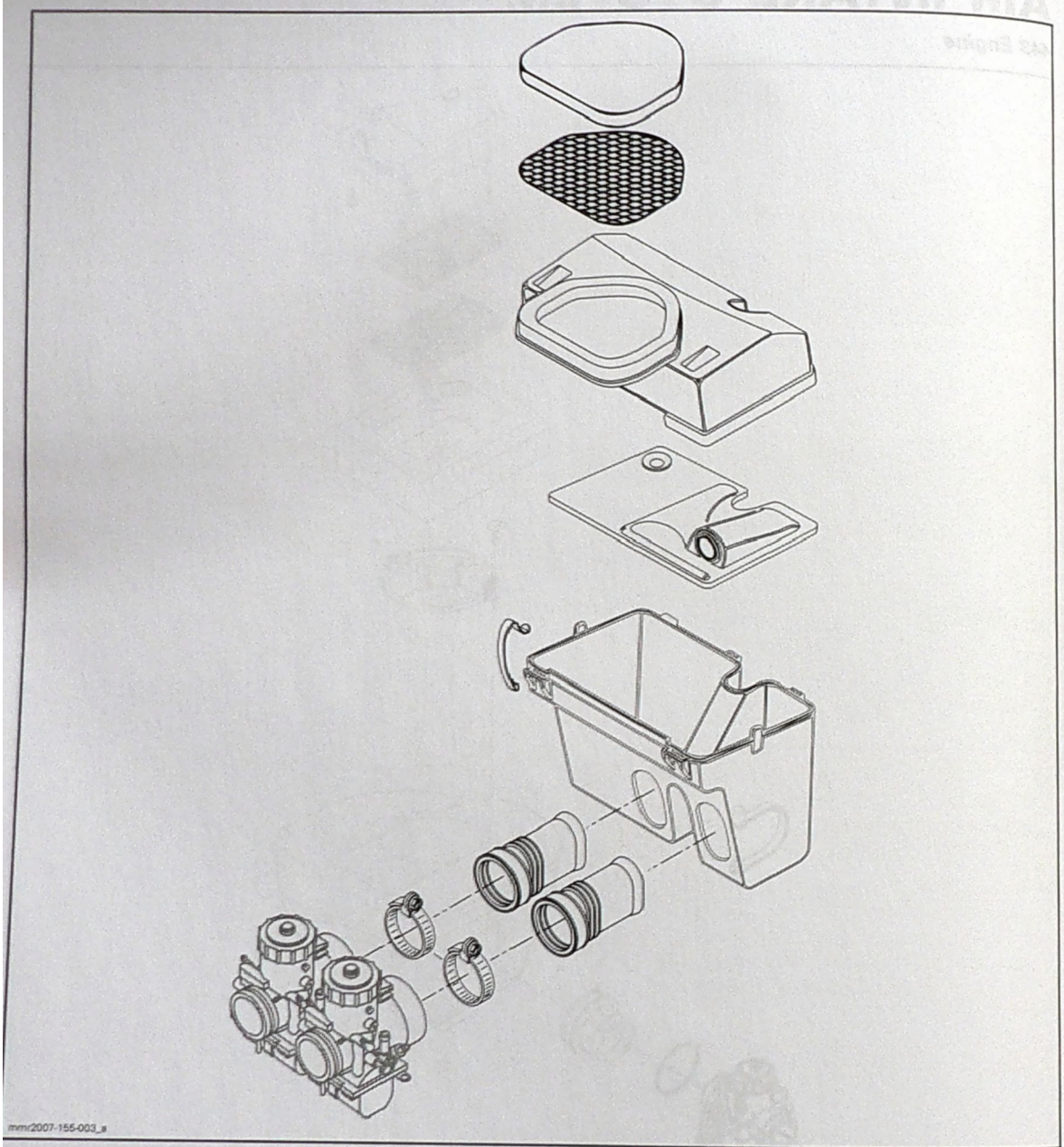
AIR INTAKE SYSTEM

443 Engine



mmr2007-155-001_a

552 Engine



mmr2007-155-003_a

PROCEDURES

AIR FILTER

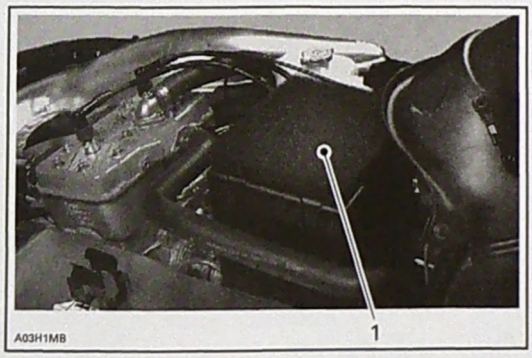
Air Filter Removal

There are 2 filters. One on hood and another one on the air intake silencer.

Pull filter out of its receptacle for cleaning.

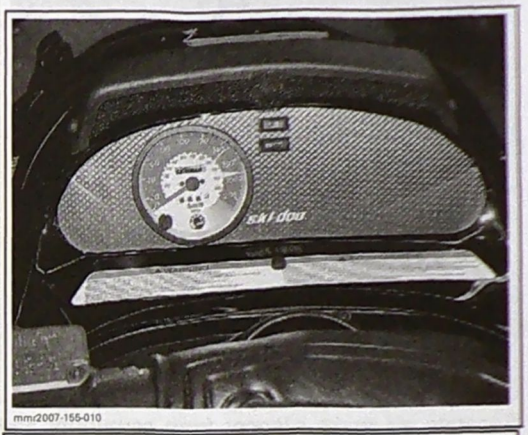
443 Engine

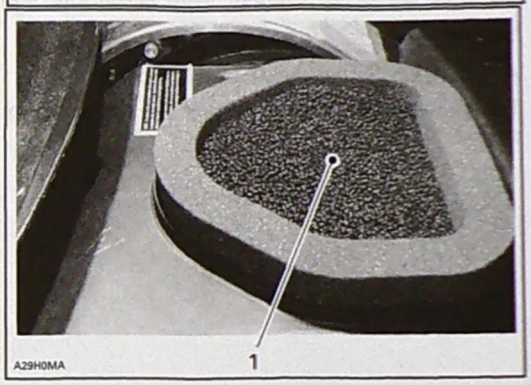




1. Air Filter

552 Engine





ACCORDING TO MODEL
1. Air Filter

Air Filter Cleaning

Blow low pressure compressed air on filter to clean it.

Replace air filter as required.

NOTE: If the filter is very dirty, clean the interior of the air intake silencer at the same time.

Air Filter Installation

The installation is the reverse of the removal procedure.

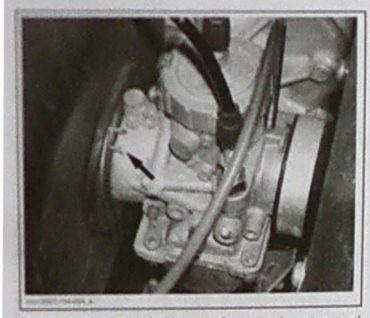
AIR INTAKE SILENCER

Air Intake Silencer Removal

Open hood

Remove drive belt guard.

Release collar (if applicable) on air intake adaptor side.



Separate air intake silencer from carburetor and pull it out of vehicle.

Air Intake Silencer Installation

The installation is the reverse of the removal procedure.

EXHAUST SYSTEM

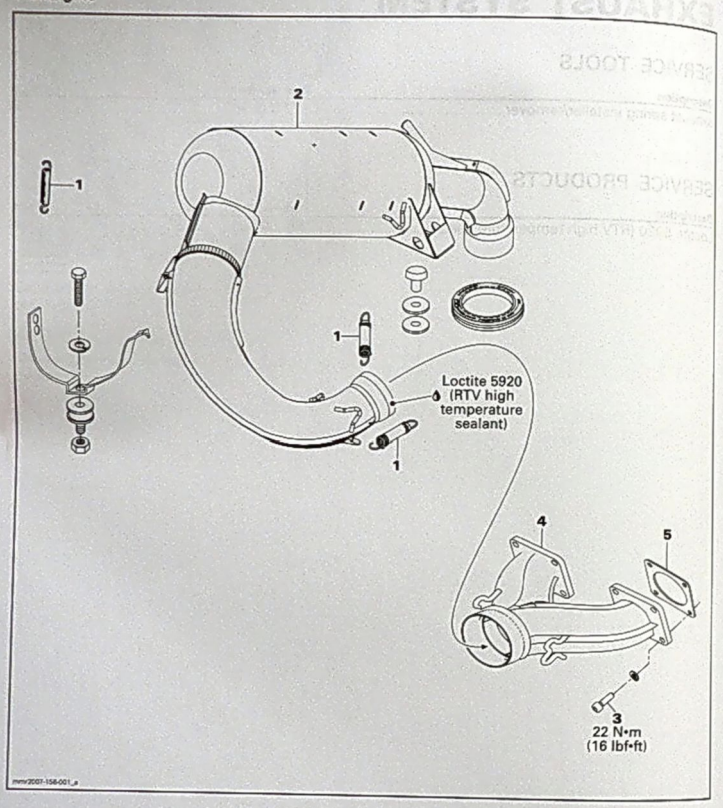
SERVICE TOOLS

Description	Part Number	Page
exhaust spring installer/remover	529 035 983	66

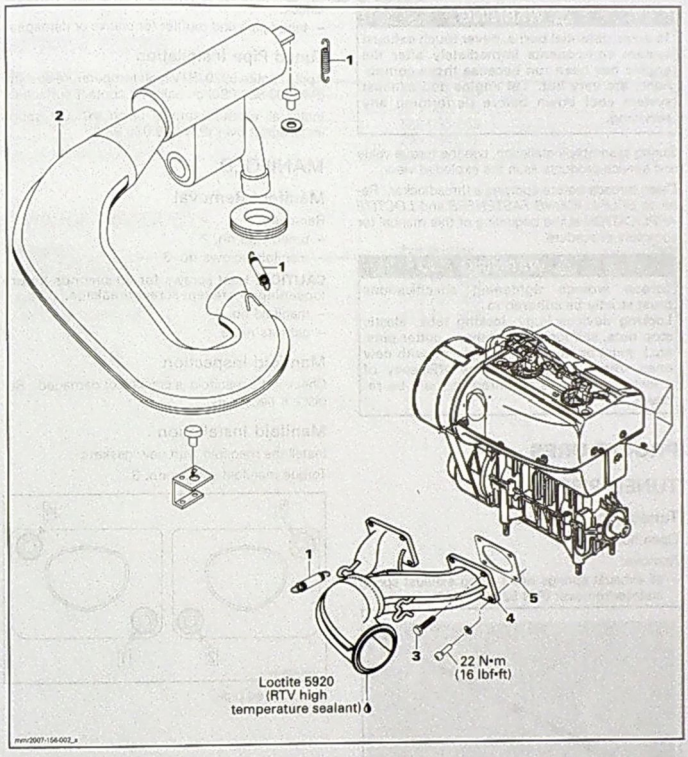
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 5920 (RTV high temperature sealant)	293 800 090	66

443 Engine


2
1
1
1
Loctite 5920
(RTV high
temperature
sealant)
4
5
3
22 N•m
(16 lbf•ft)

552 Engine


1
2
1
1
5
4
3
22 N•m
(16 lbf•ft)
Loctite 5920
(RTV high
temperature sealant)
mm/2007-156-002_a

GENERAL

⚠ WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use the torque value and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

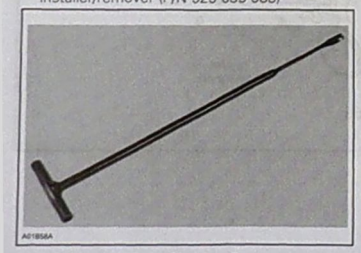
TUNED PIPE

Tuned Pipe Removal

Open hood.

Remove:

- all exhaust springs **no. 1** using exhaust spring installer/remover (P/N 529 035 983)



- tuned pipe with muffler **no. 2**.

Tuned Pipe Inspection

Check:

- tuned pipe and muffler for cracks or damages.

Tuned Pipe Installation

Apply Loctite 5920 (RTV high temperature sealant) (P/N 293 800 090) on ball joint contact surfaces.

Install all exhaust springs using exhaust spring installer/remover (P/N 529 035 983).

MANIFOLD

Manifold Removal

Remove:

- tuned pipe **no. 2**
- manifold screws **no. 3**

CAUTION: Heat screws for 30 seconds before loosening to prevent screw breakage.

- manifold **no. 4**
- gaskets **no. 5**.

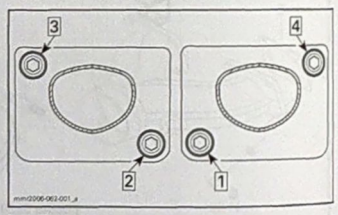
Manifold Inspection

Check if the manifold is cracked or damaged. Replace if necessary.

Manifold Installation

Install the manifold with new gaskets.

Torque manifold screws **no. 3**.



Install tuned pipe.

OIL INJECTION SYSTEM

SERVICE TOOLS

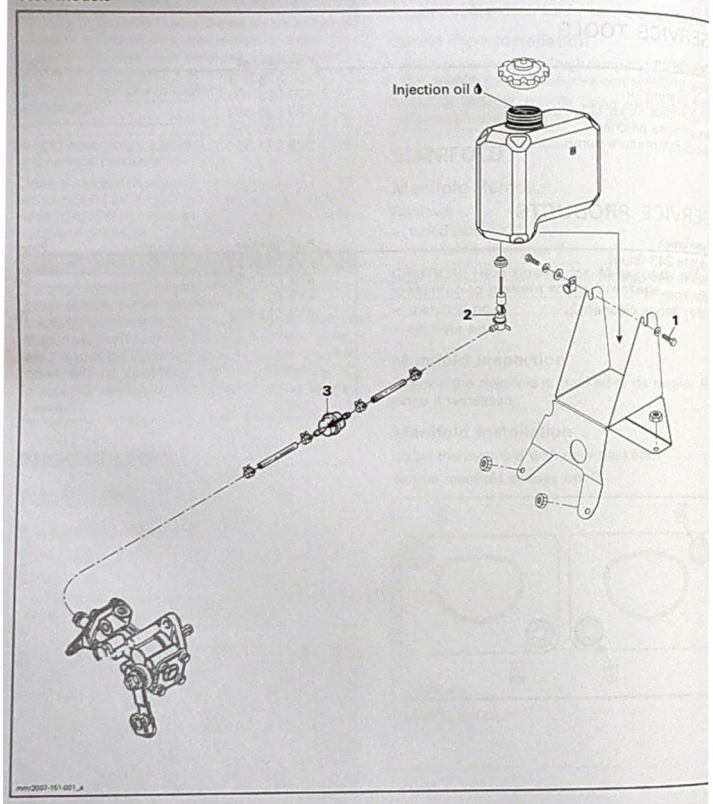
Description	Part Number	Page
gear holder	420 876 695	76
leak testing kit	529 033 100	72
multimeter Fluke 111	529 035 868	73
small hose pincher	295 000 076	72
vacuum/pressure pump	529 021 800	72, 79

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	77
Loctite 648 (green)	413 711 400	80
Molykote 111	413 707 000	77
pulley flange cleaner	413 711 809	79

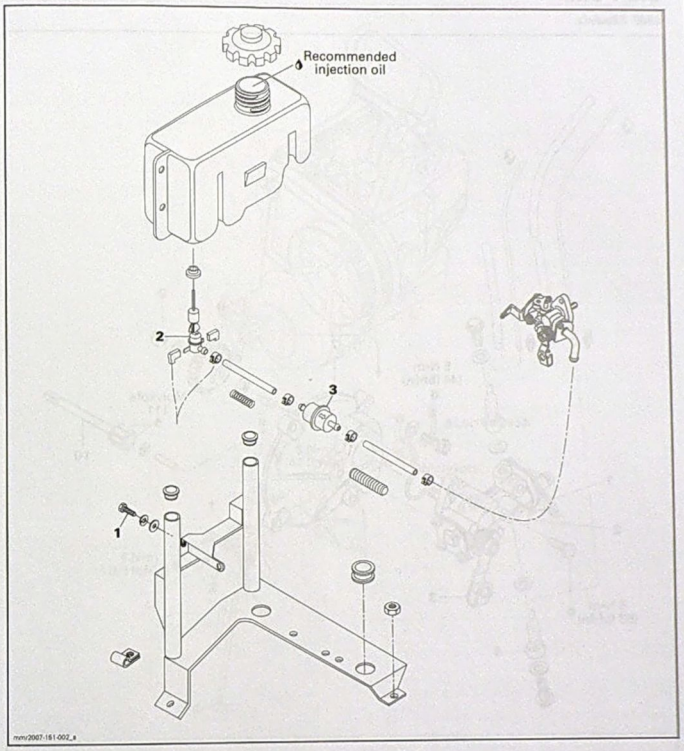
OIL INJECTION RESERVOIR

440F Models



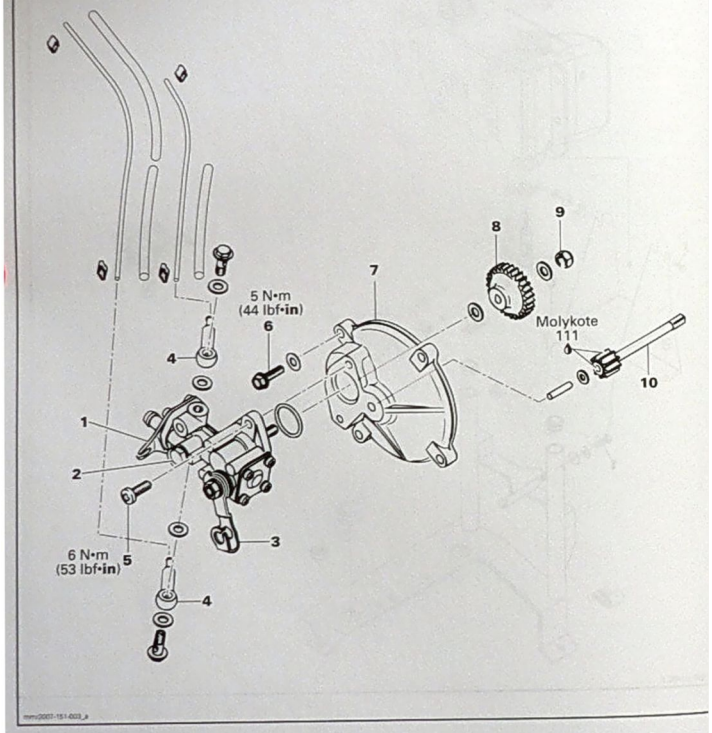
mmr2007-151-001_a

550F Models

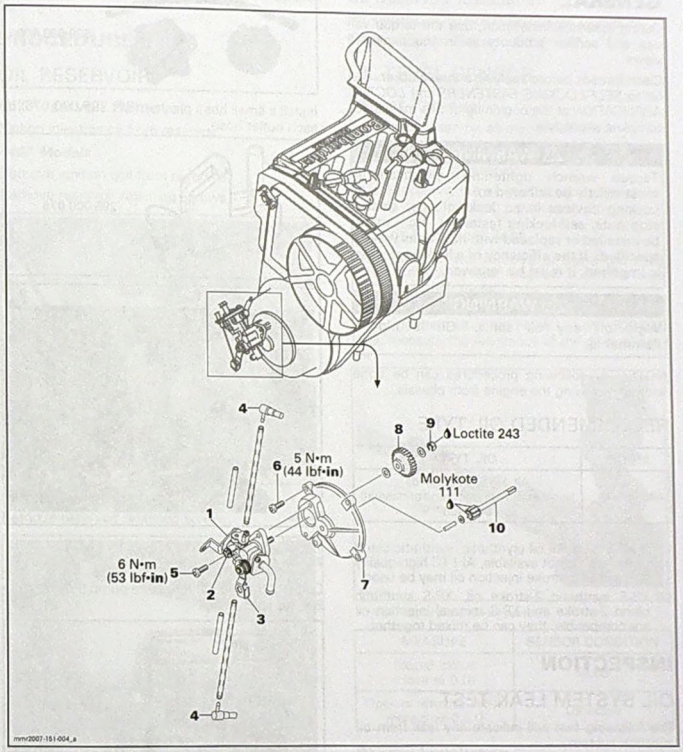


OIL PUMP

440F Models



550F Models


4
8
9
Loctite 243
5 N•m
(44 lbf•in)
6
Molykote
111
10
1
6 N•m
(53 lbf•in)
5
2
3
7
4
mmr2007-151-004_a

GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

NOTE: The following procedures can be done without removing the engine from chassis.

RECOMMENDED OIL TYPE

MODEL	OIL TYPE
440F/550F	All XP-S 2-stroke oil (synthetic, synthetic blend or mineral) can be used(1) (2)

(1) If XP-S 2-stroke oil (synthetic, synthetic blend or mineral) is not available, API TC high-quality low ash two-stroke injection oil may be used.
(2) XP-S synthetic 2-stroke oil, XP-S synthetic blend 2-stroke and XP-S mineral injection oil are compatible, they can be mixed together.

INSPECTION

OIL SYSTEM LEAK TEST

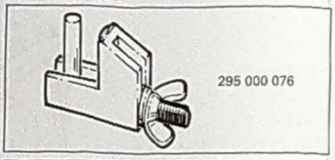
The following test will indicate any leak from oil injection system.

Install on oil reservoir a special cap from the leak testing kit (P/N 529 033 100).

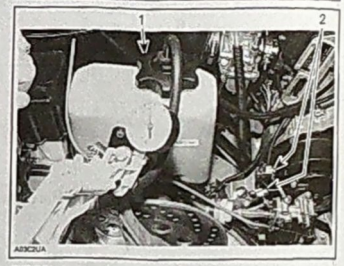


529 033 100

Install a small hose pincher (P/N 295 000 076) on each outlet hose.



295 000 076



TYPICAL
1. Special cap on reservoir
2. Hose pinchers on outlet hoses

Connect the vacuum/pressure pump (P/N 529 021 800) to special cap.



529 021 800

Pressurize oil system as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

If pressure drops, locate leak(s) and repair/replace leaking component(s).

PROCEDURES

OIL RESERVOIR

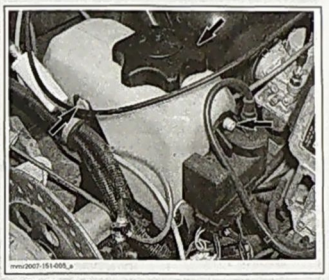
Oil Reservoir Removal

Siphon injection oil from reservoir.

440F Models

Remove ignition coil from reservoir.

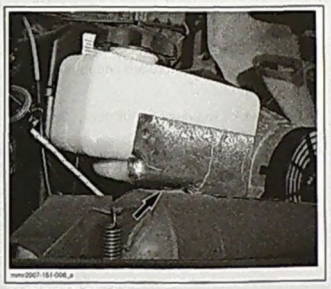
Remove reservoir retaining screws.



mmv2007-151-005_a

550F Models

Remove reservoir retaining screw.



mmv2007-151-006_a

440F/550F Models

Pull oil reservoir and unplug hose.

Oil Reservoir Installation

For installation, reverse the removal procedure.

Bleed oil pump. Refer to *OIL PUMP*.

OIL LEVEL SENSOR

Sensor Removal

Remove oil reservoir, as mentioned above.

Unplug sensor no. 2 connectors.

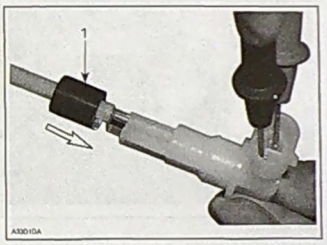
Pull sensor out of reservoir.

Before replacing the oil level sensor, check it according to the following procedure:

Sensor Electrical Test

CAUTION: Do not remove or bend the reed switch protective float magnet. It can damage the reed switch glass.

With the float magnet ring at the lowest position and using the multimeter Fluke 111 (P/N 529 035 868), measure the resistance of the oil level sensor.



A33D10A

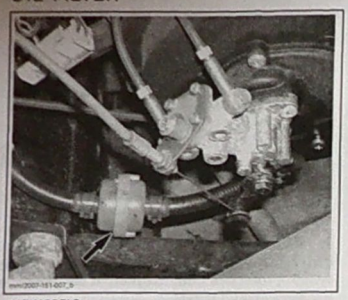
1. Float magnet at the lowest position

MEASURE	SENSOR CONDITION
Closed circuit (close to 0 Ω)	Good
Open or resistive circuit more than 0.5 Ω	Defective

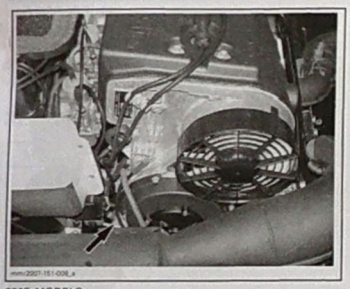
Sensor Installation

For installation, reverse the removal procedure.

OIL FILTER



440F MODELS



550F MODELS

Oil Filter Removal

Siphon injection oil reservoir.

550F Models

Remove oil reservoir and ignition coil.

440F and 550F Models

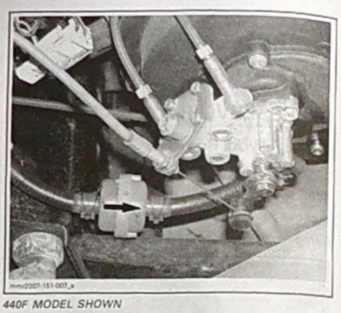
Disconnect oil filter hose from the oil level sensor.

Disconnect filter from oil hoses and remove it.

Oil Filter Installation

For installation, reverse the removal procedure.

The filter must be installed with the arrow pointing toward the pump.



440F MODEL SHOWN

Bleed oil pump. Refer to *OIL PUMP*.

OIL PUMP

Oil Pump Identification

Different engines need different pumps. See identification on lever no. 3.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
443	E8
552	03

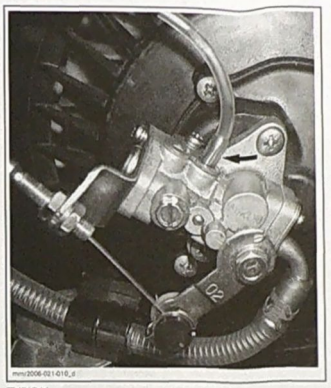
Oil Pump Verification

NOTE: Since pump is a piston type, it works when engine rotates in both forward and reverse.

On Vehicle

NOTE: Main oil line must be full of oil. See bleeding procedure further.

Lift rear of vehicle and support with a mechanical stand. Unplug small oil lines from pump.

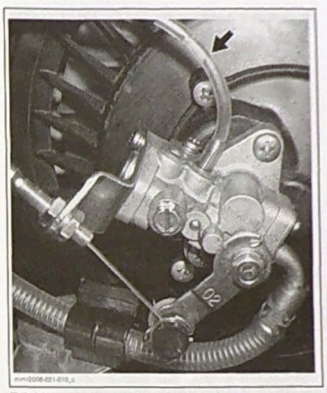


TYPICAL

Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever **no. 3** in fully open position. Oil columns must advance into small oil lines.



TYPICAL

If not, remove oil pump **no. 1** and check the pump gear **no. 8** and drive shaft **no. 10** for defects, replace as necessary. Test pump as described below.

NOTE: Through normal use, oil level must not drop in small tubes. If oil drops, verify check valves **no. 4** operation. Replace as necessary.

Test Bench

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill, rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. If not, replace pump.

Oil Pump Removal

NOTE: Before removing the oil pump **no. 1**, check its operation.

CAUTION: Never try to pull out oil pump without removing mounting flange no. 7. Damage to pump components would occur.

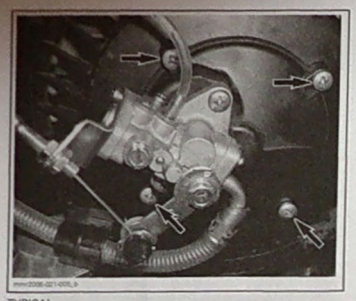
Drain injection oil reservoir.

550F Models

Remove the muffler.

440F/550F Models

Remove screws **no. 6**.



TYPICAL

Slightly pull mounting flange. Retain small gear **no. 8** to avoid it falls down then, pull it out.

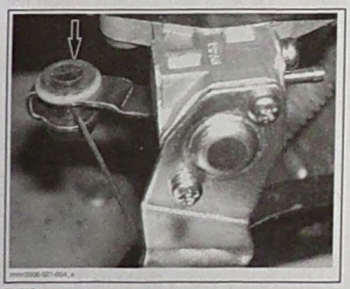
Remove circlip then unplug hose from pump. Plug end of hose to prevent oil spillage.

CAUTION: Do not use a hose pincher on inlet hose. This would damage the spring inside hose.

NOTE: Mark outlet hoses location for installation.

Unplug outlet hoses from pump.

Remove circlip then pull out throttle cable.



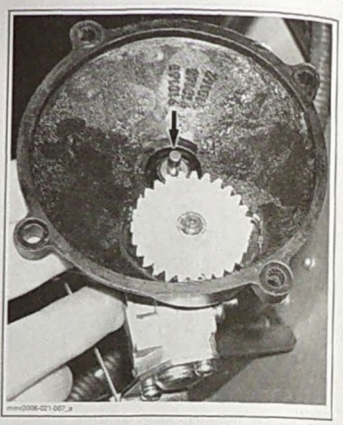
TYPICAL

Withdraw pump.

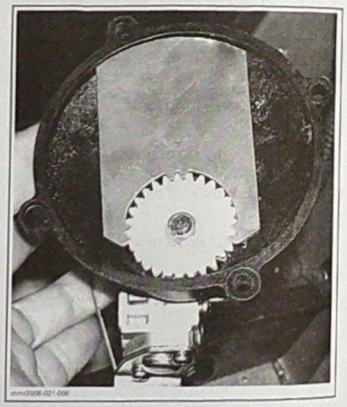
Oil Pump Disassembly

NOTE: Some oil pump components are not available as single parts.

First extract the needle roller with pliers.



Lock gear in place using gear holder (P/N 420 876 695).



Oil Pump Cleaning

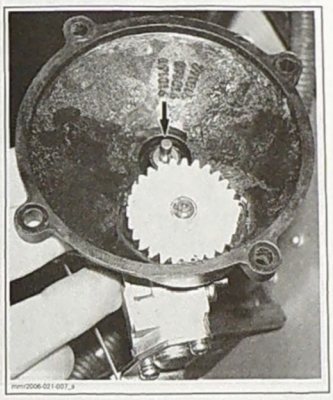
Clean all metal components in a non-ferrous metal cleaner.

Oil Pump Assembly

For assembly, reverse the disassembly procedure. However, pay attention to the following.

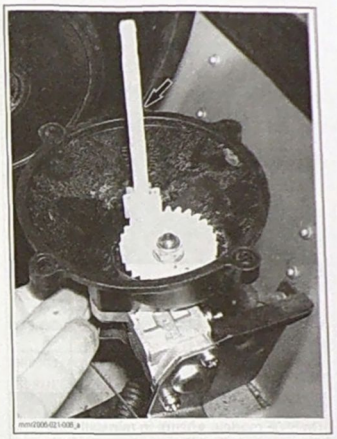
At gear **no. 8** assembly, apply a light coat of grease Molykote 111 (P/N 413 707 000) on gear teeth.

The needle roller must be engaged as deep as possible in the pump mounting flange.



mmv2006-021-007_a

Install small gear **no. 10** in mounting flange.



mmv2006-021-008_a

Oil Pump Installation

Reverse removal procedure. However, pay attention to the following.

Install pump mounting flange on rewind starter.

CAUTION: Do not force flange onto rewind starter for installation. Rotate flange while inserting so that gear shaft properly mesh with crankshaft end.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of screws **no. 5** and torque them to 6 N•m (53 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip as shown.



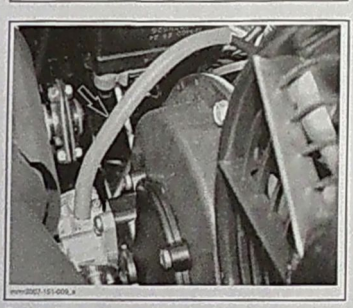
1. Plastic washer on this side
2. Circlip on this side

Verify cable and oil pump lever operation then adjust cable.

Always check for spring clip tightness on inlet hose.

⚠ WARNING

On 550F models, ensure to reinstall tube protector on small oil line as shown.



Bleed oil system.

CAUTION: Always bleed oil pump when the system has been opened.

Oil Pump Adjustment

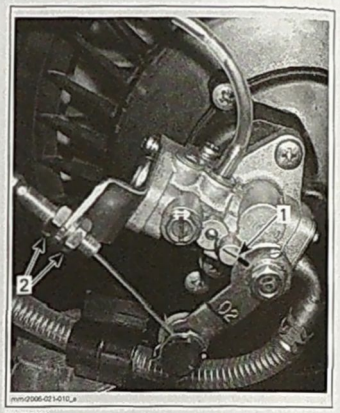
Prior to adjusting the pump, make sure all carburetor adjustments are completed and engine is stopped. Refer to *CARBURETOR AND THROTTLE CABLE*.

Eliminate the throttle cable free-play by pressing the throttle lever until a light resistance is felt, then hold in place.

The mark on the pump casting and on the lever must align. Width of lever mark is the tolerance.

Loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.



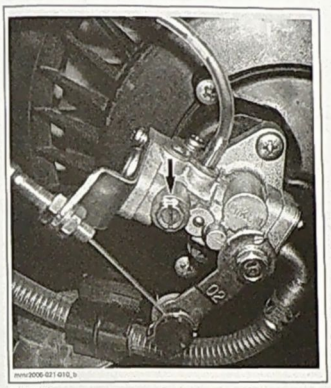
TYPICAL
1. Marks
2. Adjuster nuts

CAUTION: Proper oil pump adjustment is very important. Any delay in the opening of the pump can result in serious engine damage.

Oil Pump Bleeding

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw **no. 2** until air has escaped from the line. Add injection oil as required.

Bleed the small oil line between pump and engine by running engine at idle while holding the pump lever in fully open position.



TYPICAL

NOTE: Make a "J" hook out of mechanical wire to lift the lever.

⚠ WARNING

Do not operate throttle mechanism. Secure the rear of the vehicle on a stand.

CHECK VALVE

440F Models

Check valve is part of banjo fitting **no. 4** installed on oil pump.

550F Models

Check valve is part of injection nozzle **no. 4** installed on crankcase.

Check Valve Test

Use the vacuum/pressure pump (P/N 529 021 800).



529 021 800

Connect pump to injection nozzle/banjo fitting**no. 4**.

Test check valve as follows.

PUMP SETTING	Set to VACUUM	Set to PRESSURE
TO DO	Activate pump several times	Slowly activate pump and listen to check valve
RESULT	Air must not flow through check valve	You should hear it release pressure at approx. 20.7 kPa (3 PSI)
ACTION	**Success:** Perform next test	**Success:** Check valve is good
	Failed: Replace check valve	**Failed:** Replace check valve

INJECTION NOZZLE

550F Models

Injection Nozzle Test

Refer to *CHECK VALVE*.

Injection Nozzle Removal

CAUTION: Do not remove injection nozzle needlessly. It is likely to be damaged.

Remove air intake silencer and carburetor.

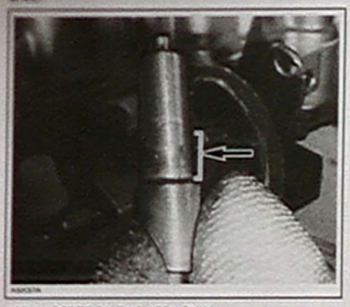
Clean injection nozzle area to remove oil or dirt.

Heat injection nozzle **no. 4** then pull it out of crankcase.

Injection Nozzle Installation

Prior to coating it with Loctite, make sure injection nozzle body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the injection nozzle (machined section). Take care that Loctite is ONLY in this area.



APPLY LOCTITE ON THIS AREA ONLY

Properly install the injection nozzle in the correct position into the crankcase to allow proper hose routing.

Punch in the injection nozzle carefully with a plastic hammer.

Clean the crankcase from surplus of Loctite 648 with a rag.

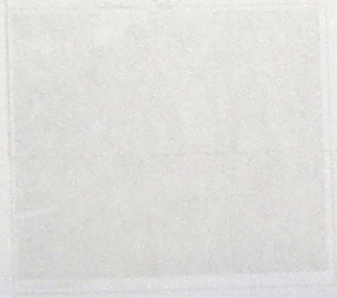
REWIND STARTER

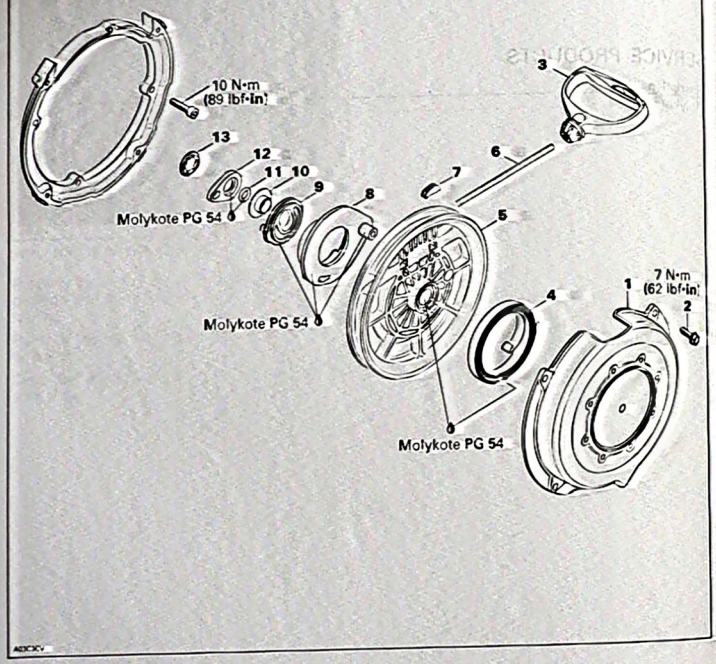
SERVICE TOOLS

Description	Part Number	Page
small hose pincher	295 000 076	89

SERVICE PRODUCTS

Description	Part Number	Page
Molykote PG 54	420 899 763	84–86




10 N•m
(89 lbf•in)
13
12
11
10
9
8
7
6
3
5
4
1
7 N•m
(62 lbf•in)
2
Molykote PG 54
Molykote PG 54
Molykote PG 54

GENERAL

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope **no. 6** is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring **no. 11** every time rewind starter is disassembled.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

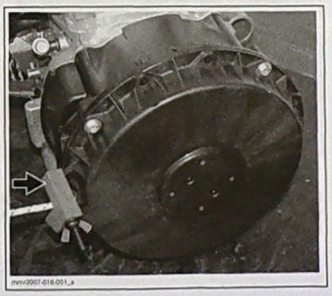
When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

PROCEDURES

STARTER HANDLE

Handle Removal

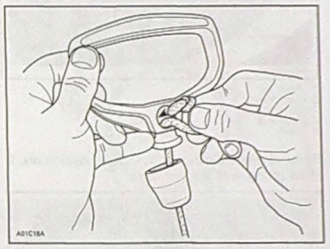
Pull rope for 50 cm (20 in) approximately. Using a small hose pincher (P/N 295 000 076), lock rope near rewind starter.



Using a small screwdriver, extract rope knot from stater handle **no. 3**. Cut rope close to knot.

Handle Installation

Prior to installing starter handle on rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter handle and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter handle over the knot.



TYPICAL

REWIND STARTER

Rewind Starter Removal

Remove starter handle **no. 3**.

Remove nuts retaining oil injection pump to rewind starter housing.

Remove oil injection pump shaft.

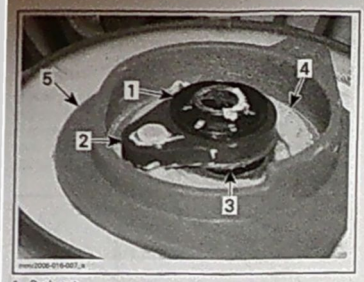
Remove screws **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

Rewind Starter Disassembly

Undo knot previously tied at removal. Let sheave get free to release spring preload.

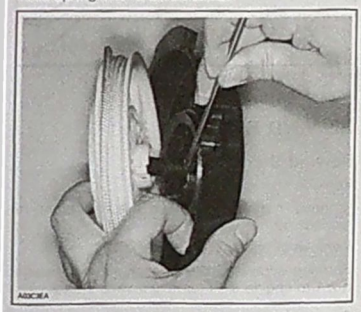
Cut push nut **no. 13**and discard.

Remove lock lever **no. 12**, O-ring **no. 11**, collar sleeve **no. 10**, pawl lock **no. 9** and pawl **no. 8**.

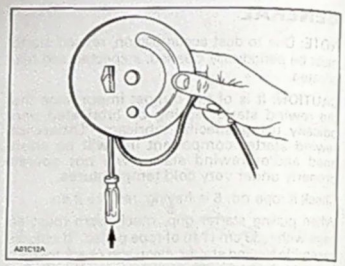


1. Push nut
2. Lock lever
3. Collar sleeve
4. Pawl lock
5. Pawl

Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.



Disengage key **no. 7** and pull out rope **no. 6**.



GENTLY TAP ON KEY

Take out the knot and then rope **no. 6**.

Rewind Starter Assembly

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counter-clockwise into guide.

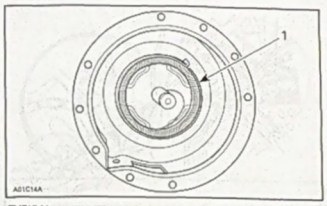
⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

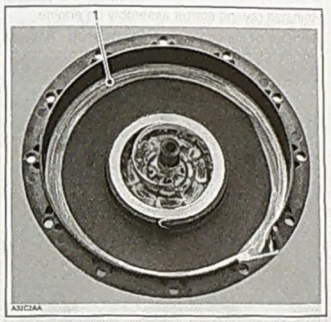


1. Outer end into guide notch

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



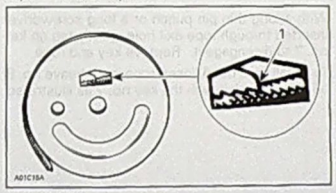
TYPICAL
1. Molykote PG 54 inside spring guide



1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: The use of standard multipurpose grease could result in rewind starter malfunction under very cold temperatures and components life will be shortened.

Insert rope **no. 6** into sheave **no. 5** orifice and lock rope with the key **no. 7**.



1. Push to lock

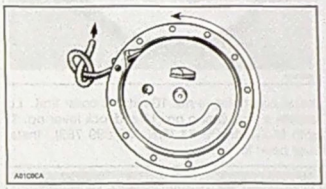
Lubricate housing post with silicone compound grease. Install sheave.

To adjust spring tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

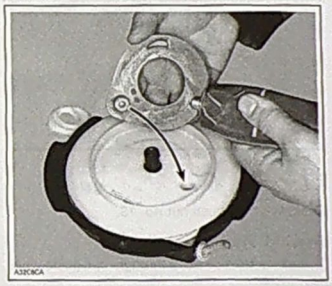
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

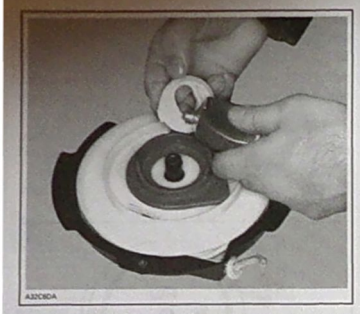


TYPICAL

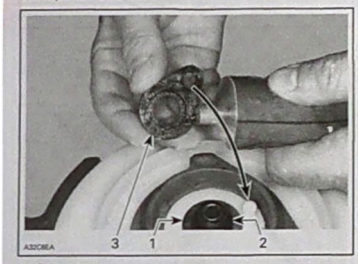
Lubricate pawl **no. 8** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



Lubricate pawl lock **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl.



Install collar sleeve **no. 10** with its collar first. Lubricate a new O-ring **no. 11** and lock lever **no. 12** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.

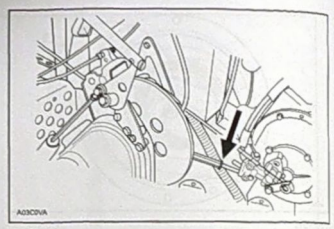


1. Collar sleeve
2. O-ring
3. Lock lever

Position a new push nut **no. 13**.

Rewind Starter Installation

Thread starter rope **no. 6** through rope guide when applicable.



TYPICAL

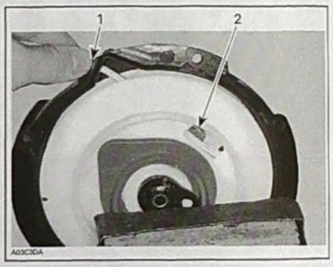
Reinstall rewind starter assembly on engine.

Reinstall oil injection pump and its shaft. Refer to *OIL INJECTION PUMP*.

ROPE

Rope Replacement

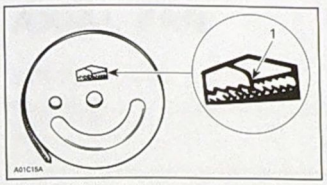
Completely pull out rope. Hold rewind starter in a vise.



1. Rope exit hole
2. Key to be removed

With a long thin pin punch or a long screwdriver inserted through rope exit hole, gently tap on key **no. 7** to disengage it. Remove key and rope.

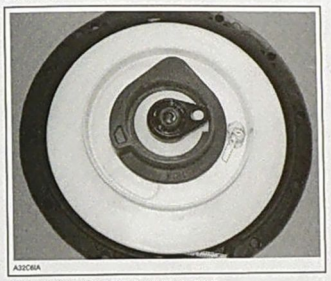
To install rope **no. 6**, insert rope into sheave no. 5 orifice and lock it with the key **no. 7** as illustrated.



1. Push to lock

NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

Fuse rope end with a lit match and insert it into sheave.



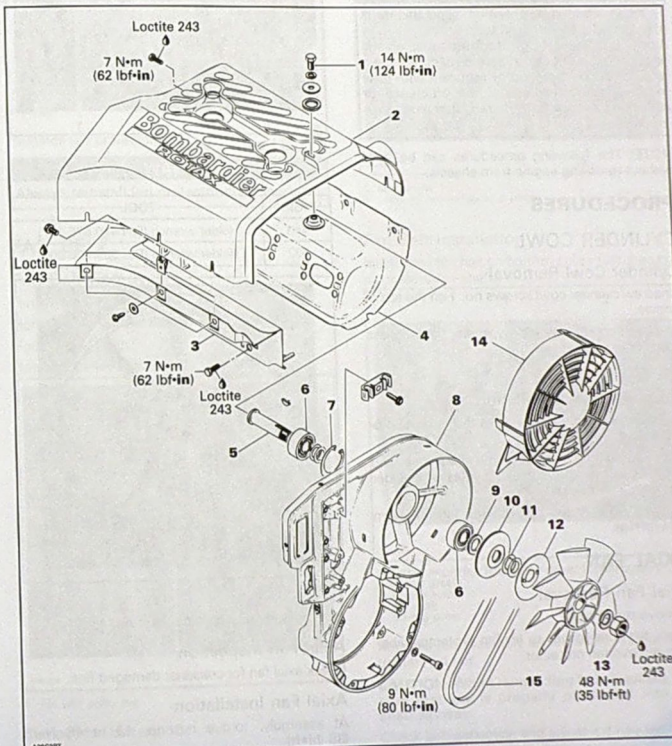
FREE PORTION INSERTED INTO SHEAVE

NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

AXIAL FAN

SERVICE TOOLS

Description	Part Number	Page
Holder wrench	420 876 357	90
Holder wrench	529 036 006	90



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

NOTE: The following procedures can be done without removing engine from chassis.

PROCEDURES

CYLINDER COWL

Cylinder Cowl Removal

Unscrew cylinder cowl screws **no. 1** on the top of engine.

Remove screws with lock washers, flat washers and rubber washers.

Pull cylinder cowl.

Cylinder Cowl Installation

The installation is the reverse of the removal procedure.

A gasket must be placed on both sides (inner and outer) of intake and exhaust cavities of cylinder cowl **no. 3** and **no. 4**.

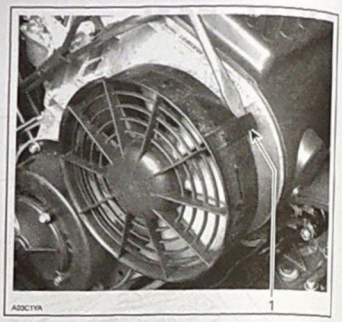
Torque cylinder cowl screws **no. 1** to 14 N•m (124 lbf•**in**).

AXIAL FAN

Axial Fan Removal

Remove tuned pipe.

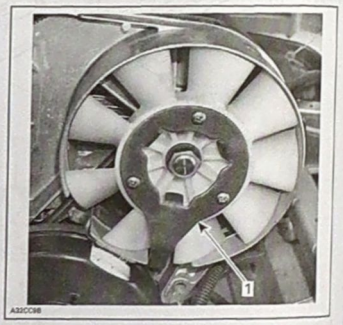
Use a flat screwdriver to lift fan protector tabs, then remove fan protector.



1. Lift tab and remove fan protector

Lock fan pulley with holder wrench and 3 screws.

ENGINE	TOOL
443	Holder wrench (P/N 420 876 357)
552	Holder wrench (P/N 529 036 006)



1. Holder wrench

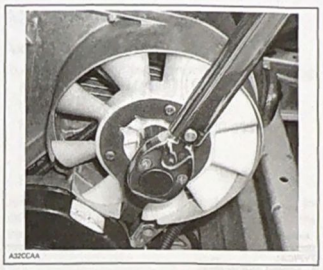
Remove fan pulley retaining nut **no. 13**.

Axial Fan Inspection

Check axial fan for cracks or damaged fins.

Axial Fan Installation

At assembly, torque nut **no. 13** to 48 N•m (35 lbf•ft).



TYPICAL

Reinstall fan protector.

⚠ WARNING

Always reinstall fan protector after servicing.

FAN BELT

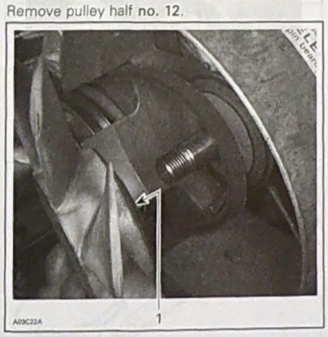
Fan Belt Removal

Remove tuned pipe.

Remove rewind starter and starting pulley.

Remove axial fan.

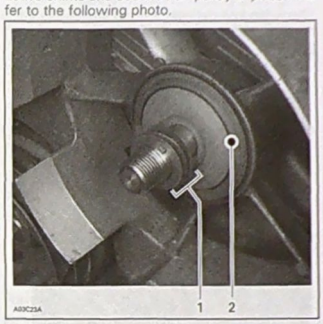
Remove pulley half no. 12.



1. Fan with pulley half

Remove fan belt no. 15.

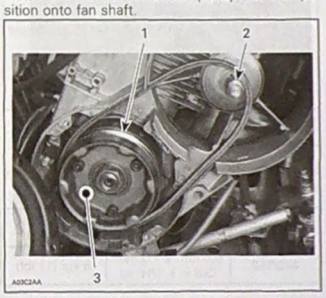
Leave shims and second half pulley in place. Refer to the following photo.



1. Keep shims
2. Leave second half pulley in place

Fan Belt Installation

Install new fan belt on bottom pulley first then position onto fan shaft.



FAN BELT PROPERLY INSTALLED ON BOTTOM PULLEY AND FAN SHAFT
1. Bottom pulley
2. Fan shaft
3. Starting pulley

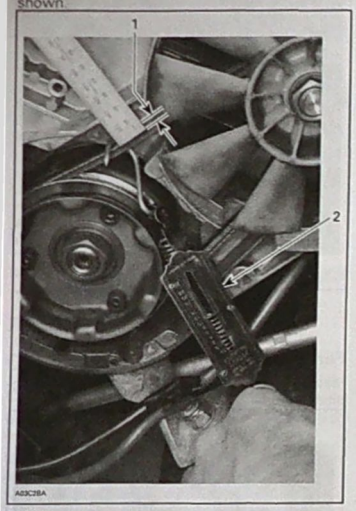
Reinstall fan assembly on fan shaft. Temporarily tighten fan nut.

CAUTION: When reinstalling fan assembly, ensure that key is properly positioned into fan shaft keyway.

Check belt deflection and adjust it if needed.

Fan Belt Deflection and Adjustment

Check fan belt deflection using a ruler and a fish scale positioned midway between pulleys as shown.

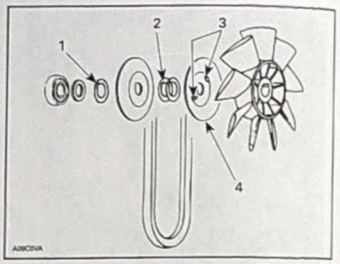


TYPICAL
1. Measure deflection here
2. Fish scale

Belt deflection must be according to the following specifications:

ENGINE	BELT DEFLECTION	FORCE APPLIED
443/552	9.5 mm ± 1.5 mm (3/8 in ± 1/16 in)	5 kgf (11 lbf)

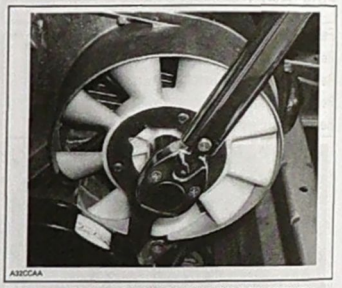
To adjust deflection tension, add or remove shim(s) **no. 11** between pulley halves **no. 9** and **no. 12**. Install excess shim(s) between distance sleeve **no. 11** and pulley half **no. 10** (housing side).



TYPICAL
1. Unused shim(s) here
2. Adjust here
3. Positioning noses
4. Some engines only

Select pulley halves so that the one with 2 positioning noses will be on fan side. Ensure to insert these noses into fan notches.

Once fan belt is properly adjusted, torque fan nut to 48 N•m (35 lbf•ft) using holder wrench.



TYPICAL — TORQUE FAN NUT USING HOLDER WRENCH

Finalizing Reassembly

Reinstall rewind starter.

Reinstall tuned pipe.

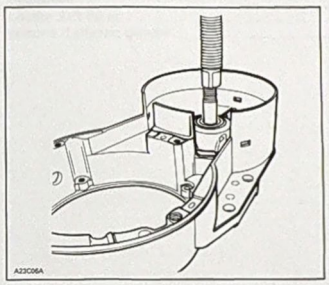
AXIAL FAN BEARING

Axial Fan Bearing Removal

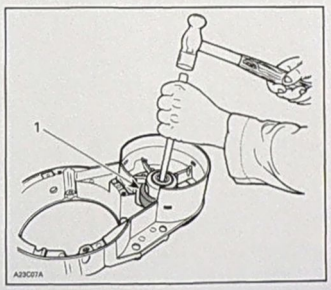
To remove the fan housing **no. 8**, do the following:

- Remove tuned pipe.
- Remove cylinder cowl.
- Remove rewind starter and starting pulley.
- Remove axial fan and fan belt.
- Remove magneto and stator.
- Remove fan housing.

Using a press, drive the fan shaft **no. 5** out. Install a support under fan housing before using the press.

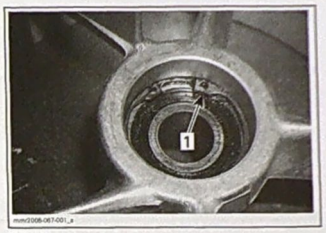


Support fan housing **no. 8** with a ring. With a punch, working all around bearing **no. 6** inner race, drive bearing out of fan housing. Keep shims for installation.



1. Ring supporting fan housing

Remove circlip **no. 7** then remaining bearing.



TYPICAL
1. Circlip

Axial Fan Bearing Installation

To install, press one bearing in place then install circlip and shims. Press the other bearing from opposite side until it is flush with housing. Press fan shaft from engine side of fan housing. Check for free rolling action.

NOTE: The bearings are sealed, do not add grease at time of assembly.

Properly reinstall removed parts.

MAGNETO SYSTEM

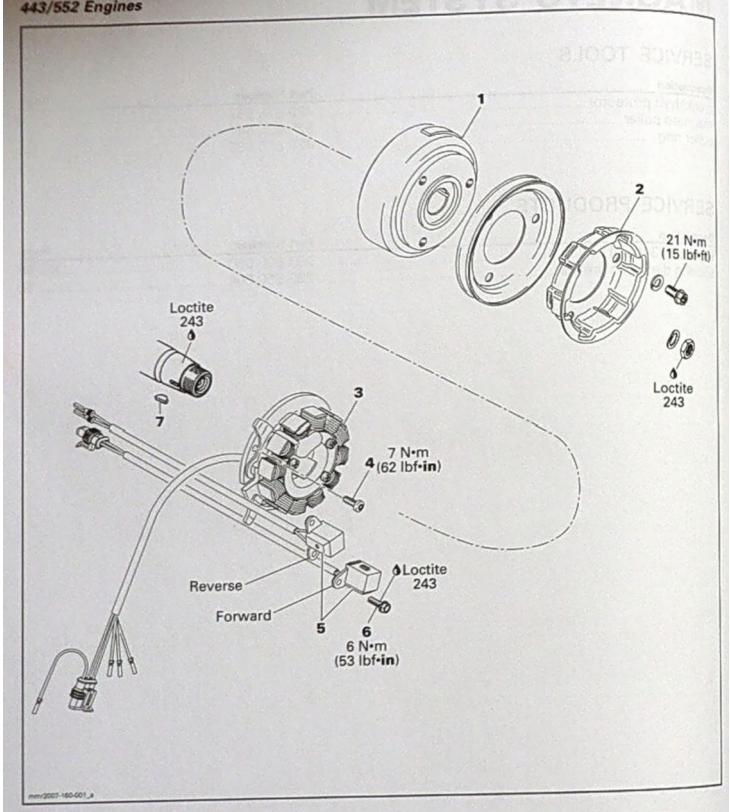
SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	420 876 557	98
magneto puller	529 035 547	98
puller ring	420 876 080	97

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	98-99
silicone dielectric grease	293 550 004	98

443/552 Engines



GENERAL

NOTE: The following procedures can be done without removing the engine. To facilitate magneto removal, hold drive pulley with the appropriate tool. Refer to *DRIVE PULLEY*.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

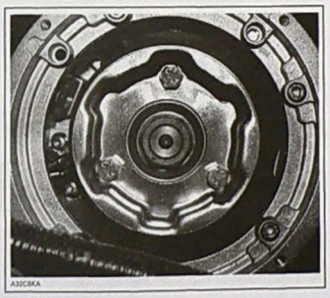
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

MAGNETO FLYWHEEL

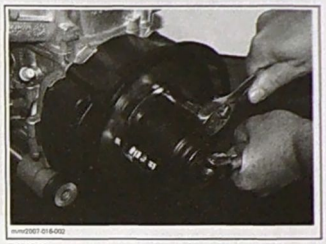
Flywheel Removal

To gain access to magneto flywheel **no. 1** assembly, remove the following parts:
- tuned pipe
- rewind starter
- starting pulley **no. 2**.


A32C8KA

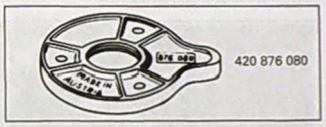
TYPICAL

NOTE: To remove starting pulley bolts, hold magneto flywheel with a socket as shown.


mmr2007-016-002

TYPICAL

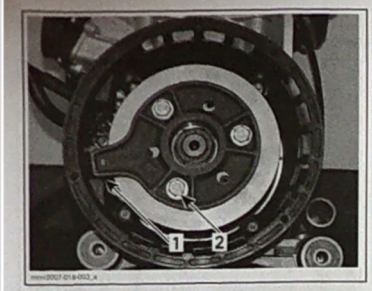
Install the puller ring (P/N 420 876 080) on magneto flywheel (or counterweight if so equipped).



420 876 080

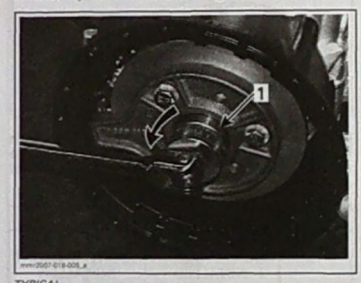
CAUTION: Use only the following screw length to bolt puller to magneto flywheel. Otherwise damage to stator behind magneto flywheel could occur.

ENGINE	SCREW LENGTH	
	WITHOUT COUNTERWEIGHT INSTALLED	WITH COUNTERWEIGHT INSTALLED
443/552	M8 x 20 mm	M8 x 30 mm



TYPICAL
1. Tab in magneto housing opening
2. M8 screws of appropriate length

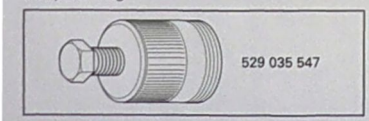
Remove magneto flywheel nut, using a 30 mm socket machined to 40 mm (1.580 in) outside diameter by 16 mm (5/8 in) long.

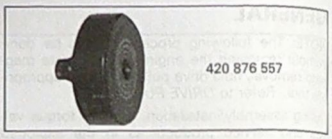


TYPICAL
1. Machined 30 mm socket

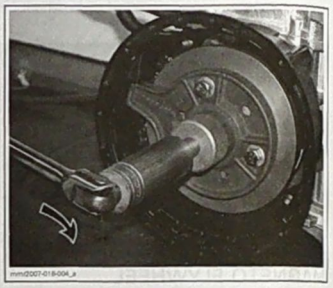
NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.

To remove magneto flywheel, install the crankshaft protector (P/N 420 876 557) on crankshaft end. Screw the magneto puller (P/N 529 035 547) into puller ring.





Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.



Flywheel Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Flywheel Installation

Clean crankshaft extension (taper) and apply Loctite 243 (blue) (P/N 293 800 060) on taper, then position Woodruff key, magneto flywheel no. 1 and lock washer on crankshaft.

Install Woodruff key no. 7 in its keyway.

Clean magneto flywheel nut threads and apply Loctite 243 (blue) (P/N 293 800 060) then tighten nut.

ENGINE	TORQUE
443/552	105 N•m (77 lbf•ft)

At reassembly coat all electric connections except Deutsch housings (waterproof housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone "sealant", this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch waterproof housing otherwise housing seal will be damaged.

STATOR

Stator Inspection

Always check stator **no. 3** before changing it. Refer to *CHARGING SYSTEM*.

Stator Removal

Remove:

- magneto flywheel **no. 1**
- all Allen socket screws **no. 4** retaining stator to magneto housing
- grommet from crankcase where trigger coils **no. 5** and stator wires exit magneto housing.

Unplug the trigger coil connectors and pull the wires through the grommet location.

NOTE: To pass the stator connector into the grommet location it is necessary to pass the trigger coil connector first.

Unplug the stator connector and remove the stator **no. 3**.

Stator Cleaning

Clean all metal components in a non-ferrous metal cleaner.

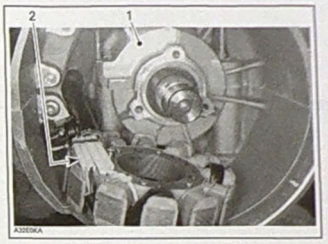
CAUTION: Clean stator using only a clean cloth.

Stator Installation

Insert the stator connector into crankcase grommet then the trigger coil connector(s).

Install the grommet on crankcase.

Position stator **no. 3** so that its wire protectors are over crankcase recess.



1. Crankcase recess
2. Wire protectors

NOTE: During installation, make sure the stator harness is located on the left side.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of stator screws then torque them to 7 N•m (62 lbf•**in**).

Reinstall all other removed parts.

TRIGGER COIL

Trigger Coil Inspection

For trigger coil inspection, refer to *IGNITION SYSTEM* for forward engine operation or *ROTAX ELECTRONIC REVERSE (RER)* for reverse engine operation.

Trigger Coil Removal

To replace trigger coil(s) **no. 5**, remove or disconnect the following:

- magneto flywheel **no. 1**
- air intake silencer to allow an access to the trigger coil connectors (if necessary)
- trigger coil connector housing(s)
- grommet from crankcase where trigger coil wire(s) exit(s) magneto housing
- retaining screws **no. 6**
- trigger coil(s) and carefully pull wires.

Trigger Coil Installation

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicon at trigger coil location then apply new silicon. Screw trigger coil then stick the trigger coil wires in the silicon.

TOP END

SERVICE TOOLS

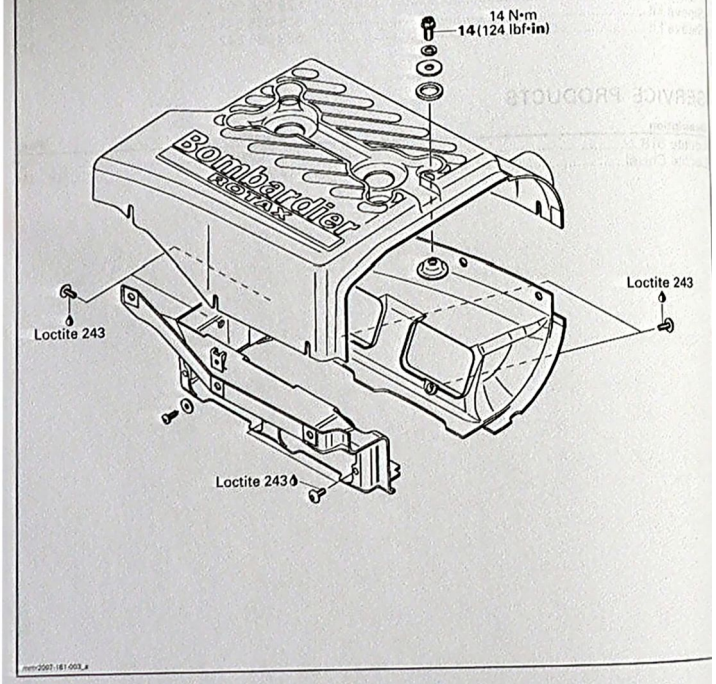
Description	Part Number	Page
Locating sleeve	529 023 800	107
Piston circlip installer	529 035 561	110
Piston circlip installer	529 035 686	110
Puller	529 035 503	107
Sleeve kit	529 035 541	107
Sleeve kit	529 035 542	107

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 518	293 800 038	106
Loctite Chisel	413 708 500	105–106

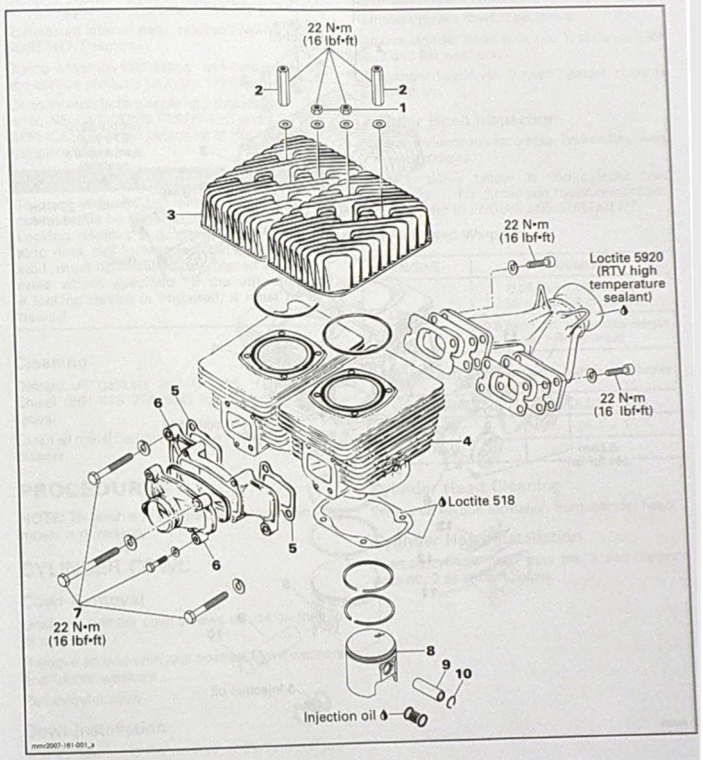
CYLINDER COWL

440F and 550F Engines



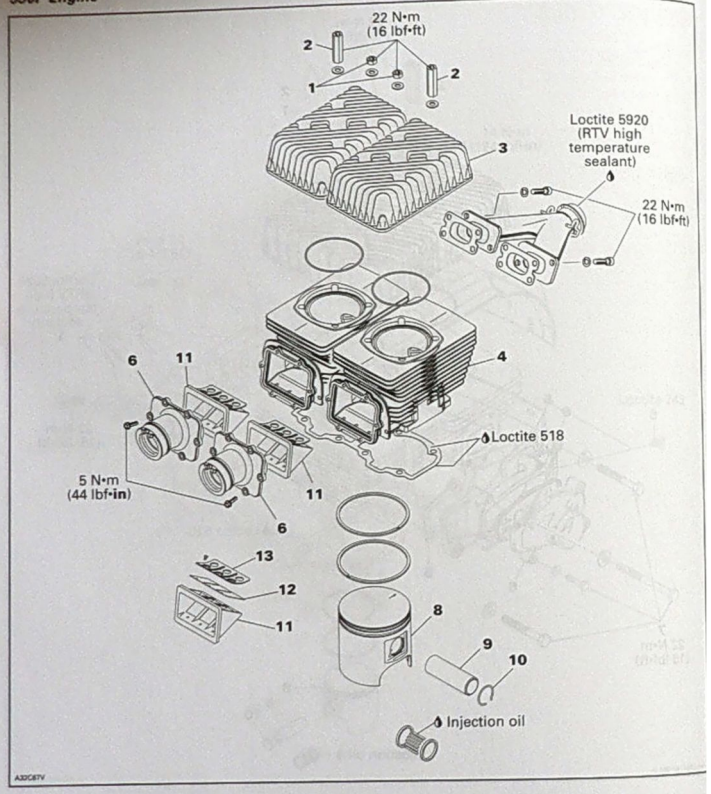
TOP END

440F Engine



TOP END

550F Engine



GENERAL

Before completely disassembling the engine, check airtightness. Refer to *LEAK TEST*.

To measure internal parts, refer to *ENGINE MEASUREMENT* section.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Cleaning

Discard all gaskets and O-rings. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

Clean all metal components in a non-ferrous metal cleaner.

PROCEDURES

NOTE: To reach any internal parts, the engine removal is necessary.

CYLINDER COWL

Cowl Removal

Unscrew cylinder cowl screws **no. 14** on the top of engine.

Remove screws with lock washers, cowl washers and rubber washers.

Pull cylinder cowl.

Cowl Installation

The installation is the reverse of the removal procedure.

Torque cylinder cowl screws **no. 14** to 14 N•m (124 lbf•**in**).

CYLINDER HEAD

Cylinder Head Removal

Remove cylinder cowl. See above.

Remove cylinder head nuts **no. 1**, distance nuts **no. 2** and flat washers.

Lift cylinder heads **no. 3** over cylinder studs to remove them.

Cylinder Head Inspection

Check cylinder heads for cracks, broken fins, warp or other damages.

Refer to tables below to find cylinder head specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

Cylinder Head Warpage

ENGINE	MAXIMUM
440F/550F	0.05 mm (.002 in) per 50 mm (2 in) of surface
	0.5 mm (.020 in) for total length of cylinder head

Cylinder Head Combustion Chamber Volume

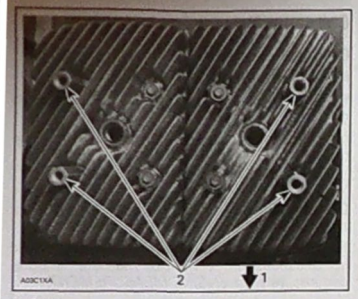
ENGINE	VOLUME (CC)
440F	25.4 ± 1
550F	35.5

Cylinder Head Cleaning

Scrape off carbon formation from cylinder head.

Cylinder Head Installation

Position cylinder head nuts **no. 1** and distance nuts **no. 2** as shown below.



1. Exhaust
2. Distance nuts

Torque cylinder head nuts **no. 1** and **no. 2** to 22 N•m (16 lbf•ft) in a criss-cross sequence; torque each cylinder head individually.

CYLINDER

Cylinder Removal

440F Engine

Remove intake manifold **no. 6**.

550F Engine

Remove intake adapters **no. 6**.

Remove reed valves **no. 11**.

440F and 550F Engines

Remove exhaust manifold.

Remove cylinder cowl and cylinder heads.

Lift cylinders **no. 4**.

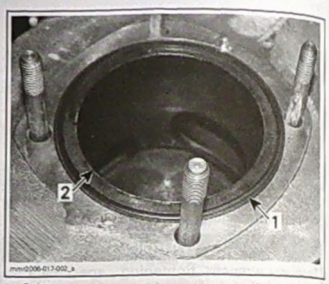
Discard the cylinder gasket.

Cylinder Inspection

Check cylinders for cracks and scoring on the top and bottom of cylinders.

Check exhaust flanges for flatness.

Check cylinder O-ring.



1. O-ring
2. Cylinder

Refer to tables below to find cylinder specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

Cylinder Taper

ENGINE	MAXIMUM
440F/550F	0.10 mm (.004 in)

Cylinder Out of Round

ENGINE	MAXIMUM
440F/550F	0.08 mm (.003 in)

Cylinder Cleaning

Scrape off carbon formation from exhaust ports.

Clean mating surfaces using Loctite Chisel (P/N 413 708 500).

Cylinder Installation

Install a new cylinder base gasket of the same thickness as previously used. Apply a thin layer of Loctite 518 (P/N 293 800 038) on each side of gasket.

NOTE: If the old gasket thickness is unknown or if a cylinder head or cylinder is replaced, measure the combustion chamber volume to determine the right gasket to use. Refer to *ENGINE MEASUREMENT* for the measurement procedures. Refer to *CYLINDER HEAD* above for the combustion chamber volume specifications.

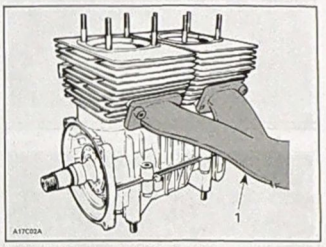
CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

Apply Loctite 518 on gasket.

Before inserting piston in the cylinder, lubricate the cylinder with new injection oil or equivalent.

Using fingers or a piston ring compressor, slide piston **no. 8** into cylinder **no. 4**.

Install exhaust manifold to align cylinders.



1. Use exhaust manifold to align cylinders

440F Engine

Torque intake manifold screws as indicated.

NOTE: Check intake manifold for flatness.

ENGINE	TORQUE
440F	22 N•m (16 lbf•ft)

550F Engine

Install reed valves.

Torque intake adapter screws as indicated.

NOTE: Check intake adapters for cracks or delamination.

ENGINE	TORQUE
550F	5 N•m (44 lbf•**in**)

440F and 550F Engines

Torque exhaust manifold bolts to 22 N•m (16 lbf•ft).

Install cylinder heads and cylinder cowl.

PISTON

Piston Removal

Remove cylinders.

NOTE: The PTO cylinder or fan housing have to be removed to give access to MAG piston with puller.

Place a clean rag over crankcase to prevent circlips **no. 10** from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston **no. 8**.



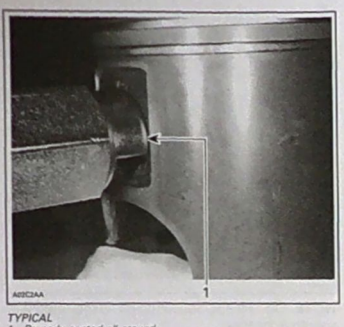
NOTE: On this engine, piston pin is mounted with cageless bearing.

Use piston pin puller along with sleeve kit and locating sleeve as per following table.

440F ENGINE TOOL
Puller (P/N 529 035 503)
Sleeve kit (P/N 529 035 541) (18 mm)
Locating sleeve (P/N 529 023 800)

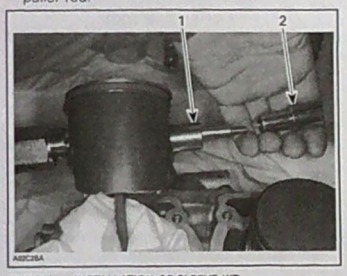
550F ENGINE TOOL
Puller (P/N 529 035 503)
Sleeve kit (P/N 529 035 542) (20 mm)
Locating sleeve (P/N 529 023 800)

– When inserting piston pin puller, make sure it sits squarely against piston.



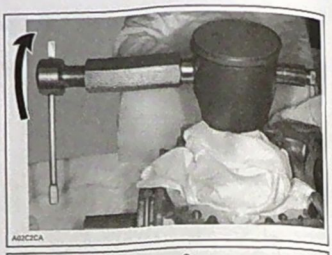
TYPICAL
1. Properly seated all around

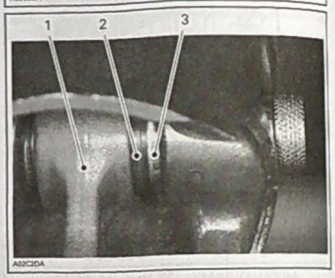
– Install sleeve then shouldered sleeve over puller rod.



TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

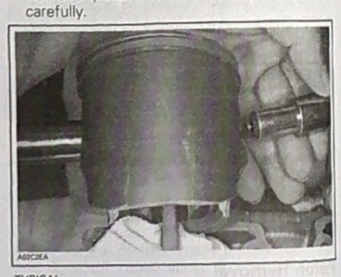
– Pull out piston pin by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.





TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

– Remove puller. Pull out shouldered sleeve carefully.

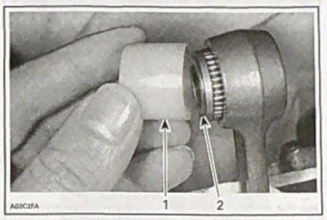


TYPICAL

– Remove piston from connecting rod.
– Install locating sleeve.

NOTE: The locating sleeve is the same that contains new cageless bearing.

– Push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

– Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

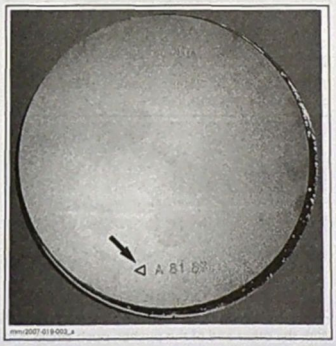
Piston Inspection

Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary. Refer to *ENGINE MEASUREMENT* to complete inspection.

Piston Cleaning

Scrape off carbon formation from piston dome.

NOTE: The arrow on the piston dome must be visible after cleaning.



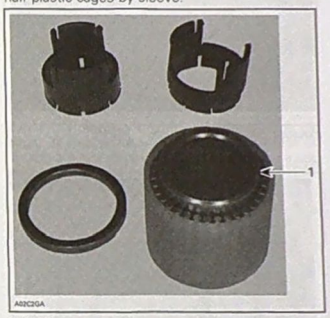
Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

Piston Installation

When reinstalling original needle bearings, make sure the proper quantity of needles is inserted between sleeve and locating sleeve.

ENGINE	NEEDLES IN ROLLER BEARING
440F	31
550F	34

When installing a new cageless bearing, replace half plastic cages by sleeve.



TYPICAL
1. Sleeve

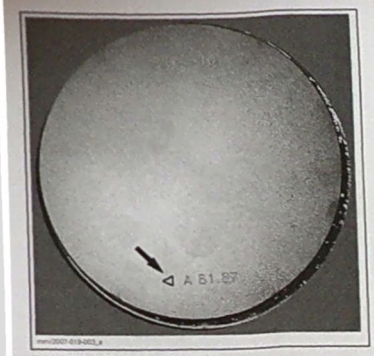
Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.



TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Place pistons over the connecting rods with the arrow on the piston dome facing towards the exhaust port.



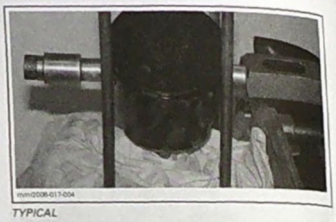
EXHAUST DIRECTION INDICATION

Install shouldered sleeve.



TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.



TYPICAL

Remove piston pin puller and sleeve kit.

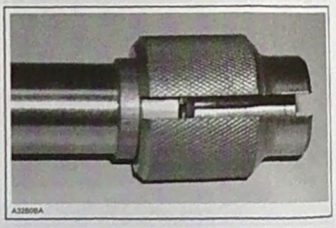
Use the appropriate piston circlip installer to install mono-hook circlips **no. 10**.

ENGINE	TOOL
440F	Piston circlip installer (P/N 529 035 561)
550F	Piston circlip installer (P/N 529 035 686)

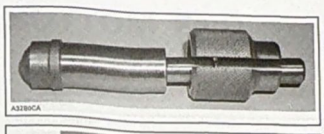
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

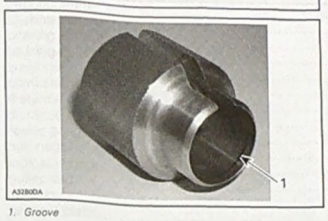


With round end of pusher, position circlip perpendicular to the support axis.

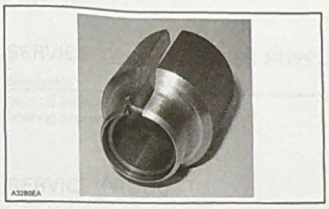


With the other end of the pusher, push circlip into the support groove.



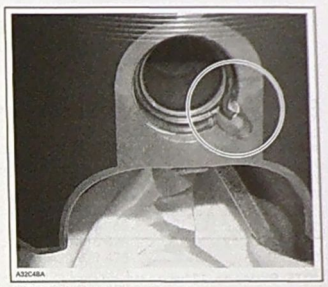


1. Groove



CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care to install new circlips with tab toward top as per following photo.



TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one as on a second attempt circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Before inserting piston in the cylinder, lubricate the cylinder with new injection oil or equivalent.

REED VALVE

550F Engine

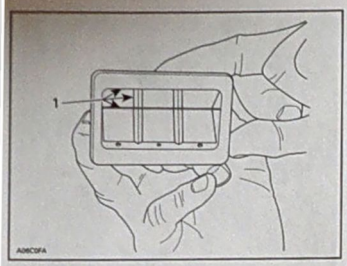
Reed Valve Removal

Remove intake adapters **no. 6** by removing carburetors and screws retaining intake adapters.

Remove reed valves **no. 11** from engine.

Reed Valve Inspection

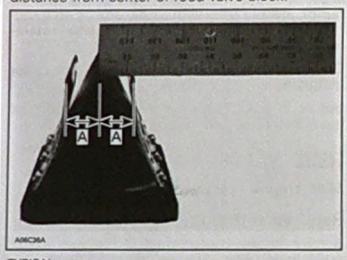
With blade stopper **no. 13** removed, check reed valve for proper tightness. There must be no play between blade **no. 12** and valve body when exerting a finger pressure on blade at blade stopper location.



1. No play

NOTE: Blades **no. 12** have a curved shape. Install with their curve facing reed block.

Check distance from blade stopper inner edge and distance from center of reed valve block.



TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

Reed Valve Installation

The installation is the reverse of the removal procedure.

NOTE: Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	120
bearing installer	529 035 980	122
bearing installer	529 035 990	120
bearing puller	529 036 004	118
crankshaft protector	420 876 552	118
crankshaft protector	420 876 557	119
distance gauge	420 876 822	121
distance gauge	529 035 965	121
feeler gauge	420 876 620	121
half rings	420 977 475	118
indicator stick	529 035 970	120
puller ring	420 977 490	118
screws	420 840 681	118
support plate	529 035 976	121

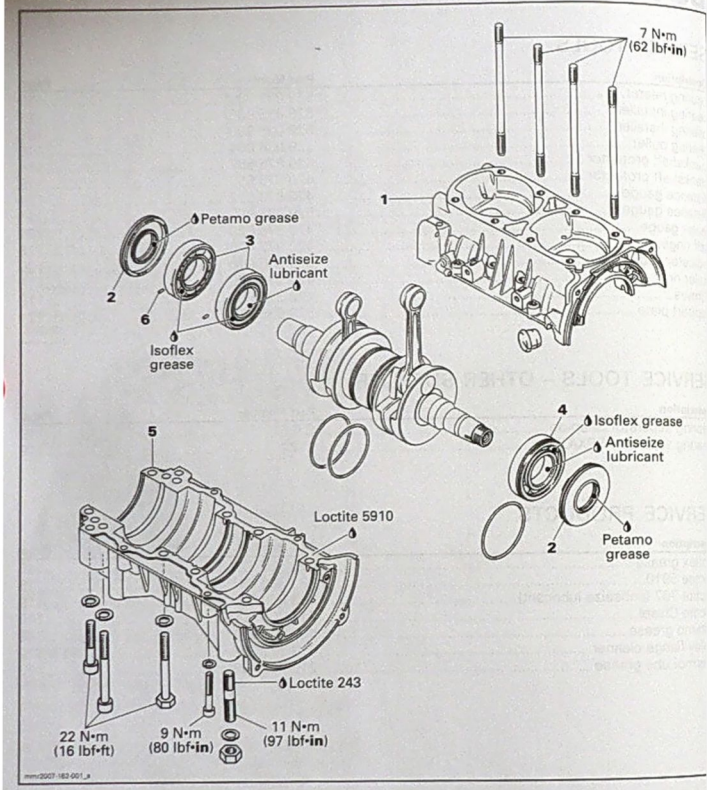
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
bearing separator Snap-on	CJ951	119
bearing separator SPX/OTC	1124	119

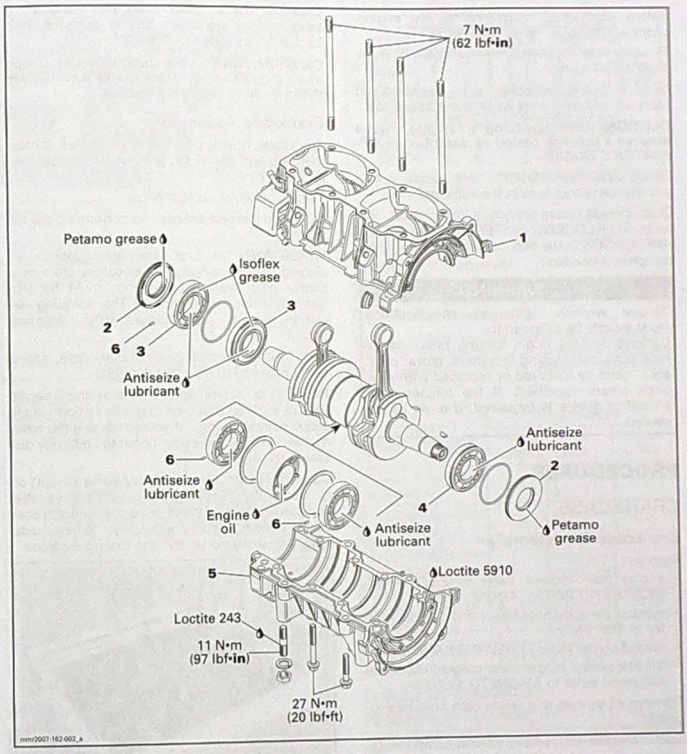
SERVICE PRODUCTS

Description	Part Number	Page
Isoflex grease	293 550 021	118
Loctite 5910	293 800 081	116
Loctite 767 (antiseize lubricant)	293 800 070	119
Loctite Chisel	413 708 500	116
Petamo grease	420 899 271	118
pulley flange cleaner	413 711 809	117, 119
ThermoLube grease	219 700 417	118

443 Engine


7 N•m
(62 lbf•in)
1
Petamo grease
3
Antiseize
lubricant
2
6
Isoflex
grease
4
Isoflex grease
Antiseize
lubricant
5
Loctite 5910
2
Petamo
grease
Loctite 243
22 N•m
(16 lbf•ft)
9 N•m
(80 lbf•in)
11 N•m
(97 lbf•in)

552 Engine


7 N•m
(62 lbf•in)
1
Petamo grease
Isoflex
grease
2
6
3
3
Antiseize
lubricant
6
Antiseize
lubricant
Engine
oil
6
Antiseize
lubricant
Antiseize
lubricant
2
4
Petamo
grease
5
Loctite 5910
Loctite 243
11 N•m
(97 lbf•in)
27 N•m
(20 lbf•ft)
mm2007-162-002_a

GENERAL

Before completely disassembling the engine, check airtightness. Refer to *LEAK TEST*.

To verify internal parts, refer to *ENGINE MEASUREMENT* section.

All oil seals and gaskets must be discarded and replaced with new ones when crankcase is split.

CAUTION: After rebuilding an engine always observe a break-in period as described in *OPERATOR'S GUIDE*.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

CRANKCASE

Crankcase Disassembly

Remove:
- engine from chassis (refer to *ENGINE REMOVAL AND INSTALLATION*)
- cylinder cowl, cylinder heads and cylinders (refer to *TOP END*)
- rewind starter (refer to *REWIND STARTER*)
- fan belt pulley, trigger coils, magneto flywheel and stator (refer to *MAGNETO SYSTEM*).

Remove all screws that retain both housings together.

Split crankcase and remove internal components.

Crankcase Inspection

Check crankcase for cracks. Replace if needed.

Crankcase Cleaning

Clean all metal components and remove old sealant from crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

Crankcase Assembly

Crankcase halves **no. 1** and **no. 5** are factory matched and therefore, are not interchangeable as single halves.

Install all internal components.

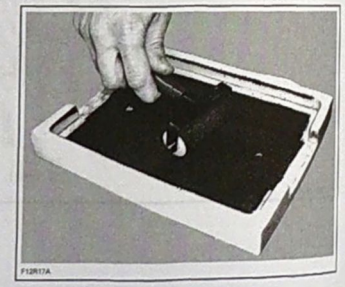
Close and torque crankcase by performing the following:

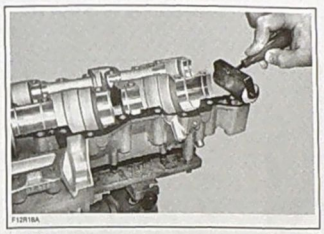
IMPORTANT: The total assembly sequence, including sealing compound application, crankcase screw installation and torquing, must be performed within 10 minutes. The torquing sequence must be accomplished without interruption.

Before screwing both parts of crankcase, seal it with Loctite 5910 (P/N 293 800 081).

NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

Use a plexiglass plate and apply some sealant on it. Use a 50 - 75 mm (2 - 3 in) soft rubber roller and spread the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.


F12R17A

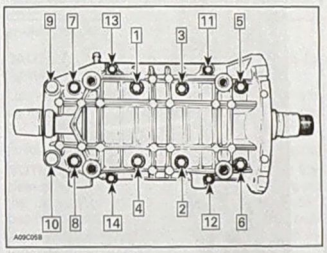


TYPICAL

Tighten all crankcase screws in place in 2 consecutive steps as indicated.

443 Engine

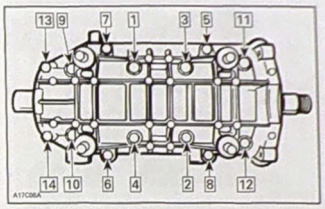
TIGHTENING STEP	M6 SCREW	M8 SCREW
Step 1: Initial torque	4 N•m (35 lbf•**in**)	13 N•m (115 lbf•**in**)
Step 2: Final torque	7 N•m (62 lbf•**in**)	22 N•m (16 lbf•ft)



TIGHTENING SEQUENCE

552 Engine

TIGHTENING STEP	M8 SCREW
Step 1: Initial torque	13 N•m (115 lbf•**in**)
Step 2: Final torque	22 N•m (16 lbf•ft)



TIGHTENING SEQUENCE

CRANKSHAFT

Crankshaft Removal

Split crankcase and remove crankshaft.

Crankshaft Inspection

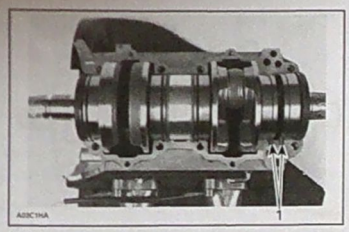
Refer to table below to find bottom end engine dimension specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (MIN.)	(MAX.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.06 mm (.0024 in)	N.A.
Crankshaft deflection on MAG side	N.A.	0.03 mm (.001 in)	N.A.
Crankshaft deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	0.2 mm (.008 in)	0.527 mm (.0207 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

Crankshaft Installation

Using pulley flange cleaner (P/N 413 711 809), remove all trace of Loctite 243 from crankshaft taper.

When installing crankshaft, position drive pins **no. 6** in crankcase recesses as illustrated.



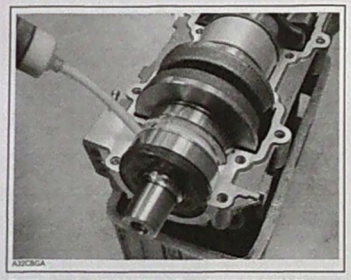
TYPICAL
1. Drive pins

At seal **no. 2** assembly, apply a light coat of Petamo grease (P/N 420 899 271) on seal lip.

Put 15 to 20 mL of Isoflex grease (P/N 293 550 021) in a syringe.

NOTE: The 50 g tube corresponds to 50 mL of grease.

With the syringe, fill in the PTO side ball bearings as shown below.



TYPICAL — BALLS COATED WITH A SEAM OF GREASE

CAUTION: Use only the recommended grease. Make sure not to push grease between outside bearing race and half crankcase.

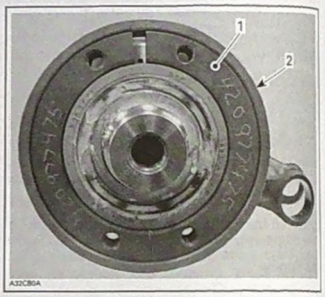
Close crankcase and install all removed parts.

CRANKSHAFT BEARINGS

Bearing Removal

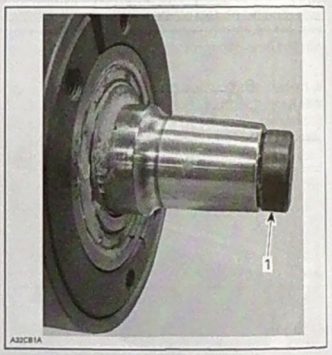
NOTE: Normally it takes approximately 10 minutes to heat up a bearing so in the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. See procedure further.

To remove PTO side bearings **no. 3** from crankshaft, install half rings (P/N 420 977 475) and puller ring (P/N 420 977 490) on the bearing.



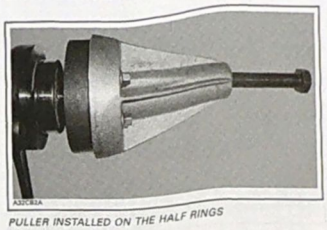
1. Half ring
2. Puller ring

Apply ThermoLube grease (P/N 219 700 417) on the crankshaft end and install crankshaft protector (P/N 420 876 552).



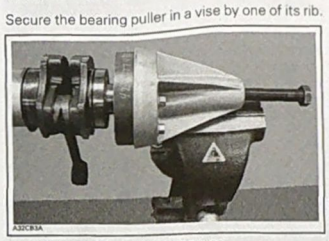
1. Crankshaft protector

Install bearing puller (P/N 529 036 004) and secure to half rings using screws (P/N 420 840 681).



PULLER INSTALLED ON THE HALF RINGS

Secure the bearing puller in a vise by one of its rib.



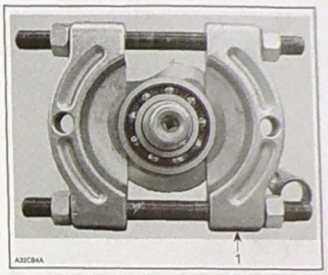
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use a bearing separator Snap-on (P/N CJ951) or a bearing separator SPX/OTC (P/N 1124) to facilitate the removal.



1. Bearing separator

Procedure for MAG side bearings no. 4 is same as of PTO side with the exception of the crankshaft protector (P/N 420 876 557).

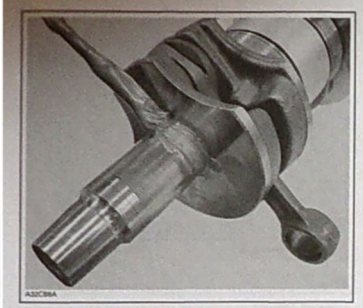
Bearing Installation

Crankshaft Preparation

Clean crankshaft end with sand paper no. 180 and remove all residue using pulley flange cleaner (P/N 413 711 809).

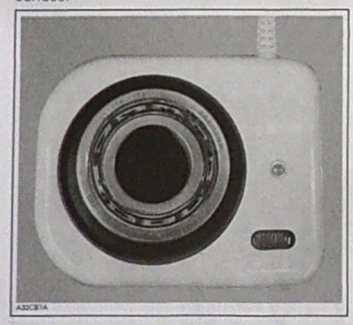


Smear Loctite 767 (antiseize lubricant) (P/N 293 800 070) on part of crankshaft where bearing fits.



Bearing Preparation

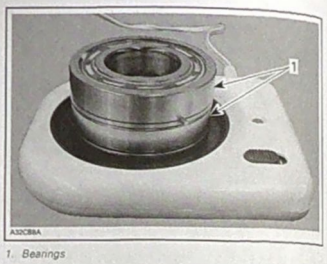
Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal (if applicable) with the heating surface.



CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

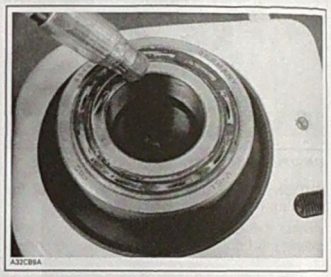
For even heat distribution, turn bearing several times during heating process.

NOTE: Two bearings can be heated at the same time on one bearing heater.



1. Bearings

Touch the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.



⚠ WARNING

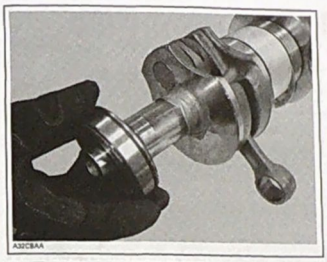
Do not touch heated bearing with bare hands. Wear heat resisting gloves before handling the heated bearing(s).

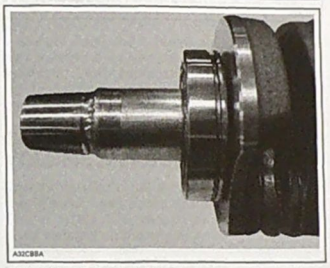
Bearing Installation

Ensure to position bearing grooves as per exploded view.

Slide in the inner PTO bearing on crankshaft. Push bearing to end position.

NOTE: The heated bearing should slide easily on the crankshaft. If required, push with a bearing installer (P/N 529 035 990).





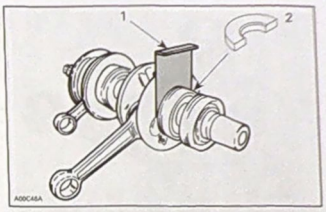
BEARING TO END POSITION

Install the O-ring.

443 Engine

To set proper clearance between inner bearing and crankshaft counterweight, use feeler gauge (P/N 420 876 620).

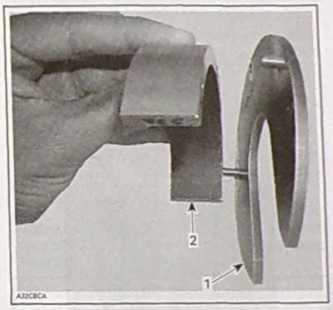
Position outer bearing using the distance gauge (P/N 420 876 822).



1. Feeler gauge
2. Distance gauge

552 Engine

Position outer bearing using support plate (P/N 529 035 976) and distance gauge (P/N 529 035 965).



1. Support plate
2. Distance gauge

Install bearing locator tool.



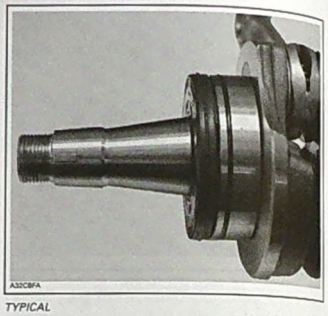
Slide in the heated outer PTO bearing onto the crankshaft.



443 and 552 Engines

Install the heated MAG side bearing.

NOTE: The heated bearing should slide easily on the crankshaft. If required, push with a bearing installer (P/N 529 035 980).



TYPICAL

ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	128
dial indicator	414 104 700	123, 127

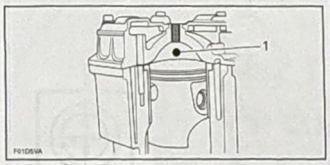
NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to *INSPECTION* in the appropriate *ENGINE* subsection.

CYLINDER HEAD WARPAGE

Check gasketed surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification. Otherwise, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

COMBUSTION CHAMBER VOLUME MEASUREMENT

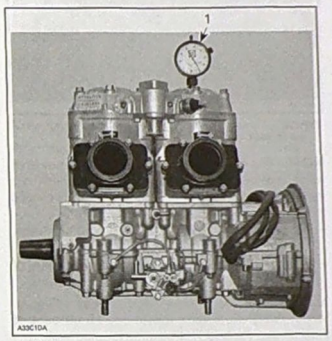
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center (TDC). It is measured with the cylinder head installed on the engine.



TYPICAL
1. Combustion chamber

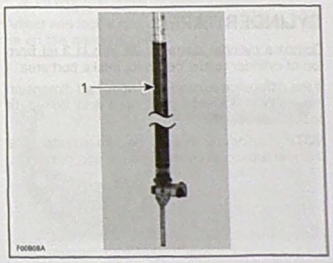
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using the dial indicator (P/N 414 104 700).



TYPICAL
1. Bring piston to TDC

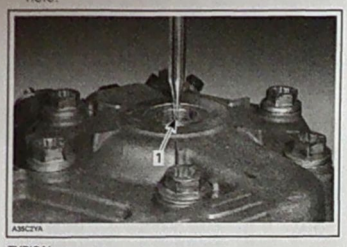
– Obtain a graduated burette (capacity 0 - 50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0 - 50 cc)

– Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.

– Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



TYPICAL
1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

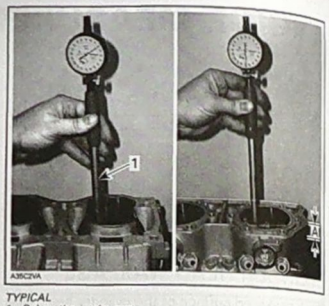
– Repeat the procedure for the other cylinder.
– Install a thicker or thinner cylinder/crankcase gasket (refer to *PARTS CATALOG*) in order to obtain the specified combustion chamber volume.

CYLINDER TAPER

Compare cylinder diameter 33 mm (1.3 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced.

NOTE: If cylinder is rebored, be sure to restore the chamfer around all cylinder sleeve port openings.

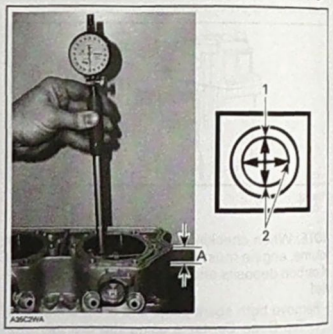


TYPICAL
1. Below the intake port
A. 33 mm (1.3 in) from top

CYLINDER OUT OF ROUND

Measuring 33 mm (1.3 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced.

NOTE: If cylinder is rebored, be sure to restore the chamfer around all cylinder sleeve port openings.

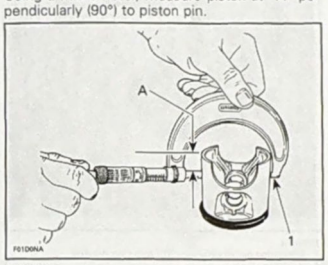


TYPICAL
1. Piston pin position
2. Measures to be compared
A. 33 mm (1.3 in)

CYLINDER/PISTON CLEARANCE

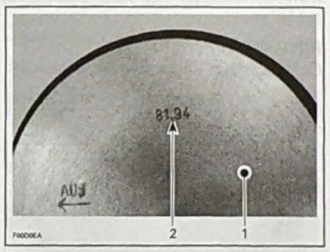
Procedure with a Used Piston

Using a micrometer, measure piston at "A" perpendicularly (90°) to piston pin.



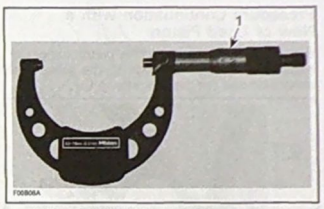
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 15 mm (.590 in)

NOTE: The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.



TYPICAL
1. Piston dome
2. Piston measurement

If piston is within tolerance, adjust and lock the micrometer to the piston dimension.

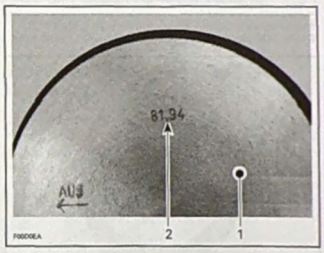


1. Micrometer set to the piston dimension

Refer to *PROCEDURE CONTINUATION WITH A NEW OR USED PISTON* further.

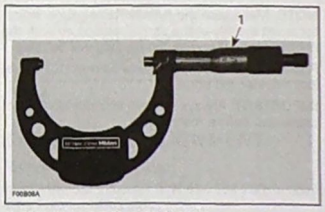
Procedure with a New Piston

Read the piston diameter on the piston dome.



1. Piston dome
2. Piston diameter

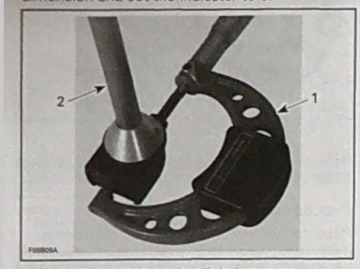
Adjust and lock a micrometer to the specified value on the piston dome.



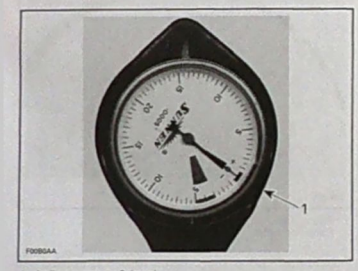
1. Micrometer set to the piston dimension

Procedure Continuation with a New or Used Piston

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge

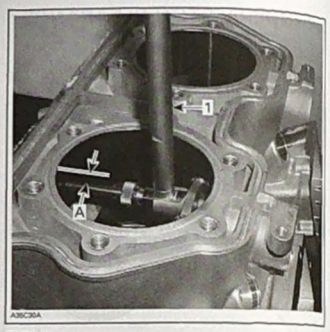


1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Position the dial bore gauge at 33 mm (1.3 in) below cylinder top edge.

IMPORTANT: Always remove cylinder-block from crankcase before measuring.



TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 33 mm (1.3 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder and piston.

NOTE: Oversize pistons are available for the 443 and 552 engines.

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

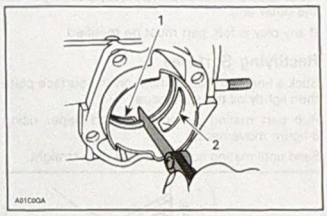


RING END GAP

Position ring halfway between transfer ports and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance.



TYPICAL
1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

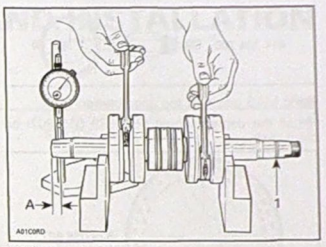
Crankshaft deflection is measured with the dial indicator (P/N 414 104 700).

Measuring in Crankcase

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring on Bench

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement "A" in following illustration.



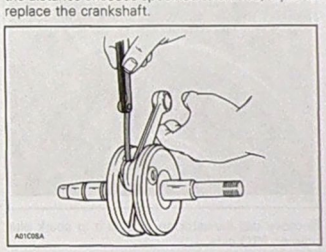
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.

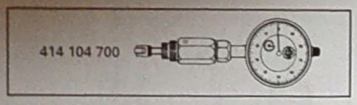


TYPICAL

CRANKSHAFT ALIGNMENT

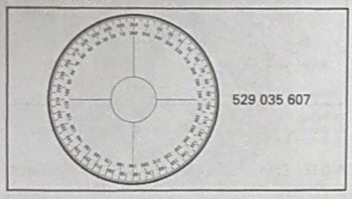
Remove both spark plugs.

Install the dial indicator (P/N 414 104 700) in spark plug hole on MAG side.



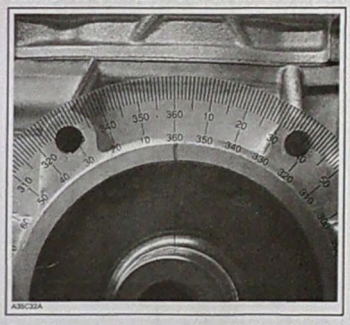
Bring MAG piston at top dead center.

Install the degree wheel (P/N 529 035 607) on crankshaft end.



Scribe a mark on crankcase.

Install degree wheel so that 360° mark aligns with the mark on crankcase. Do not rotate crankshaft.



Remove dial indicator and install it in spark plug hole on PTO side.

Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

CHECKING SURFACE FLATNESS

443 Engine

Intake manifold, intake manifold cover can be checked for perfectly mating surfaces.

Lay part on a surface plate (marble, mirror or thick glass plate).

Holding down one end of part, try pushing down the other end.

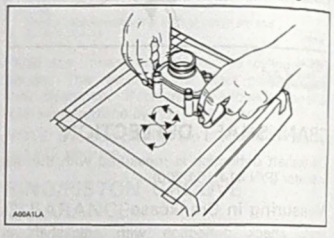
If any play is felt, part must be rectified.

Rectifying Surfaces

Stick a fine sand paper sheet on the surface plate then lightly oil the sand paper.

Rub part mating surface on sand paper using 8-figure movements.

Sand until mating surface is perfectly straight.

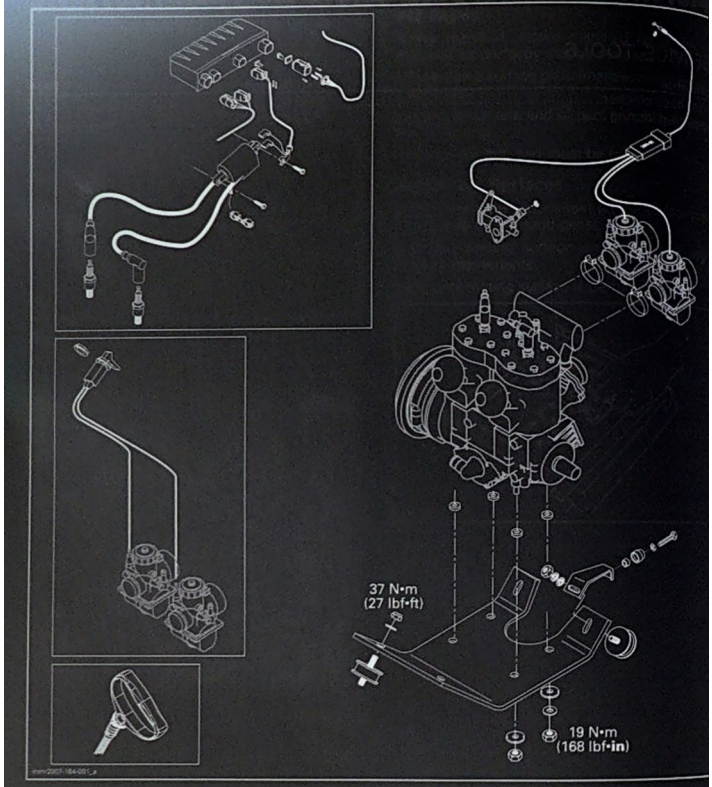


ENGINE REMOVAL AND INSTALLATION

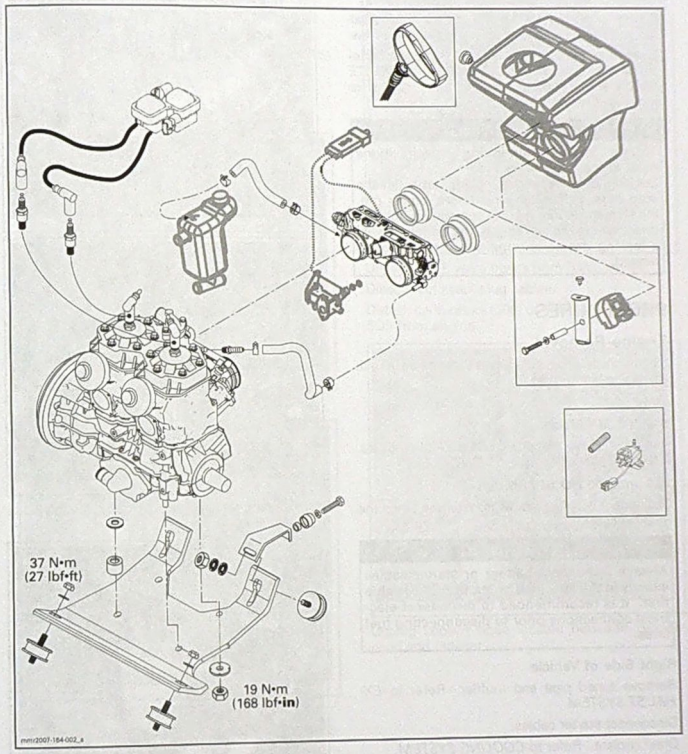
SERVICE TOOLS

Description	Part Number	Page
small hose pincher	295 000 076	132
spark plug lift ring	529 035 830	134

600 Models



600 HO SDI Models



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

Engine Removal

Place vehicle at a workstation that has access to an engine-lifting hoist.

Open hood.

600 HO SDI Models

Use B.U.D.S. software and release fuel pressure. Refer to *ENGINE MANAGEMENT*.

600 and 600 HO SDI Models

Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Right Side of Vehicle

Remove tuned pipe and muffler. Refer to *EXHAUST SYSTEM*.

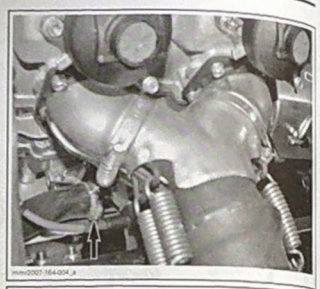
Disconnect starter cables.

Drain coolant. Refer to *COOLING SYSTEM*.

Remove rewind starter handle. Refer to *REWIND STARTER*.

Unplug electrical connectors from engine.

Disconnect the large coolant hoses from engine.

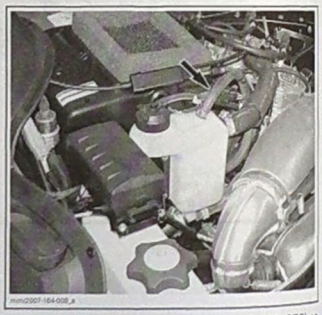


mvm2007-164-004_a



mvm2007-164-003_a

Unplug carburetor or throttle body heating hose from coolant tank.



mvm2007-164-008_a

Install a small hose pincher (P/N 295 000 076) on oil injection reservoir outlet line.

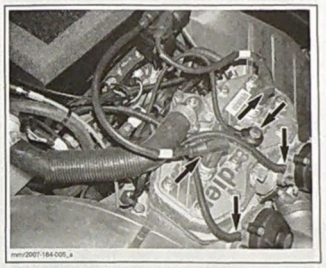
Disconnect oil lines from injection reservoir.

Left Side of Vehicle

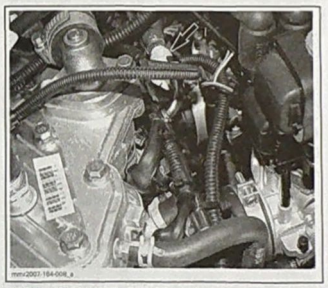
Remove:
- drive pulley (refer to *DRIVE PULLEY*)
- air intake silencer, refer to *AIR INTAKE SYSTEM*.

600 HO SDI Models

Remove knock sensor from cylinder head.

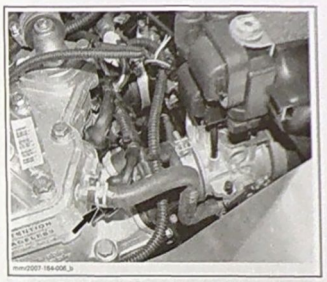


Disconnect fuel hose from fuel rail.



600 and 600 HO SDI Models

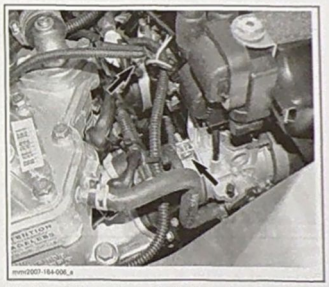
Unplug coolant hose between engine and carburetor or throttle body.



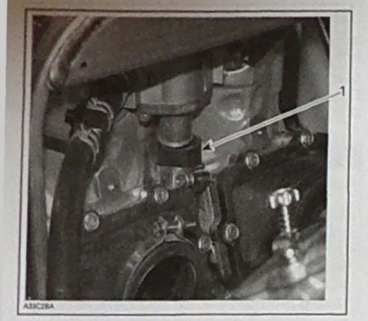
Unplug RAVE valve hoses from RAVE valves.

Disconnect spark plug cables.

Detach carburetors (600) or throttle body (600 HO SDI) from engine.



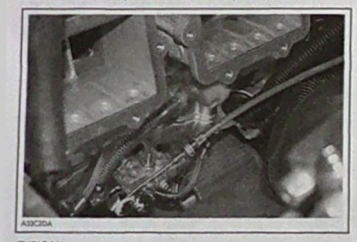
Unplug coolant hose located between cylinder head and radiator.



TYPICAL
1. Coolant hose between cylinder head and radiator

Disconnect impulse line from crankcase.

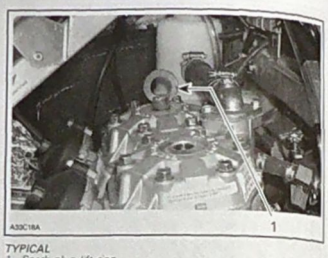
Detach oil pump cable from oil pump.



TYPICAL

Disconnect coolant temperature sensor (CTS) connector(s).

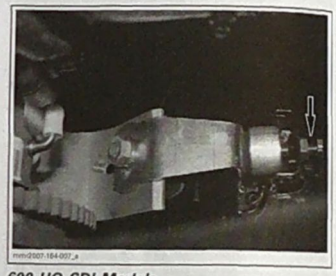
Remove spark plugs and install the spark plug lift ring (P/N 529 035 830) in a spark plug hole.



TYPICAL
1. Spark plug lift ring

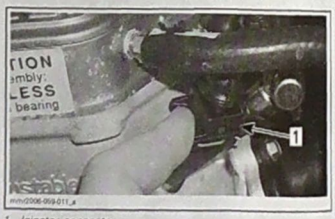
Unscrew engine support nuts.

Unscrew the engine stopper completely.



600 HO SDI Models

Disconnect fuel injectors connectors.



1. Injector connector

600 and 600 HO SDI Models

Lift out engine.

Cleaning

Clean bottom pan from any liquid spillage or dirt.

Inspection

Check if engine support is cracked, bent or damaged. Replace if necessary.

Check rubber mounts on engine support. Replace them if brittle, cracked or damaged.

Engine Installation

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

Torque engine support nuts to 37 N•m (27 lbf•ft).

Hand tighten engine stopper then torque its nut to 50 N•m (37 lbf•ft).

After carburetor or throttle body installation, check throttle cable adjustment and oil injection pump adjustment.

Properly refill and bleed cooling system.

Reinstall all remaining removed parts by using the appropriate component/system reinstallation procedures described in this shop manual.

⚠ WARNING

Keep wires and hoses away from any rotating, moving, heating, vibrating parts or sharp edges. Use proper shields and fastening devices as required.

ENGINE LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
intake plug	529 011 000	137
manifold plug	529 035 961	137
small hose pincher	295 000 076	137
vacuum/pressure pump	529 021 800	138

GENERAL

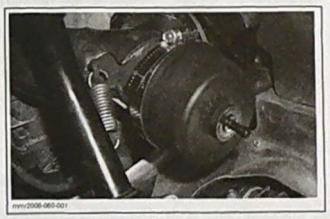
Prior to take apart an engine, it is important to proceed with a leak test to diagnose engine problems. Whenever the engine is disassembly, a leak test should be performed after reassembly.

NOTE: A flow chart has been prepared as a visual reference. See last page of this chapter.

PROCEDURES

Remove tuned pipe.

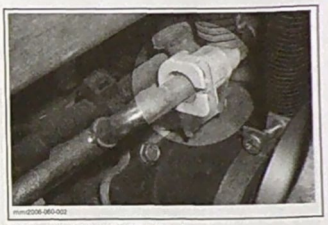
Install manifold plug (P/N 529 035 961) over exhaust manifold.



Remove carburetors/throttle body assembly (as applicable).

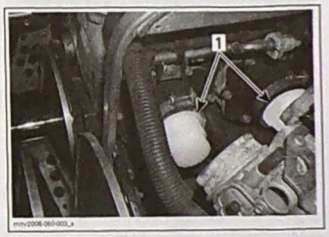
600 HO SDI Engine

Unplug fuel inlet line from fuel rail.



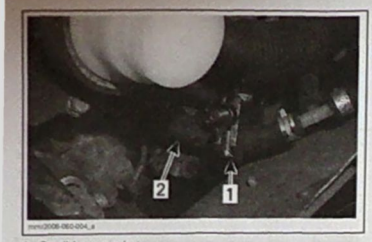
600 and 600 HO SDI Engines

Insert an intake plug (P/N 529 011 000) in each intake adaptors. Tighten with existing clamps.



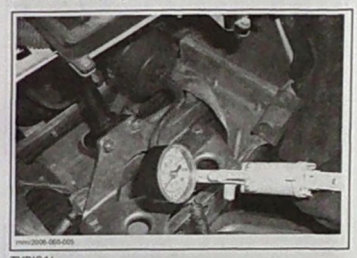
1. Intake plug

Using a small hose pincher (P/N 295 000 076), block impulse hose.



1. Small hose pincher
2. Impulse hose

Install vacuum/pressure pump (P/N 529 021 800) on manifold plug.



TYPICAL

Activate pump and pressurize engine.

TEST PRESSURE: 34 kPa (5 PSI) for 3 minutes

Do not exceed this pressure.

Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, spray a soapy solution on tester kit (manifold and intake plugs, vacuum/pressure pump and its hose).

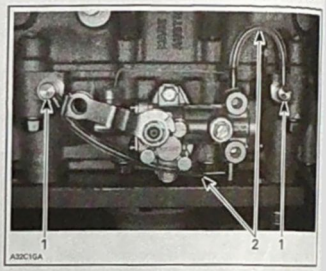
- If tester kit (manifold and intake plugs, hoses and pump) is leaking, bubbles will indicate where leak comes from.
- If tester kit is not leaking, check engine, see below for procedure.

Engine Verifications

Check the following:

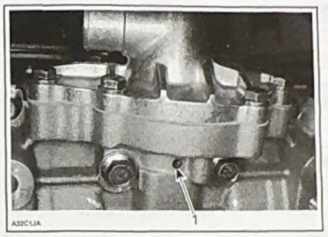
NOTE: If a leak is detected, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.

- All jointed surfaces and screw/stud threads of engine:
  - spark plug base, insulator
  - cylinder head
  - RAVE valve bellows, piston and housing
  - cylinder
  - crankcase halves (joint)
  - oil injection pump mounting flange (O-ring)
  - coolant pump housing
  - bleed screws/plugs
  - crankcase fitting PTO side.
- Small injection oil lines coming from pump. Air bubbles or oil column going toward pump, indicates a defective check valve in injection nipple.



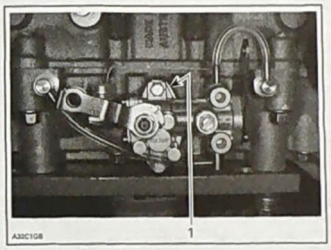
TYPICAL
1. Injection nipples
2. Small injection oil lines

- Air bubbles in antifreeze. It indicates defective cylinder head O-ring or cylinder base gasket.
- Crankshaft outer seals. One behind drive pulley and the other behind magneto.
- Leak indicator hole below coolant pump housing. If there is a leak, it indicates that a seal or pump shaft is defective (oil seal behind coolant ceramic seal).



1. Leak indicator hole

– Leaks can be also on oil pump side. Check mounting area for leaks.



TYPICAL
1. Check mounting area

– Pump shaft gear oil reservoir. See *PUMP SHAFT OIL GEAR RESERVOIR* below.

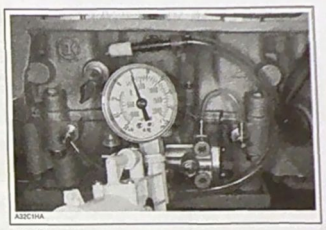
If leak still persists and can not be located, disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

Pump Shaft Oil Gear Reservoir

Install air pump on reservoir fitting and pressurize engine

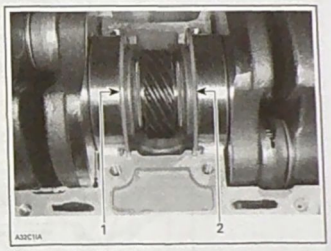
TEST PRESSURE: 34 kPa (5 PSI) for 3 minutes

Do not exceed this pressure.

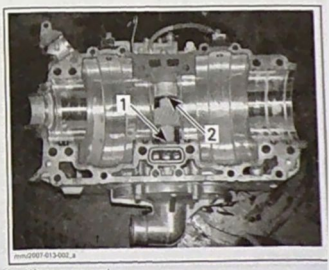


TYPICAL

If pressure drops, it indicates a defective crankshaft inner seal or a defective oil seal either on water pump side or oil pump side.

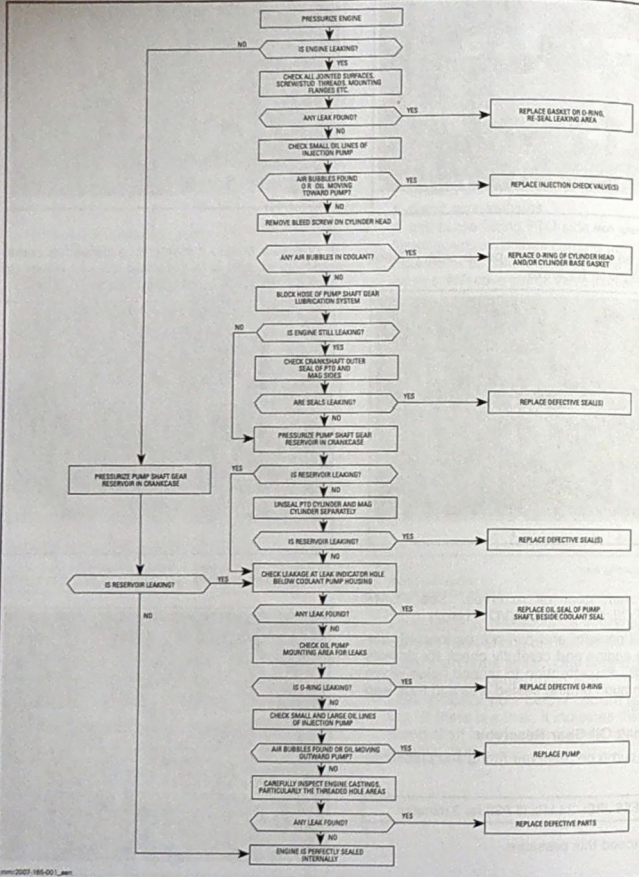


1. Inner seal on PTO side
2. Inner seal on MAG side



1. Water pump seal
2. Oil pump (seal or O-ring)

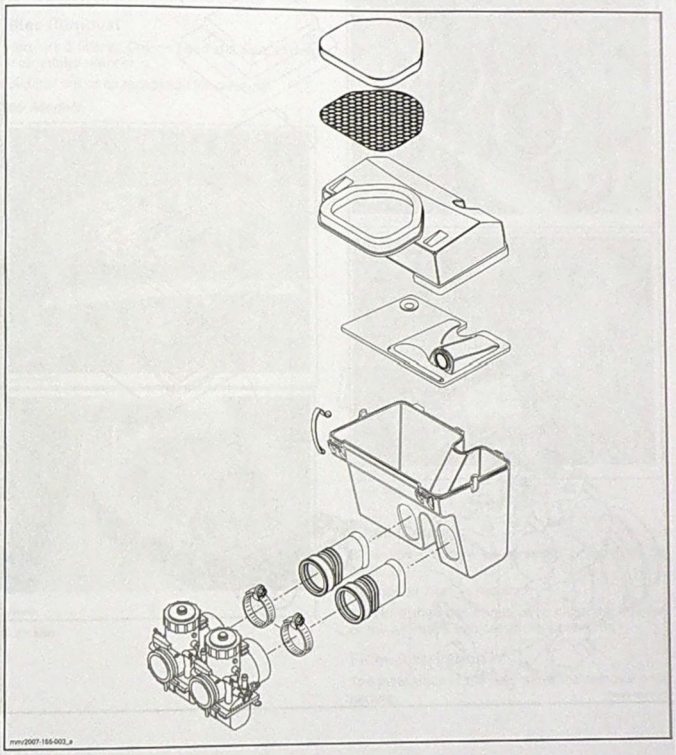
ENGINE LEAK VERIFICATION FLOW CHART



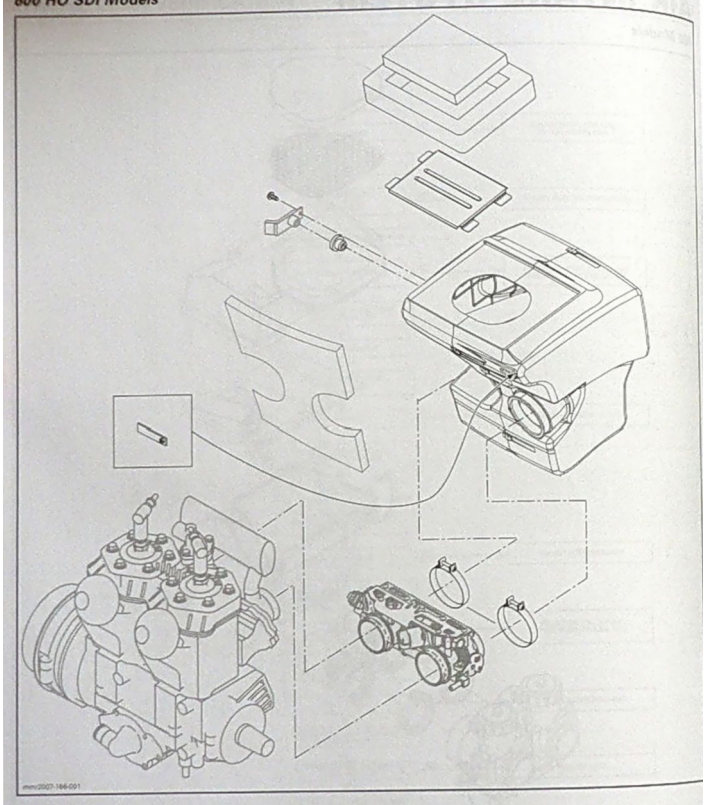
mm:2007-186-001_aen

AIR INTAKE SYSTEM

600 Models



600 HO SDI Models



PROCEDURES

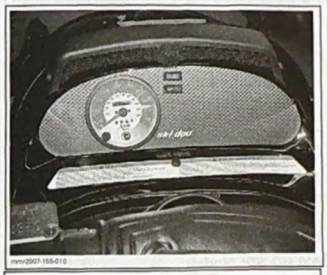
AIR FILTER

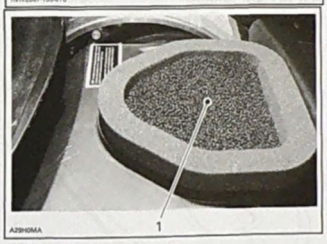
Filter Removal

There are 2 filters. One on hood and another one on air intake silencer.

Pull filter out of its receptacle for cleaning.

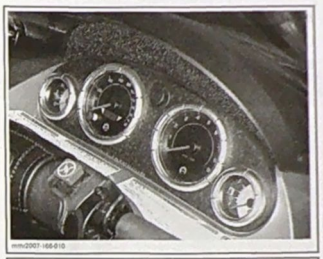
600 Models

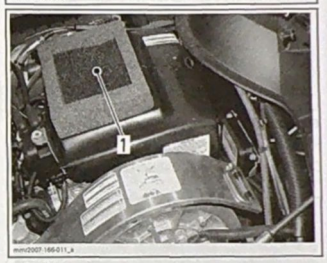




1. Air filter

600 HO SDI Models





1. Air filter

Filter Cleaning

Blow low pressure compressed air on filter to clean it.

Replace air filter as required.

NOTE: If the filter is very dirty, clean the interior of the air intake silencer at the same time.

Filter Installation

The installation is the reverse of the removal procedure.

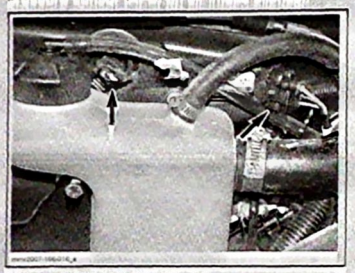
AIR INTAKE SILENCER

Air Intake Silencer Removal

Open hood.

600 HO SDI Models

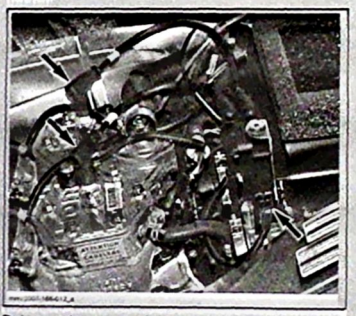
Disconnect air temperature sensor (ATS) and air pressure sensor (APS) on air intake silencer.



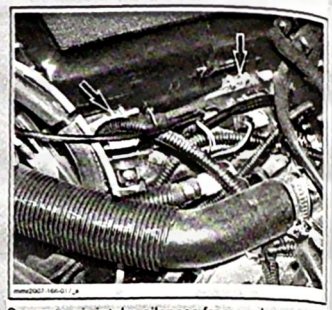
600 and 600 HO SDI Models

Remove drive belt guard.

Disconnect spark plug cables and ignition coil connector.



Release clamps on air intake adapter side.



Separate air intake silencer from carburetor (600 models) or throttle body (600 HO SDI models) and pull it out of vehicle.

Air Intake Silencer Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Torque clamps to 0.8 N•m (7 lbf•in).

600 HO SDI Models

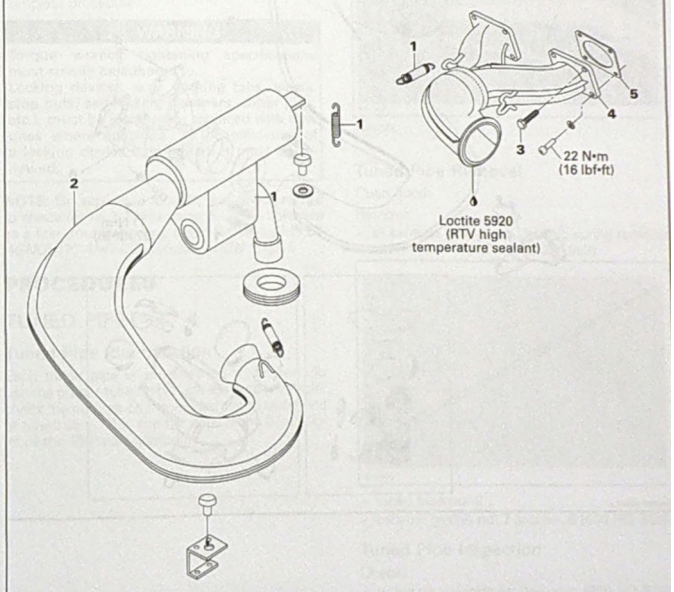
Ensure to reconnect ATS and APS sensors.

EXHAUST SYSTEM

SERVICE TOOLS

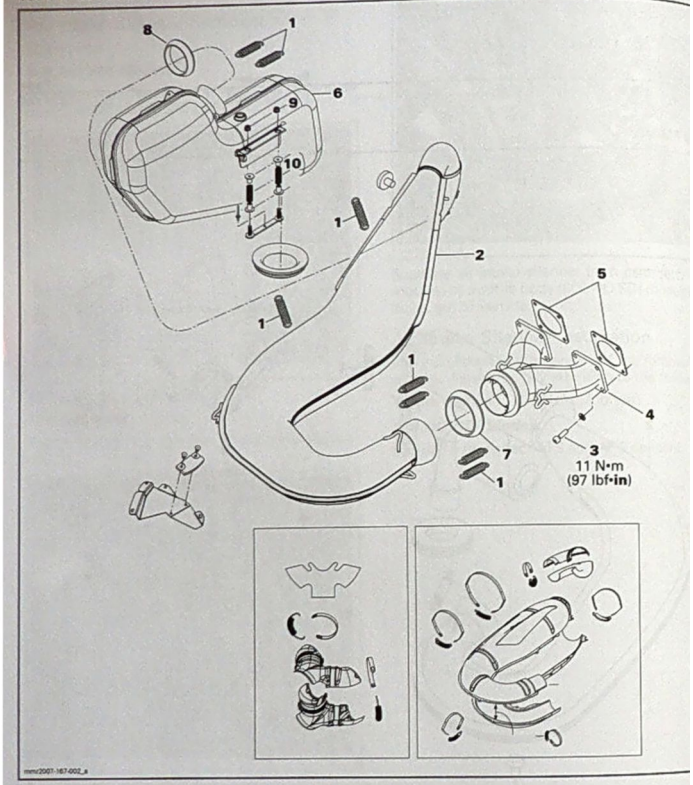
Description	Part Number	Page
spring remover and installer tool	529 035 983	147–149

600 Models



mmv2007-167-001_a

600 HO SDI Models



mmc2001-167-002_a

GENERAL

⚠ WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use the torque value and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

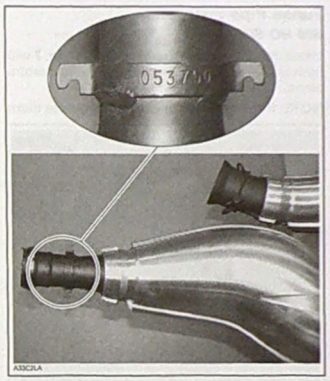
NOTE: On applicable models, it is good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

PROCEDURES

TUNED PIPE

Tuned Pipe Identification

Each tuned pipe is identified by a number. To use the proper tuned pipe with the proper vehicle, check the number on the welded clamp at the end of tuned pipe. This number depicts the 6 last digits of the BRP part number.

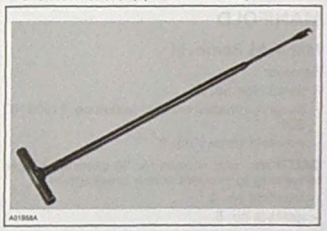


TYPICAL

Tuned Pipe Removal

Open hood.

Remove:
- all exhaust springs **no. 1** using spring remover and installer tool (P/N 529 035 983)



- tuned pipe **no. 2**
- exhaust gasket **no. 7** and **no. 8 (600 HO SDI)**.

Tuned Pipe Inspection

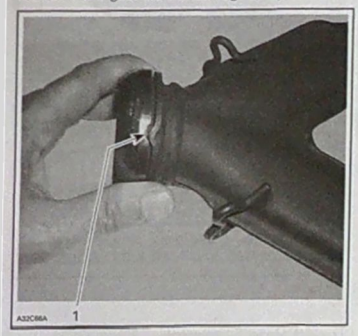
Check:
- tuned pipe shields for damages **(600 HO SDI)**.
- tuned pipe ends for cracks or damages.

Tuned Pipe Installation

600 HO SDI Models

Install doughnut shaped exhaust gasket **no. 7** with both of its notches aligned with Y-manifold protrusions.

NOTE: If the gaskets are damaged, replace them.



1. Align notches

600 and 600 HO SDI Models

Install all exhaust springs using spring remover and installer tool (P/N 529 035 983).

MANIFOLD

Manifold Removal

Remove:

- tuned pipe **no. 2**
- doughnut shaped exhaust gasket **no. 7 (600 HO SDI)**
- manifold screws **no. 3**

CAUTION: Heat screws for 30 seconds before loosening to prevent screw breakage.

- manifold **no. 4**
- gaskets **no. 5**.

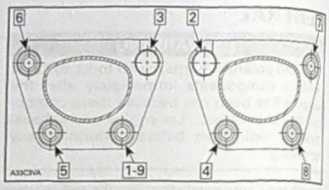
Manifold Inspection

Check if the manifold is cracked or damaged. Replace if necessary.

Manifold Installation

Install the manifold with new gaskets.

Tighten manifold screws **no. 3** using the following sequence and torque.



MODEL	TORQUE
600	22 N•m (16 lbf•ft)
600 HO SDI	11 N•m (97 lbf•in)

Install tuned pipe.

MUFFLER

600 HO SDI Models

NOTE: For **600 models**, muffler is part of tuned pipe.

Muffler Identification

Each muffler is identified by a number. To use the proper muffler with the proper vehicle, check the number on the welded clamp at the end of muffler. This number depicts the 6 last numbers of BRP part number.



TYPICAL

Muffler Removal

Remove tuned pipe **no. 2**.

Disconnect the Exhaust Gas Temperature Sensor (EGTS).

Remove exhaust springs **no. 1** using spring remover and installer tool (P/N 529 035 983).

Remove nuts **no. 9** retaining the muffler **no. 6**.

Remove the muffler.

Muffler Inspection

Check the muffler for cracks or other damages.

Check springs condition.

Muffler Installation

For installation, reverse the removal procedure.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)

600 HO SDI Models

Refer to *ENGINE MANAGEMENT* section to verify or replace the EGTS.

COOLING SYSTEM

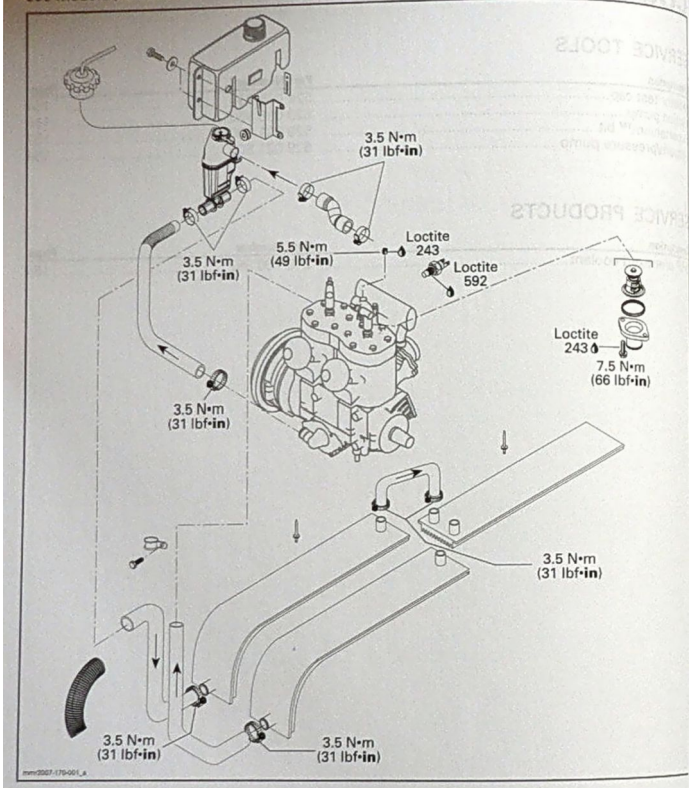
SERVICE TOOLS

Description	Part Number	Page
radiator test cap	529 035 991	154
suction pump	529 035 880	154
Supertanium™ bit	529 031 800	157
vacuum/pressure pump	529 021 800	154

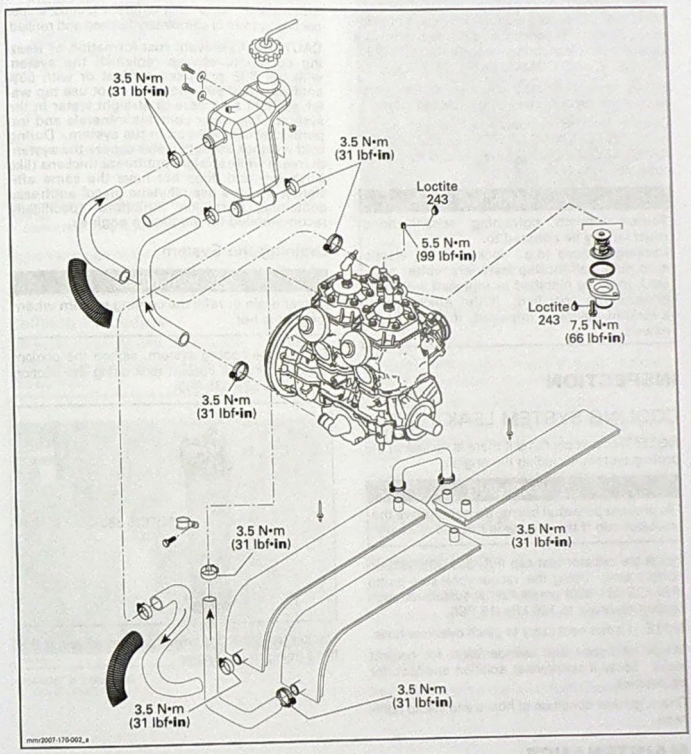
SERVICE PRODUCTS

Description	Part Number	Page
BRP premixed coolant	219 700 362	154

600 Models (carbureted)



600 HO SDI Models



GENERAL

NOTE: On applicable models, it is good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

INSPECTION

COOLING SYSTEM LEAK TEST

NOTE: This test confirms if there is no leak in the cooling system, including the engine.

⚠ WARNING

To prevent potential burns, do not remove the radiator cap if the engine is hot.

Install the radiator test cap (P/N 529 035 991) on coolant tank. Using the vacuum/pressure pump (P/N 529 021 800) pressurize all system through coolant reservoir to 100 kPa (15 PSI).

NOTE: It is not necessary to pinch overflow hose.

Check all hoses and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.

Check general condition of hoses and clamp tightness.

MAINTENANCE

COOLANT REPLACEMENT

Recommended Coolant

Use BRP premixed coolant (P/N 219 700 362) or a blend of 50% antifreeze with 50% distilled water.

To prevent antifreeze deterioration, always use same brand. Never mix different brands unless cooling system is completely flushed and refilled.

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens (like slush ice) and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

Draining the System

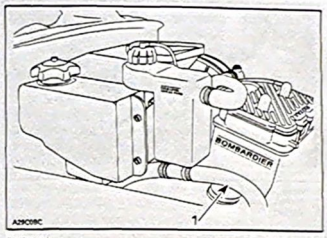
⚠ WARNING

Never drain or refill the cooling system when engine is hot.

To drain the cooling system, siphon the coolant mixture from the coolant tank using the suction pump (P/N 529 035 880).



Unplug from the bottom of coolant reservoir the hose going to the engine.



TYPICAL
1. Coolant hose going to the engine

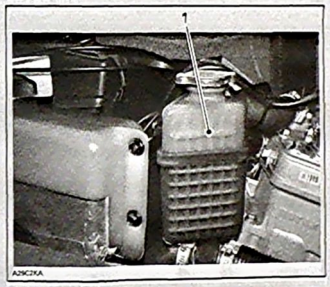
Siphon as much coolant as you can from the hose.

When the coolant level is low enough, lift the rear of vehicle to drain the radiator.

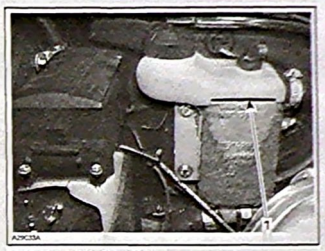
Refilling Procedure

Lift front of vehicle until the tunnel is horizontal.

With engine cold, refill coolant tank up to COLD LEVEL line.



SKANDIC WT/SUV 600
1. COLD LEVEL line



EXPEDITION TUV 600 HO SDI
1. Maximum

Wait a few minutes then refill to line.

Start engine. Refill up to line while engine is idling until all air bubbles have escaped from system (about 4 to 5 minutes).

Install pressure cap.

To make sure coolant flows through radiators, touch them by hand. They must feel warm.

Put back front of vehicle on the ground.

When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line.

Check for coolant mixture freezing point. Specification is -37°C (-35°F). Adjust as necessary.

PROCEDURES

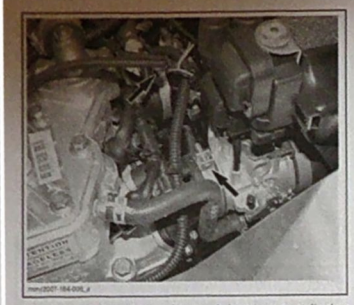
THERMOSTAT

Thermostat Removal

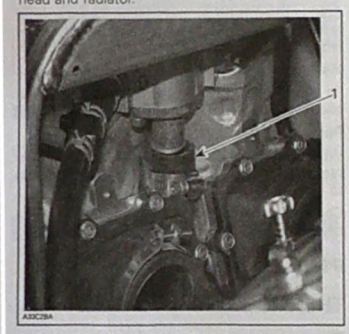
For removal of thermostat, drain the cooling system (see above).

Remove air intake silencer (refer to *AIR INTAKE SYSTEM*).

Disconnect carburetor or throttle body from engine.

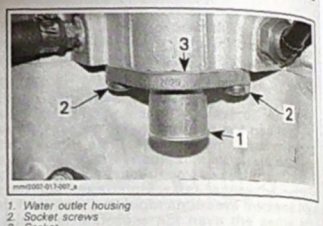


Unplug coolant hose located between cylinder head and radiator.



1. Coolant hose between cylinder head and radiator

Remove:
- housing screws
- water outlet housing
- gasket.



1. Water outlet housing
2. Socket screws
3. Gasket

Remove thermostat.

Test

Put thermostat in heated water. Thermostat should work as follows.

ENGINE TYPE	TEMPERATURE
593	Start to open: 42°C (108°F)
	Almost fully opened: 50°C (122°F)

Thermostat Installation

For installation, reverse the removal procedure.

RADIATOR CAP

Using a pressure cap tester, check the efficiency of radiator cap. If the efficiency is feeble, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

FRONT RADIATOR

Cleaning and Inspection

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if the radiator fins are damaged. Replace the front radiator if necessary.

NOTE: A radiator with many broken fins does not work properly.

Front Radiator Removal

Drain cooling system.

As applicable, remove air intake silencer, battery, electronic module, engine and fuel tank. Refer to appropriate system.

Remove track (refer to *TRACK*).

Using a Supertanium™ bit (P/N 529 031 800), drill all rivets retaining front radiator to the frame or grind the rivets with a grinding disk.

Pull the radiator a little and remove the Oetiker clamps securing coolant hoses to radiator.

Front Radiator Installation

For installation, reverse the removal procedure.

Properly refill cooling system.

REAR RADIATOR

Cleaning and Inspection

Refer to *FRONT RADIATOR* above.

Rear Radiator Removal

Drain cooling system.

Remove rear suspension. Refer to *REAR SUSPENSION*.

If applicable, remove rear part of seat and tunnel cover.

Using a grinding disk, grind all rivets retaining rear radiator to frame.

Unplug coolant hoses from rear radiator then remove radiator from vehicle.

Rear Radiator Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Properly refill cooling system.

Insert radiator protector into radiator C-rail and crimp C-rail at rear end.

COOLANT TANK

Coolant Tank Removal

Drain cooling system before removing coolant tank.

Remove all hoses from coolant tank.

Remove injection oil reservoir retaining screws to slide down the coolant tank to disengage it from oil tank.

NOTE: It is necessary to move oil tank for an easier removal/installation of coolant tank.

Coolant Tank Inspection

Check if the tank is cracked or melted. Replace if necessary.

Coolant Tank Installation

For installation, reverse the removal procedure.

WATER PUMP

Refer to *BOTTOM END* section.

COOLANT TEMPERATURE SENSOR (CTS)

600 Models (carbureted)

NOTE: For 600 HO SDI models, refer to *ENGINE MANAGEMENT*.

Static Test

General

The value of a resistor varies with the temperature. The value for common resistor or windings (such as solenoid) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the value **decreases** as the temperature increases. Use this table for sensor resistive values at given temperature.

TEMPERATURE SENSOR TABLE		
TEMPERATURE		RESISTANCE
°C	°F	Ω
- 40	- 40	72412
- 35	- 31	52637
- 30	- 22	38681
- 25	- 13	28718
- 20	- 4	21529
- 15	5	16288
- 10	14	12431
- 5	23	9565
0	32	7418
5	41	5807
10	50	4582
15	59	3644
20	68	2919
25	77	2355
30	86	1912
35	95	1562
40	104	1284
45	113	1062
50	122	882.6
55	131	738.9
60	140	622
65	149	526.3
70	158	447.5
75	167	382.3
80	176	328.1
85	185	282.8
90	194	244.8
95	203	212.8
100	212	185.6
105	221	162.4
110	230	142.7
115	239	125.9
120	248	111.5
125	257	99.02
130	266	88.26
135	275	78.93
140	284	70.81
145	293	63.71
150	302	57.49

The resistive value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine and heated with a heat gun (ensure not to heat excessively) while it is still connected to the temperature gauge. The temperature should raise on the gauge (electrical system activated).

A good test would be to put sensor in a container filled with ice and water and measure resistance. Then, boil water and read resistance again. According to the table above, the sensor value would be approximately 7418 Ω with ice/water (0°C (32°F)) and 185.6 Ω with boiling water (100°C (212°F)).

Resistance Test

Disconnect sensor connector and measure sensor resistance between wires of sensor. If out of specifications, replace sensor.

If resistance tests good, **reconnect** the CTS and disconnect the gauge connector.

Measure resistance value again between terminals on gauge connector (see *WIRING DIAGRAMS*).

If resistance value is correct, try a new gauge.

If resistance value is incorrect, repair the connectors or replace the wiring harness between gauge connector and the CTS.

Sensor Replacement

Lift rear of vehicle and securely support.

Disconnect CTS connector and remove CTS. Install the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant. If an important quantity of coolant spilled, bleed cooling system.

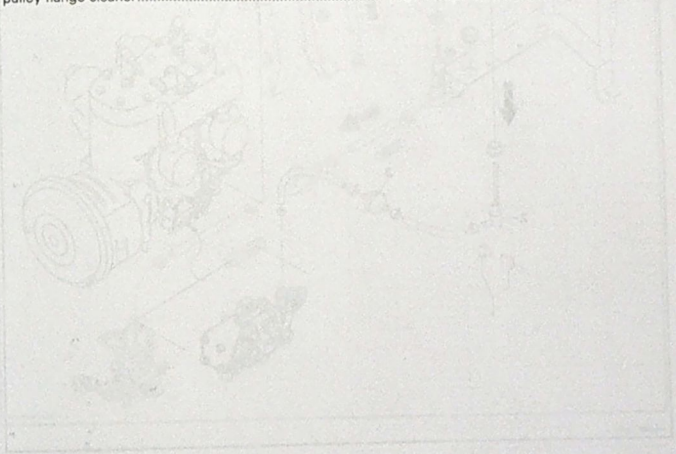
OIL INJECTION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
leak testing kit	529 033 100	163
multimeter Fluke 111	529 035 868	165
oil pump cable adjuster	529 036 045	167
small hose pincher	295 000 076	163
throttle free play wedge tool	529 036 042	167
vacuum/pressure pump	529 021 800	164, 168

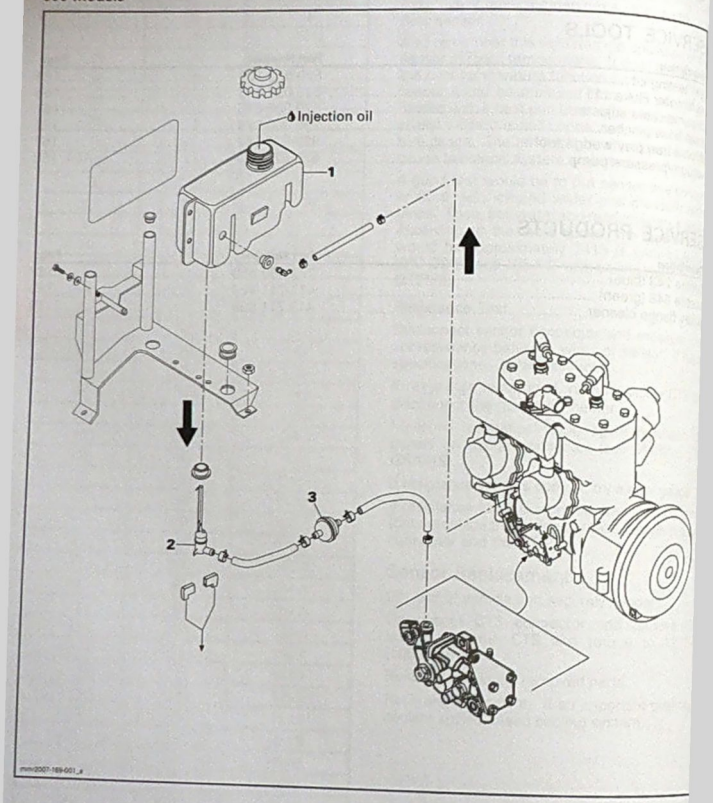
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	167
Loctite 648 (green)	413 711 400	169
pulley flange cleaner	413 711 809	169

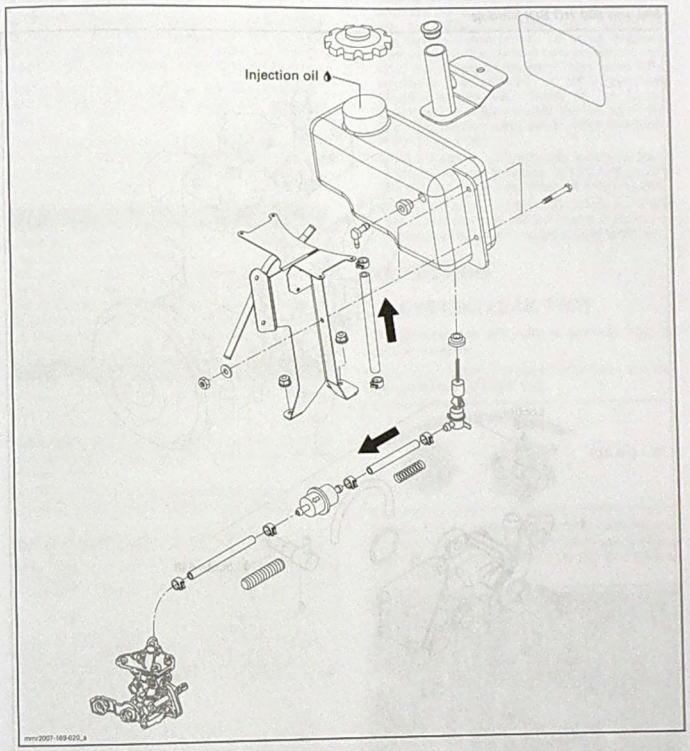


OIL INJECTION RESERVOIR

600 Models

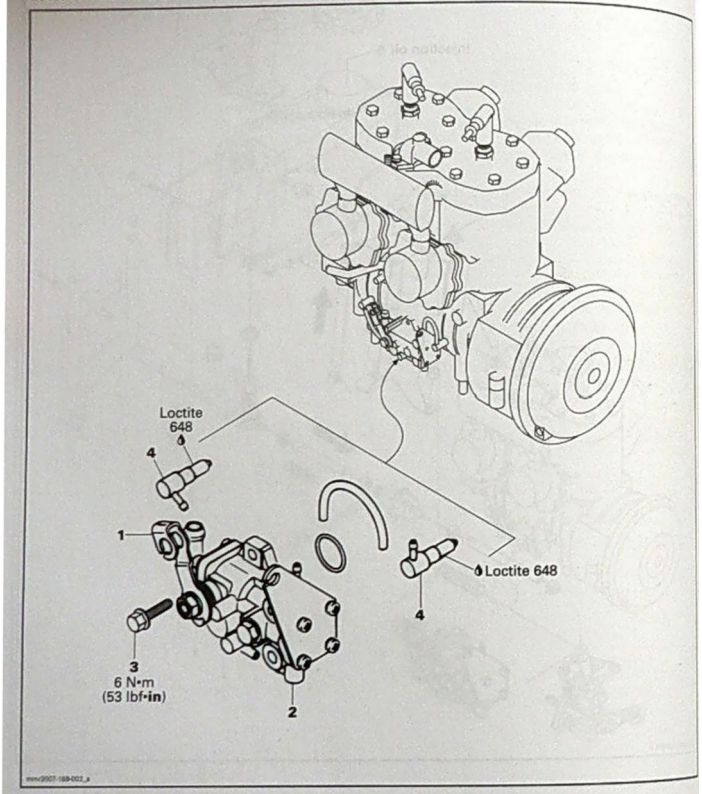


600 HO SDI Models



OIL PUMP

600 and 600 HO SDI Models



GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

CAUTION: Do not use a hose pincher on inlet/outlet hoses. This would damage the spring inside hose.

NOTE: The following procedures can be done without removing the engine from chassis.

RECOMMENDED OIL TYPE

MODEL	OIL TYPE
600	All XP-S 2-stroke oil (synthetic, synthetic blend or mineral) can be used[2] [3]
600 HO SDI	XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil [1]

[1] **CAUTION: The XP-S synthetic 2-stroke oil and the XP-S synthetic blend 2-stroke oil are specially formulated and tested for the severe requirement of these engines. Use of any other brand two-stroke oil may void the limited warranty. Use only XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

[2] If XP-S 2-stroke oil (synthetic, synthetic blend or mineral) is not available, API TC high-quality low ash two-stroke injection oil may be used.

[3] XP-S synthetic 2-stroke oil, XP-S synthetic blend 2-stroke and XP-S mineral injection oil are compatible, they can be mixed together.

INSPECTION

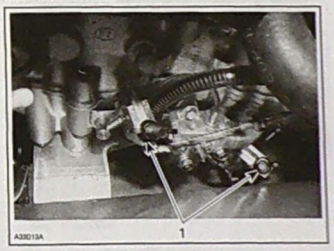
OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil injection system.

Install on oil reservoir a special cap from the leak testing kit (P/N 529 033 100).



Remove the air intake silencer and carburetor or throttle body to gain access to the oil pump hoses. Install a small hose pincher (P/N 295 000 076) on each outlet hose.



TYPICAL
1. Hose pinchers on outlet hoses

Connect the vacuum/pressure pump (P/N 529 021 800) to special cap.



Pressurize oil system as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

If pressure drops, locate leak(s) and repair/replace leaking component(s).

PROCEDURES

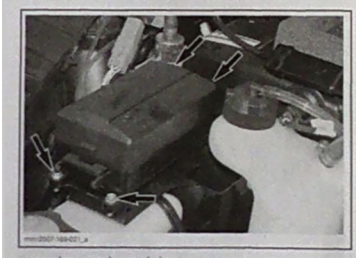
OIL RESERVOIR

Reservoir Removal

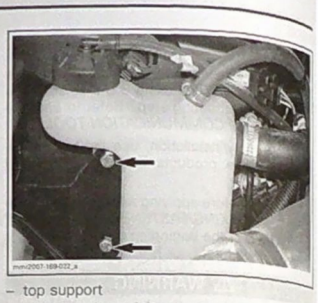
Siphon injection oil from reservoir **no. 1**.

Remove:

- rewind handle (refer to *REWIND STARTER*)
- release fuse box from its support

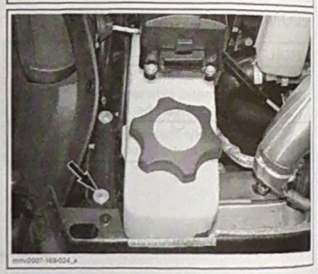


- coolant tank retaining screws



- top support
- oil reservoir retaining screws.





Pull out oil reservoir and unplug all hoses.

Reservoir Installation

For installation, reverse the removal procedure.

Bleed oil pump. Refer to *OIL PUMP BLEEDING*

OIL LEVEL SENSOR

Sensor Removal

Remove oil reservoir, as mentioned above.

Unplug sensor connectors.

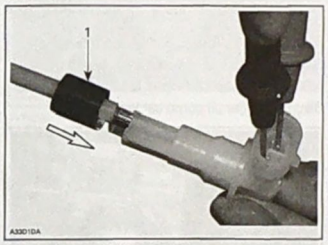
Pull sensor **no. 2** out of reservoir.

Before replacing the oil level sensor, check it according to the following procedure:

Sensor Electrical Test

CAUTION: Do not remove or bend the reed switch protective float magnet. It can damage the reed switch glass.

With the float magnet ring at the lowest position and using the multimeter Fluke 111 (P/N 529 035 868), measure the resistance of the oil level sensor.



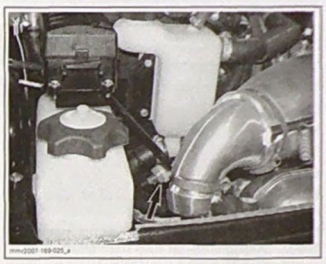
1. Float magnet at the lowest position

MEASURE	SENSOR CONDITION
Closed circuit (close to 0 Ω)	Good
Open or resistive circuit more than 0.5 Ω	Defective

Sensor Installation

For installation, reverse the removal procedure.

OIL FILTER



Oil Filter Removal

Remove air intake silencer (refer to *AIR INTAKE SYSTEM*).

Siphon injection oil reservoir.

Disconnect oil filter hose from the oil level sensor.

Disconnect oil filter **no. 3** from hoses and remove it.

Oil Filter Installation

For installation, reverse the removal procedure.

The filter must be installed with the arrow pointing toward the pump.



Bleed oil pump. Refer to *OIL PUMP BLEEDING*.

OIL PUMP

Oil Pump Identification

Different engines need different pumps. See identification on lever **no. 1**.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
593	02

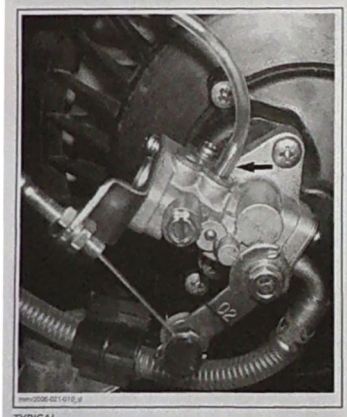
Oil Pump Verification

NOTE: Since pump is a piston type, it works when engine rotates in both forward and reverse.

On Vehicle

NOTE: Main oil line must be full of oil. See bleeding procedure further.

Lift rear of vehicle and support with a mechanical stand. Unplug small oil lines from pump.



TYPICAL

Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever **no. 1** in fully open position. Oil columns must advance into small oil lines.

If not, test pump as described below.

NOTE: Through normal use, oil level must not drop in small tubes. If oil drops, verify injection nozzle **no. 4** operation. Replace as necessary.

Test Bench

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. If not, replace pump.

Oil Pump Removal

NOTE: Before removing the injection oil pump **no. 2**, check its operation. Refer to *OIL PUMP VERIFICATION*, above in this section.

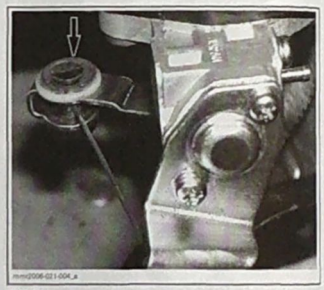
Remove:

- air intake silencer
- carburetor (600 models) or throttle body (600 HO SDI models)
- screws **no. 3** retaining oil pump to engine.

Unplug all hoses connected to oil pump **no. 2**.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.



TYPICAL

Oil Pump Cleaning

Clean all metal components in a non-ferrous metal cleaner.

Oil Pump Installation

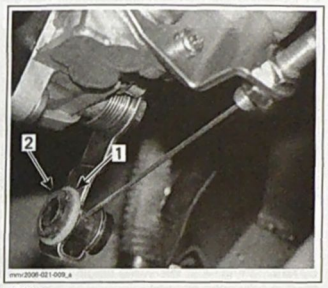
For installation, reverse the removal procedure. However, pay attention to the following.

NOTE: During installation, always check for spring clips tightness on pump inlet hoses.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of screws **no. 3** and torque them to 6 N•m (53 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.



TYPICAL
1. Plastic washer on this side
2. Circlip on this side

Verify cable and oil pump lever operation then adjust cable.

Bleed oil pump. See procedure further.

CAUTION: Always bleed oil pump when the system has been opened.

Oil Pump Adjustment

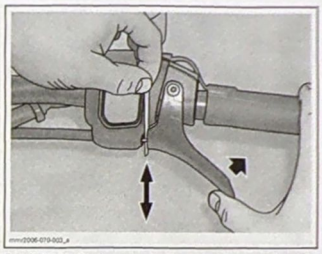
Before processing with the oil pump cable adjustment, verify throttle cable adjustment. Refer to *CARBURETOR AND THROTTLE CABLE* for **600 models** or *ADJUSTMENTS AND REPAIR PROCEDURES* in *ENGINE MANAGEMENT* section for **600 HO SDI models**).

NOTE: Do not use marks on oil pump. Proceed as follows instead.

Slightly press on throttle lever to eliminate throttle cable free play.

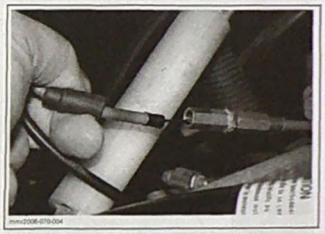
Insert the throttle free play wedge tool (P/N 529 036 042), between throttle lever and housing as shown.

Slide tool up and down until all free-play is recovered. Stop recovering free-play before throttle cam just begins to move at carburetor/throttle body.

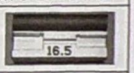
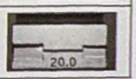


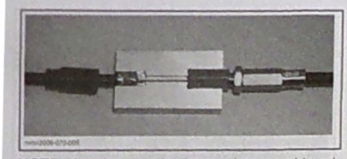
CAUTION: Carburetor's throttle slide or throttle body butterfly must not move and remain in idle position.

Move adjuster boot away and stretch oil pump cable at adjuster.



Insert cable in the appropriate slot of the oil pump cable adjuster (P/N 529 036 045).

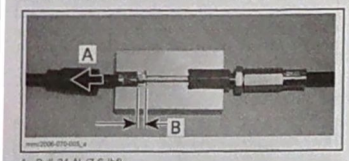
MODEL	ADJUSTMENT SPECIFICATION
600	16.5 mm (.650 in) 
600 HO SDI	20.0 mm (.787 in) 



NOTE: If tool cannot be inserted, turn cable adjuster to "lengthen" cable.

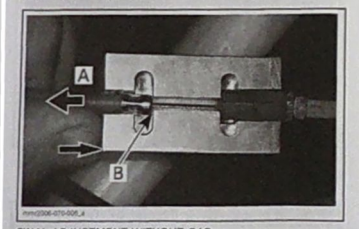
Pull cable with a force of 34 N (7.6 lbf) to recover all play in cable.

While still pulling, check if there is a gap as shown.



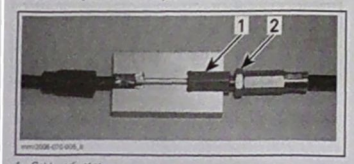
A. Pull 34 N (7.6 lbf)
B. Remove gap here

Turn cable adjuster to recover that gap.



FINAL ADJUSTMENT WITHOUT GAP
A. Pull 34 N (7.6 lbf)
B. No gap

Secure adjustment in place with lock nut.

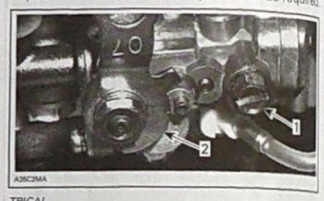


1. Cable adjuster
2. Lock nut

Remove the throttle free play wedge tool, push back cable in adjuster and slide adjuster boot in place.

Oil Pump Bleeding

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw until air has escaped from the line. Add injection oil as required.



TYPICAL
1. Bleeder screw
2. Oil pump lever

Bleed the small oil line between pump and engine by running engine at idle while holding the pump lever in fully open position.

NOTE: Make a "J" hook out of mechanical wire to lift the lever.

⚠ WARNING

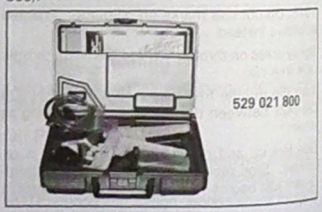
Do not operate throttle mechanism. Secure the rear of the vehicle on a stand.

INJECTION NOZZLE

A check valve is part of injection nozzle no. 4 installed on crankcase.

Injection Nozzle Inspection

Use the vacuum/pressure pump (P/N 529 021 800).



Connect pump to injection nozzle no. 4.

follows

PUMP SETTING	Set to VACUUM	Set to PRESSURE
TO DO	Activate pump several times	Slowly activate pump and listen to check valve
RESULT	Air must not flow through check valve	You should hear it release pressure at approx. 20.7 kPa (3 PSI)
ACTION	**Success:** Perform next test	**Success:** Check valve is good
	Failed: Replace injection nozzle	**Failed:** Replace injection nozzle

Injection Nozzle Removal

NOTE: Before removing injection nozzle **no. 4**, check its operation. Refer to the end of this section.

CAUTION: Do not remove injection nozzle needlessly. It is likely to be damaged.

Remove air intake silencer and carburetor or throttle body.

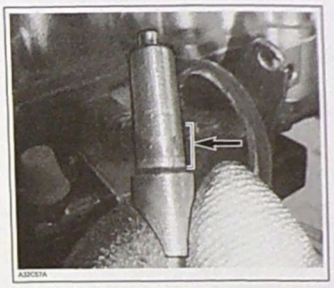
Clean injection nozzle area to remove oil or dirt.

Heat injection nozzle **no. 4** then pull it out of crankcase.

Injection Nozzle Installation

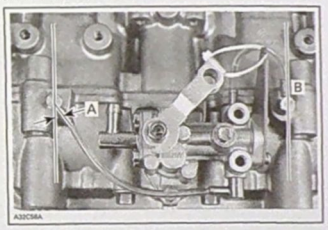
Prior to coating it with Loctite, make sure injection nozzle body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the linjection nozzle (machined section). Take care that Loctite is ONLY in this area.

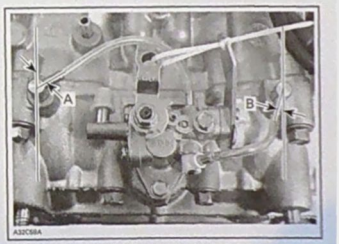


APPLY LOCTITE ON THIS AREA ONLY

Properly install the injection nozzle in the correct position into the crankcase.



POSITION FOR 600 MODELS
A. PTO side: 30° ± 10° from cylinder axis to the bottom
B. MAG side: 0° from cylinder axis to the top



TYPICAL — POSITION FOR 600 HO SDI MODELS
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the injection nozzle carefully with a plastic hammer.

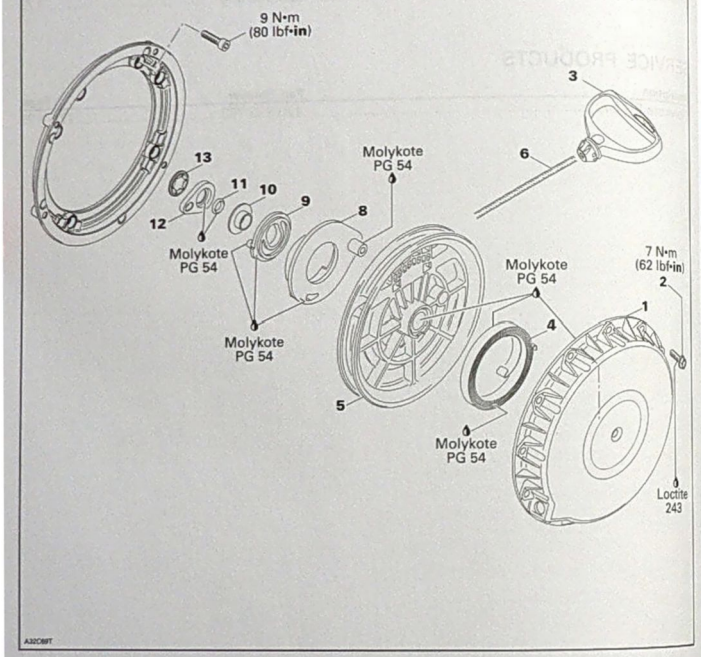
REWIND STARTER

SERVICE TOOLS

Description	Part Number	Page
small hose pincher	295 000 076	173

SERVICE PRODUCTS

Description	Part Number	Page
Molykote PG 54	420 899 763	174-175


9 N•m
(80 lbf•in)
3
6
Molykote
PG 54
13
11
10
9
8
12
Molykote
PG 54
Molykote
PG 54
Molykote
PG 54
7 N•m
(62 lbf•in)
2
1
4
5
Molykote
PG 54
Loctite
243
A32C98T

GENERAL

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope **no. 6** is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring **no. 11** every time rewind starter is disassembled.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

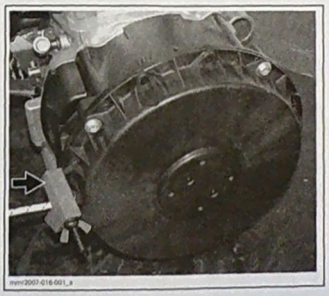
When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

PROCEDURES

STARTER HANDLE

Starter Handle Removal

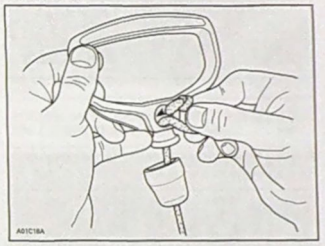
Pull rope for 50 cm (20 in) approximately. Using a small hose pincher (P/N 295 000 076), lock rope near rewind starter.



Using a small screwdriver, extract rope knot from stater handle **no. 3**. Cut rope close to knot.

Starter Handle Installation

Prior to installing starter handle on rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter handle and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter handle over the knot.



TYPICAL

REWIND STARTER

Rewind Starter Removal

Remove starter handle **no. 3**.

Remove tuned pipe/muffler.

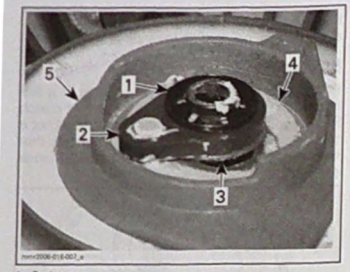
Remove screws **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

Rewind Starter Disassembly

Undo knot previously tied at removal. Let sheave get free to release spring preload.

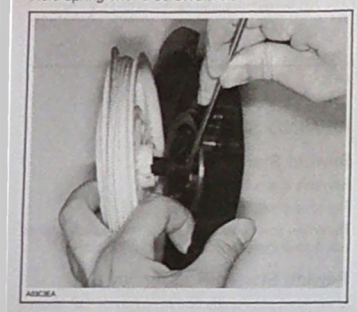
Cut push nut and discard.

Remove lock lever, O-ring **no. 11**, collar sleeve, pawl lock and pawl.



1. Push nut
2. Lock lever
3. Collar sleeve
4. Pawl lock
5. Pawl

Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.



Take out the knot and then rope **no. 6**.

Rewind Starter Assembly

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counter-clockwise into guide.

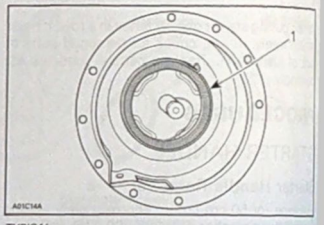
⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

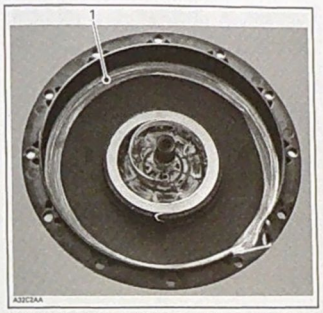


1. Outer end into guide notch

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



TYPICAL
1. Molykote PG 54 inside spring guide



1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). The use of standard multipurpose grease could result in rewind starter malfunction under very cold temperatures and components life will be shortened.

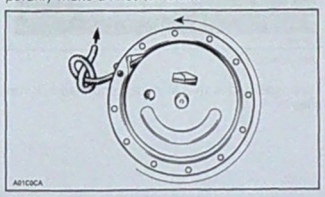
Lubricate housing post with silicone compound grease. Install sheave.

To adjust spring tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

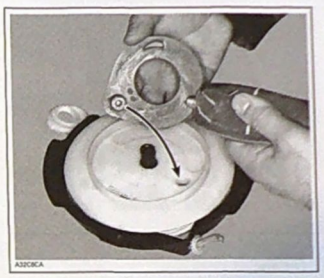
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

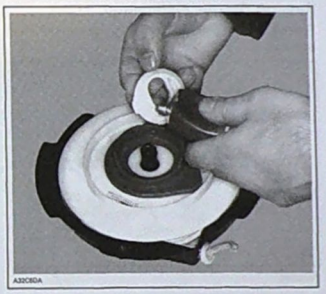


TYPICAL

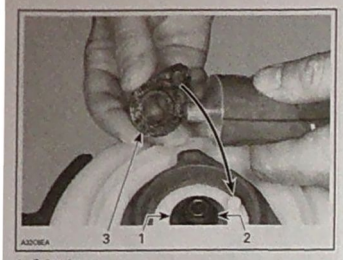
Lubricate pawl **no. 8** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



Lubricate pawl lock **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl.



Install collar sleeve **no. 10** with its collar first. Lubricate a new O-ring **no. 11** and lock lever **no. 12** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.

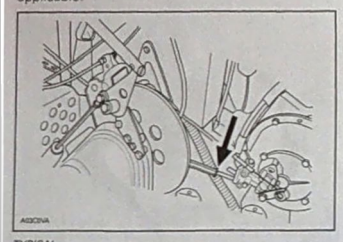


1. Collar sleeve
2. O-ring
3. Lock lever

Position a new push nut **no. 13**.

Rewind Starter Installation

Thread starter rope **no. 6** through rope guide when applicable.



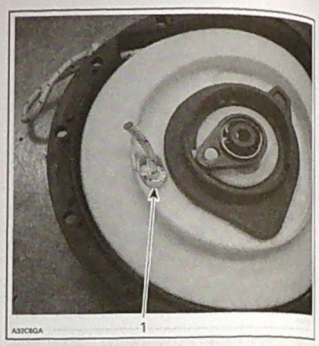
TYPICAL

Reinstall rewind starter assembly on engine.

ROPE

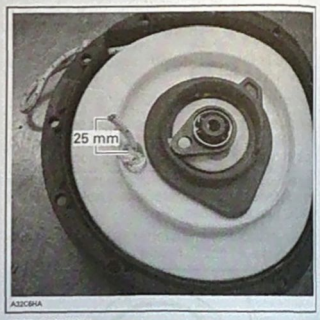
Rope Replacement

Pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Pull out the rope completely.



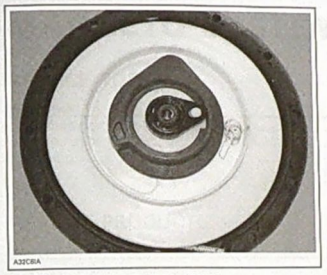
1. Knot to be untied

To install rope **no. 6**, insert rope into sheave no. 5 orifice and lock it by making a knot, leaving behind a free portion of about 25 mm (1 in) in length.



FREE PORTION

Fuse rope end with a lit match and insert it into sheave.



FREE PORTION INSERTED INTO SHEAVE

NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

MAGNETO SYSTEM

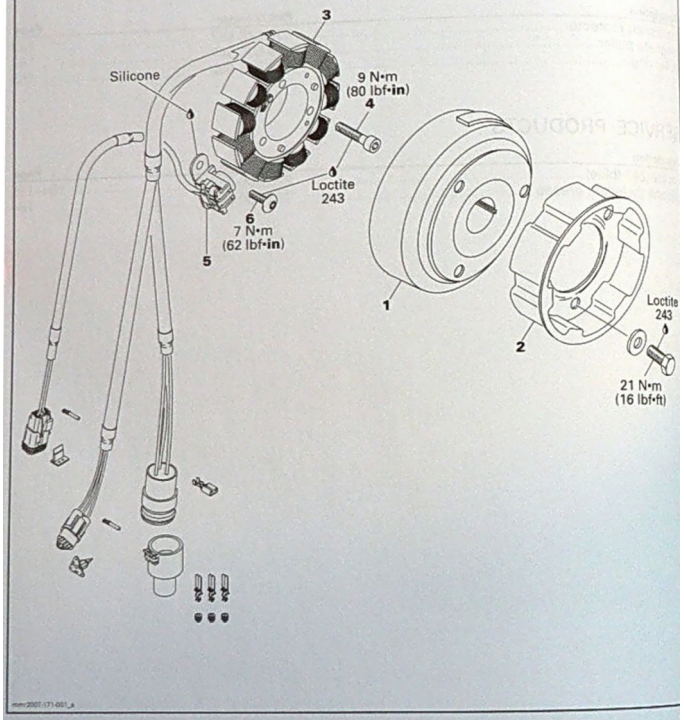
SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	420 876 557	183
magneto puller	529 035 547	183
puller ring	420 876 080	183

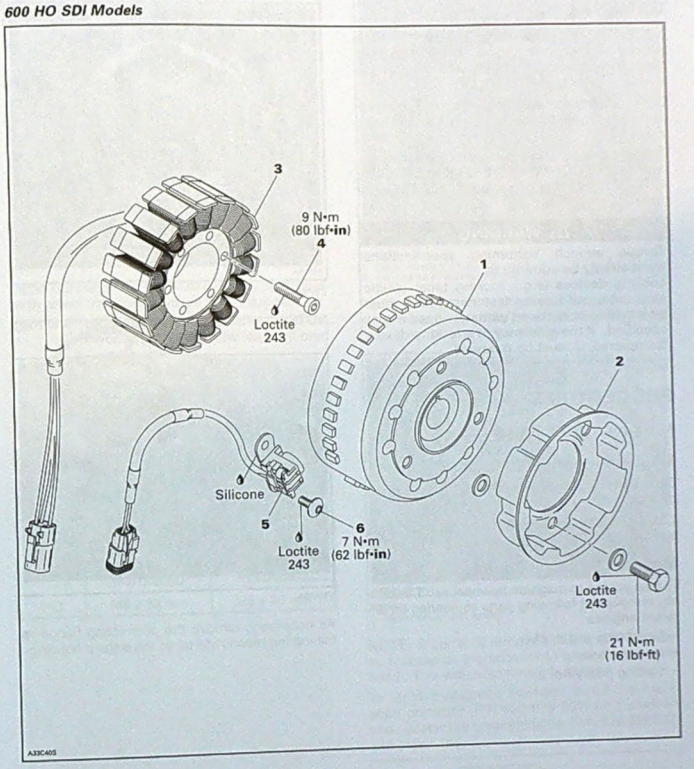
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	184–185
silicone dielectric grease	293 550 004	184

600 Models


3
Silicone
9 N•m
(80 lbf•in)
4
Loctite
243
6
7 N•m
(62 lbf•in)
5
1
2
Loctite
243
21 N•m
(16 lbf•ft)

600 HO SDI Models



GENERAL

NOTE: The following procedures can be done without removing the engine. To facilitate magneto removal, hold drive pulley with the appropriate tool. Refer to *DRIVE PULLEY*.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

MAGNETO FLYWHEEL

Magneto Flywheel Cleaning

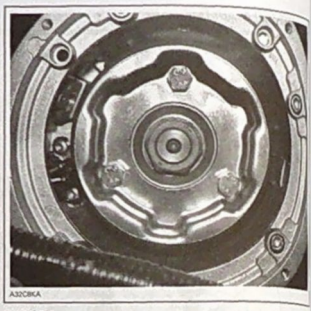
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Magneto Flywheel Removal

To gain access to magneto flywheel **no. 1** assembly, remove the following parts as needed on different engines:

- tuned pipe and muffler
- rewind starter
- starting pulley **no. 2**.



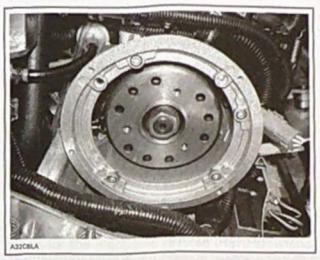
TYPICAL

NOTE: To remove starting pulley bolts, hold magneto flywheel with a socket as shown.



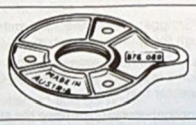
TYPICAL

As necessary, remove the connecting flange retaining the rewind starter to the engine housing


A32C8LA

TYPICAL

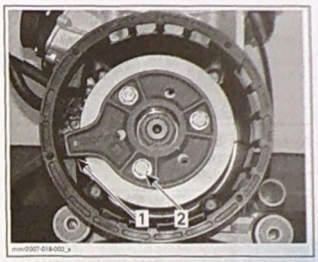
Install the puller ring (P/N 420 876 080) on magneto flywheel (or counterweight if so equipped).



420 876 080

CAUTION: Use only the following screw length to bolt puller to magneto flywheel. Otherwise damage to stator behind magneto flywheel could occur.

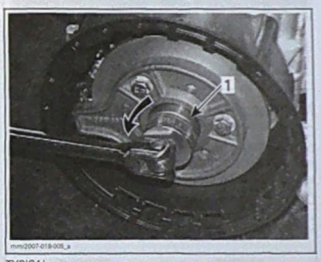
ENGINE	SCREW LENGTH	
	WITHOUT COUNTERWEIGHT INSTALLED	WITH COUNTERWEIGHT INSTALLED
593	M8 x 20 mm	M8 x 30 mm



mm2007-018-003_a

TYPICAL
1. Tab in magneto housing opening
2. M8 screws of appropriate length

Remove magneto flywheel nut, using a 30 mm socket machined to 40 mm (1.580 in) outside diameter by 16 mm (5/8 in) long.

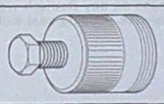


mm2007-018-005_a

TYPICAL
1. Machined 30 mm socket

NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.

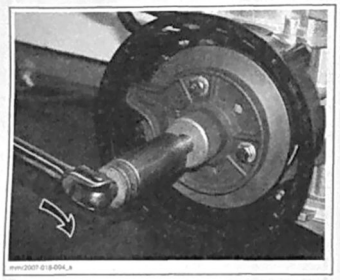
To remove magneto flywheel, install the crankshaft protector (P/N 420 876 557) on crankshaft end. Screw the magneto puller (P/N 529 035 547) into puller ring.



529 035 547



Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.



Magneto Flywheel Installation

Clean crankshaft extension (taper) and apply Loctite 243 (blue) (P/N 293 800 060) on taper, then position Woodruff key, magneto flywheel **no. 1** and lock washer on crankshaft.

Clean magneto flywheel nut threads and apply Loctite 243 (blue) (P/N 293 800 060) then tighten nut.

ENGINE	TORQUE
593	125 N•m (92 lbf•ft)

At reassembly coat all electric connections except Deutsch housings (waterproof housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone "sealant", this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch waterproof housing otherwise housing seal will be damaged.

STATOR

Stator Inspection

Always check stator **no. 3** before changing it. Refer to *CHARGING SYSTEM*.

Stator Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean stator using only a clean cloth.

Stator Removal

Remove:

- magneto flywheel **no. 1**
- all Allen socket screws **no. 4** retaining stator to magneto housing
- grommet from crankcase where CPS/trigger coils **no. 5** and stator wires exit magneto housing.

Unplug the CPS/trigger coil connectors and pull the wires through the grommet location.

NOTE: To pass the stator connector into the grommet location it is necessary to pass the CPS/trigger coil connector first.

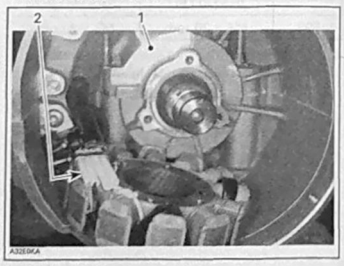
Unplug the stator connector and remove the stator **no. 3**.

Stator Installation

Insert the stator connector into crankcase grommet then the CPS/trigger coil connector(s).

Install the grommet on crankcase.

Position stator **no. 3** so that its wire protectors are over crankcase recess.



1. Crankcase recess
2. Wire protectors

NOTE: During installation, make sure the stator harness is located on the left side.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of stator screws then torque them to 9 N•m (80 lbf•**in**).

Reinstall all other removed parts.

TRIGGER COIL

600 Models

Trigger Coil Inspection

For trigger coil inspection, refer to *IGNITION SYSTEM*.

NOTE: It is possible that the engine is equipped with 2 trigger coils. If so, the trigger coil normally used for the electronic reverse (RER) is functionless as these models have a mechanical reverse.

Trigger Coil Removal

To replace the trigger coil **no. 5**, remove or disconnect the following:

- magneto flywheel **no. 1**
- air intake silencer
- trigger coil connector housing
- grommet from crankcase
- retaining screws **no. 6**
- trigger coil and carefully pull wires.

Trigger Coil Installation

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicone at trigger coil location then apply new silicone. Screw trigger coil then stick the trigger coil wires in the silicone.

CRANKSHAFT POSITION SENSOR (CPS)

600 HO SDI Models

CPS Inspection

For CPS inspection, refer to *ENGINE MANAGEMENT*.

CPS Removal

To replace the CPS **no. 5**, remove or disconnect the following:

- magneto flywheel **no. 1**
- air intake silencer
- trigger coil connector housing
- grommet from crankcase
- retaining screws **no. 6**
- CPS and carefully pull wires.

CPS Installation

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicone at CPS location then apply new silicone. Screw CPS then stick the CPS wires in the silicone.

TOP END

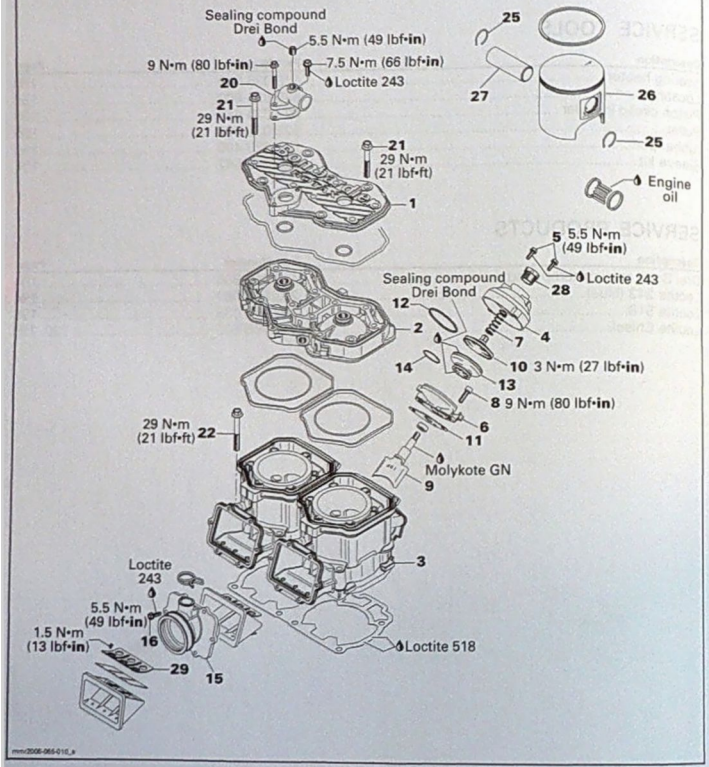
SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	198
Locating sleeve	529 023 800	196
Piston circlip installer	529 035 686	199
Puller	529 035 503	196
rubber pad	529 023 400	196
Sleeve kit	529 035 542	196

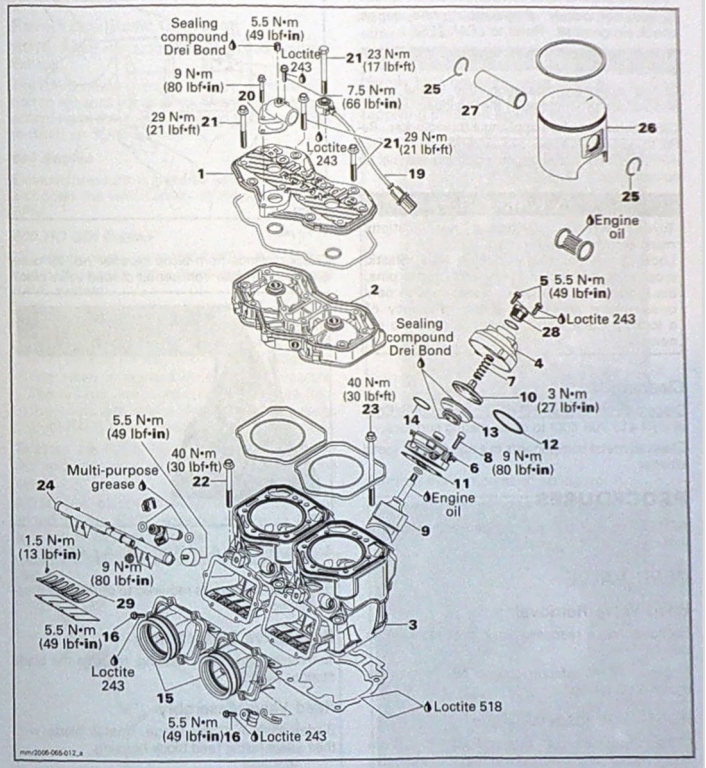
SERVICE PRODUCTS

Description	Part Number	Page
Drei Bond sealing compound	420 297 906	194
Loctite 243 (blue)	293 800 060	194
Loctite 518	293 800 038	195
Loctite Chisel	413 708 500	190, 195

600 Engine


Sealing compound
Drei Bond
5.5 N•m (49 lbf•in)
9 N•m (80 lbf•in)
7.5 N•m (66 lbf•in)
Loctite 243
20
21
29 N•m
(21 lbf•ft)
21
29 N•m
(21 lbf•ft)
1
25
27
26
25
Engine
oil
5
5.5 N•m
(49 lbf•in)
Loctite 243
28
Sealing compound
Drei Bond
12
2
7
4
14
10 3 N•m (27 lbf•in)
13
8 9 N•m (80 lbf•in)
6
11
29 N•m
(21 lbf•ft) 22
Molykote GN
9
3
Loctite
243
5.5 N•m
(49 lbf•in)
16
1.5 N•m
(13 lbf•in)
29
15
Loctite 518

600 HO SDI Engine



GENERAL

Before completely disassembling the engine, check airtightness. Refer to *LEAK TEST*.

To measure internal parts, refer to *ENGINE MEASUREMENT* section.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Cleaning

Discard all gaskets and O-rings. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

Clean all metal components in a non-ferrous metal cleaner.

PROCEDURES

NOTE: Top end can be serviced with engine in vehicle.

REED VALVE

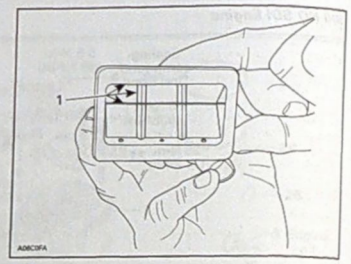
Reed Valve Removal

Remove intake resonator on top of reed valves **no. 15**.

Unscrew intake adapter screws **no. 16** then remove reed valve(s).

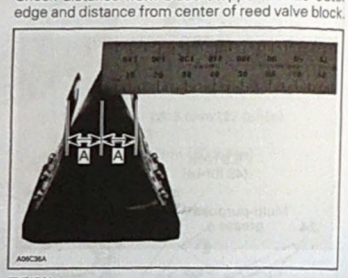
Reed Valve Inspection

Check reed valve for proper tightness. There must not be any play between blade and valve body when exerting a finger pressure on blade at blade stopper location.



1. No play

Check distance from blade stopper **no. 29** outer edge and distance from center of reed valve block.



TYPICAL
A. 593 engine: 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)
593 HO/SDI engines: 17.5 - 0, + 0.75 mm (.689 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

Reed Valve Disassembly

To remove blade from housing, remove the blade stopper **no. 29**.

Reed Valve Assembly

Blades have a curved shape. Install blade with their curve facing reed block housing.

Reed Valve Installation

The installation is the reverse of the removal procedure.

NOTE: Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

RAVE VALVE

Rave Valve Basic Operation

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

The RAVE valves change the height of the exhaust port to enhance the engine powerband and torque according to the engine RPM and throttle position (e-RAVE on SDI engines).

600 Engine

Exhaust pressure is used to inflate the bellows and open the RAVE valves at the proper engine RPM.

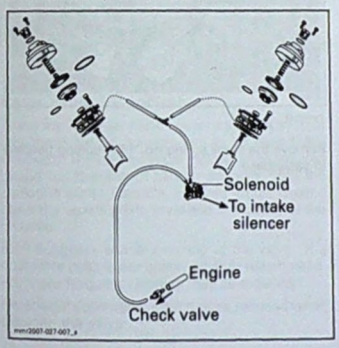
600 HO SDI Engine

The electronically controlled RAVE (e-RAVE) offers two performance enhancements to conventional RAVE system.

- The opening and closing of the valve is activated electronically. The ECM monitors altitude, engine temperature, throttle position and RPM, and operates the solenoid in optimal conditions.
- The valve is opened by crankcase pressure. The greater and more constant pressure from the crankcase opens the valve more crisply. Both RAVE valves operate at the same time.

To close the RAVE valves, the ECM deactivates the solenoid and a return spring then closes the valve.

NOTE: An electric heating element has been added to the RAVE solenoid to ensure proper function in very cold weather.

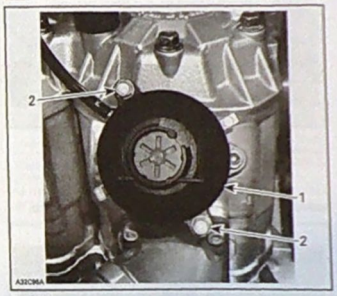


Rave Valve Removal and Disassembly

Remove RAVE valve cover **no. 4** by removing screws **no. 5**.

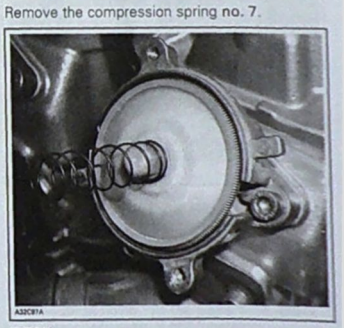
⚠ WARNING

Firmly hold cover to valve base no. 6. The compression spring no. 7 inside the valve is applying pressure against the cover.



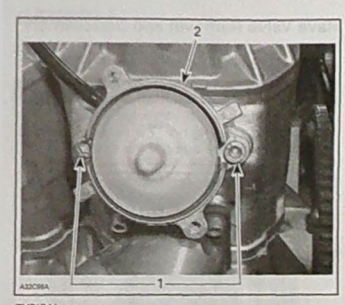
TYPICAL
1. Cover
2. Retaining screws

Remove the compression spring **no. 7**.



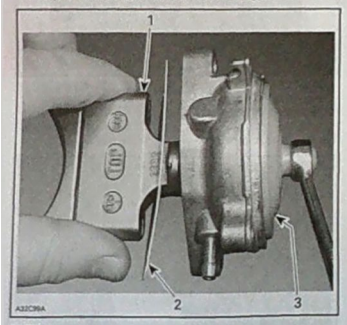
TYPICAL

Unscrew the Allen socket screw **no. 8** then remove the RAVE valve base **no. 6**.



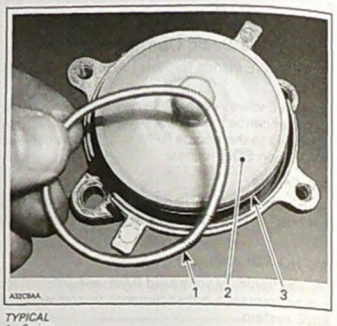
TYPICAL
1. Allen socket screws
2. RAVE valve base

Unscrew and remove the guillotine **no. 9** from the valve piston **no. 10** than remove the gasket **no. 11**.



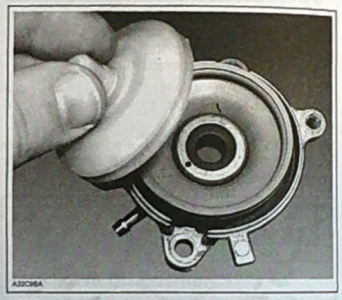
TYPICAL
1. Guillotine
2. Gasket
3. Valve piston

Remove spring **no. 12** retaining bellows **no. 13** to valve piston.



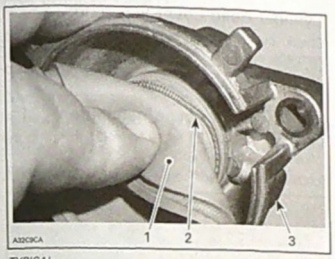
TYPICAL
1. Spring
2. Valve piston
3. Bellows

Remove valve piston.



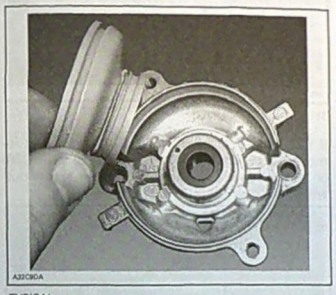
TYPICAL

Remove the small spring **no. 14** retaining bellows to valve base.



TYPICAL
1. Bellows
2. Small spring
3. Valve base

Remove bellows from valve base.



TYPICAL

Rave Valve Inspection

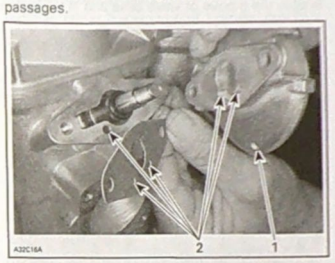
There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used.

BRP suggests annual cleaning of the valve. If a customer uses lower quality oil, than recommended, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

600 Engine

Check valve rod housing and cylinder for clogged passages.



1. Draining hole
2. Passages

NOTE: Oil dripping from draining hole indicates a loosen spring or damaged bellows.

600 and 600 HO SDI Engines

Check for cracked, dried or perforated bellows **no. 13**.

Check if the compression springs **no. 7** are in specifications.

ENGINE	SPRING P/N	COLOR	WIRE DIA. mm (in)	FREE LENGTH mm (in)
600	420 239 948	GREY	1.0 (.039)	38 (1.5)
600 HO SDI	420 239 942	BLACK	0.8 (.031)	42.5 (1.67)

In its stock configuration, the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

600 HO SDI Engine

Check if solenoid heating element is still functional once a year, the element should be warm after one minute of riding. At the same time, check if crankcase check valve is still functional.

NOTE: Make sure hoses are not kinked or damaged.

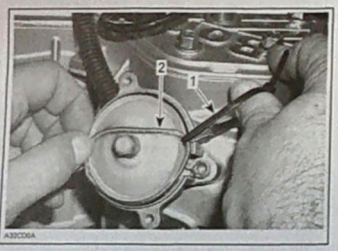
Rave Valve Assembly and Installation

Apply Drei Bond sealing compound (P/N 420 297 906) in the groove of valve base and in the piston valve groove, then install bellows.

Install RAVE valve with its mention TOP as illustrated in the following photo.



NOTE: To ease the installation of the spring **no. 12** retaining bellows **no. 13** to valve piston, refer to the following photo.



TYPICAL
1. Locking tie
2. Spring

Tighten red cap screw **no. 28** to bottom.

CYLINDER HEAD COVER

Cylinder Head Cover Removal

Unplug spark plug cables.

On **SDI models**, disconnect the knock sensor **no. 19**.

Unplug coolant hose from upper thermostat housing **no. 20**.

Unscrew all cylinder head cover screws **no. 21**.

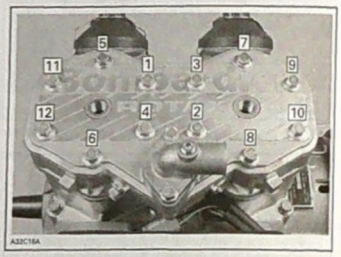
Cylinder Head Cover Inspection

Check cylinder head cover **no. 1** for cracks, warpage or other damages. Refer to *ENGINE MEASUREMENT* for the measurement procedures.

Cylinder Head Cover Installation

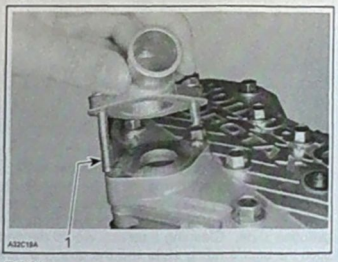
Torque screws **no. 21** to 29 N•m (21 lbf•ft) in the following illustrated sequence.

Torque knock sensor screw to 23 N•m (17 lbf•ft).



TYPICAL

If the upper coolant socket **no. 20** has been removed, apply Loctite 243 (blue) (P/N 293 800 060) on screw threads. Position the longer screw outwards.



TYPICAL
1. Longer screw

600 HO SDI Engine

Install knock sensor. Refer to *ENGINE MANAGEMENT (SDI)* section.

CYLINDER HEAD

Cylinder Head Removal

Remove the cylinder head cover **no. 1** as explained above.

Disconnect the temperature sensor connector.

Remove the cylinder head **no. 2**.

Cylinder Head Inspection

Check cylinder head **no. 2** for cracks, warpage or other damages.

Refer to tables below to find cylinder head specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

CYLINDER HEAD WARPAGE (MAXIMUM)
0.05 mm (.002 in) per 50 mm (2 in) of surface
0.5 mm (.020 in) for total length of cylinder head

COMBUSTION CHAMBER VOLUME (CC)
25.49 - 27.96

Cylinder Head Cleaning

Scrape off carbon formation from cylinder head.

Cylinder Head Installation

Install new rubber ring and round O-rings on each cylinder.

Replace O-rings around spark plug holes and on cylinder head border.

Install cylinder head cover.

CYLINDER

Cylinder Removal

600 HO SDI Engine

Release the fuel pressure of the system.

Unplug fuel injector connectors then remove the fuel rail **no. 24**. Refer to *ADJUSTMENT AND REPAIR PROCEDURES*.

600 and 600 HO SDI Engines

Remove cylinder head **no. 2** as explained above.

Remove exhaust manifold, reed valves and RAVE valves.

Unscrew cylinder screws **no. 22** and **no. 23** then remove the cylinder(s) **no. 3**.

Cylinder Inspection

Check cylinders for cracks and scoring on the top and bottom of cylinders.

Refer to tables below to find cylinder specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

MEASUREMENT	MAXIMUM
Cylinder Taper	0.10 mm (.004 po)
Cylinder Out of Round	0.08 mm (.003 po)
Piston/Cylinder Wall Clearance	0.18 mm (.0071 in)

RAVE Valve Clearance

In its stock configuration, the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

Cylinder Cleaning

Scrape off carbon formation from cylinder exhaust port.

Clean cylinders and crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

Cylinder Installation

Apply a thin layer of Loctite 518 (P/N 293 800 038) to crankcase mating surface of base gasket.

Install a new cylinder base gasket of the same thickness as previously used.

NOTE: If the old gasket thickness is unknown or if the cylinder head or cylinders are replaced, measure the combustion chamber volume to determine the right gasket to use. Refer to *ENGINE MEASUREMENT* for the measurement procedures. Refer to *CYLINDER HEAD* above for the combustion chamber volume specifications.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

Coat gasket with Loctite 518.

Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

Install cylinders. Do not tighten.

Install new rubber ring and round O-rings on each cylinder.

NOTE: Carefully clean screws before reinstallation, specifically under screw head.

Install exhaust manifold with gaskets. Do not tighten yet.

Torque cylinder screws in a crisscross sequence as per the following table.

M8	29 N•m (21 lbf•ft)
M10	40 N•m (29 lbf•ft)

Install all other removed parts.

PISTON

Piston Removal

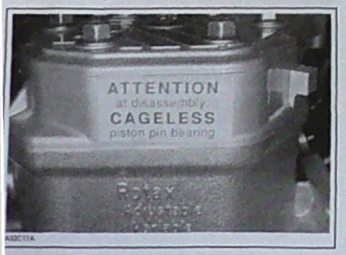
Remove cylinders, as explained above.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase. Then with a pointed tool inserted in piston notch, remove both circlips **no. 25** from piston **no. 26**.



TYPICAL

NOTE: All engines are equipped with cageless piston pin bearings.

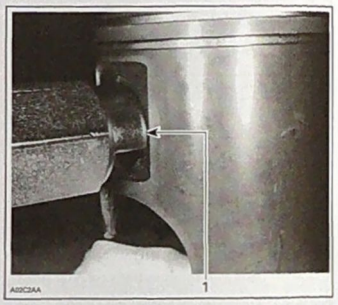


To remove piston **no. 26**, use the following tools:

TOOLS		
Puller (P/N 529 035 503)	Sleeve kit (P/N 529 035 542) (20 mm)	Locating sleeve (P/N 529 023 800)

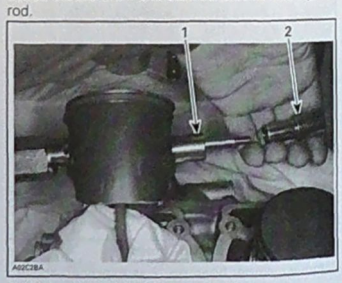
NOTE: The locating sleeve is the same that contains new cageless bearing.

Insert piston pin puller making sure it sits squarely against piston.



TYPICAL
1. Properly seated all around

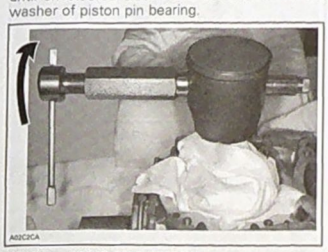
Install sleeve then shouldered sleeve over puller rod.



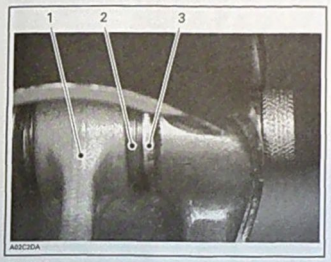
TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Screw (LH threads) extracting nut.

Pull out piston pin **no. 27** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

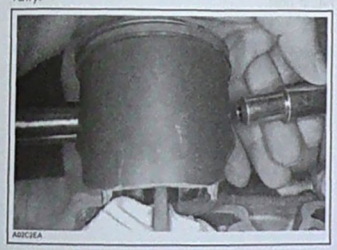


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

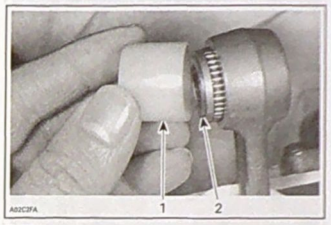
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

Piston Inspection

Inspect piston for scoring, cracking or other damages.

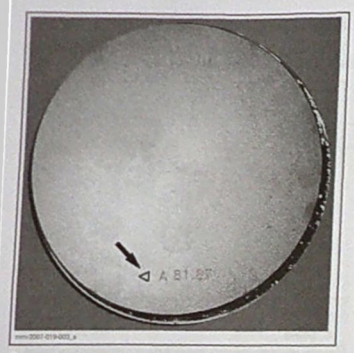
Refer to table below to find piston specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

MESUREMENT	MAXIMUM
Ring/Piston Groove Clearance	0.20 mm (.0079 in)
Ring End Gap	1.0 mm (.039 in)
Piston/Cylinder Clearance	0.18 mm (.0071 in)
Piston Skirt Wear	0.15 mm (.006 in)

Piston Cleaning

Scrape off carbon formation from piston dome.

NOTE: The arrow on the piston dome must be visible after cleaning.



Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

Piston Installation

When installing a new cageless bearing, replace half plastic cages with sleeve.

NOTE: Cageless bearing contains 28 needles on all engines.



TYPICAL
1. Sleeve

Lubricate needle bearings and thrust washers with injection oil then install washers on each end of needles.

Insert cageless bearing into connecting rod.



TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

NOTE: To ease piston pin installation if it is tight, heat piston using bearing heater (P/N 529 035 969).



CAUTION: Piston temperature must not exceed 46°C (115°F). Never use direct flame to heat the piston and never freeze the pin.

At assembly, place the pistons over the connecting rods with the arrow facing towards the exhaust port.

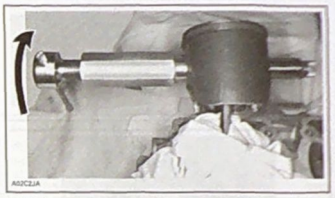


Install shouldered sleeve.



TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.



TYPICAL

CAUTION: Always install new circlips.

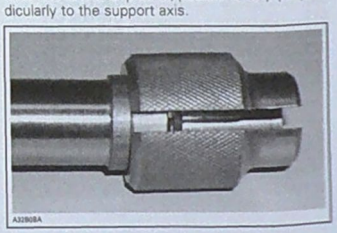
Use appropriate piston circlip installer to install mono-hook circlips no. 25.

TOOL
Piston circlip installer (P/N 529 035 686)

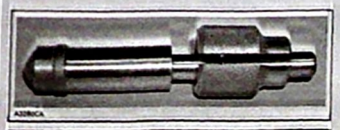
Insert circlip into support so that, when installed in piston groove, the tab faces upward.

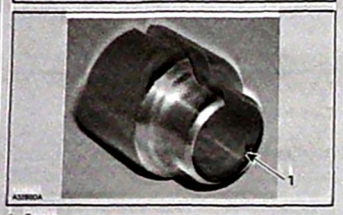


With round end of pusher, position circlip perpendicularly to the support axis.



With the other end of the pusher, push circlip into the support groove.



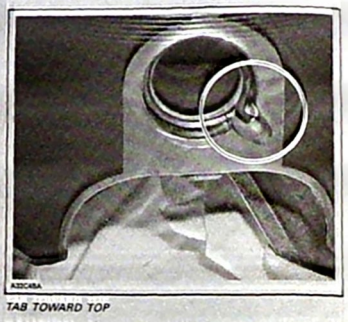


1. Groove



CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to put circlip in place. Make sure to install new circlips with tab toward top as per following photo.



TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one because, on a second attempt, the circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Install all other removed parts.

BOTTOM END

SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	212
bearing installer	259 035 980	214
bearing installer	259 035 990	213
bearing puller	420 877 635	211
ceramic seal installer	529 036 014	207
crankshaft protector	420 876 552	211
crankshaft protector	420 876 557	211
Distance gauge	529 035 966	214
Distance gauge	529 035 968	214
half rings	420 977 479	211
indicator stick	529 035 970	213
oil seal protector	529 035 822	207
oil seal pusher	529 035 757	206
puller ring	420 977 494	211
screws	420 840 681	211
support plate	529 035 976	213

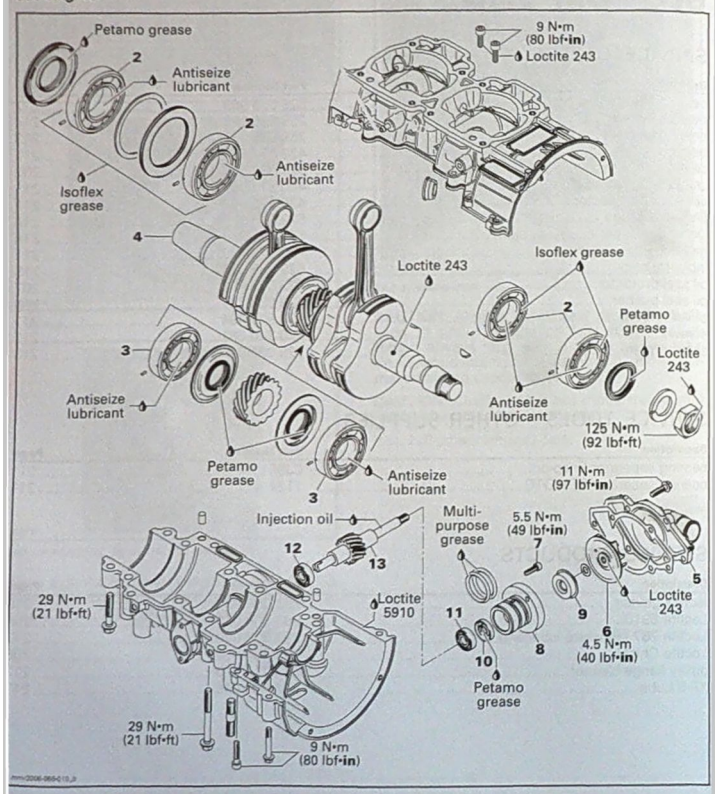
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
bearing separator Snap-on	CJ951	211
bearing separator SPX/OTC	1124	211

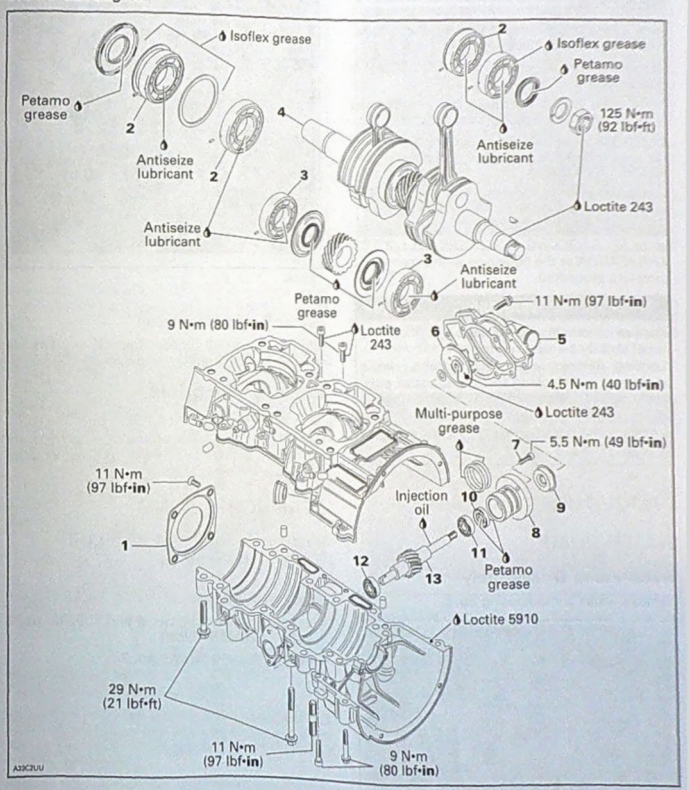
SERVICE PRODUCTS

Description	Part Number	Page
Isoflex grease	293 550 021	210
Loctite 5910	293 800 081	208
Loctite 767 (antiseize lubricant)	293 800 070	212
Loctite Chisel	413 708 500	208
pulley flange cleaner	413 711 809	212
XP-S Lube	293 600 016	211

600 Engine


Petamo grease
2
Antiseize lubricant
2
Antiseize lubricant
Isoflex grease
9 N•m (80 lbf•in)
Loctite 243
4
Loctite 243
Isoflex grease
2
Petamo grease
Loctite 243
3
Antiseize lubricant
Antiseize lubricant
125 N•m (92 lbf•ft)
Petamo grease
Antiseize lubricant
3
11 N•m (97 lbf•in)
Injection oil
12
13
Multi-purpose grease
5.5 N•m (49 lbf•in)
7
5
Loctite 243
29 N•m (21 lbf•ft)
Loctite 5910
11
9
6
4.5 N•m (40 lbf•in)
10
8
Petamo grease
29 N•m (21 lbf•ft)
9 N•m (80 lbf•in)

600 HO SDI Engine



GENERAL

Before completely disassembling the engine, check airtightness. Refer to *LEAK TEST*.

To verify internal parts, refer to *ENGINE MEASUREMENT* section.

All oil seals and gaskets must be discarded and replaced with new ones when crankcase is split.

CAUTION: After rebuilding an engine always observe a break-in period as described in *OPERATOR'S GUIDE*.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

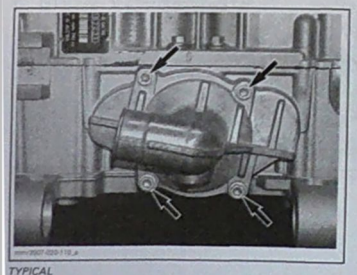
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

WATER PUMP

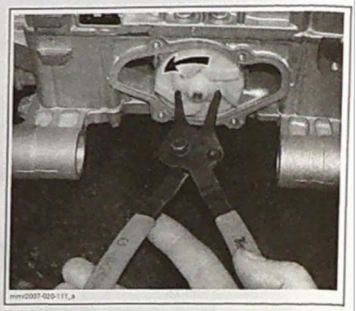
Water Pump Disassembly

Remove water pump housing **no. 5**.



TYPICAL

Remove impeller **no. 6**.



TYPICAL

Water Pump Inspection

Verify condition of impeller fins. If any fins are broke or missing, replace impeller.

Water Pump Assembly

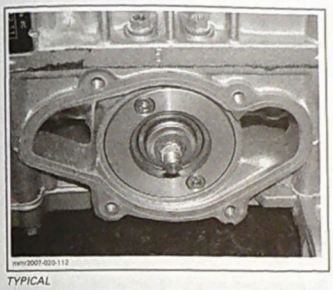
Install impeller.

Install water pump housing with a new gasket and torque screws in a criss-cross sequence to 11 N•m (97 lbf•**in**).

BEARING HOUSING

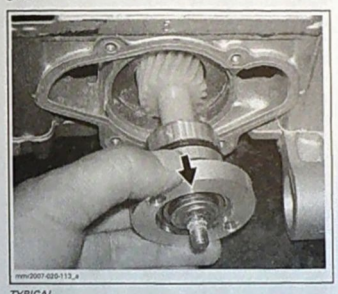
Bearing Housing and Water/Oil Pump Shaft Removal

Remove:
- oil injection pump
- water pump housing **no. 5** and impeller **no. 6** (refer to *WATER PUMP*)
- bearing housing screws **no. 7**.



TYPICAL

From injection oil pump side, push shaft out while turning shaft to release it from crankshaft worm gear.



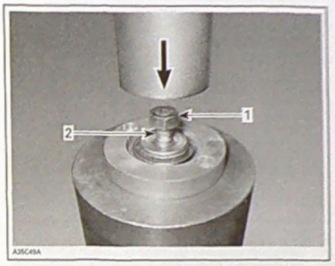
TYPICAL

Bearing Housing and Water/Oil Pump Shaft Disassembly

CAUTION: Pay attention not to damage the bearing housing no. **8** during disassembly. Marks or other damages will lead to coolant and/or oil leaking.

NOTE: For bearing housing disassembly/assembly procedures, a press is required.

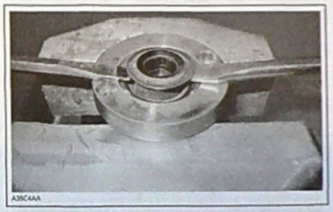
Protect the threads of shaft with a suitable M8 nut. Properly support bearing housing and push shaft out.



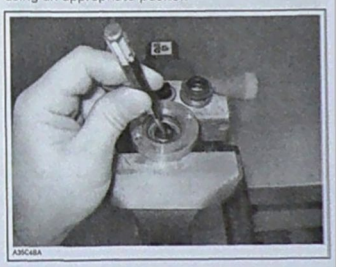
1. M8 nut
2. Shaft

CAUTION: When removing water/oil pump shaft, always replace ceramic seal no. **9** and oil seal no. **10**. Ceramic seal cannot be removed without damage.

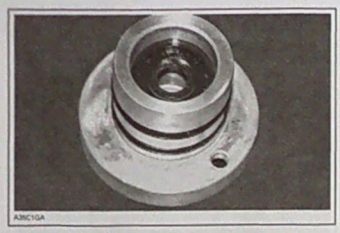
Pry inner part of ceramic seal no. **9** out.



Extract bearing no. **11** from the bearing housing using an appropriate pusher.

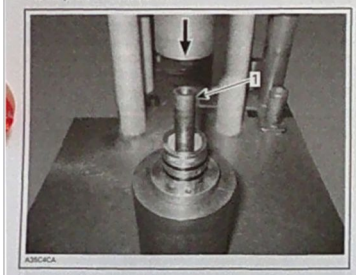


Push oil seal no. **10** out.

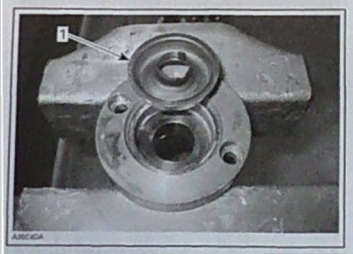


Press the outer part of ceramic seal out.

NOTE: Use a mandrel with diameter of approximately 16 mm (.63 in).

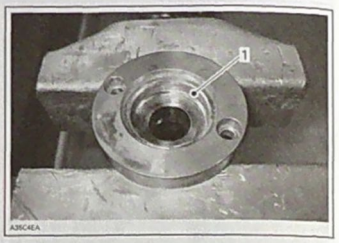


1. 16 mm (.63 in) mandrel



1. Outer part of ceramic seal

Remove sealant from bearing housing with sand paper no. 180.



1. Remove sealant

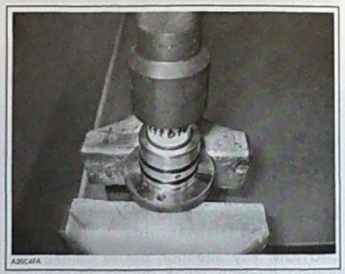
To extract bearing **no. 12** either use a hammer puller or an appropriate pusher.

Bearing Housing and Water/Oil Pump Shaft Assembly

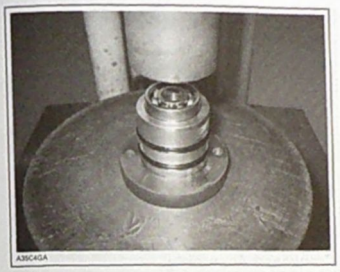
Reverse disassembly procedure and pay attention to the following.

NOTE: Never put oil in the press fit area of the oil seal and ceramic seal.

Push the new oil seal **no. 10** in bearing housing using the oil seal pusher (P/N 529 035 757).



Press bearing **no. 11** into bearing housing **no. 8**.

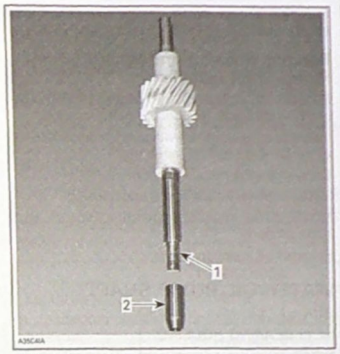

A35C4GA

Push the new ceramic seal **no. 9** in bearing housing **no. 8** using the ceramic seal installer (P/N 529 036 014).


A35C4HA

CAUTION: Never use a hammer for the ceramic seal installation. Only use a press to avoid damaging the ceramic component.

Put oil seal protector (P/N 529 035 822) on water/oil pump shaft **no. 13**.



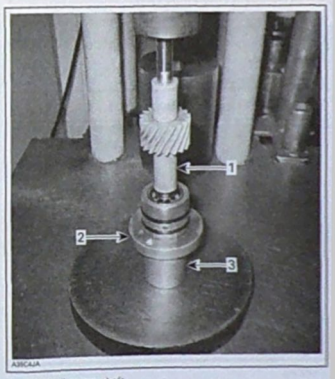
A35C4IA

1. Water/oil pump shaft
2. Oil seal protector

Press water/oil pump shaft **no. 13** into the bearing housing **no. 8** with appropriate force.

CAUTION: Inadequate force will damage the oil seal no. **10** and bearing no. **11**.

NOTE: During installation support the ceramic seal using the ceramic seal installer (P/N 529 036 014) as shown on the following illustration.



A35C4JA

1. Water/oil pump shaft
2. Bearing housing
3. Ceramic seal installer

Remove oil seal protector from water/oil pump shaft.

Bearing Housing and Water/Oil Pump Shaft Installation

Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.

Install bearing housing with shaft in crankcase half while turning shaft to mesh gears.

Torque bearing housing screws **no. 7**.

Install impeller and water pump housing.

NOTE: After impeller installation, ensure shaft turns properly.

Reinstall oil injection pump.

WATER/OIL PUMP SHAFT

For shaft removal and installation procedures, refer to *BEARING HOUSING*.

NOTE: It is not necessary to split crankcase to remove shaft.

CRANKCASE

Crankcase Disassembly

Remove cylinder head and cylinders. Refer to *TOP END*.

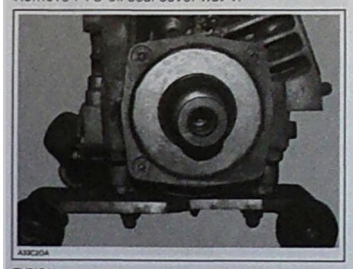
Remove rewind starter. Refer to *REWIND STARTER*.

600 Engine

Remove trigger coil, magneto flywheel and stator. Refer to *MAGNETO SYSTEM*.

600 HO SDI Engine

Remove PTO oil seal cover **no. 1**.



TYPICAL

Remove all screws that retain crankcase halves together.

Split crankcase and remove internal components.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are harmful to crankcase sealing.

Crankcase Inspection

Check crankcase for cracks or other damages. Replace if necessary.

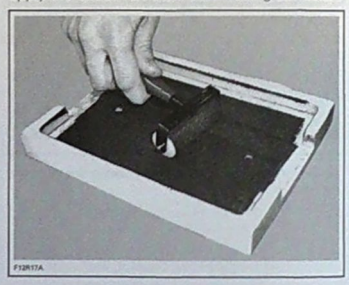
Crankcase Assembly

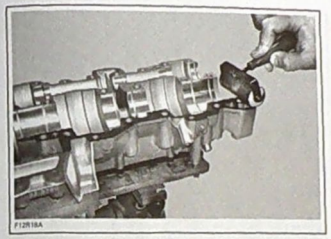
IMPORTANT: The total assembly sequence, including sealing compound application, crankcase screw installation and torquing, must be performed within 10 minutes. The torquing sequence must be accomplished without interruption.

Before screwing both parts of crankcase, seal them with Loctite 5910 (P/N 293 800 081).

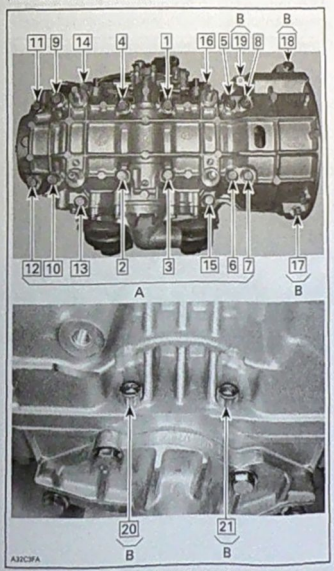
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

Use a plexiglass plate and apply some sealant on it. Use a 50 - 75 mm (2 - 3 in) soft rubber roller and spread the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.





Tighten all crankcase screws in place in the following sequence and to the appropriate torque; this must be done in two steps torquing: first, tighten screws up to 60% of the final torque (18 N•m (159 lbf•**in**)), then tighten to the required torque (i.e. 29 N•m (21 lbf•ft)).



A. Torque screws 1 through 16 to 29 N•m (21 lbf•ft)
B. Torque screws 17 through 21 to 9 N•m (80 lbf•in)

600 HO SDI Engine

Install PTO oil seal cover.

CRANKSHAFT

Crankshaft Removal

To remove crankshaft, use crankcase disassembly procedure.

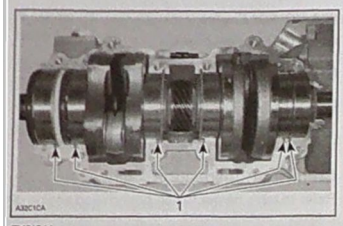
Crankshaft Inspection

Refer to table below to find bottom end engine dimension specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (MIN.)	(MAX.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.06 mm (.0024 in)	N.A.
Crankshaft deflection on MAG side	N.A.	0.05 mm (.002 in)	N.A.
Crankshaft deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	**593 ENGINES**		
	0.31 mm (.012 in)	0.677 mm (.027 in)	1.20 mm (.047 in)
	593 HO SDI ENGINES		
	0.31 mm (.012 in)	0.677 mm (.027 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

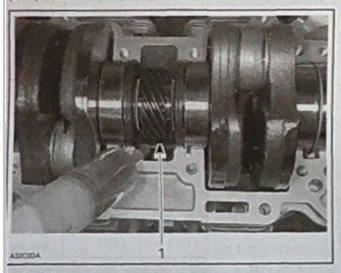
Crankshaft Installation

Position drive pins as illustrated.



TYPICAL
1. Position pins

Pour 50 mL (2 U.S. oz) of injection oil in the pan under central gear to lubricate pump gearing as per photo.



1. Oil bath

Apply Isoflex grease (P/N 293 550 021) as per following procedure:

CAUTION: Use only the recommended grease. Make sure not to push grease between outside bearing race and half crankcase.

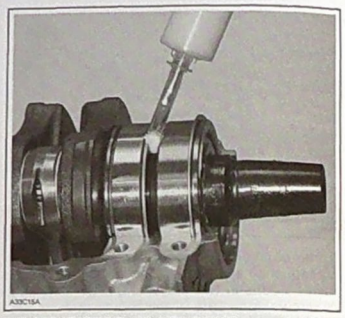
Put the following quantity of grease in a syringe.

ENGINE	QUANTITY OF GREASE
600	42 ± 5 mL
600 HO SDI	30 ± 5 mL

NOTE: The 50 g tube corresponds to 50 mL of grease.

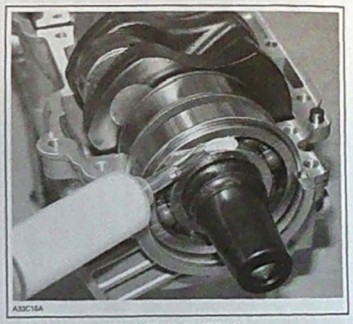
CAUTION: Do not exceed the recommended amount of grease

Fill inner side of PTO side bearing with grease (about 10 mL).

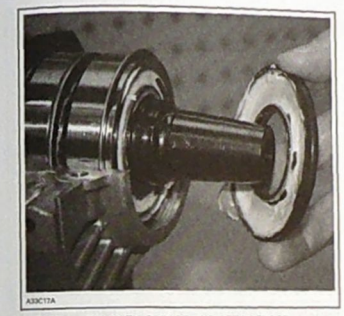


PTO SIDE BEARING FILLED WITH GREASE

With the syringe, fill the outer ball bearing and inner side of outer seal with the remaining of grease.



BALLS COATED WITH A SEAM OF GREASE



TYPICAL — FILL WITH GREASE AND SET IN PLACE

Apply 6 mL of grease to MAG side outer bearing.

NOTE: If replaced with new bearing, do not apply grease as new bearings come with grease already applied.

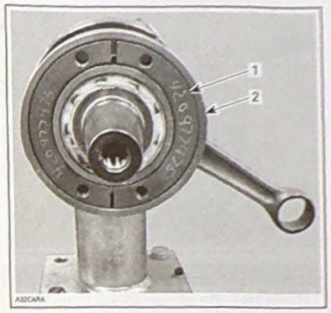
Assemble crankcase halves.

CRANKSHAFT BEARINGS

Crankshaft Bearing Removal

NOTE: It takes approximately 10 minutes to heat up a bearing. In the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. See procedure further.

To remove bearings **no. 2** and **no. 3** from crankshaft **no. 4**, install half rings (P/N 420 977 479) and puller ring (P/N 420 977 494) on the outer bearing.

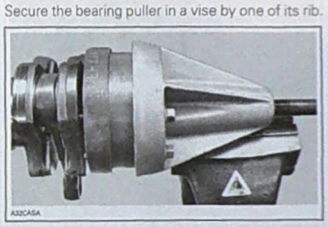


1. Half ring
2. Puller ring

NOTE: Apply grease on crankshaft end in order to hold in place the crankshaft protector (P/N 420 876 552) on PTO side and crankshaft protector (P/N 420 876 557) on MAG side.

Using screws (P/N 420 840 681), install bearing puller (P/N 420 877 635) on the half rings.

Secure the bearing puller in a vise by one of its rib.



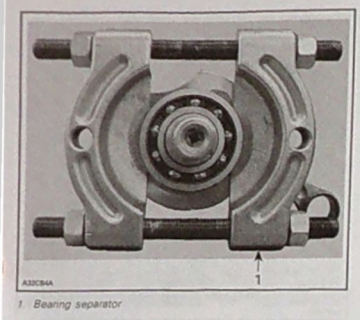
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with XP-S Lube (P/N 293 600 016) to avoid damaging the threads.

Screw in the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use a bearing separator Snap-on (P/N CJ951) or a bearing separator SPX/OTC (P/N 1124) to facilitate the removal.



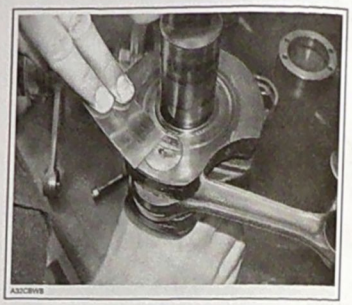
1. Bearing separator

Crankshaft Bearing Installation

Inspect crankshaft ends for damage.

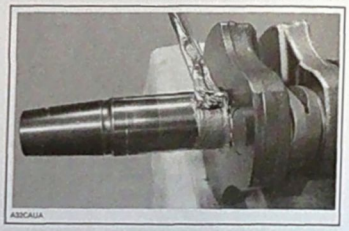
Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.





Remove all residue using pulley flange cleaner (P/N 413 711 809).

Smear Loctite 767 (antiseize lubricant) (P/N 293 800 070) on part of crankshaft where bearing fits.



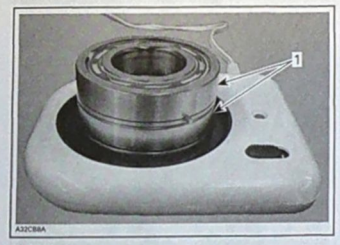
Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal with the heating surface.


A32CB7A

CAUTION: Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) on direct flame, or with a heat gun or in an oil bath. Inappropriate bearing(s) heating may result in inner seals or cage failure.

For even heat distribution, turn bearing several times during heating process.

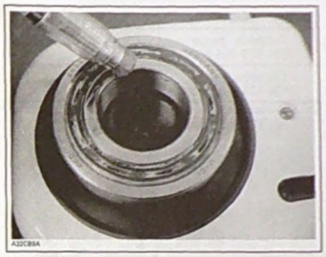
NOTE: Two bearings can be heated at the same time on one bearing heater.



A32CB8A

1. Bearings

Probe the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.

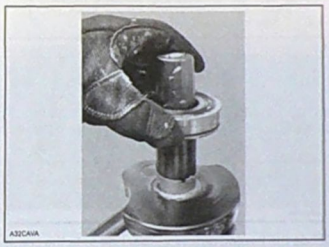

A32CB9A

⚠ WARNING

Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

CAUTION: Never reinstall a bearing that has been removed.

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

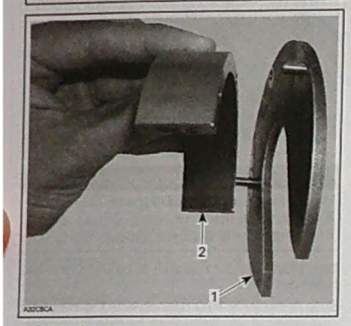

A32CAVA

NOTE: Heated bearing should slide easily onto the crankshaft. If required, push with a bearing installer (P/N 259 035 990) on the inner ring of the bearing.

Install retaining discs.

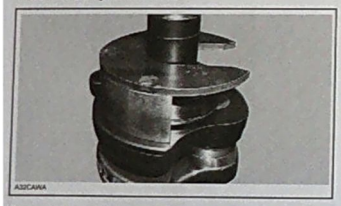
Install support plate (P/N 529 035 976) with appropriate distance gauge; refer to following table.

TOOL	ENGINE
Distance gauge (P/N 529 035 966)	600
Distance gauge (P/N 529 035 968)	600 HO SDI



1. Support plate
2. Distance gauge

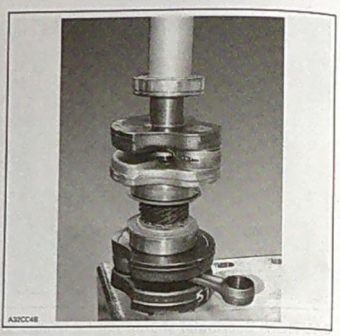
Install bearing locator tool.



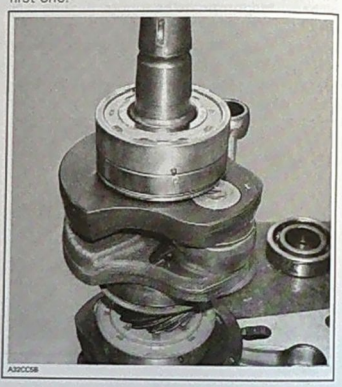
Slide the heated outer PTO bearing onto the crankshaft until it contacts the distance gauge.

Slide the first MAG bearing **with the integrated seal facing crankshaft** until it bottoms on crankshaft shoulder.

NOTE: Heated bearing should slide easily onto the crankshaft. If required, push with a bearing installer (P/N 259 035 980) on the inner ring of the bearing.



Slide-in the second bearing until it contacts the first one.



ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	220
dial indicator	414 104 700	215, 219

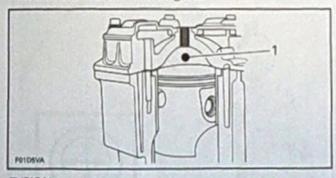
NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to *INSPECTION* in the appropriate *ENGINE* subsection.

CYLINDER HEAD WARPAGE

Check gasketed surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification. Otherwise, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

COMBUSTION CHAMBER VOLUME MEASUREMENT

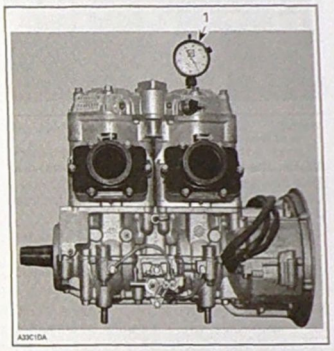
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center (TDC). It is measured with the cylinder head installed on the engine.



TYPICAL
1. Combustion chamber

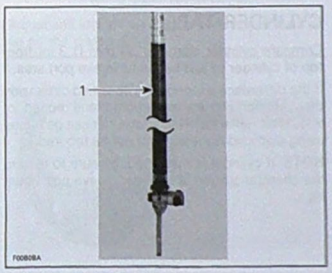
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center using the dial indicator (P/N 414 104 700).



TYPICAL
1. Bring piston to TDC

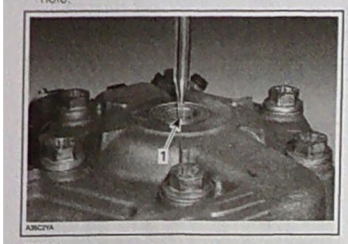
– Obtain a graduated burette (capacity 0 - 50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0 - 50 cc)

– Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.

– Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



TYPICAL
1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

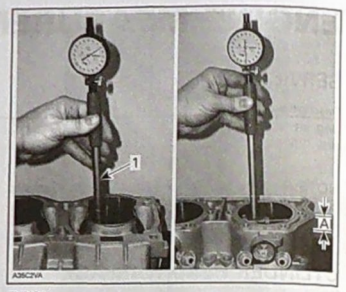
– Repeat the procedure for the other cylinder.
– Install a thicker or thinner cylinder/crankcase gasket (refer to *PARTS CATALOG*) in order to obtain the specified combustion chamber volume.

CYLINDER TAPER

Compare cylinder diameter 33 mm (1.3 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: If cylinder is machined, be sure to restore the chamfer around all cylinder sleeve port openings.

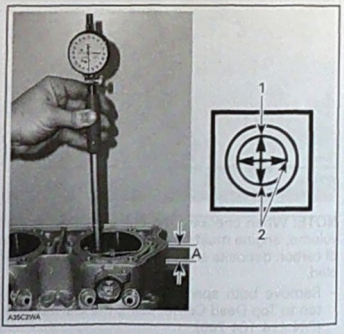


TYPICAL
1. Below the intake port
A. 33 mm (1.3 in) from top

CYLINDER OUT OF ROUND

Measuring 33 mm (1.3 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but cannot be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

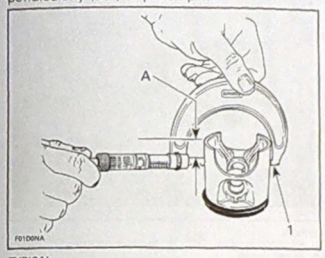


TYPICAL
1. Piston pin position
2. Measures to be compared
A. 33 mm (1.3 in)

PISTON/CYLINDER CLEARANCE

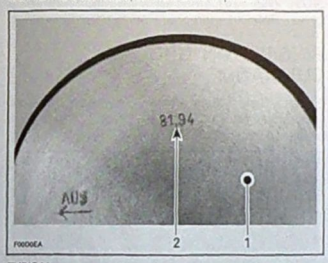
Procedure with a Used Piston

Using a micrometer, measure piston at "A" perpendicularly (90°) to piston pin.



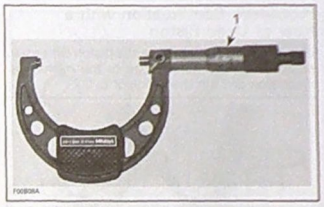
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 15 mm (.590 in)

The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.



TYPICAL
1. Piston dome
2. Piston measurement

If piston is within tolerance, adjust and lock a micrometer to the piston dimension.

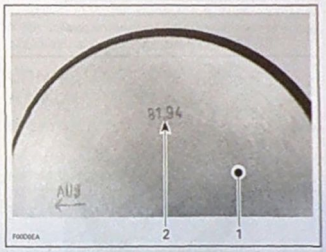


1. Micrometer set to the piston dimension

Refer to *PROCEDURE CONTINUATION WITH A NEW OR USED PISTON* further.

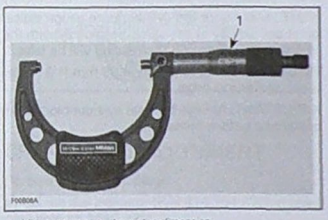
Procedure with a New Piston

Read the piston diameter on the piston dome.



1. Piston dome
2. Piston diameter

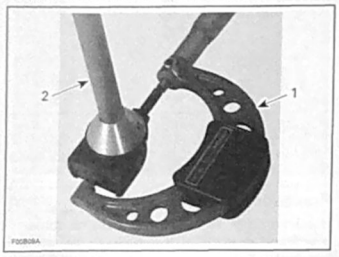
Adjust and lock a micrometer to the specified value on the piston dome.



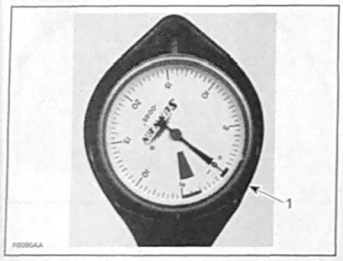
1. Micrometer set to the piston dimension

Procedure Continuation with a New or Used Piston

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge

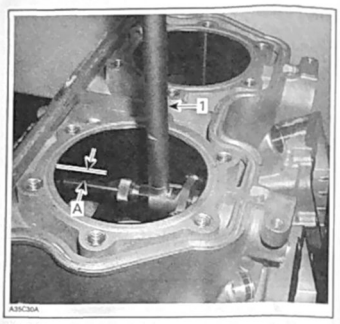


1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Position the dial bore gauge at 33 mm (1.3 in) below cylinder top edge.

IMPORTANT: Always remove cylinder-block from crankcase before measuring.



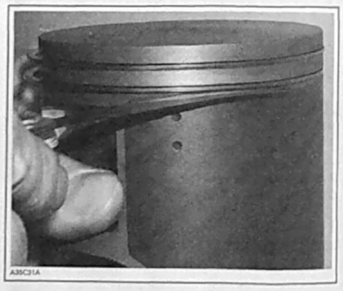
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 33 mm (1.3 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder and piston.

NOTE: Oversize pistons are available for some engines. Refer to appropriate parts catalog.

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

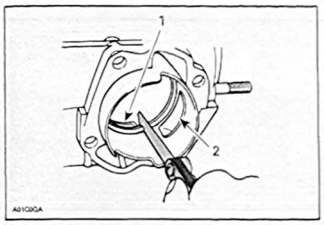


RING END GAP

Position ring halfway between transfer ports and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance.



TYPICAL
1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

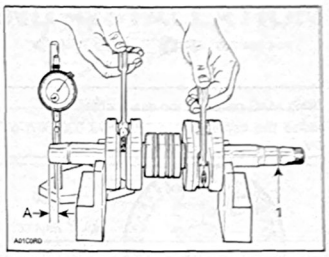
Crankshaft deflection is measured with the dial indicator (P/N 414 104 700).

Measuring in Crankcase

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring on Bench

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement "A" in following illustration.



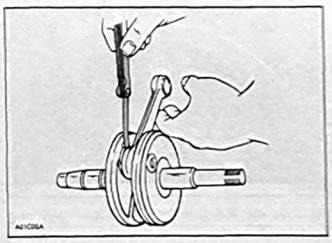
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.

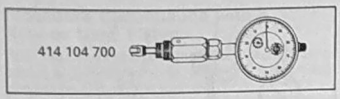


TYPICAL

CRANKSHAFT ALIGNMENT

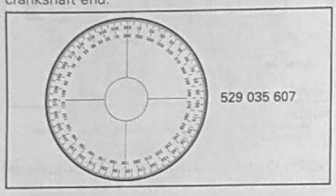
Remove both spark plugs.

Install the dial indicator (P/N 414 104 700) in spark plug hole on MAG side.



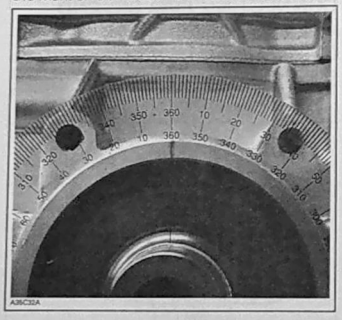
Bring MAG piston at top dead center.

Install the degree wheel (P/N 529 035 607) on crankshaft end.



Scribe a mark on crankcase.

Install degree wheel so that 360° mark aligns with the mark on crankcase. Do not rotate crankshaft.



Remove dial indicator and install it in spark plug hole on PTO side.

Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.

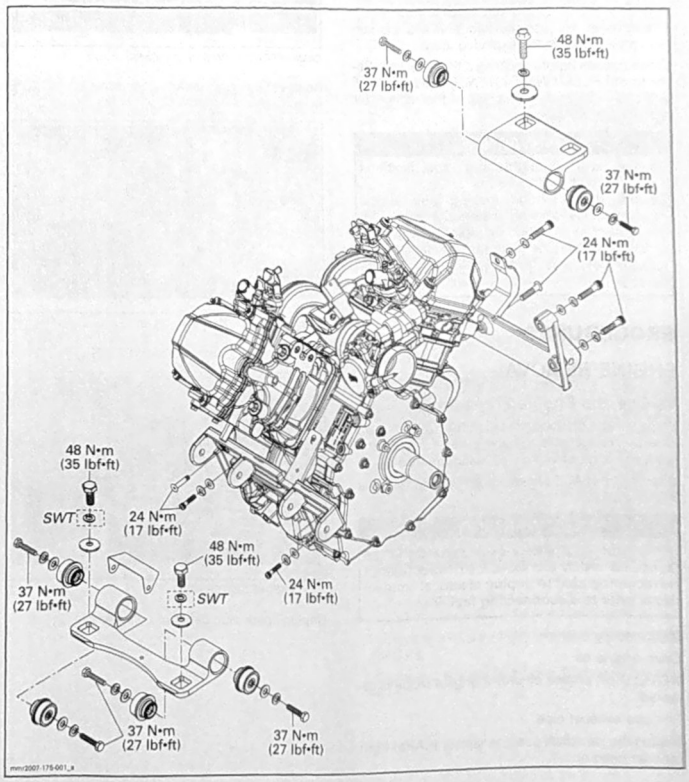
Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
engine lifting tool	529 036 022	224



GENERAL

⚠ WARNING

To avoid potential burns, let engine and exhaust system cool down before performing any servicing.

Refer also to other sections in this manual for removal and installation procedures that are not shown in this section.

During assembly, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new one where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

ENGINE REMOVAL

Vehicle and Engine Preparation

Place vehicle on a work station that will have access to an engine-lifting hoist. Then start with initial preparation of vehicle by doing the following.

Unplug the BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always unplug battery cables exactly in the specified order, the BLACK (-) cable first. It is recommended to unplug electrical connections prior to disconnecting fuel lines.

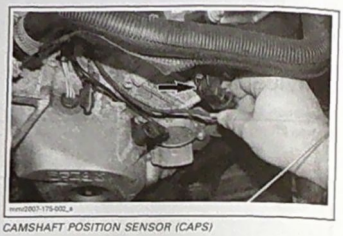
Drain cooling system.

Drain engine oil.

NOTE: Drain engine oil only if engine repair is required.

Remove exhaust pipe.

Unplug the camshaft position sensor (CAPS) from cylinder head no. 1.



CAMSHAFT POSITION SENSOR (CAPS)

Remove the crankshaft position sensor (CPS) from engine.



CRANKSHAFT POSITION SENSOR (CPS)

Unplug the oil pressure switch (OPS).

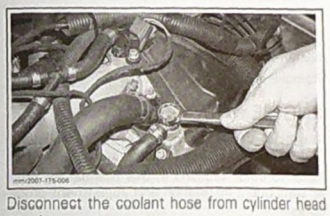


OIL PRESSURE SWITCH (OPS)

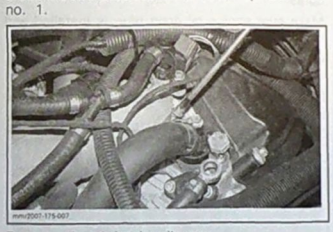
Unplug spark plug cable of cylinder no. 2.



Unscrew the Banjo fitting of cylinder head no. 1. Discard sealing rings.



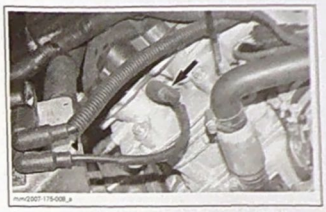
Disconnect the coolant hose from cylinder head no. 1.



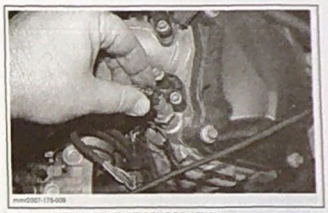
Remove the air intake silencer.

Remove the drive pulley.

Unplug spark plug cable of cylinder no. 1.

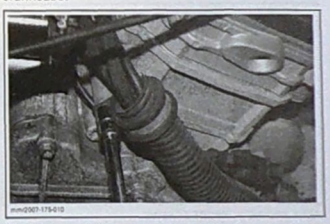


Unplug the coolant temperature sensor (CTS) connector.



COOLANT TEMPERATURE SENSOR (CTS)

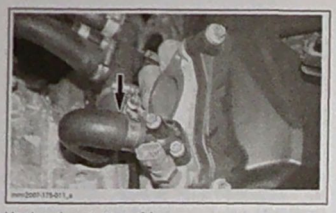
Detach wiring harness from cylinder no. 2 and crankcase.



Unplug magneto connector (under fuse box) and extract the magneto wire from protective tube.

Remove the intake manifold screws then remove manifold.

Disconnect the coolant hose from cylinder head no. 2.



Unplug the starter cable.

Lifting Engine

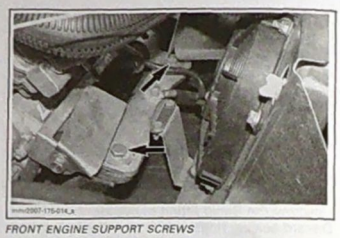
Install the engine lifting tool (P/N 529 036 022).



Unscrew engine supports screws.



REAR ENGINE SUPPORT SCREWS



FRONT ENGINE SUPPORT SCREWS

Move engine forward to release the rear support.

Lift the engine slightly and remove the coolant hose from water pump.

Remove engine from vehicle.

ENGINE INSTALLATION

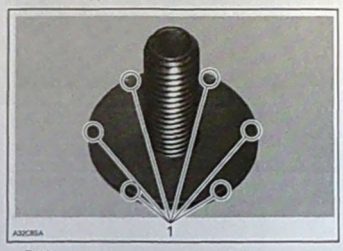
The installation is the reverse of the removal procedure. However, pay attention to the following.

Refer to other sections in this manual for proper component installation and adjustment procedures.

Make sure engine oil drain plug is installed and tight.

Check condition of engine support rubber mounts and replace them if necessary.

Install engine support washers with the teeth toward the support.



1. Teeth

Position the front heat deflector to obtain a distance of 10 ± 1.5 mm (1/2 ± 1/16 in) with the front support.

Check pulley alignment and drive belt height.

Final Assembly Procedure

Fill engine with the right amount of oil. Use oil of appropriate viscosity.

Reconnect battery.

⚠ WARNING

Connect RED (+) cable then BLACK (-) cable. Always connect RED (+) cable in first.

Fill and bleed cooling system.

Test drive vehicle to confirm proper operation.

Recheck if coolant and oil levels are adequate. Refill as necessary.

ENGINE LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
camshaft locking tool	529 035 926	228
dial gauge	414 104 700	228

GENERAL

Before performing the cylinder leak test, verify the following:
- clamp(s) tightness
- radiator and hoses.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

⚠ WARNING

Prevent burning yourself on hot engine parts.

Repair Tips

- blue exhaust gas means damaged/worn piston rings or valve stem seals
- oily contamination on leak indicator hole means a damaged oil seal on water pump shaft (refer to *COOLING SYSTEM*)
- coolant out of leak indicator hole means a damaged rotary seal on water pump shaft (refer to *COOLING SYSTEM*)
- coolant escaping from water pump housing means damaged gasket(s) and/or loosened screws (refer to *COOLING SYSTEM*).

NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

PROCEDURES

NOTE: The following instructions are the same for both cylinders.

PREPARATION

Disconnect battery.

⚠ WARNING

Always respect this order for disassembly; disconnect BLACK (-) cable first.

Remove coolant tank cap.

⚠ WARNING

To avoid potential burns, wear the appropriate safety equipment to remove the coolant tank cap.

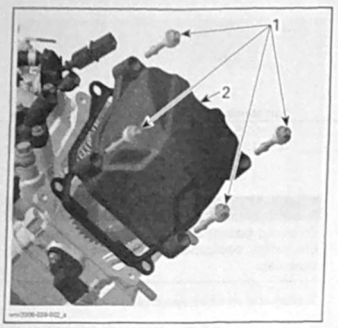
Unplug and remove spark plug cable.

Clean spark plug area and remove spark plug from cylinder head.



TYPICAL
1. Spark plug cable
2. Spark plug

Remove valve cover.



1. Valve cover screws
2. Valve cover

Rotate crankshaft until piston is at ignition TDC. See procedure below.

How to Turn Crankshaft

To turn crankshaft, there are two possible procedures.

First Procedure

– Turn the drive pulley.

Second Procedure

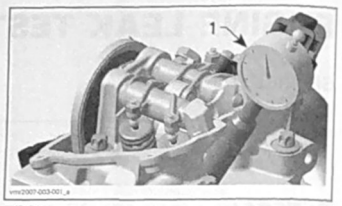
– Remove plug screw with O-ring from magneto cover.
– Use a 14 mm Allen key and turn crankshaft.

NOTE: Exhaust pipe must be removed for this operation.

CAUTION: Turn only clockwise to avoid loosening of magneto flywheel Allen screw.

How to Position Piston at TDC

Using the dial gauge (P/N 414 104 700), turn the crankshaft and set the piston to precisely ignition TDC.

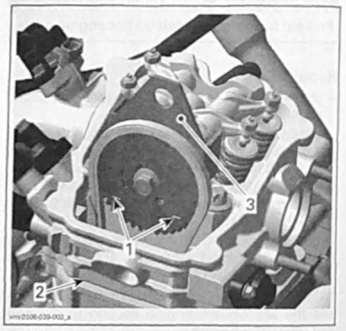


TYPICAL
1. Dial gauge

NOTE: If a dial gauge is not available, use a screwdriver or another similarly tool.

CAUTION: Do not scratch or damage piston/cylinder surface.

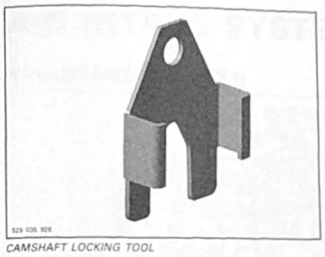
At ignition TDC the marks on the camshaft timing gear have to be parallel to cylinder head base as per following illustration.



1. Marks on camshaft timing gear
2. Cylinder head base
3. Camshaft locking tool

How to Lock Camshaft

Lock camshaft at TDC by using the camshaft locking tool (P/N 529 035 926).



CAMSHAFT LOCKING TOOL

LEAK TEST

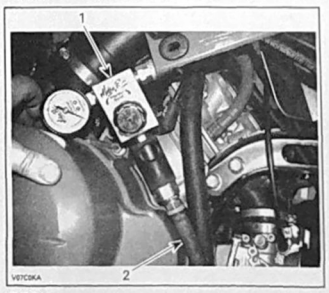
Connect to adequate air supply.

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Install gauge adapter into previously cleaned spark plug hole.

Supply combustion chamber with air pressure.



TYPICAL
1. Leak tester
2. Air supply hose

Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; reduced engine performance
41% and higher	Poor condition, diagnose and repair engine

Diagnosis

Listen for air leaks.

- air escaping on intake port/throttle body means leaking intake valve(s)
- air escaping on exhaust port means leaking exhaust valve(s)
- air bubbles out of radiator means leaking cylinder head gasket
- air/oil escaping from crankcase means damaged gasket and/or loosened screws (refer to *BOTTOM END*)
- air/coolant escaping from cylinder/head means damaged gasket(s) and/or loosened screws (refer to *CYLINDER AND HEAD*)
- air escaping into crankcase area means excessively worn cylinder and/or broken piston rings (refer to *CYLINDER AND HEAD*).

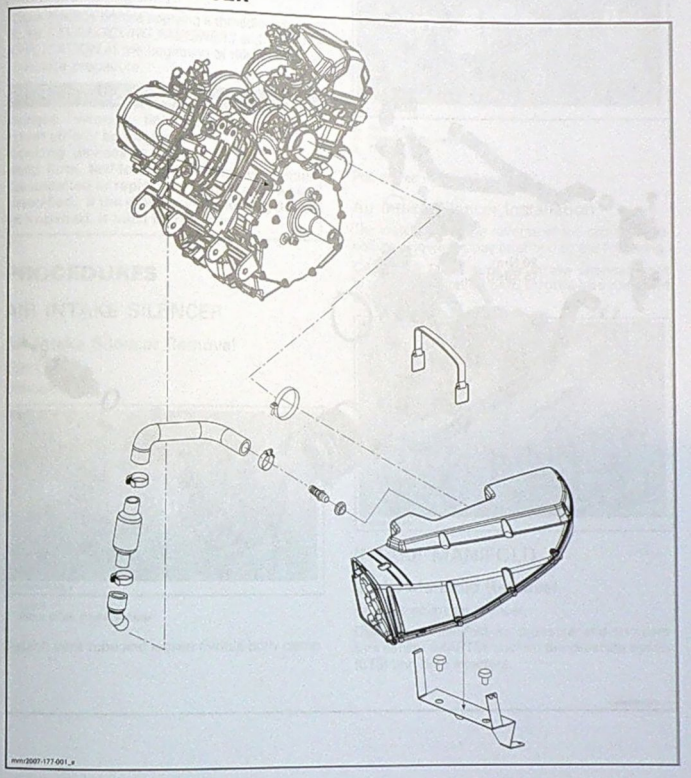
NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

REASSEMBLY

Reverse the preparation procedure. Ensure to respect torque values and use of appropriate products/lubricants. Refer to exploded views in other sections of this manual as required.

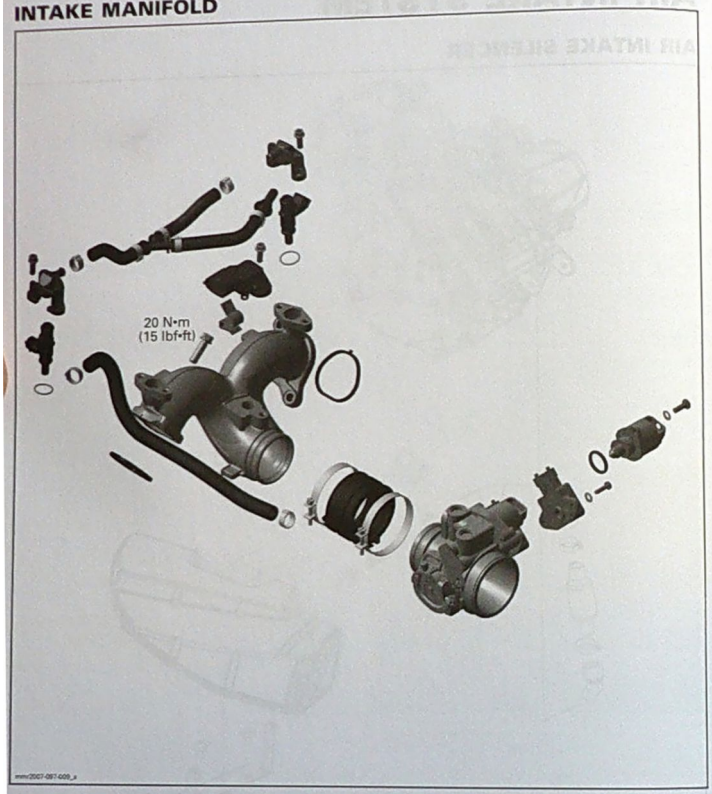
AIR INTAKE SYSTEM

AIR INTAKE SILENCER



mmr2007-177-001_a

INTAKE MANIFOLD



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

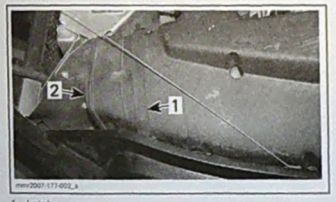
PROCEDURES

AIR INTAKE SILENCER

Air Intake Silencer Removal

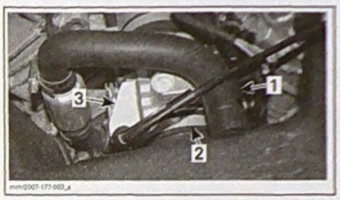
Open hood.

Unhook latch.



1. Latch
2. Front of air intake silencer

Detach vent tube and loosen throttle body clamp.



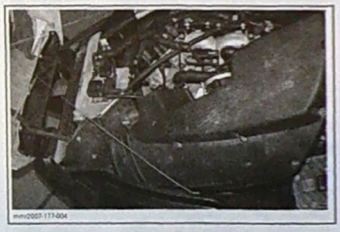
1. Vent tube
2. Throttle body clamp
3. Throttle body

Pull out air intake silencer.

Air Intake Silencer Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

CAUTION: Make sure air intake silencer boot is properly installed onto throttle body and the clamp is tight.

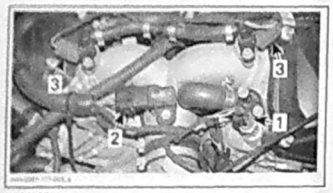


INTAKE MANIFOLD

Intake Manifold Removal

Remove air intake silencer.

Disconnect manifold air pressure and temperature sensor (MAPTS), coolant temperature sensor (CTS) and both injectors.



1. MAPTS
2. CTS
3. Injectors

Loosen clamp securing throttle body adapter to intake manifold.



1. Intake manifold clamp
2. Throttle body
3. Intake manifold

Pull throttle body and move aside.

NOTE: Keep coolant hoses connected.

Remove injector screws and pull injectors.



Remove intake manifold.

Intake Manifold Inspection

Check intake manifold for cracks, warping at flanges or any other damage. Replace if necessary.

Check if intake manifold gaskets are cracked, brittle or otherwise damaged. Replace if necessary.

Intake Manifold Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Refer to *ENGINE MANAGEMENT* to install injectors correctly.

Torque manifold screws to 20 N•m (15 lbf•ft) one cylinder at a time.

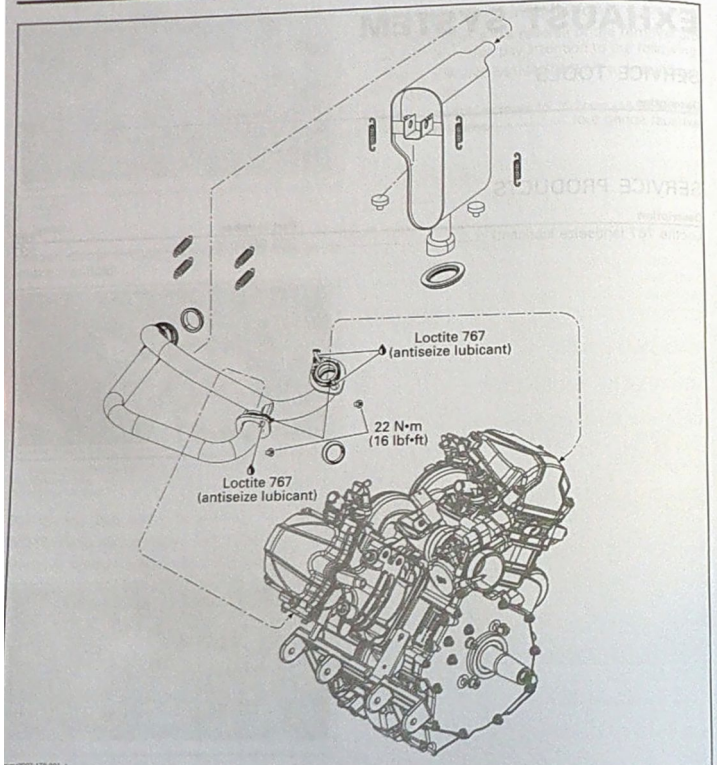
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
exhaust spring tool	529 035 983	237

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 (antiseize lubricant)	293 800 070	237


Loctite 767
(antiseize lubicant)
22 N•m
(16 lbf•ft)
Loctite 767
(antiseize lubicant)

mmr2007-178

GENERAL

⚠ WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

EXHAUST PIPE

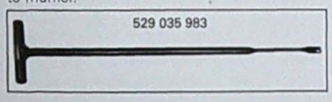
Exhaust Pipe Inspection

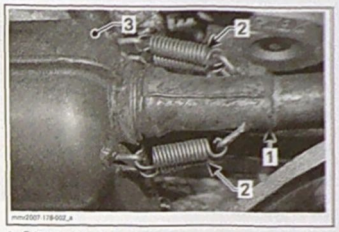
Check flexible joints and pipes for cracks or other damages. Replace exhaust pipe if necessary.

Exhaust Pipe Removal

Open the hood.

Using the exhaust spring tool (P/N 529 035 983), remove exhaust springs securing the exhaust pipe to muffler.





mmv2007-178-002_a

1. Exhaust pipe
2. Exhaust springs
3. Muffler

Unscrew nuts securing exhaust pipe to cylinder heads.

Remove exhaust pipe from vehicle.

Discard all exhaust pipe gaskets.

Exhaust Pipe Installation

Install new gaskets.

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on studs.

Using exhaust pipe flange and nuts, install exhaust pipe ends on cylinder heads. Install nuts loosely.

Align exhaust pipe end into muffler ball socket. Install exhaust springs.

Torque exhaust pipe nuts to 22 N•m (16 lbf•ft).

Install all other removed parts.

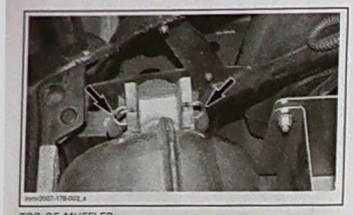
MUFFLER

Muffler Removal

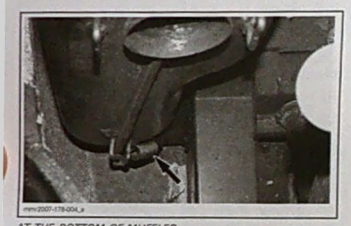
Open the hood.

Remove the exhaust pipe, see procedure above.

Using the exhaust spring tool (P/N 529 035 983), remove all exhaust springs retaining muffler to vehicle.



TOP OF MUFFLER



AT THE BOTTOM OF MUFFLER

Lift and remove muffler.

Muffler Inspection

Check muffler for cracks, perforation or other damages. Replace as required.

Check rubber dampers for damages. Replace if necessary.

Muffler Installation

The installation is the reverse of the removal procedure.

LUBRICATION SYSTEM

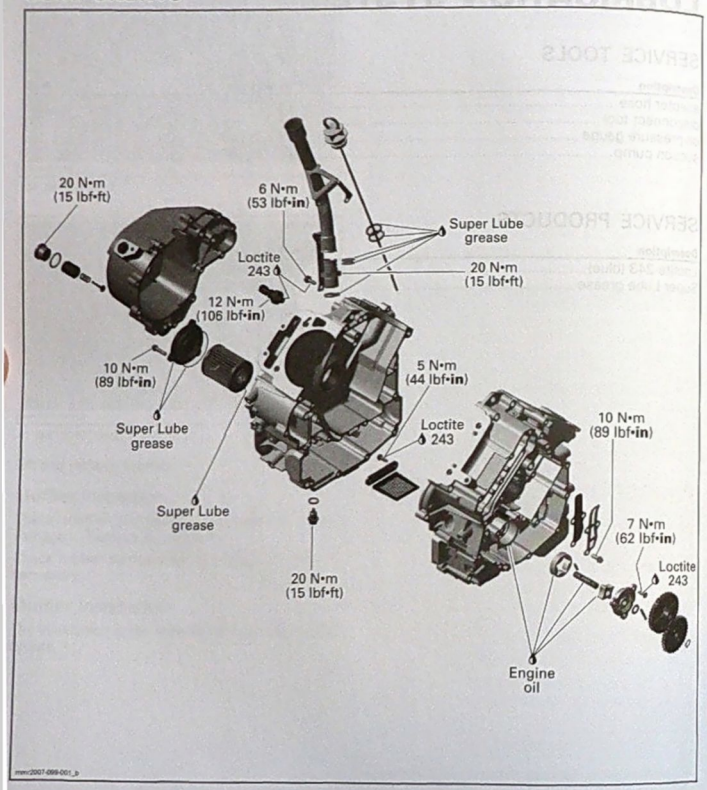
SERVICE TOOLS

Description	Part Number	Page
adapter hose	529 035 652	243
disconnect tool	529 035 714	244
oil pressure gauge	529 035 709	243
suction pump	529 035 880	242

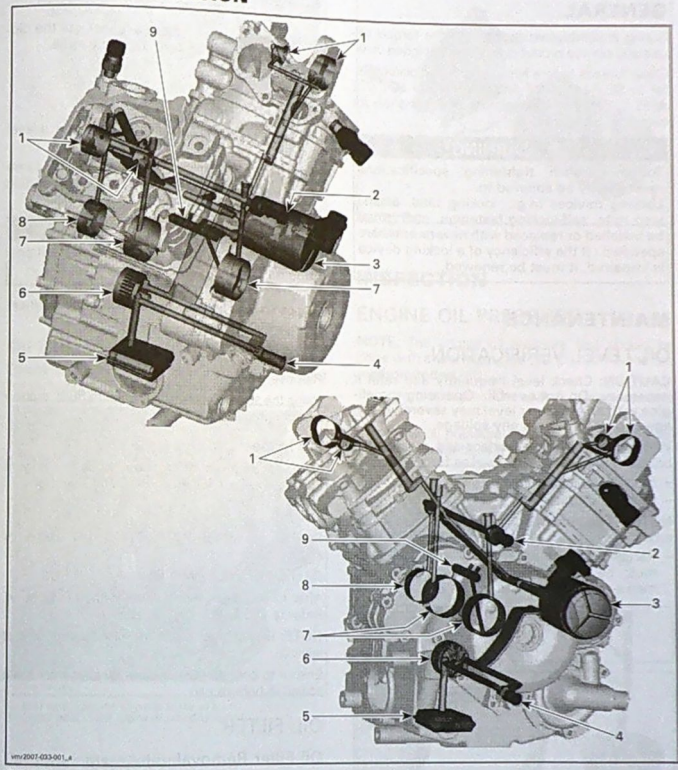
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	244, 247
Super Lube grease	293 550 030	243

COMPONENTS


20 N•m
(15 lbf•ft)
6 N•m
(53 lbf•in)
Super Lube
grease
Loctite
243
20 N•m
(15 lbf•ft)
12 N•m
(106 lbf•in)
10 N•m
(89 lbf•in)
Super Lube
grease
5 N•m
(44 lbf•in)
Loctite
243
10 N•m
(89 lbf•in)
Super Lube
grease
7 N•m
(62 lbf•in)
Loctite
243
20 N•m
(15 lbf•ft)
Engine
oil
mmr2007-069-001_b

ENGINE LUBRICATION



TYPICAL
1. *Camshaft bearings*
2. *Oil pressure switch*
3. *Oil filter*
4. *Oil pressure regulator valve*
5. *Oil strainer*
6. *Oil pump*
7. *Crankshaft main bearings*
8. *Crankshaft support bearing*
9. *Connecting rod bearings*

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAINTENANCE

OIL LEVEL VERIFICATION

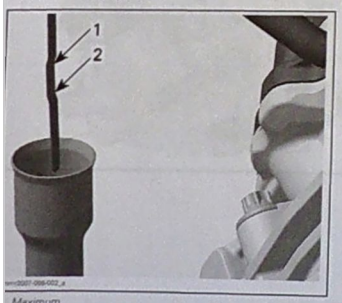
CAUTION: Check level frequently and refill if necessary. Do not overfill. Operating the engine with an improper level may severely damage engine. Wipe off any spillage.

With vehicle on a level surface and engine cold, not running, check the oil level as follows:

- Remove dipstick and wipe clean.
- Reinstall dipstick.

NOTE: Make sure it is completely inserted inside tube.

- Remove dipstick and read oil level. Oil level must be between minimum and maximum marks on dipstick.



Maximum
Minimum

NOTE: There is a capacity of 300 mL (10 U.S. oz) between the two marks.

Refill oil as necessary. Place a funnel into the dipstick tube to avoid spillage. Do not overfill.

Reinstall dipstick.

OIL CHANGE

Prior to change the oil, ensure vehicle is on a level surface.

Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

⚠ WARNING

The engine oil can be very hot. Wait until engine oil is warm.

Dispose oil and filter as per your local environmental regulations.

Oil Drain

Remove dipstick.

Using the suction pump (P/N 529 035 880), siphon oil through dipstick tube.

Oil Inspection

Oil condition gives information about the engine condition. See *TROUBLESHOOTING* section.

Oil Fill

Refill engine with BRP XP-S 0W40 synthetic oil or an equivalent.

Oil change capacity with filter: 2 L (2.11 qt).

After filling, check the oil level with the dipstick. Refer to *OIL LEVEL CHECK* above.

NOTE: Run engine to ensure oil filter area is not leaking.

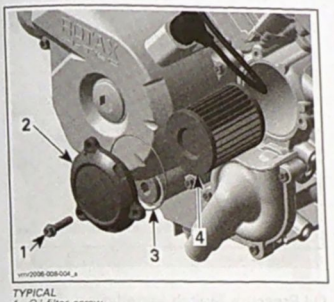
Ensure to completely wipe out oil that may have spilled in bottom pan.

OIL FILTER

Oil Filter Removal

Remove:

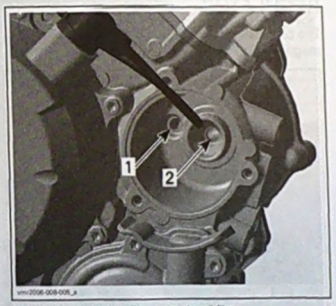
- muffler. Refer to *EXHAUST SYSTEM*
- oil filter screws
- oil filter cover
- oil filter.



TYPICAL
1. Oil filter screw
2. Oil filter cover
3. O-ring
4. Oil filter

Oil Filter Inspection

Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



1. Inlet bore from the oil pump to the oil filter
2. Outlet bore to the engine oil providing system

Oil Filter Installation

The installation is the reverse of the removal procedure. Pay attention to the following details.

Install a new gasket on oil filter cover.

Apply Super Lube grease (P/N 293 550 030) on the following locations to prevent gasket displacement and ease filter installation.



1. Slightly grease

INSPECTION

ENGINE OIL PRESSURE

NOTE: The engine oil pressure test should be done with a **warm engine** (90°C (194°F)) and the **recommended oil**.

Remove the oil pressure switch. See procedure below.

Install the oil pressure gauge (P/N 529 035 709) and the adapter hose (P/N 529 035 652).





The engine oil pressure should be within the following values.

OIL PRESSURE	IDLE	6000 RPM
MINIMAL	70 kPa (10 PSI)	350 kPa (51 PSI)
NOMINAL	180 kPa (26 PSI)	420 kPa (61 PSI)
MAXIMAL	300 kPa (43 PSI)	550 kPa (80 PSI)

If the engine oil pressure is out of specifications, check the points described in *TROUBLESHOOTING* section.

Remove oil pressure gauge and adapter hose.

NOTE: To remove adapter hose from oil pressure gauge, use the disconnect tool (P/N 529 035 714).



Reinstall the oil pressure switch.

PROCEDURES

OIL PRESSURE SWITCH

Oil Pressure Switch Activation

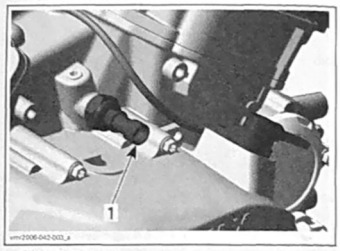
Oil pressure switch works when engine oil pressure is between 20 and 40 kPa (2.9 and 5.8 PSI).

Oil Pressure Switch Test

Refer to *ENGINE MANAGEMENT*.

Oil Pressure Switch Removal

Unplug then unscrew the oil pressure switch, mounted on the crankcase.



1. Oil pressure switch

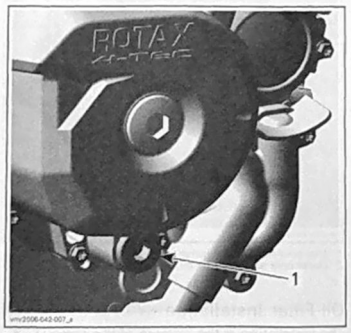
Oil Pressure Switch Installation

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of oil pressure switch. Do not apply threadlocker on the end of switch.

Torque switch to 12 N•m (106 lbf•**in**).

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the engine magneto side (inside magneto cover).

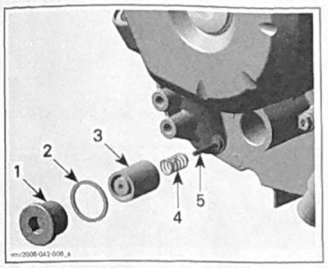


TYPICAL
1. Engine oil pressure regulator

NOTE: The oil pressure regulator system works when the oil pressure exceeds 450 kPa (65 PSI).

Regulator Removal

Remove plug screw and pull oil pressure regulator out.



1. *Plug screw*
2. *Gasket ring*
3. *Pressure regulator housing*
4. *Spring*
5. *Pressure regulator valve*

Regulator Inspection

Inspect pressure regulator housing and valve for scoring or other damages.

Check spring for free length.

SPRING FREE LENGTH	
NEW NOMINAL	39 mm (1.535 in)
SERVICE LIMIT	37 mm (1.457 in)

NOTE: Replace worn or damaged components.

Clean bore and thread in the magneto housing from metal shavings and other contaminations.

Regulator Installation

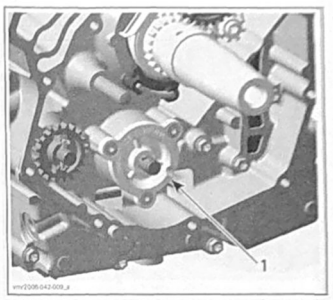
For installation, reverse the removal procedure. Pay attention to the following details.

Install a new gasket ring on the plug screw.

Torque plug screw to 20 N•m (15 lbf•ft).

OIL PUMP

The oil pump is located on the engine PTO side (behind cover).



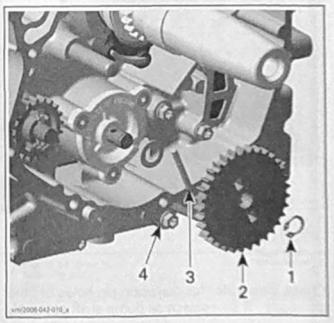
1. *Oil pump*

Oil Pump Removal

Remove parts to access the engine crankcase PTO cover.

Remove the engine crankcase PTO cover. Refer to *BOTTOM END* section.

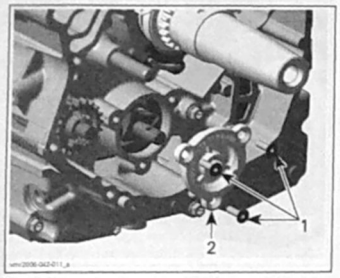
Remove:
- retaining ring
- oil pump gear
- needle pin
- thrust washer



1. *Retaining ring*
2. *Oil pump gear*
3. *Needle pin*
4. *Thrust washer*

- oil pump cover screws and pull oil pump cover

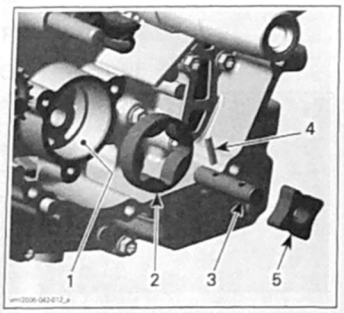
– oil pump shaft with inner rotor and outer rotor.



1. Retaining screws
2. Oil pump cover

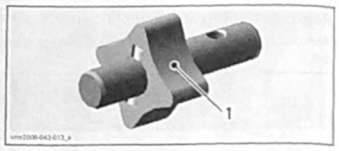
Oil Pump Inspection

Inspect oil pump for marks or other damages. Check for scratches in crankcase between outer rotor and oil pump bore. If so, replace damaged parts.



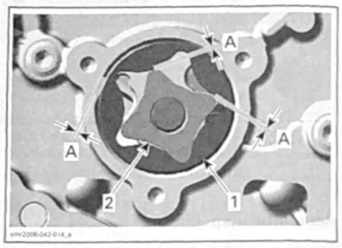
1. Oil pump bore
2. Outer rotor
3. Oil pump shaft
4. Needle pin
5. Inner rotor

Check inner rotor for corrosion pin holes or other damages. If so, replace oil pump shaft assembly.



1. Pittings on the teeth

Using a feeler gauge, measure the clearance of inner and outer rotors as shown.

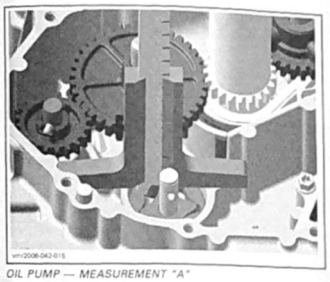


1. Outer rotor
2. Inner rotor
A. Service limit: 0.25 mm (.009 in)

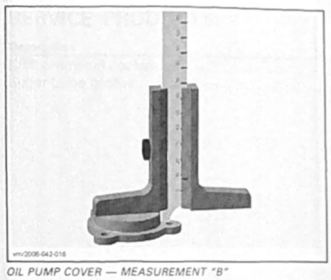
If clearance of inner and outer rotors exceeds the tolerance, replace oil pump shaft assembly. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.

If clearance between outer rotor and its bore in crankcase exceeds the tolerance, replace the complete oil pump assembly and/or the crankcase.

Using a depth gauge, measure the axial clearance of the oil pump as shown.



OIL PUMP — MEASUREMENT "A"



OIL PUMP COVER — MEASUREMENT "B"

Difference between measurements should not exceed 0.2 mm (.008 in). If so, replace the complete oil pump assembly.

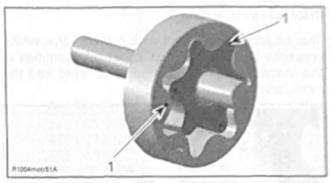
NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

Oil Pump Installation

For installation, reverse the removal procedure.

Pay attention to the following details.

NOTE: The outer rotor and inner rotor are marked. When installing, make sure both markings are on the upper side.



TYPICAL
1. Markings

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of oil pump cover screws. Torque them to 7 N•m (62 lbf•in).

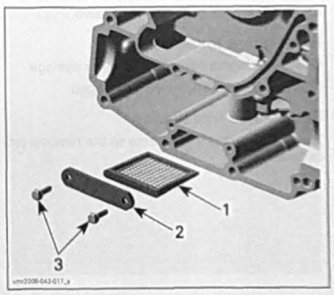
After reinstallation of the remaining parts, check for smooth operation of the oil pump assembly.

Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications (refer to *OIL PRESSURE TEST* above).

ENGINE OIL STRAINER

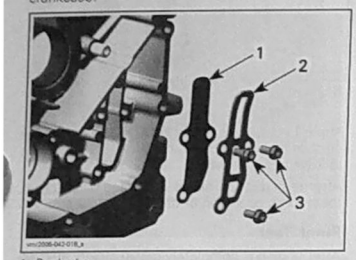
The engine oil strainer is located between both crankcase halves. Refer to *BOTTOM END* for removal, inspection and installation procedures.



1. Engine oil strainer
2. Retaining plate
3. Screws

REED VALVE

The engine is equipped with a reed valve which prevents accumulation of larger oil quantities in the crankcase. The reed valve is fitted into the crankcase.



1. Reed valve
2. Stopper plate
3. Screws

Reed Valve Removal

Remove PTO cover (refer to *BOTTOM END*) section.

Unscrew reed valve retaining screws.

Remove stopper plate and reed valve.

Reed Valve Inspection

Check reed valve for cracks or other damage.

NOTE: Replace reed valve if damaged.

Reed Valve Installation

The installation is the reverse of the removal procedure.

COOLING SYSTEM

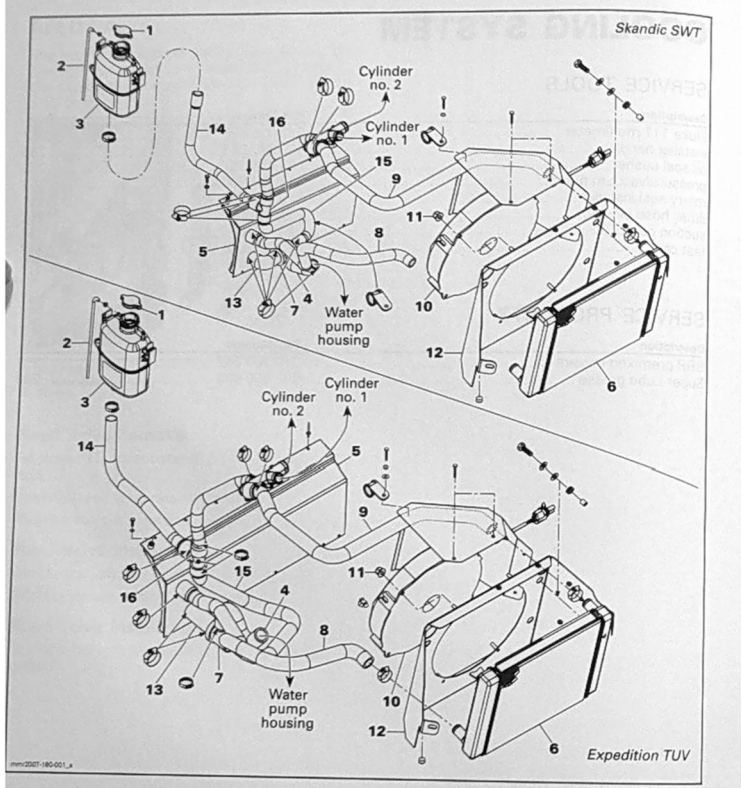
SERVICE TOOLS

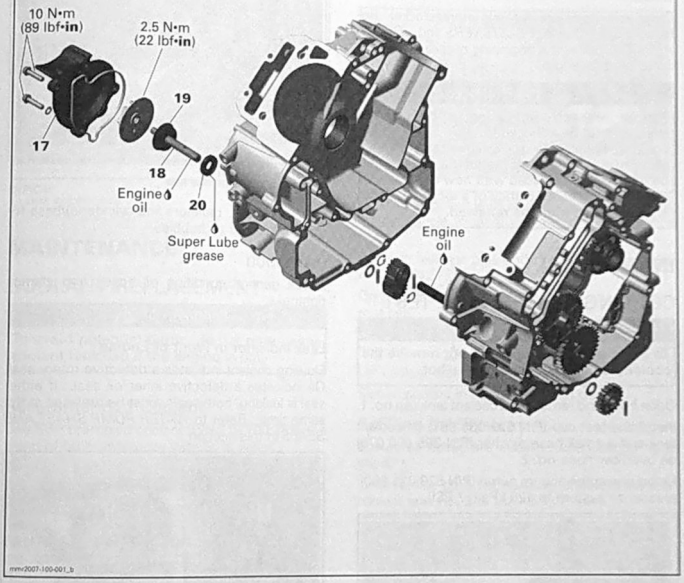
Description	Part Number	Page
Fluke 111 multimeter	529 035 868	257
installer handle	420 877 650	260
oil seal pusher	529 035 757	260
pressure/vacuum pump	529 021 800	252
rotary seal installer	529 035 766	261
small hose pincher	295 000 076	252
suction pump	529 035 880	253, 257
test cap	529 035 991	252

SERVICE PRODUCTS

Description	Part Number	Page
BRP premixed coolant	219 700 362	253
Super Lube grease	293 550 030	260




Skandic SWT
1
2
3
14
16
Cylinder no. 2
Cylinder no. 1
15
9
11
8
5
13
7
4
Water pump housing
10
12
6
1
2
3
Cylinder no. 2
Cylinder no. 1
14
5
9
15
11
16
4
8
13
7
Water pump housing
10
12
6
Expedition TUV
mm2007-180-001_a


10 N•m
(89 lbf•in)
2.5 N•m
(22 lbf•in)
19
17
18
Engine
oil
20
Super Lube
grease
Engine
oil
mmr2007-100-001_b

GENERAL

⚠ WARNING

Never start engine without coolant. Some engine parts such as the rotary seal on water pump shaft can be damaged.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

INSPECTION

COOLING SYSTEM LEAK TEST

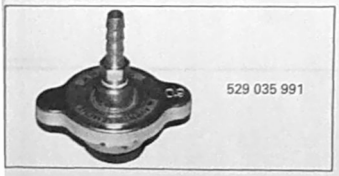
⚠ WARNING

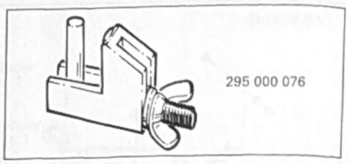
To avoid potential burns, do not remove the coolant tank cap if the engine is hot.

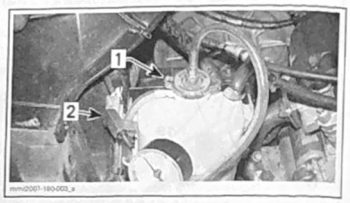
Open hood and remove the coolant tank cap **no. 1**.

Install the test cap (P/N 529 035 991) on coolant tank and a small hose pincher (P/N 295 000 076) on overflow hose **no. 2**.

Using pressure/vacuum pump (P/N 529 021 800), pressurize system to 120 kPa (17 PSI).







1. Test cap with pump
2. Hose pincher on overflow hose

Check all hoses, radiators and cylinder(s)/base for coolant leaks or air bubbles.

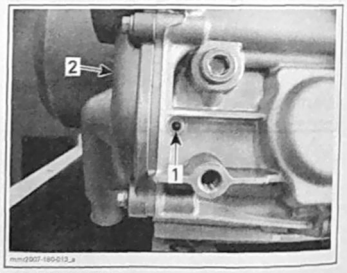
Inspection

Check general condition of hoses and clamps tightness.

Check the leak indicator holes.

Leak Indicator in Front of Engine

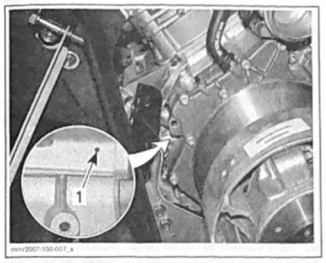
Flowing coolant indicates a defective rotary seal. Oil indicates a defective inner oil seal. If either seal is leaking, both seals must be replaced at the same time. Refer to *WATER PUMP SHAFT AND SEALS* in this section.



1. Leak indicator hole
2. Water pump housing

Leak Indicator on PTO Side

The PTO side leak indicator hole indicates if the PTO gasket is in good condition. If a liquid leaks by this hole, the PTO gasket replacement is necessary.



TYPICAL
1. Leak indicator hole

MAINTENANCE

COOLANT REPLACEMENT

⚠ WARNING

To avoid potential burns, do not remove the coolant tank cap if the engine is hot.

Recommended Coolant

Use BRP premixed coolant (P/N 219 700 362) or a blend of 50% antifreeze with 50% water.

To prevent antifreeze deterioration, always use the same brand. Never mix different brands unless cooling system is completely flushed and refilled.

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

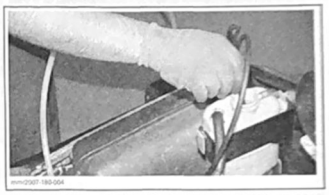
Draining the System

⚠ WARNING

Never drain or refill cooling system when engine is hot.

Remove coolant tank cap **no. 1**.

Siphon as much coolant through coolant tank **no. 3** with the suction pump (P/N 529 035 880).



When the coolant level is low enough, lift the rear of the vehicle to drain the rear radiator. Siphon again.

Remove exhaust pipe and muffler. Refer to *EXHAUST SYSTEM*.

On **Expedition TUV**, place a drain pan under bottom pan.

Disconnect the hose **no. 4** from the water pump housing.

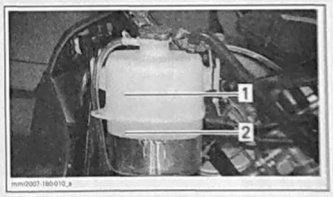
Let coolant drain.

Siphon coolant in bottom pan and clean it.

Refilling the System

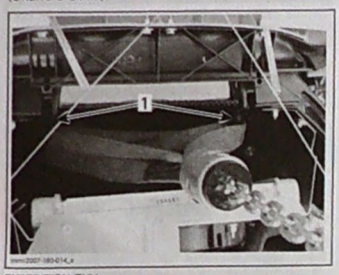
Ensure all hoses are installed and clamps tightened.

With vehicle on a flat surface, engine cold, refill coolant tank **no. 3** to MAXIMUM mark.



1. Maximum mark
2. Minimum mark

Place a lifting strap around the bumper frame (Expedition TUV) or around front engine support (Skandic SWT).

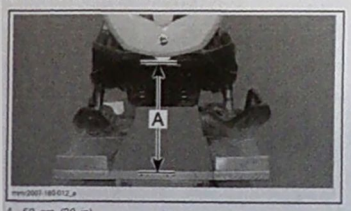


EXPEDITION TUV
1. Bumper frame



SKANDIC SWT — SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Lifting strap
2. Front engine support

Lift the front of the vehicle 50 cm (20 in) off the ground and secure safely.



A. 50 cm (20 in)

Connect B.U.D.S. on vehicle. Refer to *ENGINE MANAGEMENT* for procedure and connector location.

Start engine.

Refill coolant tank to keep coolant level between MINIMUM and MAXIMUM marks.

CAUTION: Never allow coolant tank to be empty during filling procedure.

Let engine idling for about 10 minutes or until radiators **no. 5** and **no. 6** are warm (which means that the thermostat **no. 7** is open).

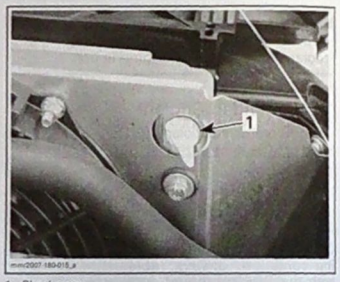
Keep engine idling until coolant temperature reaches 98°C (208°F). Monitor engine coolant temperature by using B.U.D.S. or any appropriate digital thermometer.

CAUTION: Never allow coolant to exceed 100°C (212°F).

Open the bleed screw of front radiator slightly (upper right corner) to bleed all air bubbles. Close it when coolant comes out and no more air bubbles appear.

⚠ WARNING

Engine coolant is very hot, to avoid potential burns use pliers to loosen bleed screw.



1. Bleed screw

Stop engine.

Put vehicle back on the ground.

Verify coolant level in coolant tank **no. 3**, it must reach the MAXIMUM mark. Refill if necessary

Install coolant tank cap.

Recheck coolant level after vehicle has completely cooled down. Fill coolant if necessary.

After the first few kilometers (miles) of running, recheck level in coolant tank.

PROCEDURES

COOLANT TANK CAP

Using a pressure cap tester, check the efficiency of coolant tank cap **no. 1**. If the efficiency is feeble, install a new 110 kPa (16 PSI) cap (do not exceed this pressure).

FRONT RADIATOR

Cleaning and Inspection

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if the radiator fins are damaged. Replace the front radiator **no. 6** if necessary.

NOTE: A radiator with many broken fins does not work properly.

Front Radiator Removal

Drain cooling system, see *DRAINING THE SYSTEM*.

Remove screws securing front radiator to its support

Unplug radiator hoses **no. 8** and **no. 9** from the front radiator then remove it from vehicle.

Front Radiator Installation

For installation, reverse the removal procedure.

RADIATOR FAN

Radiator Fan Test

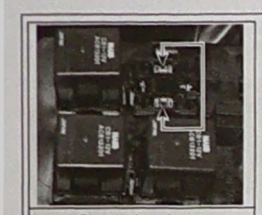
The ECM controls the radiator fan **no. 10** via the input of the coolant temperature sensor (CTS). The radiator fan should turn on when coolant temperature reaches 98°C (208°F) and should turn off when coolant cools down at 95°C (203°F).

To verify the radiator fan, connect the vehicle to B.U.D.S. Refer to *ENGINE MANAGEMENT* for procedure and connector location.

In **Activation tab**, press **Coolant fan** button.

If fan turns, check CTS, relay R3, wiring harness and connectors. If all parts are good, check the ECM. Refer to *ENGINE MANAGEMENT*.

If fan does not turn when the button is pressed, use the following troubleshooting chart to resolve the problem.



Fan Removal

Remove nuts **no. 11** that attach radiator fan to radiator support **no. 12**.

Disconnect the fan connector and remove fan from vehicle.

Fan Installation

The installation is the reverse of the removal procedure.

RELAY R3

Relay Voltage Test

TEST	WIRE COLOR	VOLTAGE	NOTE
COIL side	YELLOW/ RED and WHITE	10.5 to 13.5 Vdc	Engine idling (1500 to 1600 RPM)
CONTACT side	BLUE/RED and RED/BLACK	00.0 to 0.10 Vdc	Engine idling (1500 to 1600 RPM)

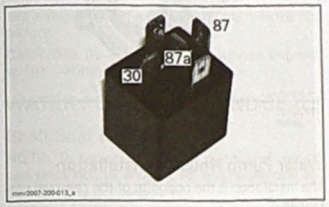
Relay Continuity Test

Remove the relay from vehicle.

Use the Fluke 111 multimeter (P/N 529 035 868), and select the ohms position.

Probe relay as follows.

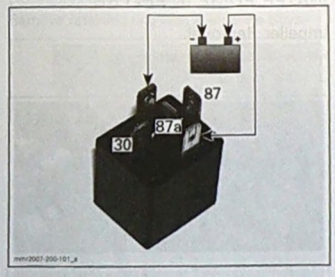
TERMINAL		RESISTANCE
30	87	0.5 Ω max.
	87a	Open circuit (OL)



mm2007-200-013_a

Connect battery as shown and probe relay as follows.

TERMINAL		RESISTANCE
30	87	Open circuit (OL)
	87a	0.5 Ω max.



mm2007-200-101_a

REAR RADIATOR

Rear Radiator Cleaning and Inspection

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if the radiator fins are damaged. Replace the rear radiator if necessary.

NOTE: A radiator with many broken fins does not work properly.

Rear Radiator Removal

Drain cooling system, see *DRAINING THE SYSTEM*.

Remove rear suspension. Refer to the appropriate rear suspension section.

Remove fuel tank. Refer to *FUEL TANK AND FUEL PUMP*.

Using a grinding disk, grind all rivets retaining rear radiator **no. 5** to frame.

Unplug radiator hoses **no. 8** and **no. 13** from the rear radiator then remove it from vehicle.

Rear Radiator Installation

For installation, reverse the removal procedure.

COOLANT TANK

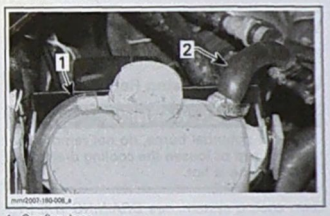
The coolant expands as the temperature (up to 100 - 110°C (212 - 230°F)) and pressure rise in the system. If the limiting system working pressure cap is reached 110 kPa (16 PSI), the pressure relief valve in the pressure cap is lifted from its seat and allows coolant to flow through the overflow hose into the coolant tank **no. 3**.

Tank Removal

Open hood.

Siphon coolant tank with the suction pump (P/N 529 035 880).

Unplug overflow hose **no. 2** and throttle body coolant hose.



mm2007-180-008_a

1. Overflow hose
2. Throttle body heater hose

Squeeze tabs and lift tank vertically to remove.

Unplug coolant tank hose **no. 14**.

Tank Installation

The installation is the reverse of the removal procedure.

COOLANT TEMPERATURE SENSOR (CTS)

Refer to *ENGINE MANAGEMENT* section for testing and replacement procedures of the coolant temperature sensor (CTS).

THERMOSTAT

Thermostat Removal

Drain cooling system. Refer to *DRAINING THE SYSTEM* above in this section.

Remove exhaust pipe and muffler.

Disconnect the upper hose **no. 8** from the rear radiator **no. 5**.

Disconnect the lower hose **no. 15** from the T-fitting **no. 16**.

Pull this hose to remove thermostat **no. 7**.

Thermostat Inspection

To verify the thermostat, put it in water and heat water. Thermostat should open when water temperature reaches 45°C (113°F).

If there is no operation, replace the thermostat.

Thermostat Installation

The installation is the reverse of the removal procedure.

Refill cooling system in accordance with the procedure in *REFILLING THE SYSTEM* above in this section.

WATER PUMP HOUSING

It is located on the engine MAG side.

Water Pump Housing Removal

⚠ WARNING

To avoid potential burns, do not remove the radiator cap or loosen the cooling drain plug if the engine is hot.

Drain cooling system, see *DRAINING THE SYSTEM*.

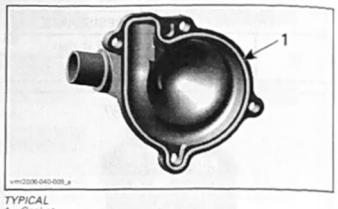
Remove hose **no. 4** from water pump housing **no. 17**.

Remove screws retaining water pump housing.

Pull water pump housing to remove it.

Water Pump Housing Inspection

Check if gasket is brittle, hard or damaged and replace as necessary.



TYPICAL
1. Gasket

Water Pump Housing Installation

The installation is the opposite of the removal procedure.

CAUTION: To prevent leaking, take care that the gasket is exactly in groove when you reinstall the water pump housing.

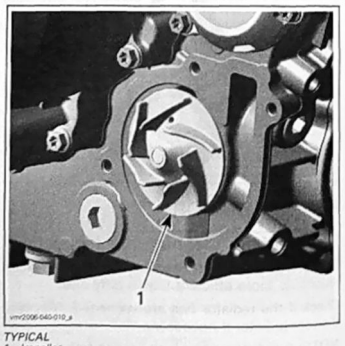
Tighten screws of water pump housing in a criss cross sequence.

WATER PUMP IMPELLER

Impeller Removal

Remove water pump housing.

Unscrew impeller.



TYPICAL
1. Impeller

CAUTION: Water pump shaft and impeller have right-hand threads. Remove by turning counterclockwise and install by turning clockwise.

Impeller Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Impeller Installation

The installation is the opposite of the removal procedure.

CAUTION: Be careful not to damage impeller wings during installation.

WATER PUMP SHAFT AND SEALS

Shaft/Seal Removal

NOTE: To replace the water pump shaft **no. 18** and seals **no. 19** and **no. 20**, engine removal and disassembly is necessary.

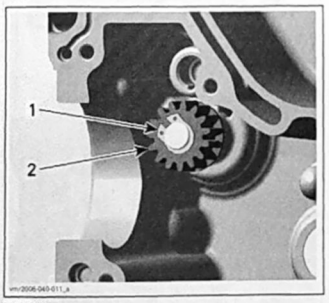
Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* section.

Remove both cylinders and heads, refer to *CYLINDER AND HEAD*.

Separate crankcase, refer to *BOTTOM END*.

Remove water pump housing and impeller. See procedures in this section.

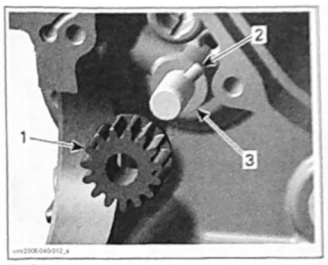
Remove retaining ring with appropriate pliers.



TYPICAL
1. Retaining ring
2. Water pump gear

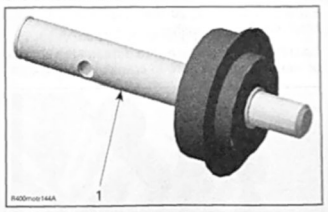
Remove the water pump gear. The water pump gear is held by a needle pin on the water pump shaft.

Remove needle pin and thrust washer.

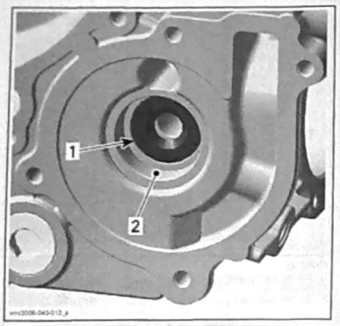


TYPICAL
1. Water pump gear
2. Needle pin
3. Thrust washer

Using a soft hammer to push out water pump shaft **no. 18** with rotary seal **no. 19** from inside of crankcase MAG side.



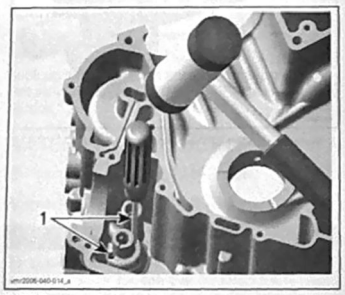
1. Water pump shaft with rotary seal



TYPICAL
1. Oil seal behind the rotary seal
2. Rotary seal bore

Extract oil seal **no. 20** from inside of crankcase MAG side with a pusher.

CAUTION: Be careful not to damage the surface of the rotary seal bore in crankcase MAG side.



TYPICAL
1. Extract oil seal with a pusher

Parts Inspection

Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.

Shaft/Seal Installation

For installation, reverse the removal procedure. However, pay attention to the following.

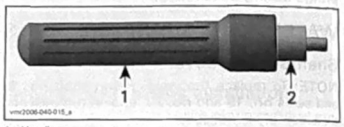
When installing water pump shaft, always replace together retaining ring, oil seal, water pump shaft with rotary seal with new parts.

CAUTION: Never use the retaining ring a second time. Always install a new one.

Apply engine oil on the water pump shaft and intermediate shaft.

NOTE: Never use oil in the press fit area of the oil seal and rotary seal.

Use the oil seal pusher (P/N 529 035 757) and the installer handle (P/N 420 877 650) to install inner oil seal.

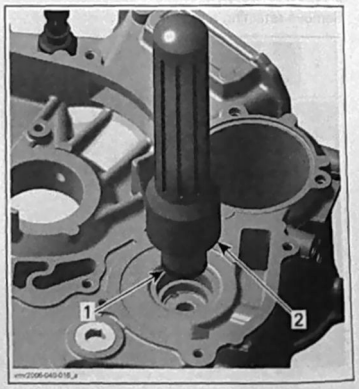


1. Handle
2. Pusher

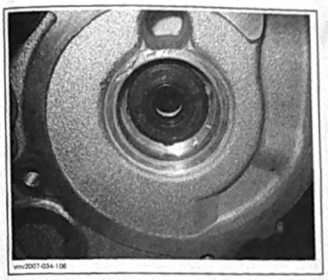
Apply Super Lube grease (P/N 293 550 030) inside lips of oil seal **no. 20**.

When installing the oil seal on the pusher, make sure sealing lip points outside.

Push inner oil seal in place.

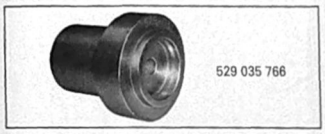


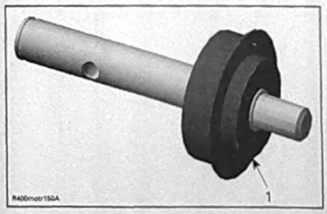
1. Inner oil seal
2. Installer handle with oil seal pusher



Slide water pump shaft with the new rotary seal into crankcase.

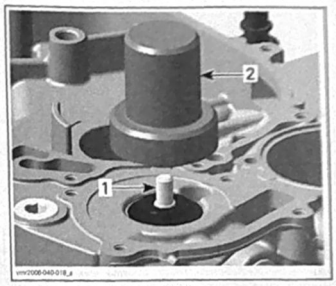
To properly install water pump shaft with rotary seal, use the rotary seal installer (P/N 529 035 766).





1. Surface where rotary seal is pushed by tool

CAUTION: Never use a hammer for the rotary seal installation. Only use a press to avoid damaging the ceramic component.



1. Water pump shaft with rotary seal
2. Water pump rotary seal installer

After installation, water pump shaft with rotary seal must rotate freely.

Tighten screws of the water pump housing crosswise.

Properly reinstall remaining parts. Refer to appropriate sections.

Refill all fluids.

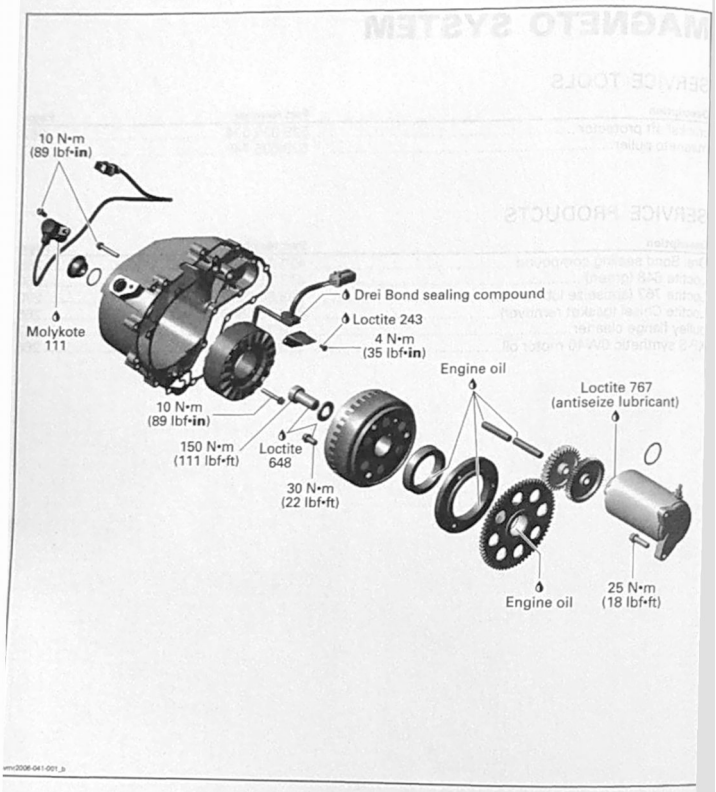
MAGNETO SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	529 036 034	267
magneto puller	529 035 748	267

SERVICE PRODUCTS

Description	Part Number	Page
Drei Bond sealing compound	420 297 906	265
Loctite 648 (green)	413 711 400	269
Loctite 767 (antiseize lubricant	293 800 070	270
Loctite Chisel (gasket remover)	413 708 500	265
pulley flange cleaner	413 701 809	267
XP-S synthetic 0W40 motor oil	293 600 054	266


10 N•m
(89 lbf•in)
Molykote
111
Drei Bond sealing compound
Loctite 243
4 N•m
(35 lbf•in)
Engine oil
Loctite 767
(antiseize lubricant)
10 N•m
(89 lbf•in)
150 N•m
(111 lbf•ft)
Loctite
648
30 N•m
(22 lbf•ft)
Engine oil
25 N•m
(18 lbf•ft)

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

MAGNETO COVER

NOTE: The magneto cover can be removed without removing the engine.

Magneto Cover Removal

Remove muffler. Refer to *EXHAUST SYSTEM*.

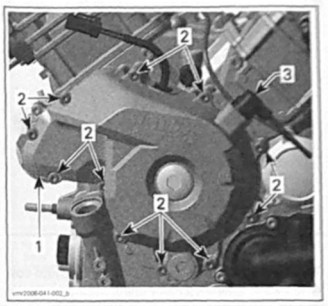
Drain engine oil (refer to *LUBRICATION SYSTEM*).

Remove crankshaft position sensor (CPS) and cut tie raps.

Disconnect magneto connector.

Remove the dipstick's tube and unscrew its adaptor.

Remove magneto cover retaining screws.



TYPICAL
1. Magneto cover
2. Retaining screws
3. Crankshaft position sensor

Pull magneto cover.

Magneto Cover Inspection and Cleaning

Check magneto cover for cracks or other damage. Replace if necessary.

NOTE: Clean all metal components in a non-ferrous metal cleaner. Use the Loctite Chisel (gasket remover) (P/N 413 708 500), or suitable equivalent.

⚠ WARNING

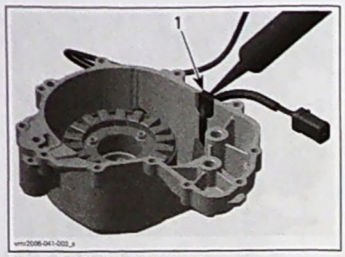
Wear safety glasses and work in a well ventilated area when working with strong chemical products. Also wear suitable non-absorbent gloves to protect your hands.

Magneto Cover Installation

For installation, reverse the removal procedure. However, pay attention to the following.

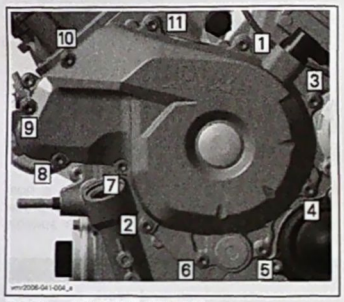
NOTE: At installation replace magneto cover gasket.

Apply Drei Bond sealing compound (P/N 420 297 906) on stator cable grommet as shown in next illustration.



1. Apply Drei Bond sealing compound

Tightening sequence for screws on magneto cover is as per following illustration.



TYPICAL — TIGHTENING SEQUENCE

Refill engine with XP-S synthetic 0W40 motor oil (P/N 293 600 054).

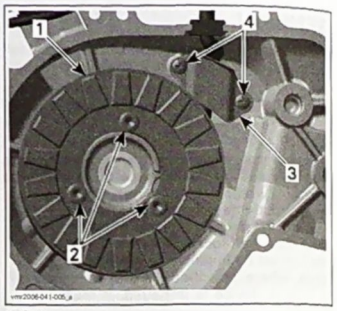
STATOR

Stator Removal

Remove magneto cover (refer to *MAGNETO COVER* above).

Remove screws securing holding strip.

Remove stator retaining screws then the stator.



1. Stator
2. Stator retaining screws
3. Holding strip
4. Holding strip screws

Stator Inspection

Check stator condition. If damaged replace it.

Check if stator wires are brittle, hard or otherwise damaged.

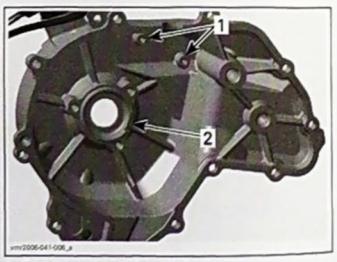
For electrical inspection, refer to *CHARGING SYSTEM*.

Stator Installation

For installation, reverse the removal procedure. However, pay attention to the following.

CAUTION: When installing the stator take care that the cable is in place (guide for the wire).

NOTE: There is only one position for the stator (notch in the magneto housing cover).



1. Threads for cable holding strip
2. Notch for stator

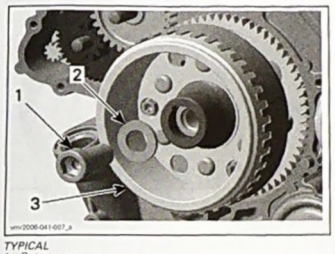
ROTOR

Rotor Removal

Lock crankshaft (refer to *BOTTOM END*).

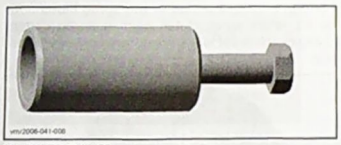
Remove magneto cover. Refer to *MAGNETO COVER* above.

Using a 14 mm Allen key, remove screw and washer securing rotor to crankshaft.

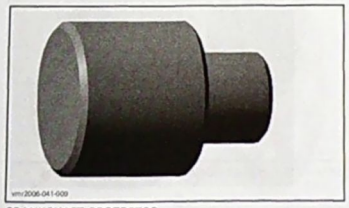


TYPICAL
1. Rotor screw
2. Washer
3. Rotor

Install the magneto puller (P/N 529 035 748) and the crankshaft protector (P/N 529 036 034) then remove rotor.

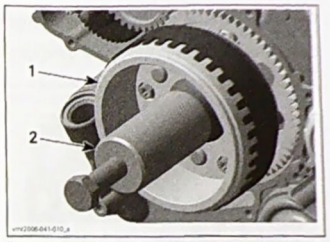


MAGNETO PULLER



CRANKSHAFT PROTECTOR

NOTE: Use grease to place protector on crankshaft end prior to screw on the magneto puller.



TYPICAL
1. Rotor
2. Magneto puller

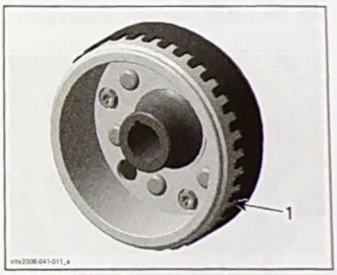
Screw magneto puller bolt to remove rotor.

Rotor Inspection

Check inner side of rotor for scratches or other damage.

Check keyway of the rotor for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.



1. Rotor with trigger wheel

Check woodruff key and keyway on the crankshaft for wear or damages.

Replace parts as necessary.

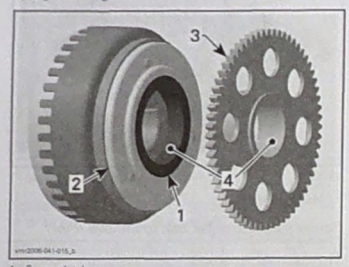
Rotor Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Clean crankshaft taper and rotor with pulley flange cleaner (P/N 413 701 809).

CAUTION: Taper on crankshaft and rotor must be free of grease.

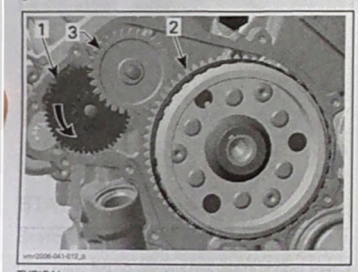
Oil sprag clutch in sprag clutch housing and install sprag clutch gear.



1. Sprag clutch
2. Sprag clutch housing
3. Sprag clutch gear
4. Apply engine oil here

Slide rotor onto crankshaft. The woodruff key and the keyway must be aligned.

Rotate starter double gear counterclockwise to align intermediate gear teeth with sprag clutch gear.



TYPICAL
1. Starter double gear
2. Sprag clutch gear
3. Intermediate gear

SPRAG CLUTCH

Sprag Clutch Removal

Remove magneto cover (refer to *MAGNETO COVER* above).

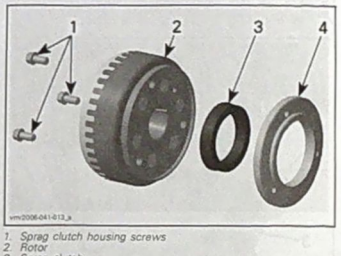
Lock crankshaft (refer to *BOTTOM END*).

Loosen sprag clutch housing screws located inside rotor.

Remove rotor (refer to *ROTOR* above).

Remove sprag clutch gear.

Remove sprag clutch housing screws and sprag clutch housing.



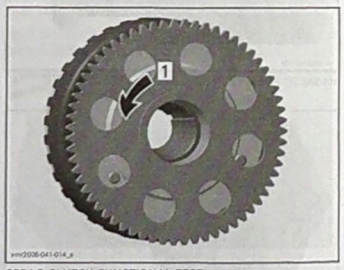
1. Sprag clutch housing screws
2. Rotor
3. Sprag clutch
4. Sprag clutch housing

Sprag Clutch Inspection

Inspect sprag clutch and sprag clutch housing for wear and damage.

Also check the collar of the sprag clutch gear.

Perform a functional test of the sprag clutch. To do so, rotate sprag clutch gear in sprag clutch. Sprag clutch must lock in counterclockwise direction.



SPRAG CLUTCH FUNCTIONAL TEST
1. Lock

NOTE: Sprag clutch, housing and gear must be replaced at the same time, if damaged.

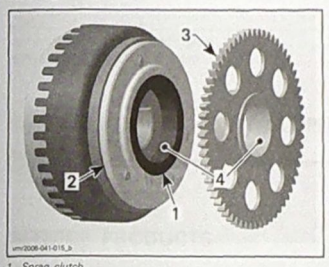
Sprag Clutch Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply Loctite 648 (green) (P/N 413 711 400) on threads of sprag clutch housing screws.

Install screws but do not torque yet.

Apply engine oil on sprag clutch and inside sprag clutch gear hole.



1. Sprag clutch
2. Sprag clutch housing
3. Sprag clutch gear
4. Apply engine oil here

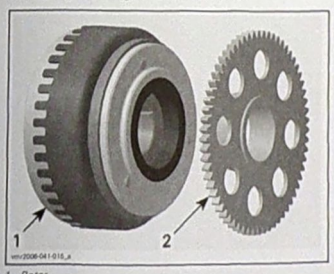
Install rotor then torque sprag clutch housing screws to 30 N•m (22 lbf•ft).

SPRAG CLUTCH GEAR

Sprag Clutch Gear Removal

Remove rotor (refer to *ROTOR* above).

Pull sprag clutch gear from the rotor.

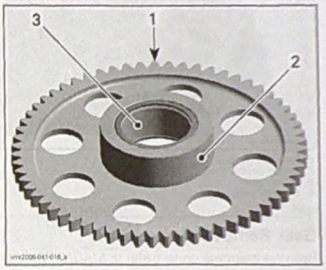


1. Rotor
2. Sprag clutch gear

Sprag Clutch Gear Inspection

Inspect gear, especially teeth and sprag clutch collar, for wear and other damage.

Check needle bearing condition. Replace sprag clutch gear if necessary.



INSPECT
1. Teeth
2. Collar
3. Needle bearing

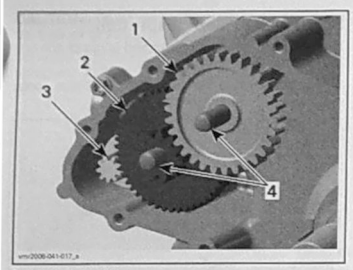
Sprag Clutch Gear Installation

The installation is the reverse of the removal procedure.

NOTE: Apply engine oil on needle bearing and collar of sprag clutch gear.

STARTER DRIVE GEARS

The starter drive gears are located on the engine MAG side behind the magneto cover. No need to remove engine.



1. *Intermediate gear*
2. *Starter double gear*
3. *Starter gear*
4. *Location pins*

Gear Removal

Remove magneto cover (refer to *MAGNETO COVER* above).

Remove location pins, starter double gear and intermediate gear.

Gear Inspection

Inspect gears and location pins for wear and damage.

Replace parts as necessary.

Gear Installation

The installation is the reverse of the removal procedure. Pay attention to the following details.

Apply Loctite 767 (antiseize lubricant (P/N 293 800 070) on starter gear before installing the starter double gear.

Apply engine oil on location pins.

CYLINDER AND HEAD

SERVICE TOOLS

Description	Part Number	Page
camshaft locking tool	529 035 926	278
piston circlip installer	529 035 921	296
piston ring compressor	529 035 919	293
valve guide installer	529 035 853	291
valve guide remover	529 035 924	291
valve spring compressor clamp	529 035 724	287
valve spring compressor cup	529 035 764	287

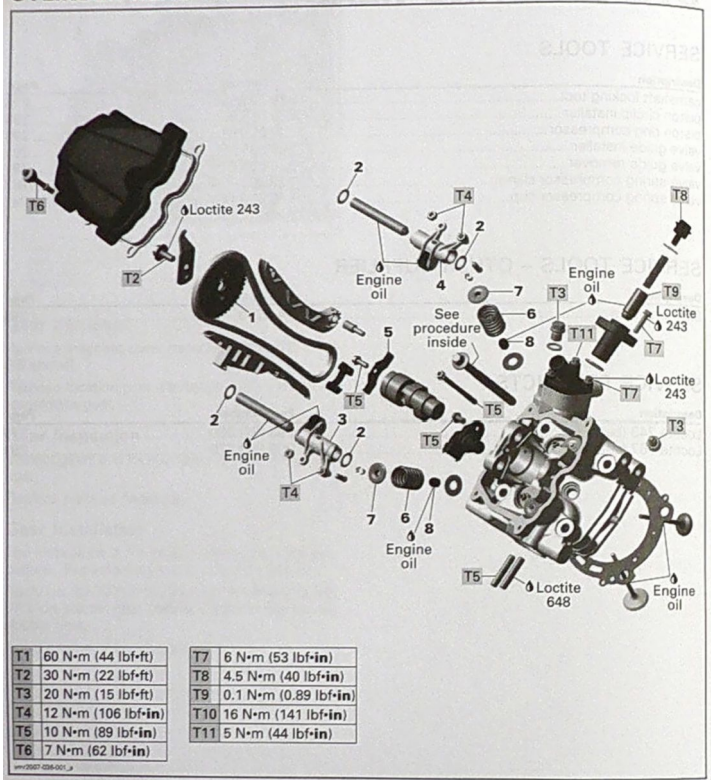
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on pliers	YA 8230	289

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	279
Loctite 767 (antiseize lubricant)	293 800 070	291

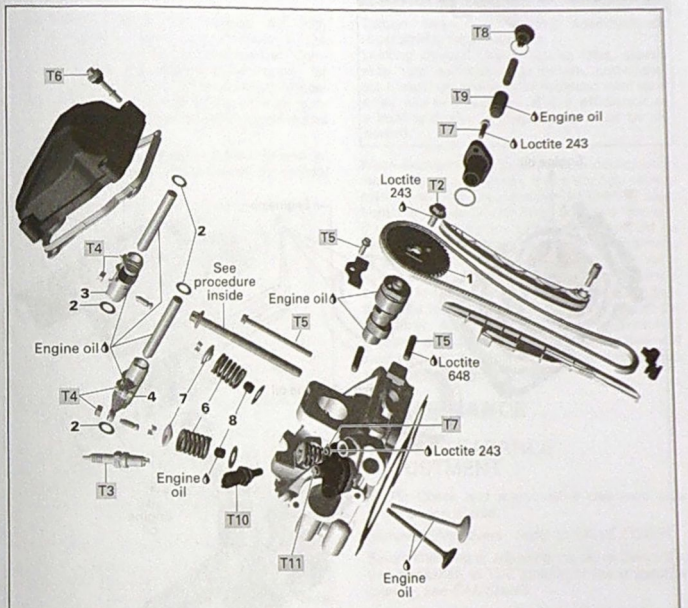
CYLINDER HEAD NO. 1



T1	60 N•m (44 lbf•ft)
T2	30 N•m (22 lbf•ft)
T3	20 N•m (15 lbf•ft)
T4	12 N•m (106 lbf•**in**)
T5	10 N•m (89 lbf•**in**)
T6	7 N•m (62 lbf•**in**)

T7	6 N•m (53 lbf•**in**)
T8	4.5 N•m (40 lbf•**in**)
T9	0.1 N•m (0.89 lbf•**in**)
T10	16 N•m (141 lbf•**in**)
T11	5 N•m (44 lbf•**in**)

CYLINDER HEAD NO. 2

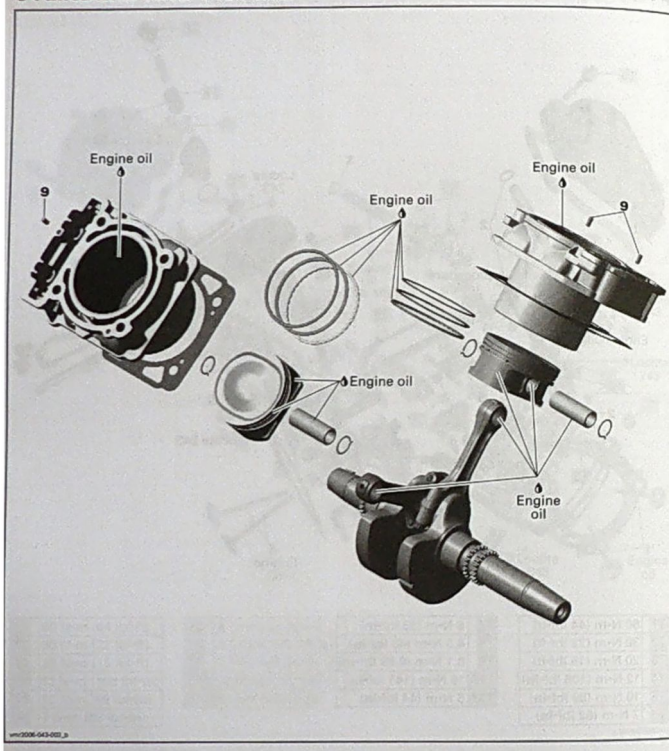


T1	60 N•m (44 lbf•ft)
T2	30 N•m (22 lbf•ft)
T3	20 N•m (15 lbf•ft)
T4	12 N•m (106 lbf•**in**)
T5	10 N•m (89 lbf•**in**)
T6	7 N•m (62 lbf•**in**)

T7	6 N•m (53 lbf•**in**)
T8	4.5 N•m (40 lbf•**in**)
T9	0.1 N•m (0.89 lbf•**in**)
T10	16 N•m (141 lbf•**in**)
T11	5 N•m (44 lbf•**in**)

vmv2007-036-002_a

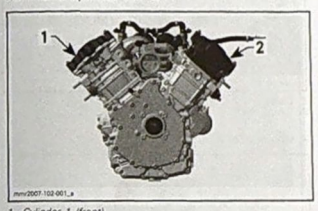
CYLINDERS AND PISTONS



GENERAL

Components which are identical for both cylinders/cylinder heads are identified in the two exploded views by the same number. Components which are different or which are, for instance, present of one of the cylinders/cylinder heads but not on the other, have different numbers. The information given below always relates as a general rule.

Special reference is made in the text to work instructions which are not the same for cylinder no. 1 and cylinder no. 2.



1. Cylinder 1 (front)
2. Cylinder 2 (rear)

When diagnosing an engine problem, always perform a cylinder leak test. This will help solving a problem. Refer to the instructions included with your leak tester and to *LEAK TEST* section for procedures.

Always place the vehicle on level surface.

NOTE: For a better understanding, the many illustrations are taken with engine out of vehicle. To perform the following instructions, it is not necessary to remove engine from vehicle.

Always disconnect BLACK (-) cable from the battery, then RED (+) cable before working on the engine.

Even if the removal of many parts is not necessary to reach another part, it is recommended to remove these parts in order to check them.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

When disassembling parts that are duplicated in the engine, (e.g.: valves), it is a strongly recommended to note their position (PTO/MAG side, front/rear cylinder) and to keep them as a "group". If you find a defective component, it would be much easier to find the cause of the failure among its group of parts (e.g.: you found a worn valve guide. A bent spring could be the cause and it will be easy to know which one among the springs is the cause to replace it if you grouped them at disassembly). Also, since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their "group".

MAINTENANCE

VALVE CLEARANCE ADJUSTMENT

NOTE: Check and adjust valve clearance only when engine is cold.

Remove valve covers. Refer to *VALVE COVER*.

Before checking or adjusting the valve clearance, turn crankshaft to TDC ignition of the respective cylinder, see *CAMSHAFT*.

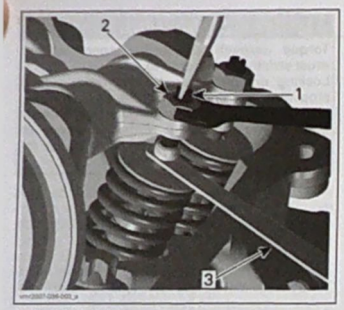
Using a feeler gauge, check the valve clearance.

VALVE CLEARANCE	
EXHAUST	0.04 to 0.15 mm (.0016 to .0059 in)
INTAKE	0.04 to 0.10 mm (.0016 to .0039 in)

If the valve clearance is out of specification, adjust valves as follows.

NOTE: Use mean value of exhaust/intake to ensure a proper valve adjustment.

Hold the adjustment screw at the proper position and torque the locking nut.



1. Adjustment screw
2. Locking nut
3. Feeler gauge

Repeat the procedure for each valve.

Before installing valve covers, recheck valve clearance.

PROCEDURES

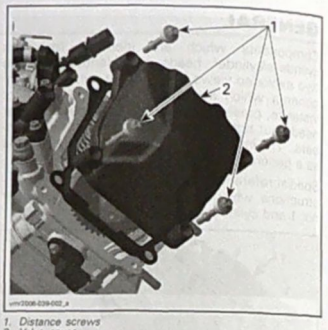
VALVE COVER

Cover Removal

Open hood.

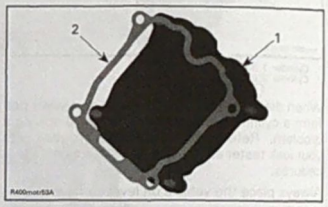
Remove:

- air intake silencer, refer to *AIR INTAKE SYSTEM*
- distance screws of valve cover



1. Distance screws
2. Valve cover

- valve cover and gasket.



1. Valve cover
2. Gasket

Repeat the procedure for the other valve cover if required.

Cover Inspection

Check the gasket on the valve cover if it is brittle, cracked or hard. If so, replace the gasket.

Cover Installation

For installation, reverse the removal procedure.

Torque the valve cover distance screws in a criss-cross sequence.

TIMING CHAIN TENSIONER

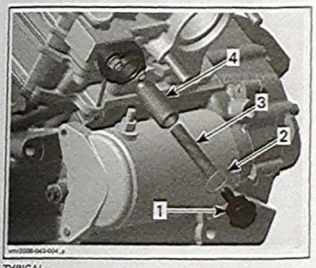
NOTE: Before removal and installation, make sure that the respective cylinder is set to TDC ignition. Refer to *CAMSHAFT*.

Tensioner Removal

⚠ WARNING

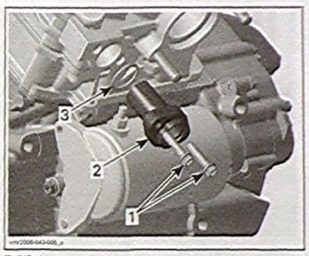
Timing chain tensioner is spring loaded. Never perform this operation immediately after the engine has been run because the exhaust system can be very hot. Wait until exhaust system is warm or cold.

Remove:
- chain tensioner plug
- O-ring
- spring
- chain tensioner plunger



TYPICAL
1. *Chain tensioner plug*
2. *O-ring*
3. *Spring*
4. *Chain tensioner plunger*

- screws retaining chain tensioner housing
- chain tensioner housing with O-ring.



TYPICAL
1. *Chain tensioner screws*
2. *Chain tensioner housing*
3. *O-ring*

Tensioner Inspection

Check the housing for cracks or other damages. Replace if necessary.

Check chain tensioner plunger for free movement and/or scoring.

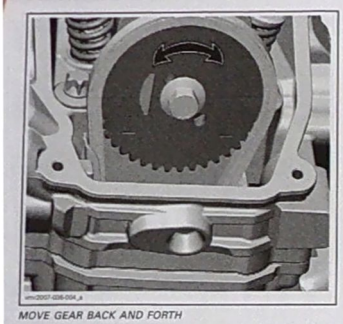
Check if O-rings are brittle, cracked or hard. Replace if necessary.

Check spring condition. Replace if broken or worn.

Tensioner Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Before installing the chain tensioner make sure, that the camshaft timing gear can be moved back and forth.



MOVE GEAR BACK AND FORTH

Apply engine oil on the plunger before installing.

Slightly screw in the plunger until the timing chain allows no more back and forth movement of the camshaft timing gear. Then screw in the plunger an additional 1/8 turn to reach the required torque of 0.1 N•m (.9 lbf•**in**).

CAUTION: Improper adjustment of the timing chain will lead to severe engine damage.

Fit the spring on one side into the slot of the plug screw and on the other side into the plunger. Turn spring only clockwise in order to fit the spring end into the notch of the plunger and to avoid loosening the plunger during spring installation. Do not preload the spring.

NOTE: Do not forget to place the O-ring on chain tensioner plug.

Then compress the spring and screw in the plug screw.

Finally, tighten the plug screw to 4.5 N•m (40 lbf•**in**).

CAMSHAFT TIMING GEAR

Gear Removal

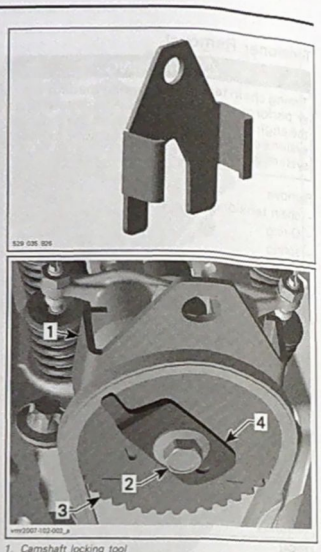
Remove the valve cover.

Turn crankshaft to TDC ignition of the respective cylinder, see *CAMSHAFT*.

Unscrew timing chain tensioner.

Remove camshaft timing gear screw.

To prevent timing chain stretching during removal of camshaft timing gear screw, use the camshaft locking tool (P/N 529 035 926).



1. *Camshaft locking tool*
2. *Camshaft timing gear screw*
3. *Camshaft timing gear*
4. *Trigger wheel (cylinder head 1 only)*

Remove the camshaft timing gear.

NOTE: Secure timing chain with a retaining wire.

Gear Inspection

Check camshaft timing gear for wear or deterioration.

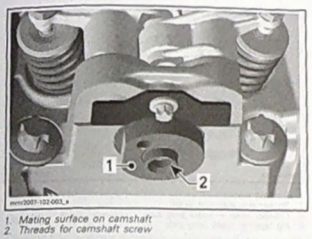
If gear is worn or damaged, replace it as a set (camshaft timing gear and timing chain).

For crankshaft gear, refer to *BOTTOM END* section, see *CRANKSHAFT*.

Gear Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Clean mating surface and threads of camshaft prior to assemble camshaft timing gear.

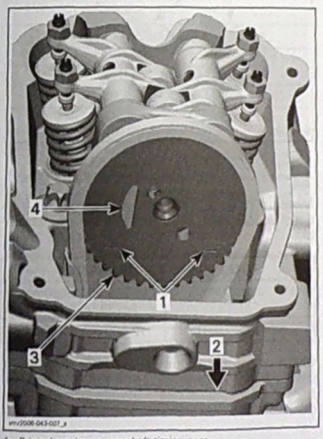


1. Mating surface on camshaft
2. Threads for camshaft screw

CAUTION: Crankshaft and camshaft must be on TDC ignition position to place camshaft timing gear and timing chain in the proper position. Refer to *CAMSHAFT*.

Install camshaft timing gear so that the timing gear tabs are located into the flat zone of the camshaft.

The printed marks on the camshaft timing gear must be parallel to the cylinder head base. See the following illustration for a proper positioning.



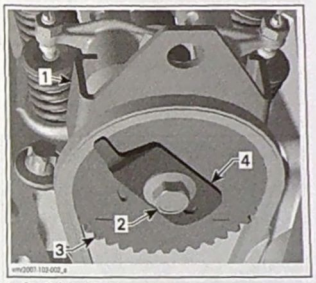
1. Printed marks on camshaft timing gear
2. Cylinder head base
3. Camshaft timing gear
4. Timing gear tab

Install the camshaft locking tool.

Install the chain tensioner (see *CHAIN TENSIONER* above) and check again if marks on the timing gear are parallel to cylinder head base and crankshaft is at TDC ignition.

Apply Loctite 243 (blue) (P/N 293 800 060) on camshaft screw threads and tighten it to 30 N•m (22 lbf•ft).

NOTE: On cylinder 1, install the trigger wheel on camshaft timing gear.



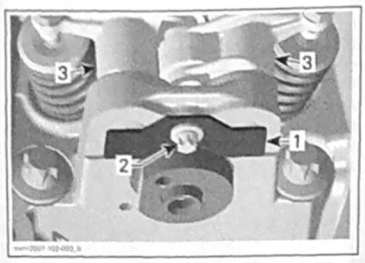
1. Camshaft locking tool
2. Camshaft screw
3. Camshaft timing gear
4. Trigger wheel (cylinder head 1 only)

Remove the camshaft locking tool.

ROCKER ARM

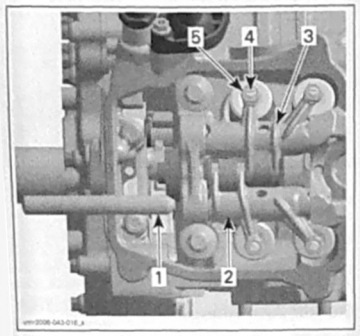
Rocker Arm Removal

Remove:
- valve cover
- chain tensioner
- camshaft timing gear no. 1
- Allen screw and camshaft retaining plate



1. Camshaft retaining plate
2. Camshaft retaining plate screw
3. Rocker arms

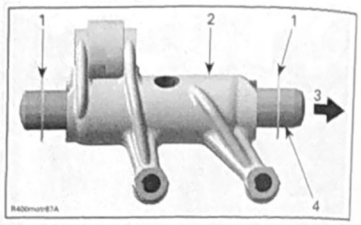
– rocker arm shafts
– rocker arm



1. Rocker arm shaft
2. Rocker arm (exhaust side)
3. Rocker arm (intake side)
4. Adjustment screw
5. Locking nut

– thrust washers no. 2.

CAUTION: Pay attention not to lose thrust washers or drop them into the timing chain compartment.

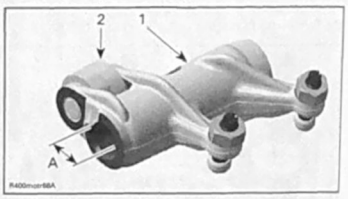


1. 2 thrust washers
2. Rocker arm (exhaust side)
3. Cylinder head — spark plug side
4. Big taper to spark plug side

Rocker Arm Inspection

Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.

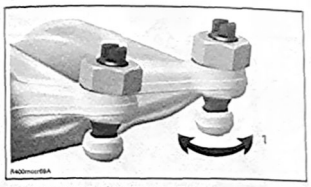


1. Rocker arm (exhaust side)
2. Roller
A. Bore for rocker arm shaft

Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.

ROCKER ARM BORE DIAMETER	
NEW	12.036 to 12.050 mm (.4739 to .4744 in)
SERVICE LIMIT	12.060 mm (.4748 in)

Check adjustment screws for free movement, cracks and/or excessive play.

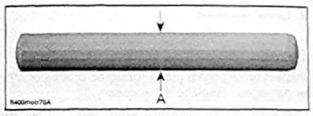


1. Free movement of adjustment screw top

Rocker Arm Shaft

Check for scored friction surfaces; if so, replace parts.

Measure rocker arm shaft diameter.



A. Measure rocker arm shaft diameter here

ROCKER ARM SHAFT DIAMETER	
NEW	12.000 to 12.018 mm (.4724 to .4731 in)
SERVICE LIMIT	11.990 mm (.4720 in)

Any area worn excessively will require parts replacement.

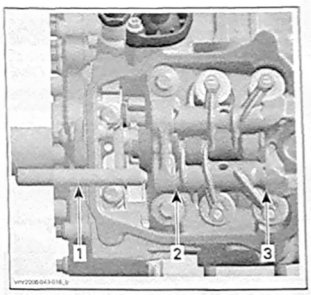
Rocker Arm Installation

NOTE: Use the same procedure for exhaust and intake rocker arm.

Apply engine oil on rocker arm shaft.

Install the rocker arm shafts with the chamfered edge first and use following procedure:

- Insert a rocker arm shaft in its bore in cylinder head.
- Install a thrust washer **no. 2** then the proper rocker arm **no. 3** (exhaust side) or **no. 4** (intake side).
- Push in rocker arm shaft until its chamfer reaches the end of rocker arm bore.



1. Rocker arm shaft
2. Thrust washer (timing chain side)
3. Thrust washer (spark plug side)

- Place the other thrust washer and push rocker arm shaft to end position.
- Install the camshaft retaining plate **no. 5**.

TIMING CHAIN

Refer to *BOTTOM END*, see *TIMING CHAIN*.

CYLINDER HEAD

Cylinder Head Removal

Open hood.

Remove air intake silencer. Refer to *AIR INTAKE SYSTEM*.

Disconnect battery. Refer to *CHARGING SYSTEM*.

Drain coolant (refer to *COOLING SYSTEM*).

Remove exhaust pipe. Refer to *EXHAUST SYSTEM*.

Unplug coolant hoses on the top of cylinder heads.

Disconnect both spark plug cables.

Unscrew the Banjo fitting on the top of cylinder 1.

On MAG side, disconnect the camshaft position sensor (CAPS), the oil pressure switch (OPS) and remove the crankshaft position sensor (CPS) from magneto cover.

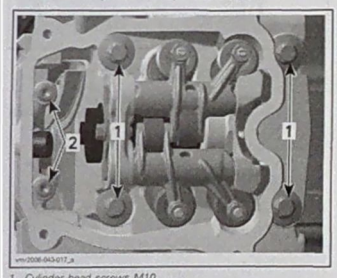
On PTO side, disconnect the coolant temperature sensor (CTS) on the top of cylinder 2.

Remove screws securing intake manifold to cylinder heads.

Remove intake manifold with throttle body.

Remove:
- chain tensioner (see *CHAIN TENSIONER* above)
- valve cover and gasket (see *VALVE COVER* above)
- camshaft timing gear

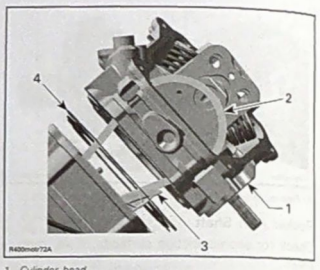
NOTE: Before removing cylinder head screws, blow out remaining coolant by air pressure. During cylinder head removal, the remaining coolant in cylinder head could leak into the engine and may contaminate the oil.
- cylinder head screws M6
- cylinder head screws M10 retaining cylinder head and cylinder to cylinder base.



1. Cylinder head screws M10
2. Cylinder head screws M6

Pull up cylinder head.

Remove:
- chain guide
- cylinder head gasket and scrap it.



1. Cylinder head
2. Timing chain
3. Chain guide
4. Cylinder head gasket

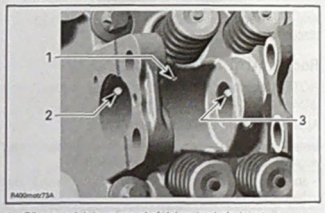
Cylinder Head Inspection

Inspect timing chain guide for wear, cracks or other damages. Replace if necessary.

Check for cracks between valve seats, if so, replace cylinder head.

Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.

Clean oil support through the cylinder head from contamination.



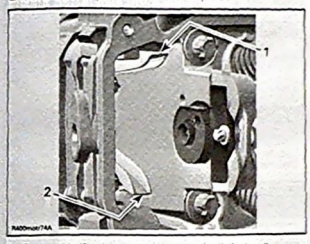
1. Oil port to lubricate camshaft lobes intake/exhaust
2. Oil supply to camshaft bearing journal timing chain side
3. Oil supply to camshaft bearing journal spark plug side

Cylinder Head Installation

NOTE: The cylinder heads are not identical in design. Do not invert the cylinder heads at assembly.

For installation, reverse the removal procedure. Pay attention to the following details.

Ensure dowel pins no. 9 are in place.

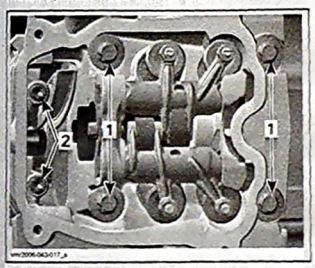


1. Chain guide (fixed between cylinder and cylinder head)
2. Chain tensioner guide (mounted in crankcase)

Install a **NEW** cylinder head gasket.

First, torque cylinder head screws M10 in criss-cross sequence to 20 N•m (15 lbf•ft) then finish by tightening to 60 N•m (44 lbf•ft).

Install cylinder head screws M6.



1. Cylinder head screws M10
2. Cylinder head screws M6

Check chain guide for movement.

CAUTION: Chain guide has to be fixed between cylinder and cylinder head.

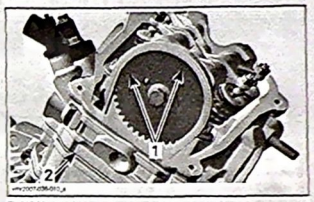
Install camshaft timing gear and perform proper camshaft timing. Refer to *CAMSHAFT*.

Install all remaining components as described in this section.

CAMSHAFT

Camshaft Timing

NOTE: If a piston (of cylinder 1 or 2) is set to TDC ignition, the camshaft timing gear of the opposite cylinder must be in the following position.

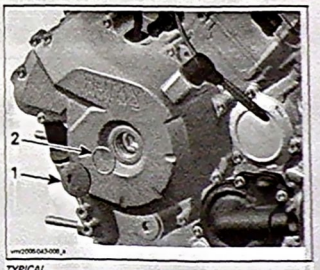


TYPICAL
1. Marks on timing gear of the opposite cylinder
2. Cylinder head base

Camshaft Timing Cylinder 2

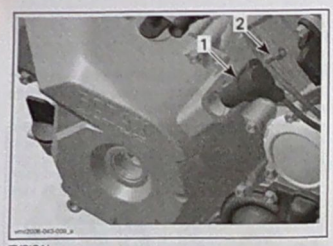
Turn crankshaft until piston is at TDC ignition as follows.

Remove:
- spark plug cable and spark plug of both cylinders
- valve covers of both cylinders
- plug screw and O-ring of magneto cover



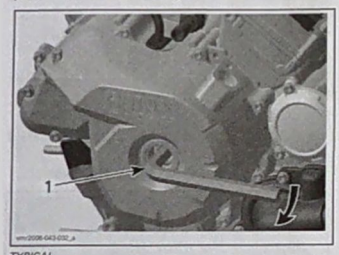
TYPICAL
1. Plug screw
2. O-ring

- crankshaft position sensor.



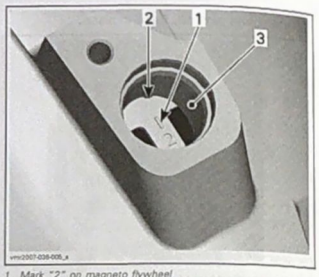
TYPICAL
1. Crankshaft position sensor
2. Screw

Use a 14 mm Allen key to turn crankshaft until piston 2, rear is at TDC ignition.



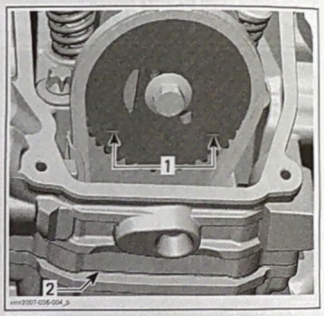
TYPICAL
1. Allen key 14 mm

When rear piston is at TDC ignition, marks on magneto flywheel "2" and on the magneto cover are aligned.



1. Mark "2" on magneto flywheel
2. Notch on magneto cover
3. Crankshaft position sensor location

At TDC ignition, the printed marks on the camshaft timing gear have to be parallel to cylinder head base.

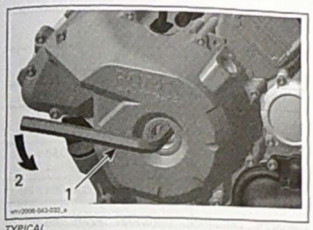


TYPICAL
1. Printed marks on camshaft timing gear
2. Cylinder head base

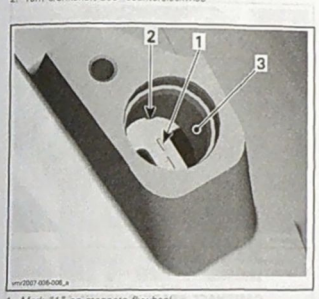
Camshaft Timing Cylinder 1

Turn cylinder 2 to TDC ignition, see *CAMSHAFT TIMING CYLINDER 2*.

Using a 14 mm Allen key, turn crankshaft 280° counterclockwise, until marks on magneto flywheel "1" and magneto cover are aligned.

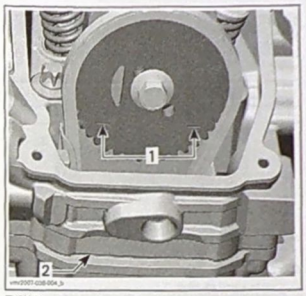


TYPICAL
1. Allen key 14 mm
2. Turn crankshaft 280° counterclockwise



1. Mark "1" on magneto flywheel
2. Notch on magneto cover
3. Location of crankshaft position sensor

NOTE: At TDC ignition, the printed marks on the camshaft timing gear have to be parallel to cylinder head base as per following illustration.



TYPICAL
1. Printed marks on camshaft timing gear
2. Cylinder head base

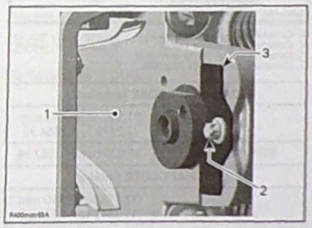
Camshaft Removal

The removal procedure is the same for both camshafts.

Each camshaft is different in design. Thus, it is important not to mix up any parts of the camshaft assembly with that of the other cylinder. Keep parts as a group.

Remove:

- valve cover (see *VALVE COVER* above)
- chain tensioner (see *CHAIN TENSIONER* above)
- camshaft timing gear (see *CAMSHAFT TIMING GEAR* above)
- camshaft retaining plate

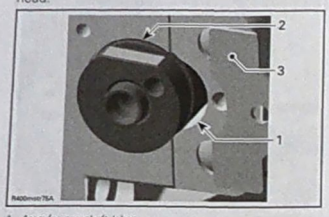


1. Cylinder head
2. Allen screw
3. Camshaft retaining plate

- rocker arms (see *ROCKER ARM* above)

– camshaft.

NOTE: For removal rotate camshaft so that intake/exhaust lobe shows to upper side of cylinder head.

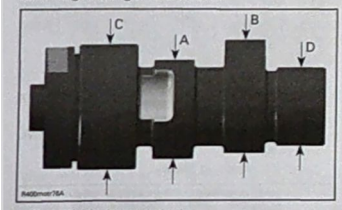


1. Area for camshaft lobes
2. Camshaft
3. Camshaft retaining plate

Camshaft Inspection

Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.

Measure camshaft bearing journal diameter and lobe height using a micrometer.

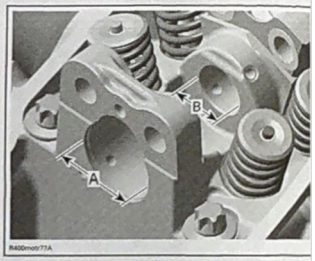


A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft journal timing chain side
D. Camshaft journal spark plug side

CAMSHAFT LOBE (exhaust)	
NEW	31.940 to 32.140 mm (1.2575 to 1.2654 in)
SERVICE LIMIT	31.920 mm (1.2567 in)
CAMSHAFT LOBE (intake)	
NEW	32.110 to 32.310 mm (1.2642 to 1.2721 in)
SERVICE LIMIT	32.090 mm (1.2634 in)

CAMSHAFT JOURNAL (timing chain side)	
NEW	34.959 to 34.975 mm (1.3763 to 1.3770 in)
SERVICE LIMIT	34.950 mm (1.3760 in)
CAMSHAFT JOURNAL (spark plug side)	
NEW	21.959 to 21.980 mm (.8645 to .8654 in)
SERVICE LIMIT	21.950 mm (.8642 in)

Measure clearance between both ends o camshaft and cylinder head.



A. Camshaft bearing journal timing chain side
B. Camshaft bearing journal spark plug side

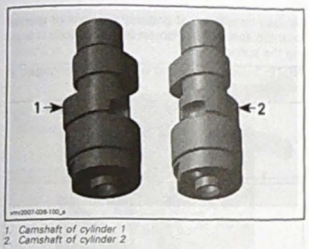
CAMSHAFT BEARING JOURNAL (timing chain side)	
NEW	35.000 to 35.025 mm (1.3780 to 1.3789 in)
SERVICE LIMIT	35.040 mm (1.3795 in)
CAMSHAFT BEARING JOURNAL (spark plug side)	
NEW	22.000 to 22.021 mm (.8661 to .8670 in)
SERVICE LIMIT	22.040 mm (.8677 in)

Replace parts that are not within specifications.

Camshaft Installation

For installation, reverse the removal procedure Pay attention to the following details.

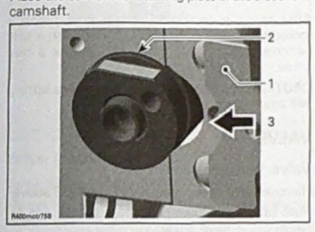
CAUTION: The camshafts are not identical i design. Do not invert the camshafts during as sembly. Any mix-up of the components wi lead to engine damage.



1. Camshaft of cylinder 1
2. Camshaft of cylinder 2

Properly install rocker arms. Refer to *ROCKER ARM* above.

Place the camshaft retaining plate in the slot of the camshaft.



1. Camshaft retaining plate position
2. Slot retaining camshaft
3. Direction of movement

Install camshaft timing gear and perform proper camshaft timing, as described above.

Adjust valve clearance. Refer to *VALVE CLEARANCE ADJUSTMENT*.

For other parts, refer to proper installation procedure.

VALVE SPRING

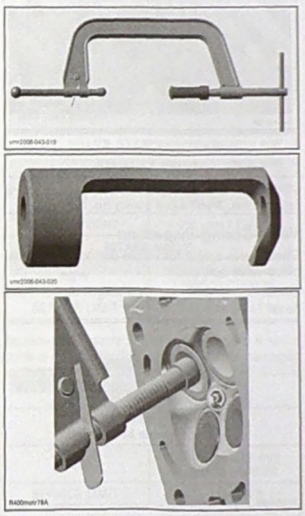
Valve Spring Removal

Remove:
- rocker arms (see *ROCKER ARM* above)
- cylinder head (see *CYLINDER HEAD* above).

Compress valve spring **no. 6**; use the valve spring compressor clamp (P/N 529 035 724) and the valve spring compressor cup (P/N 529 035 764).

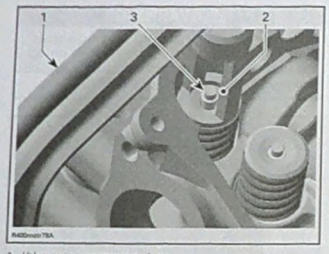
⚠ WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could fly away because of the strong spring preload.



LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters.



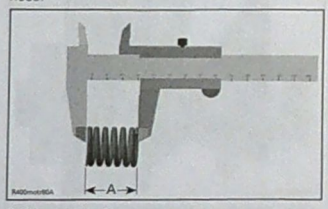
1. Valve spring compressor clamp
2. Valve spring compressor cup
3. Valve cotter

Withdraw valve spring compressor, valve spring retainer **no. 7** and valve spring **no. 6**.

Valve Spring Inspection

Check valve spring for visible damages. If so, replace valve spring.

Check valve spring for free length and straightness.



A. Valve spring length

VALVE SPRING FREE LENGTH	
NOMINAL NEW	40.81 mm (1.607 in)
SERVICE LIMIT	39.00 mm (1.535 in)

Replace valves springs if not within specifications.

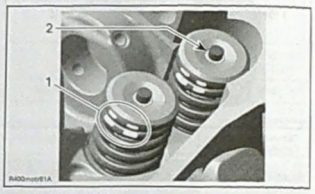
Valve Spring Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Colored area of the valve spring must be placed on top.

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

NOTE: Valve cotter must be properly engaged in valve stem grooves.



1. Position of the valve spring
2. Valve cotter

After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

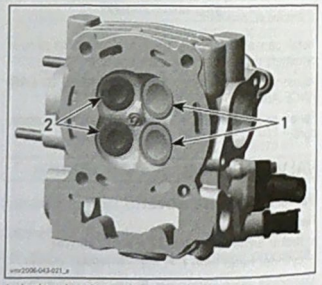
CAUTION: An improperly locked valve spring will cause engine damage.

VALVE

Valve Removal

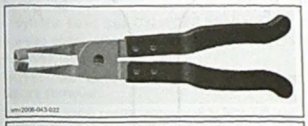
Remove valve spring, see *VALVE SPRING* above.

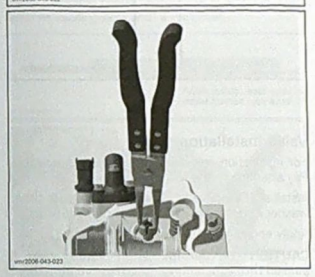
Push valve stem, then pull valves (intake and exhaust) out of valve guide.



1. Intake valves 31 mm
2. Exhaust valves 27 mm

Remove valve stem seal no. 8 with a special pliers, such as the Snap-on pliers (P/N YA 8230), and discard it.





Valve Inspection

Valve Stem Seal

Always install new seals whenever valves are removed.

Valve

Inspect valve surface, check for abnormal stem wear and bending. If out of specification, replace by a new one.

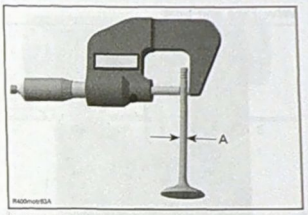
VALVE OUT OF ROUND (intake and exhaust valves)	
NEW	0.005 mm (.0002 in)
SERVICE LIMIT	0.06 mm (.0024 in)

Valve Stem and Valve Guide Clearance

Measure valve stem and valve guide in three places using a micrometer and a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Change valve if valve stem is out of specification or has other damages such as wear or friction surface.



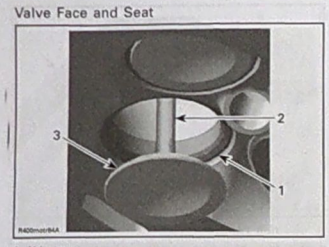
A. Valve stem diameter

VALVE STEM DIAMETER	
EXHAUST VALVE	
NEW	4.956 to 4.970 mm (.1951 to .1957 in)
SERVICE LIMIT	4.930 mm (.1941 in)
INTAKE VALVE	
NEW	4.966 to 4.980 mm (.1955 to .1960 in)
SERVICE LIMIT	4.930 mm (.1941 in)

Replace valve guide out of cylinder head if valve guide is out of specification or has other damages such as wear or friction surface (see *VALVE GUIDE PROCEDURE* below).

VALVE GUIDE DIAMETER (intake and exhaust valves)	
NEW	5.006 to 5.018 mm (.1971 to .1976 in)
SERVICE LIMIT	5.050 mm (.1988 in)

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool (see *VALVE GUIDE PROCEDURE* below).

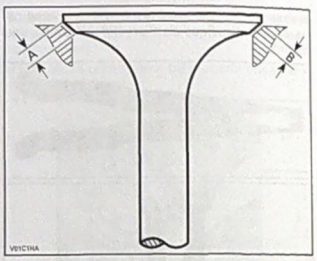
Measure valve face contact width.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width using a caliper.

VALVE SEAT CONTACT WIDTH	
EXHAUST VALVE	
NEW	1.25 to 1.55 mm (.049 to .061 in)
SERVICE LIMIT	2.00 mm (.078 in)
INTAKE VALVE	
NEW	1.05 to 1.35 mm (.041 to .053 in)
SERVICE LIMIT	1.80 mm (.070 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.



A. Valve face contact width
B. Valve seat contact width

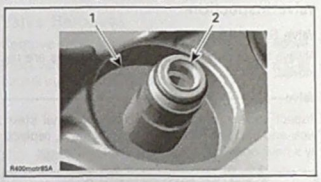
Valve Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Install a **NEW** valve stem seal. Make sure thrust washer is installed before installing seal.

Apply engine oil on valve stem and install it.

CAUTION: Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Thrust washer
2. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

CAUTION: An improperly locked valve spring will cause engine damage.

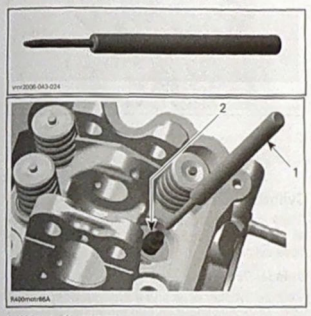
VALVE GUIDE

Valve Guide Removal

Remove:
- cylinder head (see *CYLINDER HEAD* above)
- valve spring (see *VALVE SPRING* above)
- valves (see *VALVE* above).

NOTE: Clean valve guide area from contamination before removal.

Using the valve guide remover (P/N 529 035 924), remove valve guide with a hammer.



1. Valve guide remover
2. Valve guide

Valve Guide Inspection

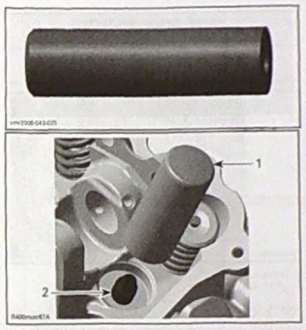
Always replace valve stem seals whenever valve guides are removed.

Clean the valve guide bore before reinstalling the valve guide into cylinder head.

Valve Guide Installation

For installation, reverse the removal procedure. Pay attention to the following details.

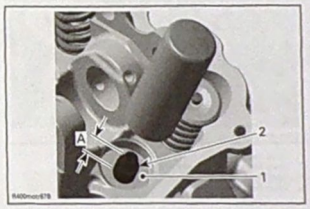
Use the valve guide installer (P/N 529 035 853) to install valve guide.



1. Valve guide installer
2. Valve guide

NOTE: Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on valve guide prior to install it into the cylinder head.

CAUTION: Push valve guide in the cold cylinder head as per following illustration.

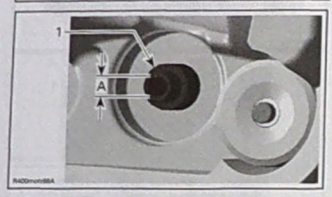


1. Thrust surface of cylinder head
2. Valve guide
A. Measurement from thrust surface to valve guide top

VALVE GUIDE (measurement "A")	
NEW	14.00 to 14.40 mm (.5512 to .5669 in)

Valve guide to be adjusted in diameter by using a reamer.

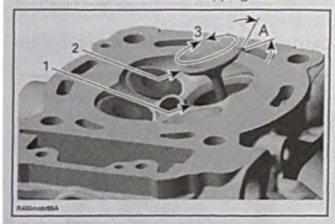
VALVE GUIDE DIAMETER (intake and exhaust valves)	
NEW	5.006 to 5.018 mm (.1971 to .1976 in)



1. Valve guide
A. Valve guide diameter

NOTE: Ensure to turn reamer in the right direction. Use cutting oil and make brakes to clean reamer/valve guide from metal shavings.

Apply some lapping compound to valve face and work valve on its seat with a lapping tool.



1. Valve seat
2. Valve face (contact surface to valve seat)
3. Turn valve while pushing against cylinder head
A. Valve seat angle 45°

NOTE: Ensure to seat valves properly. Apply marking paste to ease checking contact pattern.

Repeat procedure until valve seat/valve face fits together.

CYLINDER

Cylinder Removal

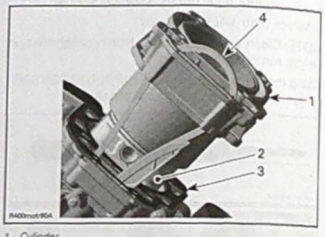
NOTE: Before removal or installation, make sure respective cylinder is set to TDC ignition. Refer to *CAMSHAFT*.

Remove:

- chain tensioner (see *CHAIN TENSIONER*)
- camshaft timing gear (see *CAMSHAFT TIMING GEAR*)
- cylinder head (see *CYLINDER HEAD*).

Pull cylinder.

Discard cylinder base gaskets.



1. Cylinder
2. Piston assembly
3. Cylinder base gasket
4. Camshaft timing chain

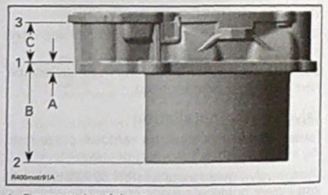
Cylinder Inspection

Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore and if it is out of specifications, replace cylinder and piston rings.

Measure cylinder bore at 3 recommended positions. See the following illustration.



1. First measuring of diameter
2. Second measuring of diameter
3. Third measuring of diameter
A. 7 mm (.276 in) from cylinder bottom
B. 68 mm (2.68 in)
C. 32 mm (1.260 in)

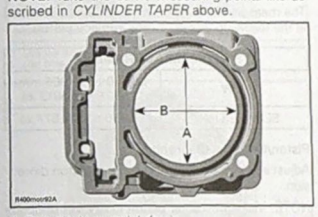
CYLINDER TAPER IN DIAMETER	
NEW (maximum)	0.038 mm (.0015 in)
SERVICE LIMIT	0.090 mm (.0035 in)

Distance between measurements should not exceed the service limit mentioned above.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take another measurement 90° from first one and compare.

NOTE: Take the same measuring points like described in *CYLINDER TAPER* above.



A. Perpendicular to crankshaft axis
B. Parallel to crankshaft axis

CYLINDER OUT OF ROUND	
NEW (maximum)	0.015 mm (.0006 in)
SERVICE LIMIT	0.020 mm (.0008 in)

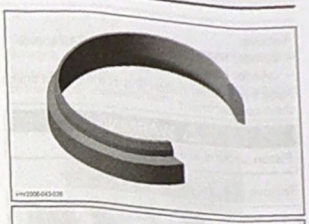
Cylinder Installation

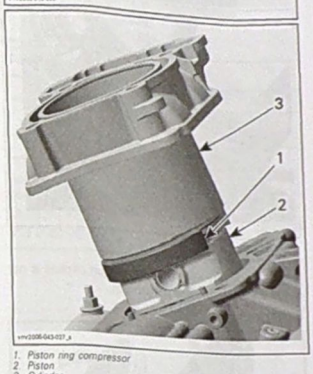
For installation, reverse the removal procedure. Pay attention to the following details.

CAUTION: Always replace cylinder base gasket before installing the cylinder.

First mount cylinder 2. Then remove the crankshaft locking bolt. Crank the engine further and position piston 1 at TDC. Mount cylinder 1. The cylinder can not be pushed fully over the piston unless the piston is located at TDC.

Apply engine oil in the bottom area of the cylinder bore and also on the band of the piston ring compressor (P/N 529 035 919) piston ring compressor tool.





1. Piston ring compressor
2. Piston
3. Cylinder

NOTE: Put timing chain through the chain pit then put the cylinder in place.

CAUTION: Chain guide has to be fixed between cylinder and cylinder head.

NOTE: After both cylinders are installed, turn crankshaft until piston of cylinder 2 is at TDC ignition and lock crankshaft. Refer to *CAMSHAFT*.

Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

Piston Removal

NOTE: Before removal or installation, make sure respective cylinder is set to TDC ignition. Refer to *CAMSHAFT*.

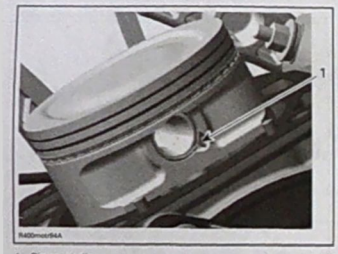
Remove:
- cylinder head (see *CYLINDER HEAD* above)
- cylinder (see *CYLINDER* above).

Place a rag under piston and in the area of timing chain compartment.

⚠ WARNING

Piston circlips are spring loaded.

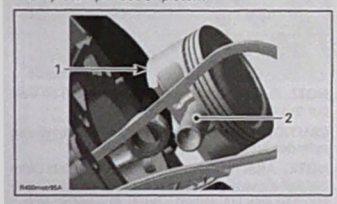
Remove one piston circlip and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin out of piston.



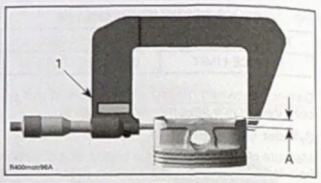
1. Piston
2. Piston pin

Detach piston from connecting rod.

Piston Inspection

Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 8 mm (.315 in) perpendicularly (90°) to piston pin.



1. Measuring perpendicularly (90°) to piston pin
A. 8 mm (.315 in)

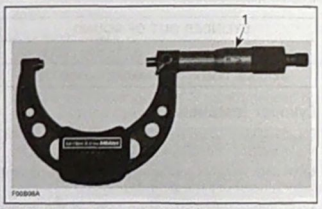
The measured dimension should be as described in the following tables. If not, replace piston.

PISTON MEASUREMENT	
NEW	90.950 to 90.966 mm (3.5807 to 3.5813 in)
SERVICE LIMIT	90.850 mm (3.577 in)

Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

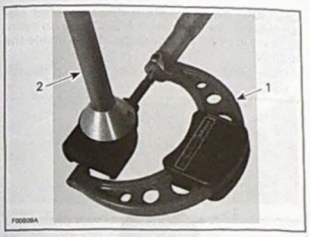
NOTE: Make sure used piston is not out of specification.



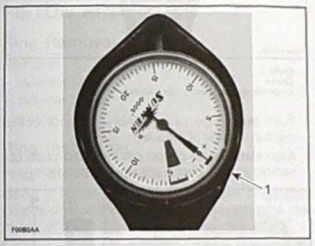
1. Micrometer set to the piston dimension

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



TYPICAL
1. Indicator set to 0 (zero)

Position the dial bore gauge 20 mm (.787 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE	
NEW	0.027 to 0.057 mm (.0011 to .0022 in)
SERVICE LIMIT	0.100 mm (.0040 in)

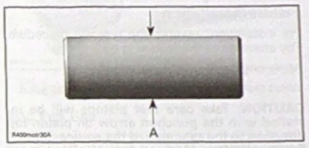
If clearance exceeds specified tolerance, replace piston by a new one and measure piston/cylinder clearance again.

Connecting Rod Small End Radial Clearance

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement positions.

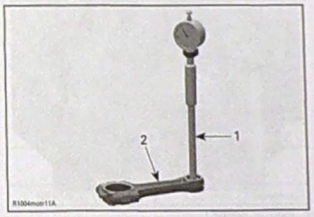


A. Piston pin diameter

PISTON PIN DIAMETER	
NEW	19.996 to 20.000 mm (.7872 to .7874 in)
SERVICE LIMIT	19.980 mm (.7866 in)

Replace piston pin if diameter is out of specifications.

Measure inside diameter of connecting rod small end bushing.



1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
NEW	20.010 to 20.020 mm (.7878 to .7882 in)
SERVICE LIMIT	20.060 mm (.7898 in)

Replace connecting rod if diameter of connecting rod small end is out of specifications. Refer to *BOTTOM END* for removal procedure.

Compare measurements to obtain the connecting rod small end radial clearance.

CONNECTING ROD SMALL END RADIAL CLEARANCE	
SERVICE LIMIT	0.080 mm (.0035 in)

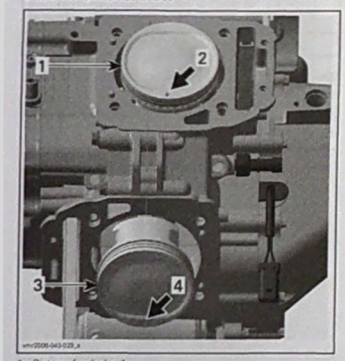
Piston Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply engine oil on the piston pin.

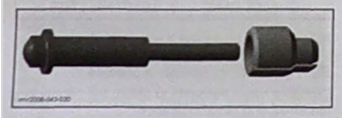
Insert piston pin into piston and connecting rod.

CAUTION: Take care that pistons will be installed with the punched arrow on piston top direction to the rear side of the engine.
Front cylinder: Mark on top of piston must show to intake side.
Rear cylinder: Mark on top of piston must show to exhaust side.



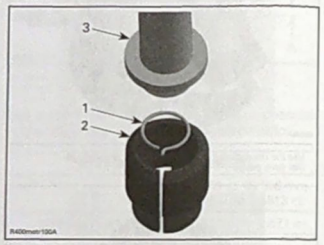
1. Piston of cylinder 1
2. Mark on piston must show to intake side of cylinder 1
3. Piston of cylinder 2
4. Mark on piston must show to exhaust side of cylinder 2

Use the piston circlip installer (P/N 529 035 921) piston appropriate circlip installer to assemble the new piston circlip as per following procedure:



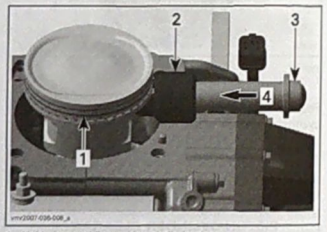
CAUTION: Always replace disassembled piston circlip(s) by new ones. Place a rag on cylinder base to avoid dropping the circlip inside the engine.

– Place circlip in sleeve as per following illustration.



1. Circlip
2. Sleeve
3. Assembly jig from piston clip installer

– Push taper side of assembly jig until circlip reaches middle of sleeve.
– Align sleeve with piston pin axis and push assembly jig until circlip engages in piston.



1. Hold piston while pushing circlip in place
2. Sleeve
3. Assembly jig
4. Direction to push circlip

NOTE: Take care that the hook of the piston circlip is positioned properly.



CORRECT POSITION OF THE PISTON CIRCLIP

PISTON RINGS

Ring Removal

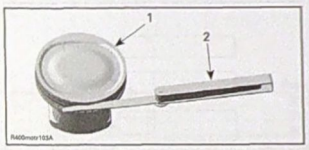
Remove:
- cylinder head
- cylinder
- piston.

Ring Inspection

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE	
UPPER COMPRESSION RING	
NEW	0.030 to 0.070 mm (.0012 to .0028 in)
SERVICE LIMIT	0.150 mm (.0059 in)
LOWER COMPRESSION RING	
NEW	0.020 to 0.060 mm (.0008 to .0024 in)
SERVICE LIMIT	0.150 mm (.0059 in)
OIL SCRAPER RING	
NEW	0.010 to 0.180 mm (.0004 to .0071 in)
SERVICE LIMIT	0.250 mm (.0098 in)



1. Piston
2. Feeler gauge

Ring End Gap

To measure the ring end gap place the ring in the cylinder in the area of 8 to 16 mm (5/16 to 5/8 in) from top of cylinder.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds above described specified tolerance.

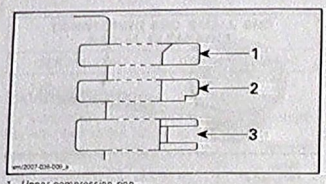
RING END GAP	
UPPER COMPRESSION RING	
NEW	0.20 to 0.40 mm (.008 to .016 in)
SERVICE LIMIT	1.50 mm (.059 in)
LOWER COMPRESSION RING	
NEW	0.20 to 0.40 mm (.008 to .016 in)
SERVICE LIMIT	1.50 mm (.059 in)
OIL SCRAPER RING	
NEW	0.20 to 0.70 mm (.008 to .028 in)
SERVICE LIMIT	1.50 mm (.059 in)

Ring Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: First install spring and then rings of oil scraper ring.

Install the oil scraper ring first, then the lower compression ring with the word "N and TOP " facing up, then the upper compression ring with the word "N and TOP" facing up.



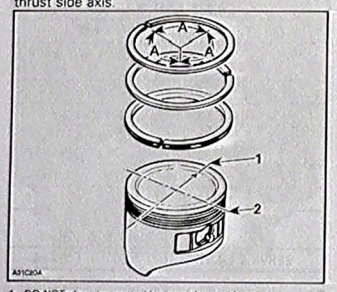
1. Upper compression ring
2. Lower compression ring
3. Oil scraper ring

CAUTION: Ensure that top and second rings are not interchanged.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. DO NOT align ring gap with piston thrust side axis
2. DO NOT align ring gap with piston pin bore axis
A. 120°

BOTTOM END

SERVICE TOOLS

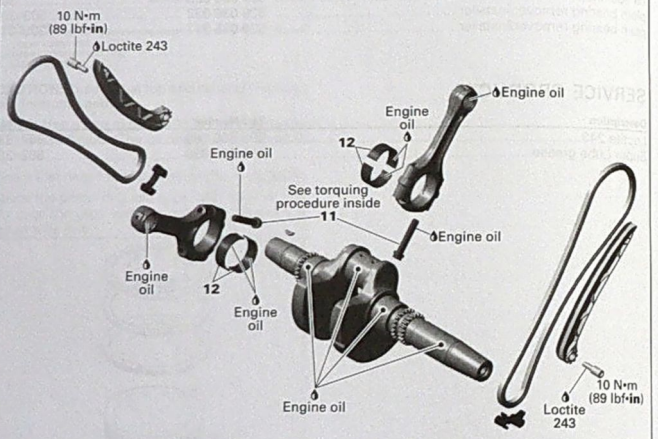
Description	Part Number	Page
crankcase support sleeve	529 036 031	309
crankshaft locking bolt	529 035 617	313
oil seal installer	529 036 033	302
plain bearing remover/installer	529 036 032	303–304
plain bearing remover/installer	529 035 917	309–310

SERVICE PRODUCTS

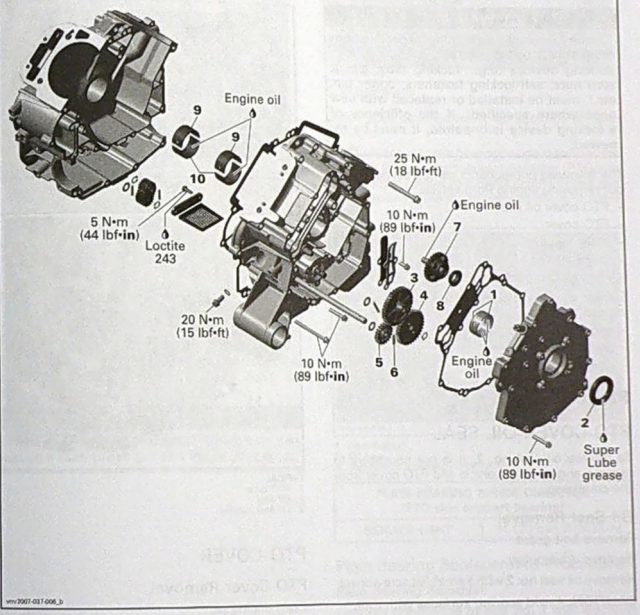
Description	Part Number	Page
Loctite 243	293 800 060	307, 311
Super Lube grease	293 550 030	302, 304



CRANKCASE AND PTO COVER



CRANKSHAFT



vm2007-037-006_b

GENERAL

During assembly/installation, use the torque values and service products as shown in the exploded view(s).

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* in *INTRODUCTION* section.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

The following components can be serviced without removing engine from vehicle:
- PTO cover oil seal
- PTO cover
- drive gears
- timing chain
- timing chain guide.

Engine removal is necessary to service the following components:
- engine oil strainer
- crankcase
- crankshaft.

PROCEDURES

PTO COVER OIL SEAL

To replace oil seal **no. 2**, it is not necessary to remove engine from vehicle and PTO cover from the crankcase.

Oil Seal Removal

Remove belt guard.

Remove drive pulley.

Remove oil seal **no. 2** with a small flat screwdriver.

CAUTION: Avoid scoring surfaces with tool.

Oil Seal Inspection

Check oil seal running surface of crankshaft PTO side for grooves. Replace if necessary.

Oil Seal Installation

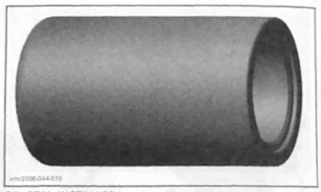
The installation is the reverse of the removal procedure.

Pay attention to the following details.

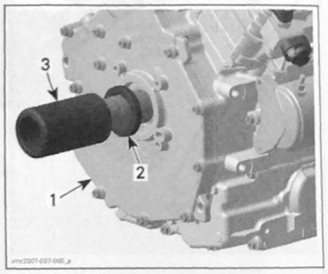
Lubricate oil seal with Super Lube grease (P/N 293 550 030).

CAUTION: Oil seal must be installed with sealing lip toward the engine.

Push oil seal in place by using the oil seal installer (P/N 529 036 033).



OIL SEAL INSTALLER



TYPICAL
1. PTO cover
2. Oil seal
3. Oil seal installer

PTO COVER

PTO Cover Removal

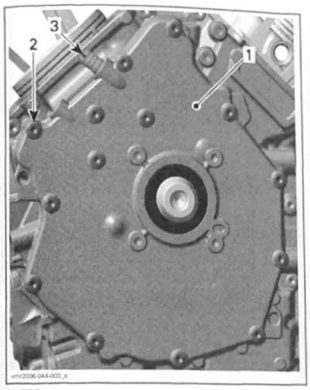
Drain engine oil.

Disconnect battery. Refer to *CHARGING SYSTEM*.

Remove air intake silencer.

Remove drive pulley. Refer to *DRIVE SYSTEM*.

Remove PTO cover screws and pull the cover.



1. PTO cover
2. PTO cover screws
3. Vent hose nipple

PTO Cover Inspection

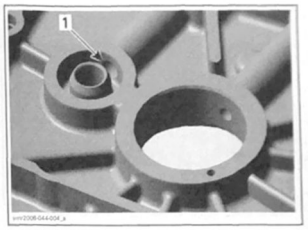
Check the PTO cover for cracks or other damage.

Replace PTO cover if damaged.

Clean oil breather bore in PTO cover from contaminations with part cleaner then use an air gun to dry it.

⚠ WARNING

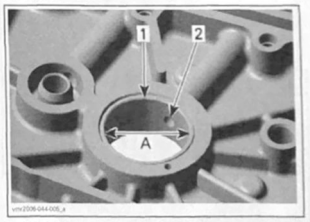
Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.



1. Oil breather bore

Check plain bearings **no. 1** for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to crankshaft journal diameter (PTO support bearing). Refer to *CRANKSHAFT* in this section. Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore
A. Measure plain bearing inside diameter

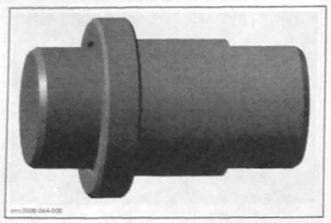
PLAIN BEARING INSIDE DIAMETER (PTO side support bearing)	
SERVICE LIMIT	34.120 mm (1.3433 in)

Plain Bearing Replacement Procedure

Plain Bearing Removal

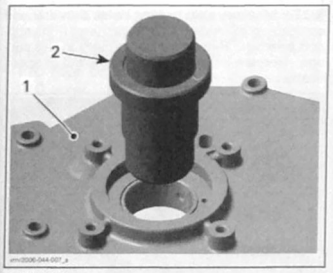
Carefully remove the oil seal **no. 2** with a screwdriver, without damaging the PTO cover.

Push-out the plain bearings from the outside towards the inside using the plain bearing remover/installer (P/N 529 036 032).



PLAIN BEARING REMOVER/INSTALLER — PTO COVER

The PTO cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



1. PTO cover
2. Plain bearing remover/installer

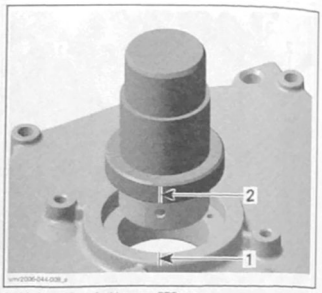
Plain Bearing Installation

CAUTION: Unless otherwise instructed, never use hammer to install plain bearings. Use press only.

Install plain bearings with the proper plain bearing remover/installer (P/N 529 036 032) in a cool PTO cover. Do not lubricate plain bearings and/or PTO cover for installation.

Carefully press-in the plain bearings in the same direction as during disassembly, from the outside towards the inside. Support PTO cover with suitable support with straight surface, in order to prevent damage of the sealing surface.

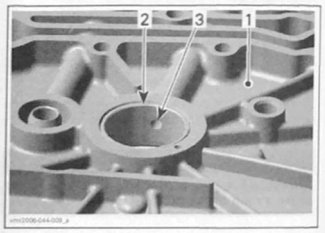
CAUTION: Mark position of oil bore on PTO cover and on plain bearing remover/installer. Align mark on plain bearing remover/installer with mark on PTO cover.



1. Mark position of oil bore on PTO cover
2. Mark position of oil bore on plain bearing remover/installer

NOTE: Wrong oil bore position will stop oil supply to plain bearings and will damage the engine.

CAUTION: The partition of the plain bearings must be positioned near to oil bore in counter-clockwise direction. (refer to no. 3 in next illustration).



1. PTO cover (inside)
2. Partition
3. Oil bore

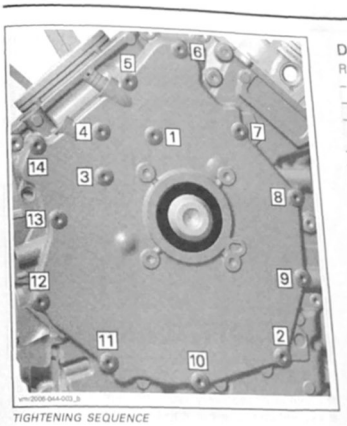
PTO Cover Installation

For installation, reverse the removal procedure, but pay attention to the following details.

NOTE: At installation, replace PTO cover gasket and oil seal.

Lubricate oil seal with Super Lube grease (P/N 293 550 030).

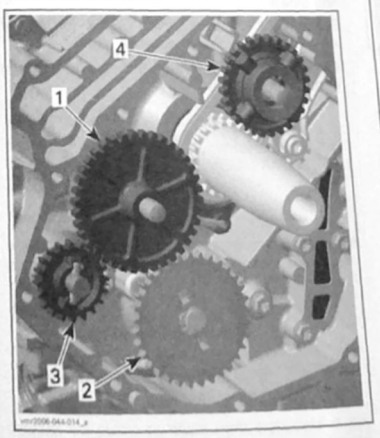
Tightening sequence for screws on PTO cover is as per following illustration.



TIGHTENING SEQUENCE

DRIVE GEARS

The drive gears are located on the engine PTO side behind the PTO cover.



1. *Intermediate gear*
2. *Oil pump gear*
3. *Water pump gear*
4. *Breather gear*

mm/2007-183

Drive Gear Removal

Remove:
- PTO cover (refer to *PTO COVER*)
- intermediate gear **no. 3**
- oil pump gear **no. 4** (refer to *OIL PUMP* in *LUBRICATION SYSTEM*)
- water pump gear **no. 5**.

To remove water pump gear, pull the shaft assembly a bit out and turn it about one teeth until it stays out.

Now you can push water pump gear down. Remove needle pin **no. 6** and pull water pump gear out.

Remove breather gear **no. 7**.

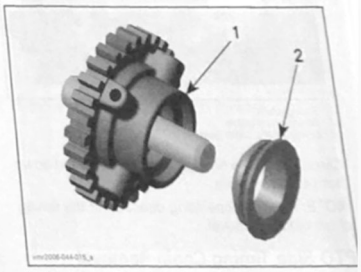
Drive Gear Inspection

Intermediate Gear/Oil Pump Gear/ Water Pump Gear

Inspect gears for wear or other damage. Replace if damaged.

Breather Gear

The engine is equipped with a breather gear which prevents engine oil coming out through the breathing system into the air intake silencer.



1. *Breather gear*
2. *V-ring*

Inspect gear for wear or other damage.

Check ball bearing for excessive play and smoo operation. Replace breather gear assembly if n essary.

Drive Gear Installation

The installation is essentially the reverse of th moval procedure, but pay attention to the fo ing details.

Install a **NEW** V-ring **no. 8** on the breather g

Adequately oil the ball bearing of the breather gear.

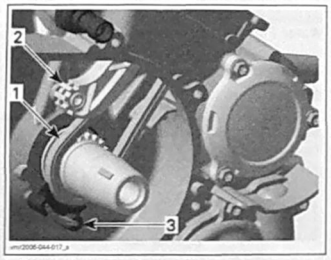
TIMING CHAIN

The engine is equipped with two timing chains. One of the timing chain is located on engine MAG side behind the magneto cover. The second timing chain is located on engine PTO side behind the PTO cover.

Magneto Side Timing Chain Removal

Remove:

- valve cover, chain tensioner and camshaft timing gear (refer to *CYLINDER AND HEAD*)
- magneto cover and rotor (refer to *MAGNETO SYSTEM*)
- timing chain guide and lower timing chain guide.



1. Timing chain
2. Timing chain guide
3. Lower timing chain guide

Carefully pull the timing chain sideward and down from the crankcase.

NOTE: Mark the operating direction of the timing chain before removal.

PTO Side Timing Chain Removal

Remove:

- valve cover, chain tensioner and camshaft timing gear (refer to *CYLINDER AND HEAD* section)
- PTO cover (refer to *PTO COVER*)
- intermediate gear and breather gear (refer to *DRIVE GEARS*)
- timing chain guide and lower timing chain guide (see illustration above).

Carefully pull the timing chain sideward and down from the crankcase.

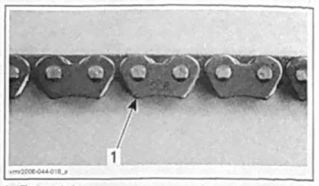
NOTE: Mark the operating direction of the timing chain before removal.

Timing Chain Inspection

Inspection is the same for both timing chains.

NOTE: Check timing chain on camshaft timing gear for excessive radial play.

Check chain condition for wear and teeth condition.



1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft timing gear and timing chain).

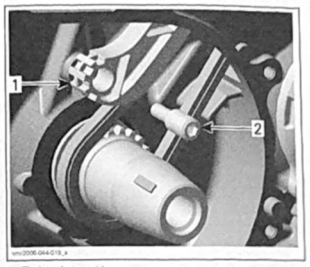
Timing Chain Installation (MAG and PTO)

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

Refer to *CYLINDER AND HEAD* for proper camshaft timing gear installation.

CAUTION: Improper valve timing will damage engine components.

TIMING CHAIN GUIDE



1. Timing chain guide
2. Bearing screw

Guide Removal

Refer to *TIMING CHAIN* above.

Guide Inspection

Check timing chain guide for wear, cracks or other damage. Replace if necessary.

Guide Installation

The installation is the reverse of the removal procedure.

Apply Loctite 243 (P/N 293 800 060) to bearing screw.

CRANKCASE

NOTE: Before disassembly, remove engine from vehicle, refer to *ENGINE REMOVAL AND INSTALLATION*.

Crankcase Disassembly

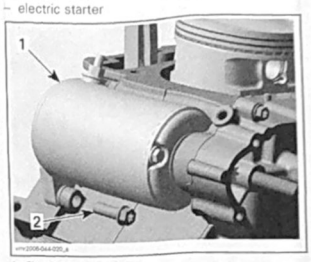
It is recommended to measure crankshaft axial play on PTO end prior to disassemble crankcase. Refer to *CRANKSHAFT*.

Remove:

- cylinder heads and cylinders
- pistons
- PTO cover (refer to *PTO COVER*)
- drive gears (refer to *DRIVE GEARS*)

NOTE: Oil pump removal from crankcase is not necessary, but recommended to see condition of oil pump (refer to *LUBRICATION SYSTEM* section).

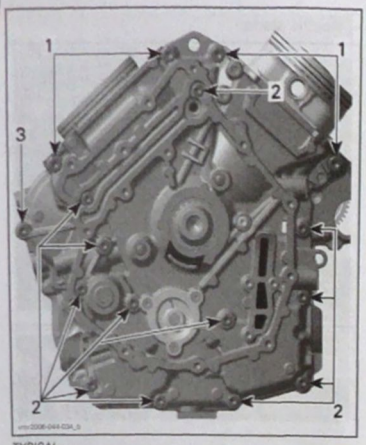
- electric starter



1. Electric starter
2. Screw

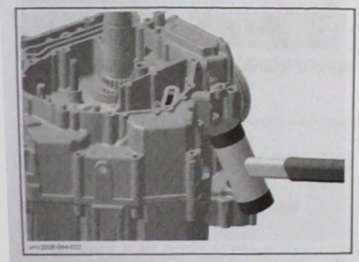
- magneto cover and rotor (refer to *MAGNETO SYSTEM* section)
- electric starter drive gears (refer to *MAGNETO SYSTEM* section)
- water pump housing (refer to *COOLING SYSTEM* section)
- oil filter (refer to *LUBRICATION SYSTEM* section)
- cylinder heads, cylinders and pistons (refer to *CYLINDER AND HEAD* section)
- timing chains and timing chain guides (refer to *TIMING CHAIN*).

Remove retaining screws of crankcase.



TYPICAL
1. Four screws M8 x 65
2. 12 screws M6 x 75
3. One screw M6 x 35

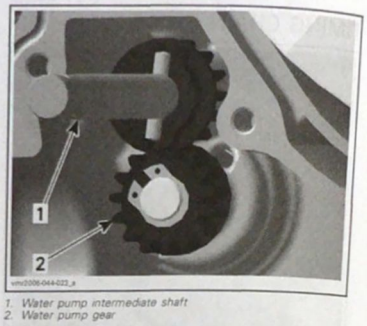
Carefully split crankcase halves by using a screwdriver and a soft hammer.



NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.

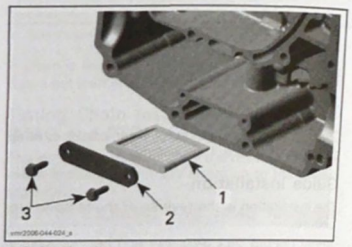
Pull crankshaft out of crankcase.

Remove the water pump intermediate shaft and the water pump gear.



1. Water pump intermediate shaft
2. Water pump gear

Remove engine oil strainer.



1. Engine oil strainer
2. Retaining plate
3. Screws

Crankcase Inspection

NOTE: Remove all remaining parts from the crankcase halves; they could get damaged during repair work.

Clean the engine oil strainer with part cleaner and use an air gun to dry it. After cleaning, check if the strainer is damaged (cracks, holes). If so, replace it.

Clean crankcase halves from contaminations and blow the oil supply lines with compressed air.

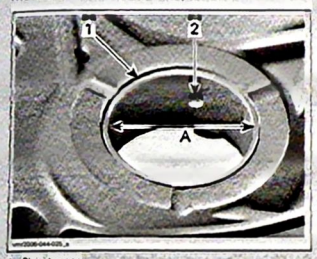
⚠ WARNING

Use safety goggles to avoid eye injuries.

Check crankcase halves for cracks or other damage. Replace if damaged.

Check plain bearings no. 9 and no. 10 for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to PTO/MAG side journal diameters of crankshaft (refer to *CRANKSHAFT*). Replace if the measurements are out of specification.



1. Plain bearing
2. Oil bore
A. Measure plain bearing inside diameter

PLAIN BEARING INSIDE DIAMETER (PTO/MAG)	
SERVICE LIMIT	42.100 mm (1.6574 in)

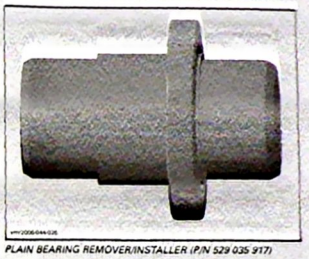
Plain Bearing Replacement

Plain Bearing Removal

CAUTION: Always support crankcase halves properly when ball bearings or plain bearings are removed. Damages to crankcase halves may occur if this procedure is not performed correctly.

NOTE: Always use a press for removal of plain bearings.

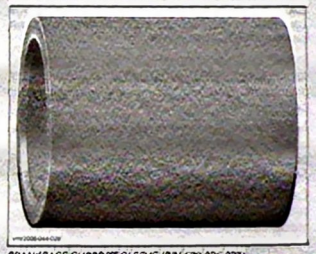
Remove plain bearings no. 9 and no. 10 with the plain bearing remover/installer (P/N 529 035 917).



PLAIN BEARING REMOVER/INSTALLER (P/N 529 035 917)

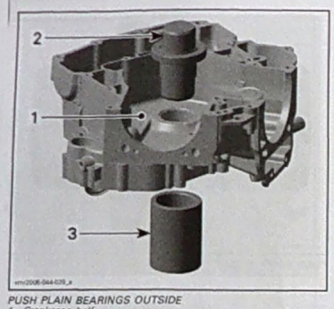
Carefully push the plain bearings out, from the crankcase half inside towards the outside.

NOTE: Place the crankcase support sleeve (P/N 529 036 031) under crankcase halves before removing plain bearings.



CRANKCASE SUPPORT SLEEVE (P/N 529 036 031)

NOTE: During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.



PUSH PLAIN BEARINGS OUTSIDE
1. *Crankcase half*
2. *Plain bearing remover/installer (P/N 529 035 917)*
3. *Crankcase support sleeve (P/N 529 036 031)*

Plain Bearing Installation

CAUTION: Unless otherwise instructed, never use hammer to install ball bearings or plain bearings. Use press only.

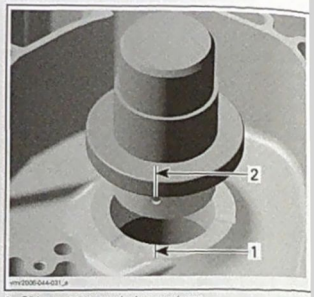
Install plain bearings with the plain bearing remover/installer (P/N 529 035 917) in a cool crankcase. Do not lubricate plain bearings and/or crankcase for installation.

NOTE: Place the proper crankcase support sleeve under crankcase halves before installing the plain bearings (refer to *BEARING REMOVAL PROCEDURE*).

Carefully press-in the plain bearings in the same direction as during disassembly, from the crankcase inside towards the outside.

During reassembly, make sure not to damage the sealing surfaces of the crankcase halves.

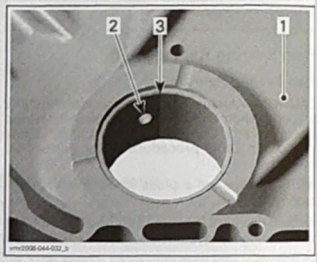
CAUTION: Mark position of oil bore on crankcase half and on plain bearing remover/installer. Align mark on plain bearing remover/installer with mark on crankcase half.



1. *Oil bore position marked on crankcase*
2. *Oil bore position marked on plain bearing remover/installer*

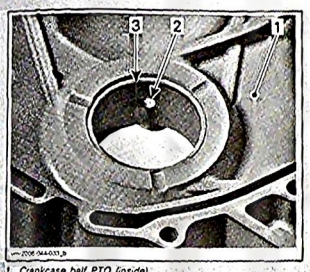
NOTE: Wrong oil bore position will stop oil supply to plain bearings and will cause engine damage.

CAUTION: The partition of the plain bearings in crankcase half MAG side must be positioned near to oil bore in clockwise direction (refer to no. 3 in next illustration).



1. *Crankcase half MAG (inside)*
2. *Oil bore*
3. *Partition*

CAUTION: The partition of the plain bearings in crankcase half PTO side must be positioned near to oil bore in counterclockwise direction (refer to no. 3 in next illustration).



1. Crankcase half PTO (inside)
2. Oil bore
3. Partition

NOTE: Use an O-ring (42 mm diameter x 1 to 1.5 mm (.04 to .06 in) thickness) to hold plain bearings in place during installation. The O-ring will disappear in the groove of the plain bearing remover/installer.

Crankcase Assembly

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.

Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

Install a **NEW** crankcase gasket.

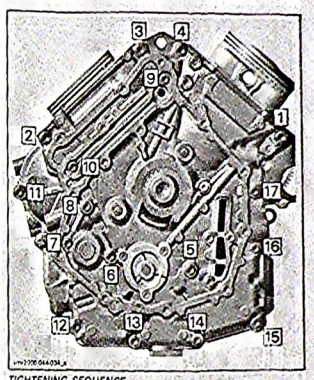
Oil the plain bearings before mounting the crankshaft.

Install the crankshaft. Refer to *CRANKSHAFT* for proper procedure.

Reinstall engine oil strainer. Apply Loctite 243 (P/N 293 800 060) to retaining plate screws.

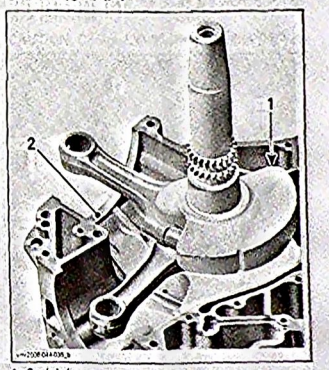
Reinstall water pump shaft shafts/gears (refer to *COOLING SYSTEM* section).

Tightening sequence for screws on crankcase is as per following illustration.



TIGHTENING SEQUENCE

CRANKSHAFT



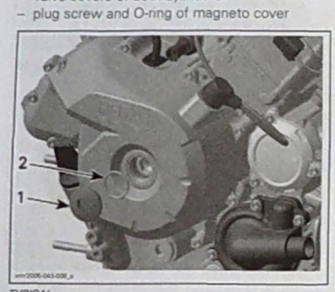
1. Crankshaft
2. Crankcase MAG

Crankshaft Locking Procedure

NOTE: When crankshaft is locked, the rear piston (cylinder 2, rear) is at TDC ignition. Crankshaft can not be locked at cylinder 1 (front) TDC.

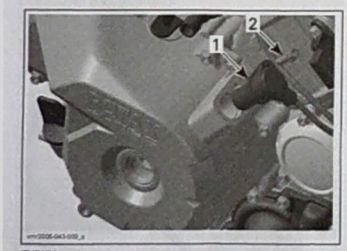
Remove:

- spark plug cable and spark plug of both cylinders
- valve covers of both cylinders
- plug screw and O-ring of magneto cover



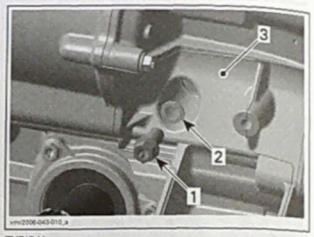
TYPICAL
1. Plug screw
2. O-ring

- crankshaft position sensor



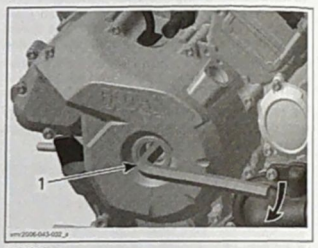
TYPICAL
1. Crankshaft position sensor
2. Screw

- plug screw with sealing ring.



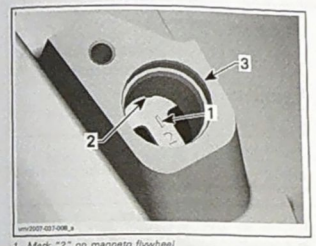
TYPICAL
1. Plug screw
2. Sealing ring
3. Crankcase PTO side, front side

Use a 14 mm Allen key to turn crankshaft until piston 2, rear is at TDC ignition.



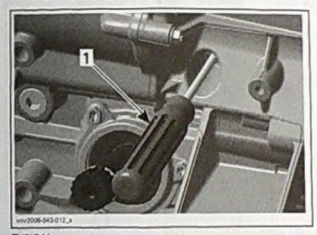
TYPICAL
1. Allen key 14 mm

When rear piston is at TDC ignition, marks on magneto flywheel "2" and on the magneto cover are aligned.



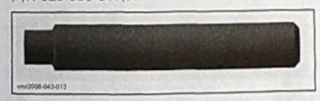
1. Mark "2" on magneto flywheel
2. Notch on magneto cover
3. Crankshaft position sensor location

Use a screwdriver to check if the groove in the crankshaft is aligned with the hole.



TYPICAL
1. Screwdriver

Lock crankshaft with the crankshaft locking bolt (P/N 529 035 617).





TYPICAL
1. Crankshaft locking bolt

Crankshaft Removal

Refer to *CRANKCASE*.

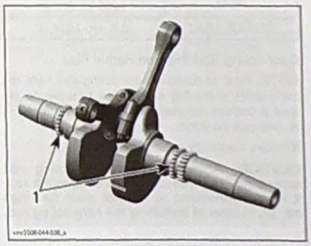
NOTE: It is recommended to verify crankshaft axial play before splitting the crankcase. Refer to *CRANKSHAFT INSPECTION*.

Crankshaft Inspection

Check crankshaft plain bearings as explained in *CRANKCASE*.

Replace crankshaft if the gears are worn or otherwise damaged.

CAUTION: Components with less than the service limit always have to be replaced. If this is not observed, severe damage may be caused to the engine.



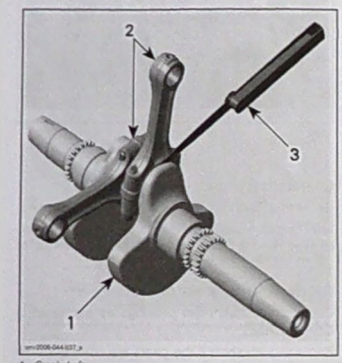
1. Crankshaft timing gears

Connecting Rod Small End Radial Clearance

Refer to *CYLINDER AND HEAD* section.

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rods and crankshaft counterweight. If the distance exceeds specified tolerance, replace the crankshaft.



1. Crankshaft
2. Connecting rods
3. Feeler gauge

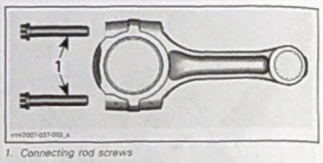
CONNECTING ROD BIG END AXIAL PLAY	
NEW	0.200 to 0.500 mm (.008 to .020 in)
SERVICE LIMIT	0.6 mm (.024 in)

Connecting Rod Big End Radial Play

NOTE: Prior to remove connecting rod from the crankshaft, mark big end halves together to ensure a correct reinstallation (cracked surface fits in only one position).

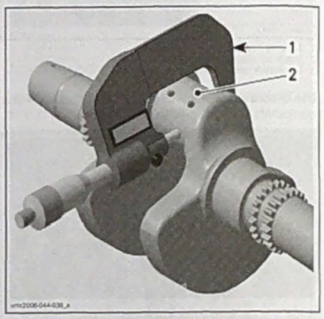
Remove connecting rods from crankshaft.

CAUTION: Always replace connecting rod screws no. 11 if removing the connecting rod. It is recommended to replace plain bearings no. 12, in case of installing the connecting rod.



1. Connecting rod screws

Measure crankpin. Compare to inside diameter of connecting rod big end.

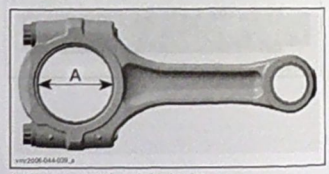


1. Micrometer
2. Crankpin area for plain bearing

To measure the connecting rod big end diameter, use the **OLD** screws **no. 11**.

Install the **OLD** plain bearings **no. 12** as they were mounted initially.

Do the torque procedure as described further.



A. Connecting rod big end plain bearing

CRANKSHAFT PIN DIAMETER	
NEW	40.009 to 40.025 mm (1.5752 to 1.5758 in)
SERVICE LIMIT	39.990 mm (1.5744 in)
CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	40.100 mm (1.5787 in)
CONNECTING ROD BIG END RADIAL CLEARANCE	
SERVICE LIMIT	0.09 mm (.0035 in)

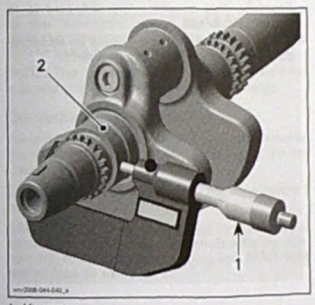
Crankshaft Axial Play

Measure crankshaft axial play on PTO end using a dial indicator. If the distance exceeds specified tolerance, replace crankcase and/or crankshaft.

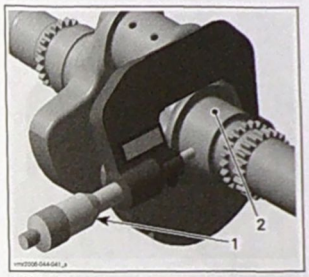
CRANKSHAFT AXIAL PLAY	
NEW	0.200 to 0.500 mm (.008 to .020 in)
SERVICE LIMIT	0.6 mm (.024 in)

Crankshaft Radial Play MAG/PTO Side

Measure crankshaft on MAG/PTO side. Compare to inside diameter of MAG/PTO plain bearing (refer to *CRANKCASE*).



1. Micrometer
2. Crankshaft area for MAG plain bearing



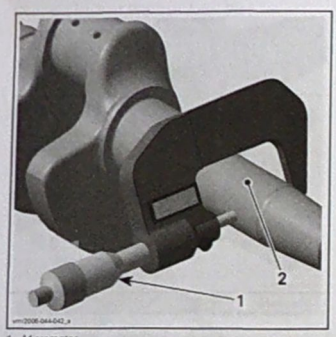
1. Micrometer
2. Crankshaft area for PTO plain bearing

CRANKSHAFT MAG/PTO SIDE DIAMETER	
NEW	42.024 to 42.040 mm (1.6545 to 1.6551 in)
SERVICE LIMIT	42.000 mm (1.6535 in)

CRANKSHAFT MAG/PTO SIDE RADIAL CLEARANCE	
SERVICE LIMIT	0.07 mm (.0031 in)

Crankshaft Radial Play (PTO side support bearing)

Measure crankshaft journal of PTO support bearing. Compare to inside diameter of PTO support bearing in PTO cover (refer to *PTO COVER*).



1. Micrometer
2. Crankshaft journal (PTO support bearing)

CRANKSHAFT JOURNAL DIAMETER (PTO support bearing)	
NEW	34.024 to 34.040 mm (1.3395 to 1.3402 in)
SERVICE LIMIT	34.010 mm (1.3390 in)

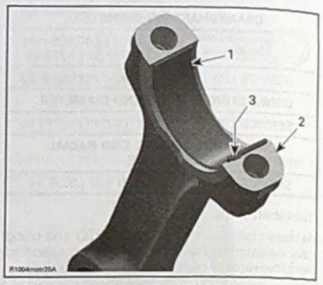
CRANKSHAFT PTO SUPPORT BEARING RADIAL CLEARANCE	
SERVICE LIMIT	0.10 mm (.0039 in)

Crankshaft Assembly

For assembly, reverse the disassembly procedure. Pay attention to following details.

NOTE: Use **NEW** plain bearings **no. 12**, when connecting rod big end diameter is out of specification.

Put plain bearings correctly in place and clean the split surface on both sides (cracked area) carefully with compressed air.

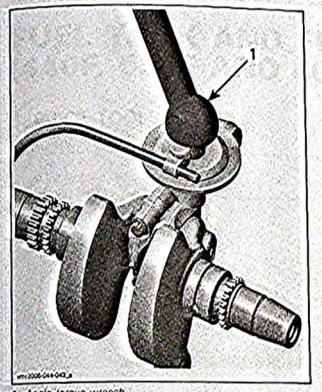


1. Half plain bearing of connecting rod big end
2. Split surface of the connecting rod
3. Nose of plain bearing in line with connecting rod groove

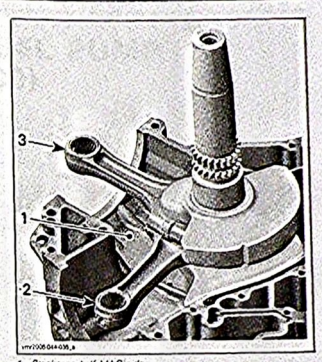
NOTE: Oil the plain bearing surface of the connecting rod and crank pin before installation.

Torque **NEW** connecting rod screws **no. 11** as per following procedure:

- First, install screws with half of the recommended torque. Do not apply any thread locker.
- Secondly, torque connecting rod screws to 20 N•m (15 lbf•ft).
- Finish tightening the screws with an additional 60° turn using an angle torque wrench.



1. Angle torque wrench



1. Crankcase half MAG side
2. Connecting rod cylinder 1
3. Connecting rod cylinder 2

CAUTION: Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. The plain bearing tapered end must be against the counterweight. Besides, as the "crankpin" screw has been stretched from the previous installation, it is very important to **use a NEW screw at assembly.**

NOTE: The running direction of the big end bearings and of the piston pins must not change.

Crankshaft Installation

For installation of crankshaft in crankcase reverse the removal procedure. Pay attention to the following details.

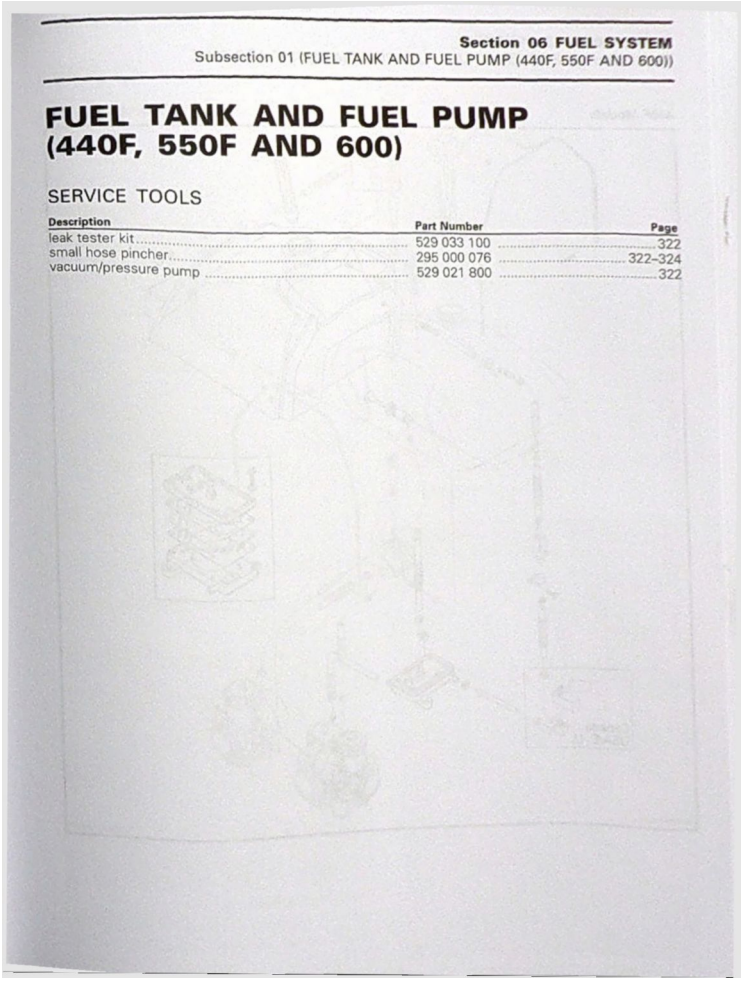
Do not mix up the connecting rods of cylinders 1 and 2 during installation.

CAUTION: Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod MAG side has to face to cylinder 1.

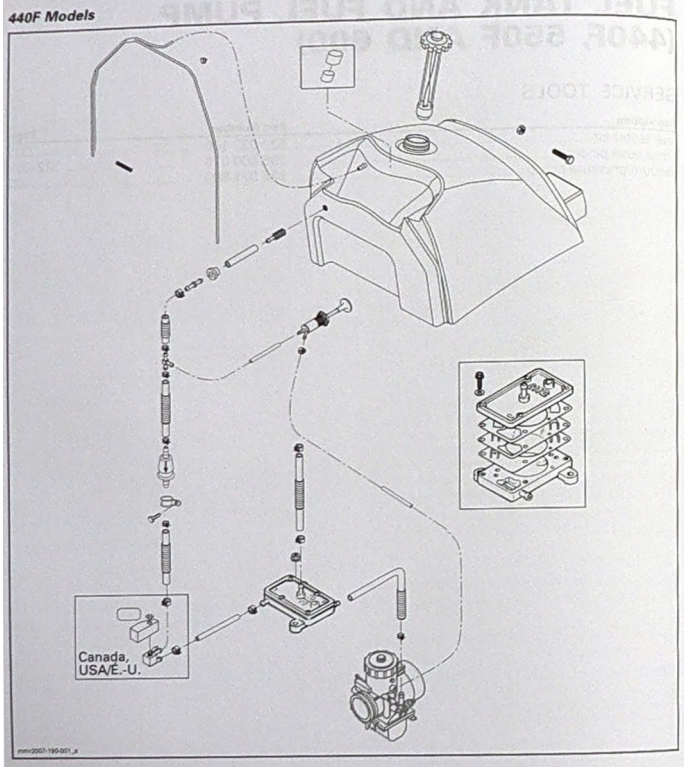
FUEL TANK AND FUEL PUMP (440F, 550F AND 600)

SERVICE TOOLS

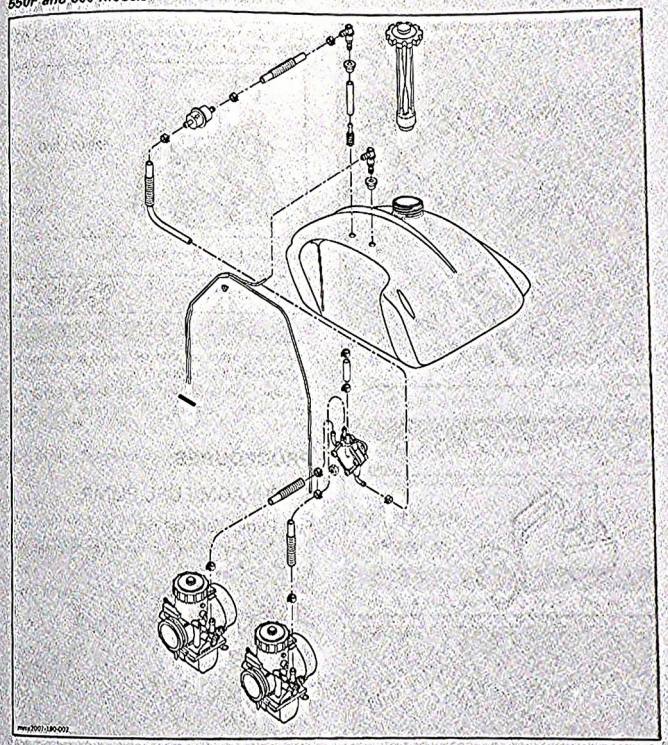
Description	Part Number	Page
leak tester kit	529 033 100	322
small hose pincher	295 000 076	322-324
vacuum/pressure pump	529 021 800	322



440F Models



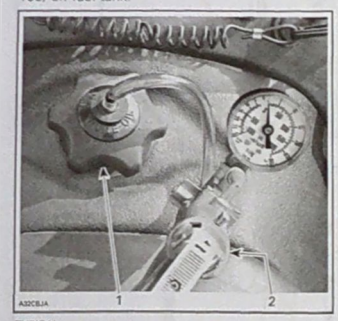
550F and 600 Models



INSPECTION

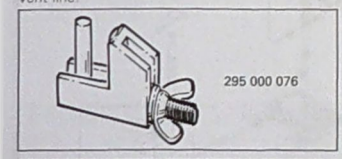
FUEL SYSTEM LEAK TEST

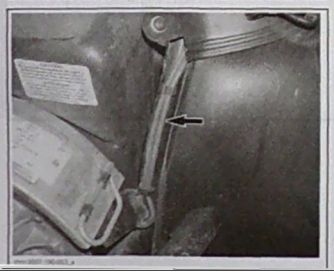
Install the test cap of leak tester kit (P/N 529 033 100) on fuel tank.



TYPICAL
1. Test cap on tank
2. Vacuum/pressure pump

Install a small hose pincher (P/N 295 000 076) on vent line.





On applicable models, ensure primer button is fully depressed.

Using the vacuum/pressure pump (P/N 529 021 800), inject air into fuel tank.



Pressurize fuel system as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

If pressure drops, locate fuel leak(s) and repair or replace leaking component(s).

To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

PROCEDURES

DIAPHRAGM FUEL PUMP

Fuel Pump Verification

Check fuel pump valves operation as follows:

Empty fuel tank.

NOTE: For the following test, ensure hoses have a tight fit.

Disconnect outlet hose from fuel tank.

Alternately apply pressure and vacuum with vacuum/pressure pump (P/N 529 021 800) to disconnected hose. The inlet valve should release with pressure and hold under vacuum.

Disconnect inlet hose from carburetor.

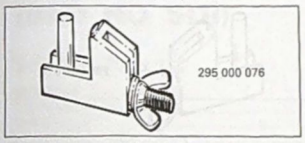
Repeat the same procedure to disconnected hose. This time the outlet valve should hold with pressure and release under vacuum.

Fuel Pump Removal

Remove the air intake silencer and carburetor(s).

NOTE: Do not disconnect cables from carburetor(s).

Install a small hose pincher (P/N 295 000 076) on fuel supply line close to pump inlet.



Disconnect fuel inlet and outlet hoses.

Disconnect impulse line.

Remove screws securing fuel pump to chassis.

Fuel Pump Installation

Inverse removal procedure. However, pay attention to the following.

Install hoses using arrows on pump that shows direction of fuel flow.

⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

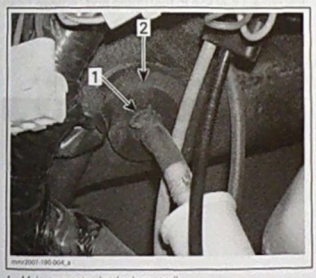
IN-TANK FUEL STRAINER

Strainer Replacement

Drain fuel tank.

Remove clamp and unplug supply hose.

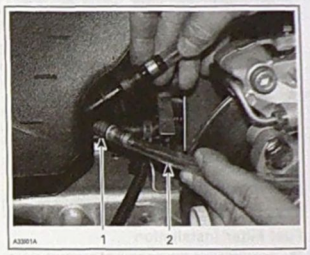
Pull out male connector from grommet.



mmr2007-190-004_a

1. Male connector (under hose end)
2. Grommet

Pull out grommet from fuel tank then, pull out pick-up hose and fuel strainer.



TYPICAL
1. Fuel strainer
2. Pickup hose

Replace fuel strainer and grommet.

To facilitate the installation, grommet should be on smaller diameter of male connector.

Install grommet on fuel tank and push male connector through grommet.

⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

FUEL FILTER

Fuel Filter Removal

⚠ WARNING

Work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery prior to working on the fuel system.

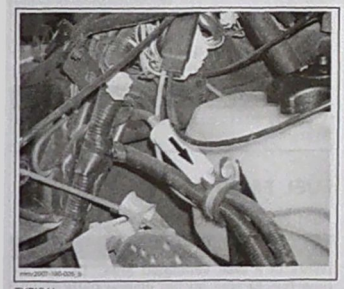
Disconnect both ends of fuel filter line.



Fuel Filter Installation

The installation is the reverse of removal procedure. However, pay attention to the following.

Install filter with the arrow pointing in the direction of fuel flow.



TYPICAL

⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

FUEL TANK

Fuel Tank Removal

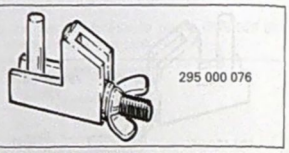
Remove air intake silencer.

Remove console.

Remove seat base from body.

Remove fuel tank cap.

Empty fuel tank and install a small hose pincher (P/N 295 000 076) on fuel line.



⚠ WARNING

Whenever a fuel line is disconnected, obstruct line with a hose pincher. Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

Unplug fuel line from fuel pump.

Unplug primer tube if applicable.

Unplug vent tube from tank.

Remove fuel tank.

Fuel Tank Installation

Properly reinstall fuel tank.

Reconnect vent tube.

⚠ WARNING

Make sure vent tube is not kinked.

Reconnect fuel line to fuel pump and remove hose pincher.

Reconnect primer tube.

Reinstall seat base.

Connect fuel line and remove hose pincher.

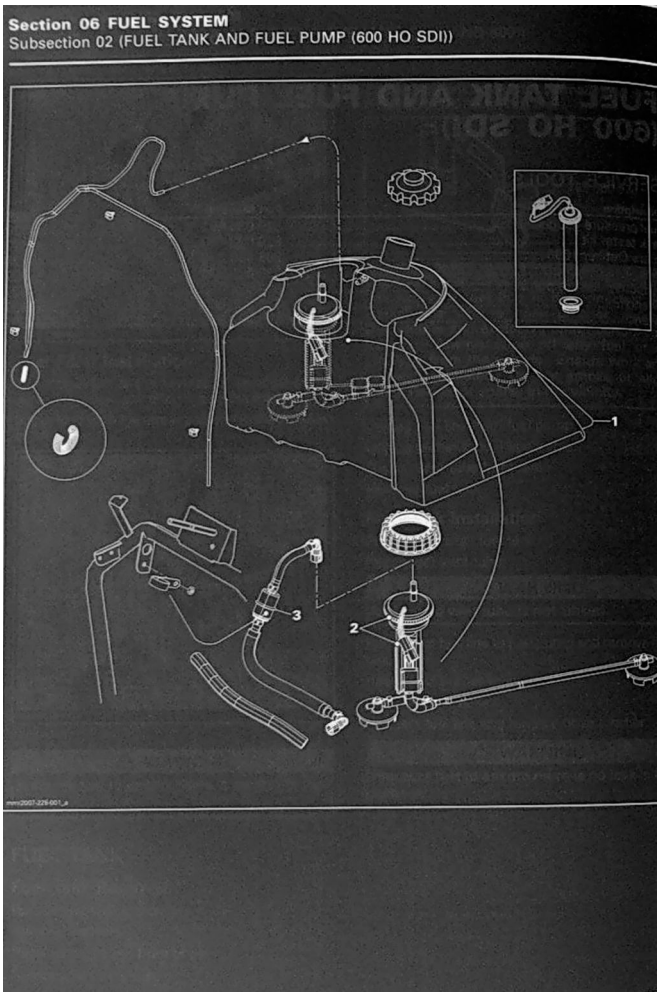
⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

FUEL TANK AND FUEL PUMP (600 HO SDI)

SERVICE TOOLS

Description	Part Number	Page
fuel pressure gauge	529 035 591	328
leak tester kit	529 033 100	327
pliers Oetiker 1099	295 000 070	328
small hose pincher	295 000 076	327
vacuum/pressure pump	529 021 800	327
wrench	529 035 603	329, 332
wrench	529 035 899	330, 332


1
2
3

INSPECTION

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

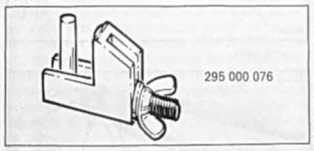
FUEL SYSTEM LEAK TEST

Install the test cap of leak tester kit (P/N 529 033 100) on fuel tank.



TYPICAL
1. Test cap on tank
2. Vacuum/pressure pump

Install a small hose pincher (P/N 295 000 076) on vent line.





TYPICAL

Using the vacuum/pressure pump (P/N 529 021 800), inject air into fuel tank.



Pressurize fuel system as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

If pressure drops, locate fuel leak(s) and repair or replace leaking component(s).

To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

FUEL PRESSURE TEST

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for connections. In B.U.D.S., refer to the **Activation** tab.

⚠ WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

Install fuel pressure gauge (P/N 529 035 591) between disconnected hose (in-line installation).



Remove tether cord cap. Depress START/RER button and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using B.U.D.S. between tests so that the gauge is "reset" to zero (0).

FUEL PRESSURE (when depressing START/RER button)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace fuel pressure regulator.

NOTE: For resolving a fuel pressure problem, refer to *TROUBLESHOOTING* in this section.

Release fuel pressure in the system using B.U.D.S. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for connections. In B.U.D.S., look in the **Activation** tab.

Remove pressure gauge and plastic clip. Reinstall fuel hose.

⚠ WARNING

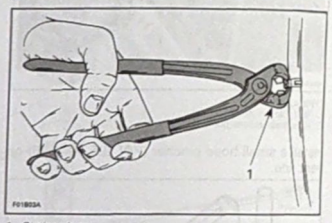
Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

PROCEDURES

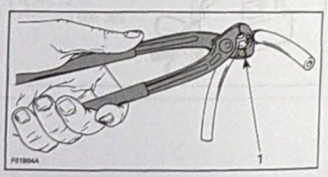
OETIKER CLAMPS

Clamp Replacement

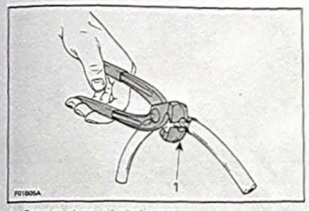
To secure or cut Oetiker clamps on fuel lines, use pliers Oetiker 1099 (P/N 295 000 070).



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

⚠ WARNING

Use of improper fuel lines could compromise fuel system integrity.

FUEL PUMP

Fuel Pump Electrical Test

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+ on BLUE/BLACK wire and – on WHITE wire) to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe BLUE/BLACK wire and battery ground of fuel pump connector on vehicle harness side. When depressing the START/RER button, you should read battery voltage for approximately 2 seconds (then, the voltage will drop). If battery voltage does not appear, the problem can be in fuse, relay(s), harness or in fuel pump connector. Repair or replace appropriate part (fuel pump may be blown).

Check continuity between WHITE wire of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector B. If there is no continuity the problem is in the harness. Otherwise, refer to *ENGINE CONTROL MODULE (ECM)* in the *ENGINE MANAGEMENT (SDI)* section.

Fuel Pump Removal

Open hood.

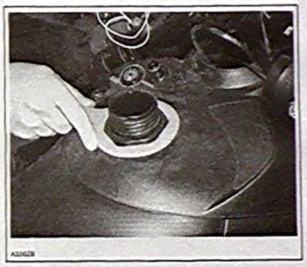
Release the fuel pressure in the system using B.U.D.S. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for connections. In B.U.D.S., refer to the **Activation** tab.

Drain fuel tank as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).



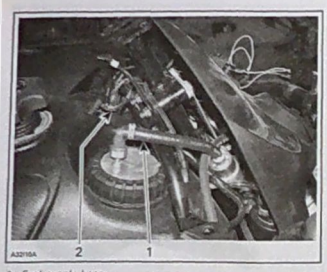


TYPICAL

Unbolt console, then move it forward.

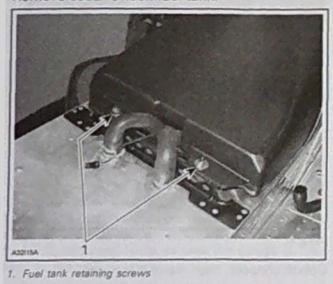
Disconnect fuel supply hose from fuel pump module no. 2.

Disconnect vent tube from vent elbow.



1. Fuel supply hose
2. Vent tube

Remove seat. Unbolt fuel tank.

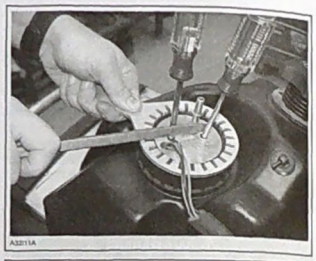


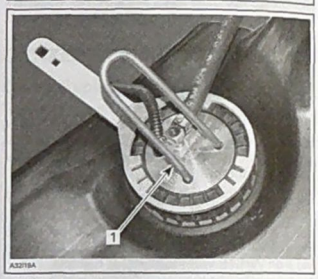
1. Fuel tank retaining screws

Move fuel tank rearward, then unplug the fuel pump module electric connector.

With two screwdrivers or a bent rod holding the flange, unscrew fuel pump nut using fuel pump nut wrench (P/N 529 035 899).







1. Bent rod

Pull fuel pump module out of fuel tank to expose sensor body.

Remove fuel pump module. Guide fuel pickups when pulling out fuel pickup hoses.

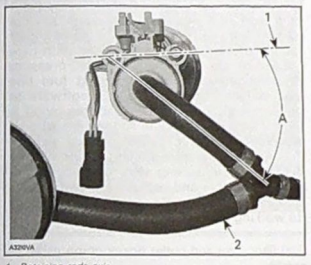


Fuel Pump Repair

Fuel Hose Kit

Unfasten blue hose clamp retaining old fuel hose assembly to pump inlet nipple. Remove old fuel hose assembly.

Install fuel hose assembly to pump at an angle of 46 ± 3° from retaining rods axis.



1. Retaining rods axis
2. Fuel hose ass'y
A. 46° ± 3

Install a new blue hose clamp on fuel hose assembly.

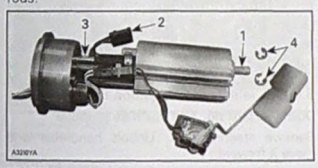
Pump Kit

Disconnect fuel hose from pump inlet nipple.

Disconnect pump electric connector.

Disconnect pump outlet hose from pump module flange nipple.

Remove E-clips. Slide pump ass'y out of retaining rods.



TYPICAL
1. Pump inlet nipple
2. Pump electric connector
3. Pump module flange nipple
4. E-clips

Reverse removal procedure for installation.

Regulator Kit

Remove 2 screws retaining regulator to pump module flange.

Replace O-rings with new ones. Install them in pump module flange bore.

CAUTION: Regulator O-rings must be installed in pump module flange bore.

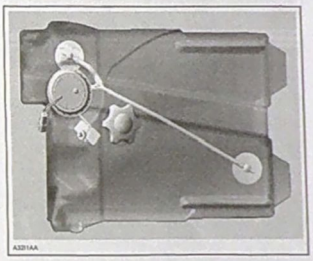
Reverse removal procedure for installation.

Fuel Pump Installation

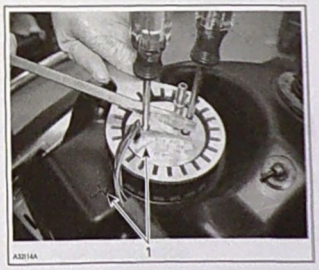
For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Make sure that rear pickup hose is positioned as per following illustration.

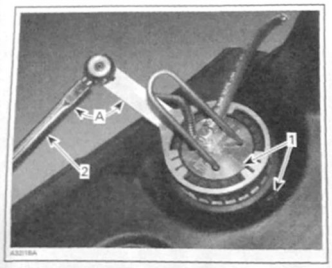


Align the arrow on fuel pump module with the one on fuel tank. Keep arrows aligned during fuel pump module nut tightening.



1. Arrows

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 30 N•m (22 lbf•ft).



A32118A

1. Arrows
2. Torque wrench
A. 90°

Bleed the fuel system as per following procedure.

Fuel Bleeding Procedure

The rear fuel pickup hose has to be bled.

Pour 12 L (3.17 U.S. gal.) of recommended fuel in the fuel tank.

Apply parking brake. Start the engine. Let it run at idle speed.

Lift the front of vehicle at a 45° angle.

Put the vehicle back on the ground.

Do the above procedure three times.

Stop the engine. The rear fuel pickup hose is now bled.

IN-TANK FUEL STRAINER

Strainer Replacement

Remove fuel pump as explained above.

Replace fuel strainers.

Reinstall fuel pump as explained above.

FUEL FILTER

Filter Replacement

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the B.U.D.S. software to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery prior to working on the fuel system.

Fuel filter, inlet and outlet hoses come as an assembly.

Use B.U.D.S. release the fuel pressure. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for connections.

Disconnect both ends of fuel filter line.

Unscrew the fuel filter support nut then remove the filter **no. 3**.

The installation is the reverse of removal procedure.

FUEL TANK

Fuel Tank Removal

Open hood.

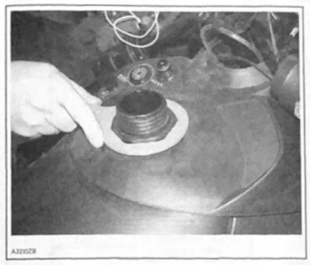
Release the fuel pressure in the system using B.U.D.S. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for connections. In B.U.D.S., refer to the **Activation** tab.

Drain fuel tank **no. 1** as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).



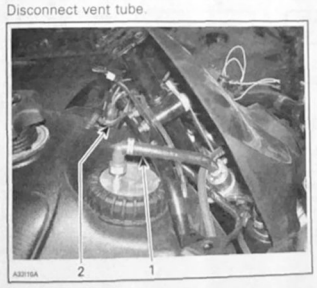


TYPICAL

Unbolt console, then move it forward.

Disconnect fuel supply hose from fuel pump **no. 2**.

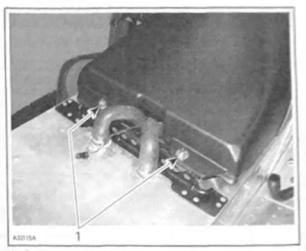
Disconnect vent tube.



1. Fuel supply hose
2. Vent tube

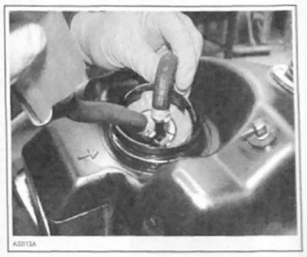
Remove seat.

Unbolt fuel tank.



1. Fuel tank retaining screws

Move fuel tank rearward, then unplug the fuel pump electric connector.



Remove fuel tank.

Fuel Tank Installation

Installation is the reverse of removal. However, pay attention to the following.

Properly reinstall and secure fuel tank.

Reconnect vent tube.

⚠ WARNING

Make sure vent tube is not kinked.

Reconnect fuel line to fuel pump and electrical connector.

Reinstall seat, handlebar and steering pad.

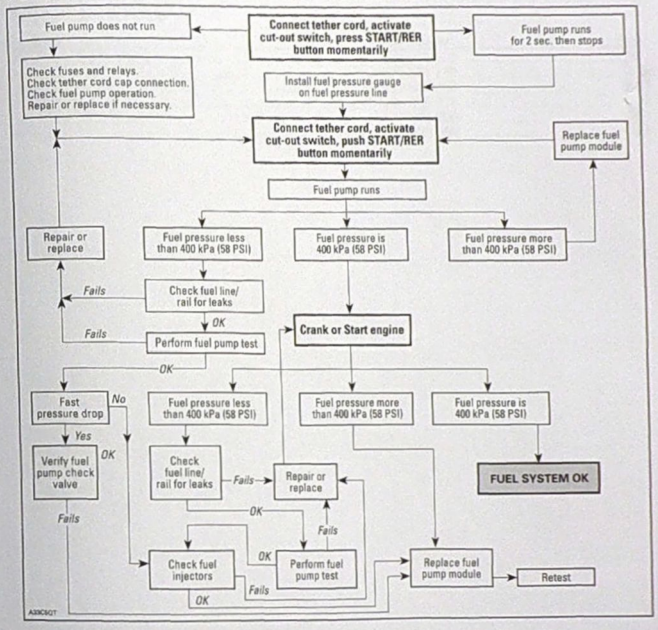
Bleed fuel pump rear pickup hose as described in *FUEL PUMP INSTALLATION*.

⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

TROUBLESHOOTING

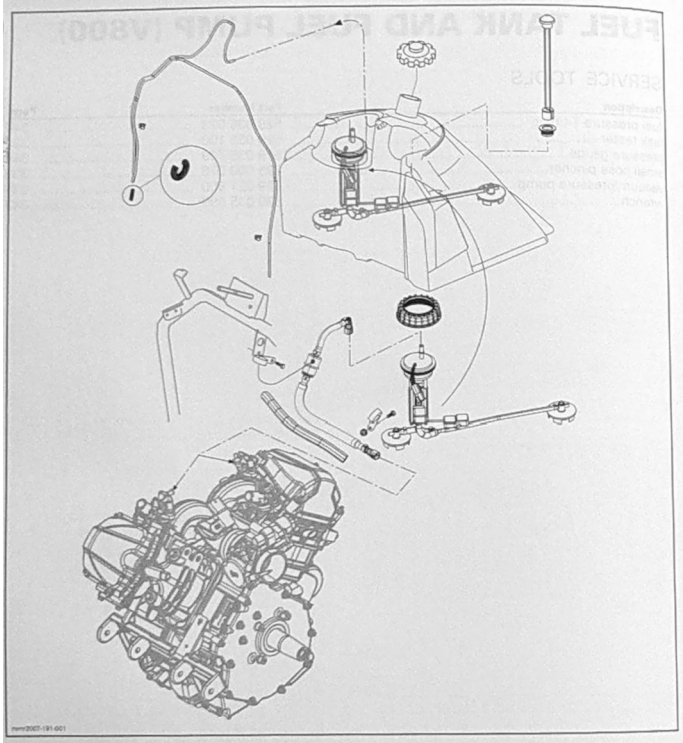
FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART



FUEL TANK AND FUEL PUMP (V800)

SERVICE TOOLS

Description	Part Number	Page
fuel pressure T-fitting	529 036 023	340
leak tester kit	529 033 100	339
pressure gauge	529 035 709	340
small hose pincher	295 000 076	339
vacuum/pressure pump	529 021 800	339
wrench	529 035 899	343

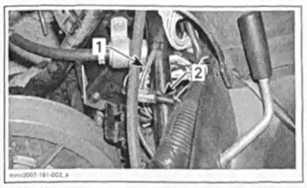

1

INSPECTION

FUEL SYSTEM LEAK TEST

Fill up fuel tank.

Install a small hose pincher (P/N 295 000 076) on vent line.



1. Vent line
2. Small hose pincher

Install the test cap of leak tester kit (P/N 529 033 100) on fuel tank.

Install the vacuum/pressure pump (P/N 529 021 800) on test cap.



TYPICAL
1. Test cap on tank
2. Air pump

Pump air to pressurize fuel tank as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

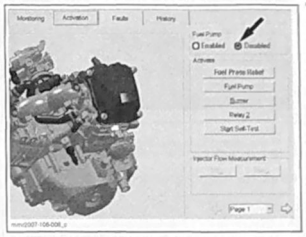
If pressure drops, locate fuel leak(s) and repair/replace leaking component(s).

To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

FUEL PRESSURE TEST

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Disable fuel pump using B.U.D.S. Look in the **Activation** tab.



Release fuel pressure by running engine until it runs out of gas.

⚠ WARNING

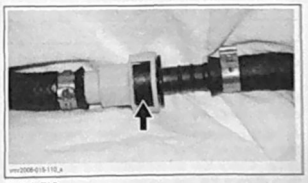
The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

Ensure there is no leak from hoses and fittings. Repair any leak.

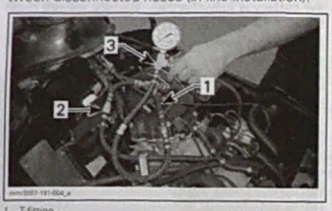
Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.



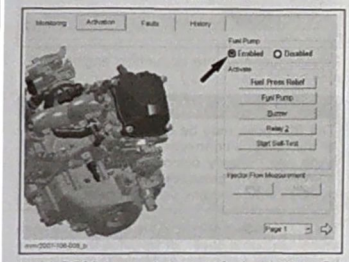
PRESS TAB

Install the fuel pressure T-fitting (P/N 529 036 023) and the pressure gauge (P/N 529 035 709) between disconnected hoses (in-line installation).



1. *T-fitting*
2. *T-fitting adapter (spare part P/N 513 033 135)*
3. *Pressure gauge connected to T-fitting*

Re-enable fuel pump using B.U.D.S.



Install DESS key and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using valve on fuel gauge. Ensure gauge is "reset" to zero (0).

FUEL PRESSURE (when installing DESS key)
345 ± 20 kPa (50 ±3 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, the fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace the fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace the fuel pump.

NOTE: For resolving a fuel pressure problem, refer to *TROUBLESHOOTING* in this section.

Release fuel pressure from fuel gauge valve.

Remove pressure gauge and T-fitting from inlet hose.

Reconnect inlet hose.

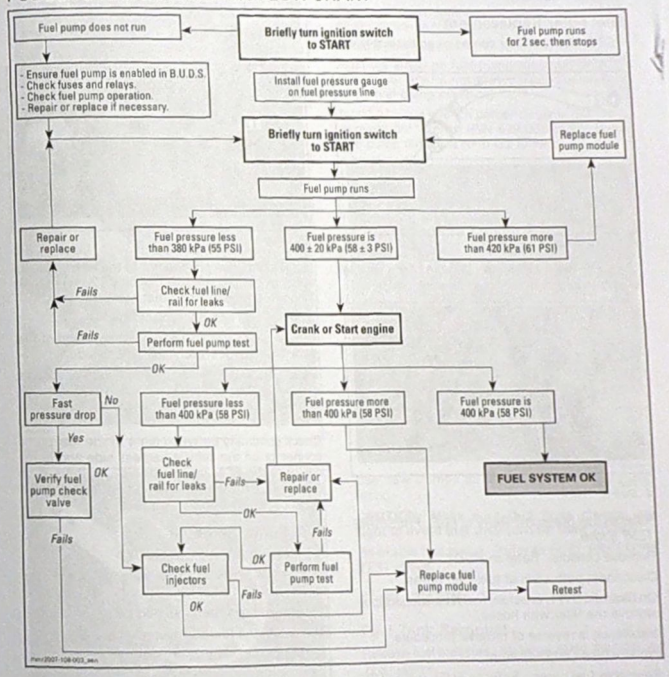
⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

TROUBLESHOOTING

FUEL SYSTEM DIAGNOSTIC FLOW CHART

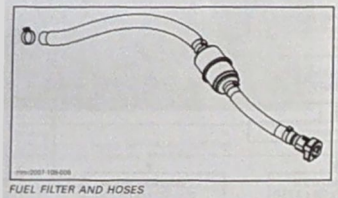


PROCEDURES

FUEL FILTER

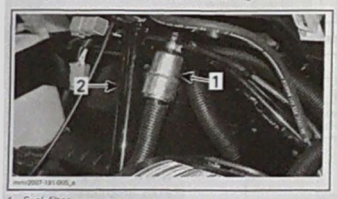
Fuel Filter Replacement

NOTE: The fuel filter comes as an assembly with the hoses.



FUEL FILTER AND HOSES

The fuel filter is located on LH side of the vehicle in engine compartment near steering column.



1. Fuel filter
2. Steering column

Release fuel pressure. Refer to *FUEL PRESSURE TEST* above.

Remove console. Refer to *BODY*.

Disconnect both ends of fuel filter hoses.

On **Skandic SWT**, unscrew fuel filter support then remove the filter with hoses.

Installation is reverse of removal procedure.

Install a new Oetiker clamp.

Re-enable fuel pump. Refer to *FUEL PRESSURE TEST* above.

FUEL PUMP

Fuel Pressure Test

Refer to *INSPECTION* in this section.

Fuel Pump Electrical Test

NOTE: Ensure fuel pump is enabled in B.U.D.S.

Install DESS key. The fuel pump should run for 2 seconds to build up the pressure in the system.

If pump does not work, remove console and disconnect its plug connector.



1. Fuel pump connector

Install a temporary connector to the suspected fuel pump connector to test. Apply 12 V (+) on pin 3 and (–) on pin 4 to this test harness.

If pump does not run, replace it.

Otherwise, probe pin 3 and battery ground of fuel pump connector on vehicle harness side.

Install DESS key. You should read battery voltage; otherwise, the problem can be in fuse 4, relay R1, harness or in fuel pump connector. Repair or replace appropriate part.

Check continuity between pin 4 of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector "B". If there is no continuity the problem is in the harness. Otherwise, try a new ECM.

Fuel Pump Removal

Remove console, refer to *BODY*.

Release fuel pressure and disable fuel pump. Refer to *FUEL PRESSURE TEST* above.

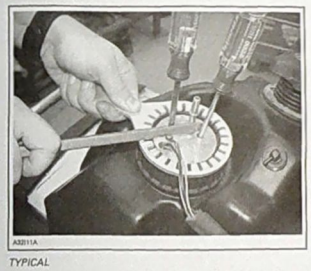
Disconnect hose from fuel pump.

Disconnect the fuel pump connector.

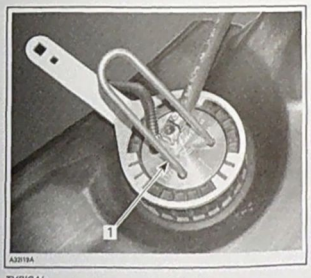


1. Fuel pump hose
2. Fuel pump connector

With two screwdrivers or a bent rod holding the flange, unscrew the fuel pump nut using fuel pump nut wrench (P/N 529 035 899).



TYPICAL



TYPICAL
1. Bent rod

Remove fuel pump assembly.

Fuel Pump Installation

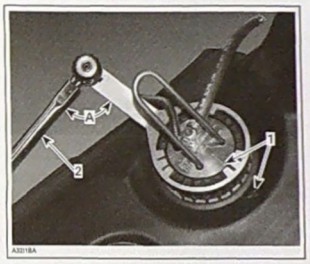
For installation, reverse the removal process but pay attention to the following.

Ensure to insert strainer to the rearmost and left most position in fuel tank.

Install a new gasket.

Align the arrow on fuel pump assembly with the one on fuel tank. Keep arrows aligned when tightening fuel pump assembly.

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 43 N•m (32 lbf•ft).



TYPICAL
1. Arrows
2. Torque wrench
A. 90°

Use new clamps to secure hoses to fuel pump fitting.

CAUTION: Make sure that hose clamps are tight to avoid that they turn on their fittings.

Re-enable fuel pump. Refer to *FUEL PRESSURE TEST* above.

FUEL TANK

Fuel Tank Removal

Release fuel pressure. Refer to *FUEL PRESSURE TEST* above.

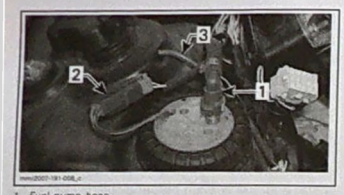
Remove console. Refer to *BODY*.

Unscrew seat support and move it rearward.

Disconnect outlet hose from fuel pump.

Disconnect the fuel pump connector.

Unplug vent tube from tank.



1. Fuel pump hose
2. Fuel pump connector
3. Vent tube

Remove fuel tank and set it aside.

Fuel Tank Installation

Installation is the reverse of removal procedures. However, pay attention to the following.

Ensure to plug vent tube.

⚠ WARNING

Make sure vent tube is not kinked.

Connect fuel pump hose and fuel pump connector.

Re-enable fuel pump. Refer to *FUEL PRESSURE TEST* above.

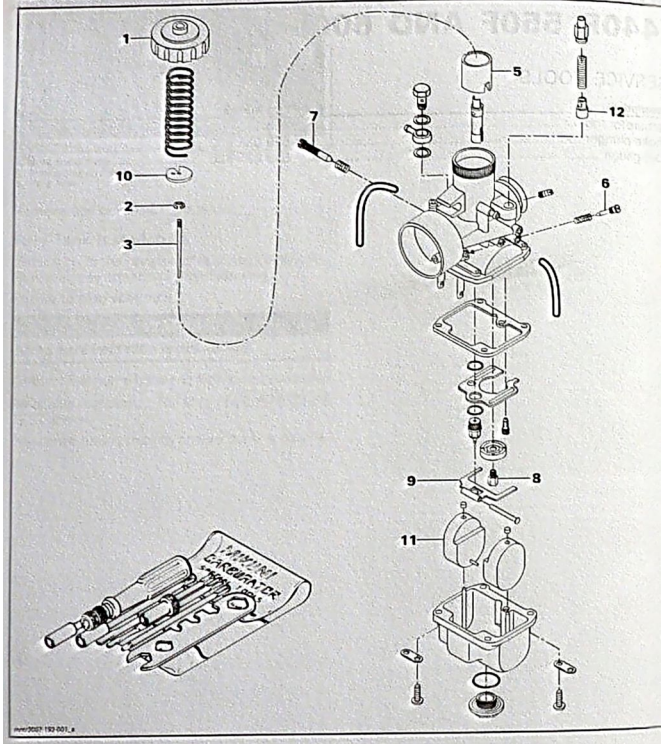
Pressurize fuel system to ensure there is no leak.

VM CARBURETORS (440F, 550F AND 600)

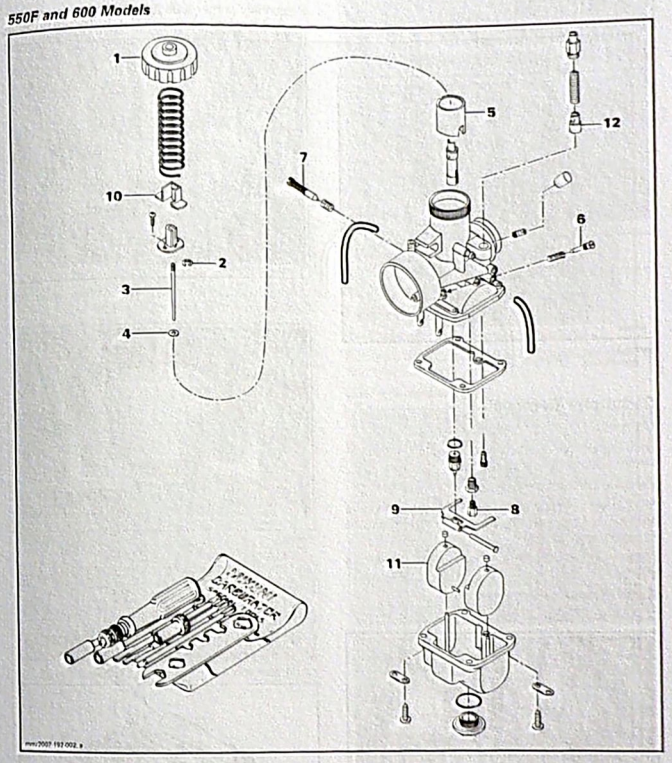
SERVICE TOOLS

Description	Part Number	Page
carburetor tool kit	404 112 000	348-349
choke plunger tool	529 035 602	356
float gauge	529 035 520	351

440F Models



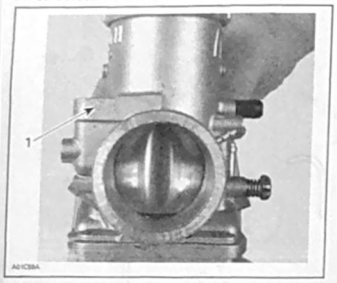
550F and 600 Models



CARBURETOR

Carburetor Identification

All carburetors are identified on their body.



TYPICAL
1. Identification: 34-617

Carburetor Removal

Lift hood.

Loosen/remove clamp(s) retaining air intake silencer adapter to carburetor(s).

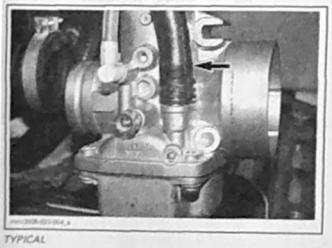
Remove the air intake silencer.

NOTE: When applicable, the following procedure applies to both carburetors. Carburetors can be removed individually.

Loosen clamp retaining carburetor to intake adapter.

Remove carburetor from engine.

Disconnect fuel inlet line.

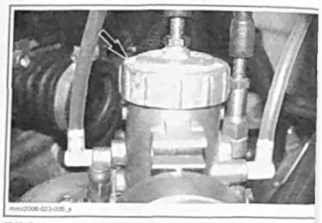


TYPICAL

Disconnect primer tube if applicable.



Unscrew carburetor cover **no. 1** then pull o throttle slide **no. 5** from carburetor.



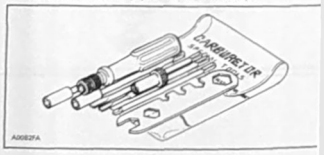
TYPICAL

Disconnect throttle cable from throttle slide.

Unscrew choke plunger from carburetor.

Carburetor Disassembly

NOTE: To ease the carburetor disassembly an assembly procedures it is recommended to us carburetor tool kit (P/N 404 112 000).



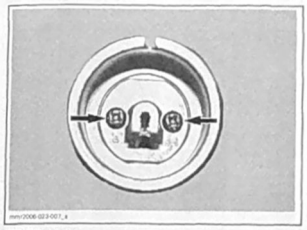
E-Clip and Jet Needle

440F Models

Raise spring and hold while removing retaining plate **no. 10** then, remove the jet needle **no. 3**.

550F and 600 Models

Remove screws from needle retaining plate **no. 10** to remove the jet needle **no. 3**.



All Models

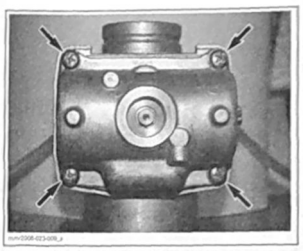
Remove jet needle with its E-clip.

Float Bowl

Unscrew drain plug of float bowl. Recover the remaining fuel in a container.



Unscrew the 4 screws retaining the float bowl to the carburetor body.



Remove float bowl.

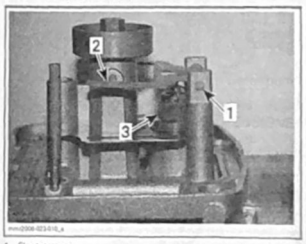
NOTE: Upon float bowl removal, make sure not to drop carburetor floats.

Needle Valve

Remove float bowl as explained above.

Pull out pin retaining float arm to carburetor body. Remove float arm.

Unscrew needle valve.

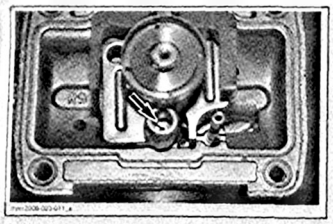


1. Float arm pin
2. Float arm
3. Needle valve

Pilot Jet

Remove float bowl as explained above.

Unscrew pilot jet **no. 8** using narrow screwdriver from carburetor tool kit (P/N 404 112 000).

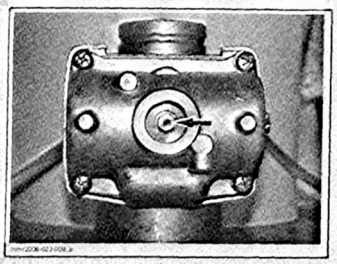


Main Jet

Remove float bowl as explained above.

Unscrew main jet from carburetor body.

NOTE: To replace main jet by a different size, main jet is accessible through the drain plug without removing float bowl.



Carburetor Cleaning

The entire carburetor should be cleaned with a general solvent and dried with compressed air.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and pilot/main jets should be cleaned in a carburetor cleaner following manufacturer's instructions.

⚠ WARNING

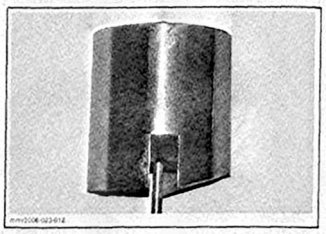
Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

Carburetor Inspection

Check inlet needle tip condition. If worn, the inlet needle and seat must be replaced as a matched set.

NOTE: Install needle valve for snowmobile carburetor only. It is designed to operate with a fuel pump system.

Check throttle slide **no. 5** for wear. Replace as necessary.



Check idle speed screw straightness. Replace as necessary.

Check for fuel soaked into float **no. 11**, replace as necessary.

Check float for cracks or other damages affecting free movement; replace as necessary.

Carburetor Assembly

The assembly is the reverse of the disassembly procedure. Pay attention to the following.

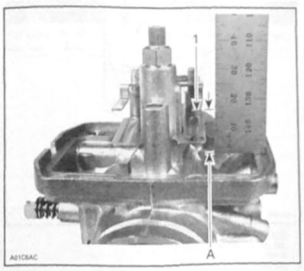
Float

Verify float adjustment after installation.

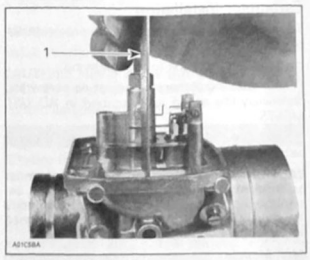
CAUTION: Spark plugs will foul if float is adjusted too low. Engine may be damaged if float is adjusted too high.

Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

- Make sure that float arm **no. 9** is symmetrical not distorted.
- With carburetor chamber upside-down on a level surface, measure height "H" between bowl seat and top edge of float arm. Keep ruler perfectly vertical and in line with main jet hole.

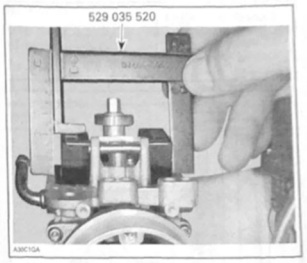


TYPICAL — VM TYPE
1. Measure from top of float arm
A. Float height (including float arm thickness)



TYPICAL — VM TYPE
1. Ruler vertical and in line with main jet

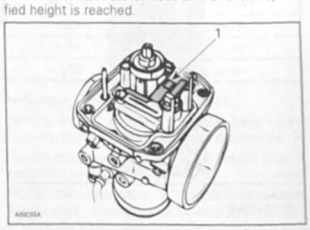
Float level height can be checked using float gauge (P/N 529 035 520). Keep tool in line with main jet as explained above.



MODEL	FLOAT HEIGHT mm ± 1.0 (in ± .039)
440F	35.5 (1.392)
550F	23.90 (.941)
600	18.1 (.713)

To Adjust Height

Bend the contact tab of float arm until the specified height is reached.



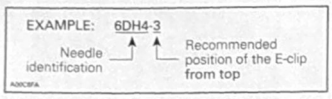
TYPICAL
1. Contact tab

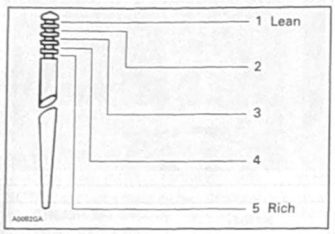
E-Clip and Jet Needle

Make sure E-clip is installed in the proper groove of jet needle.

The position of the needle in the throttle slide is adjustable by means of an E-clip **no. 2** inserted into 1 of 5 grooves located on the upper part of the needle. Position 1 (at top) is the leanest, 5 (at bottom) the richest.

NOTE: The last digit of the needle identification number gives the recommended calibrated position of the E-clip **from the top** of the needle.

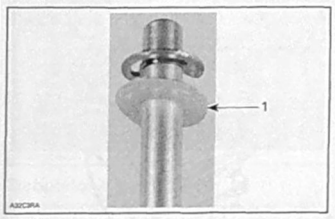




CLIP POSITIONS

Install the nylon packing **no. 4** underneath jet needle E-clip on all applicable throttle slides.

CAUTION: Serious engine damage can occur if this part is not installed.

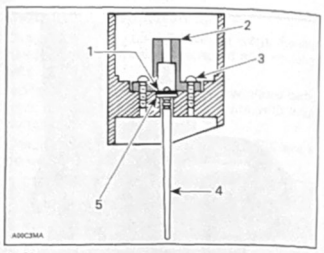


TYPICAL
1. Nylon packing

Install jet needle in throttle slide.

550F and 600 Models

When installing jet needle plate, do not obstruct hole in throttle slide.



1. Clip
2. Jet needle plate
3. Screw
4. Jet needle
5. Nylon packing

Carburetor Installation

To install carburetor on engine, inverse removal procedure.

However, pay attention to the following:

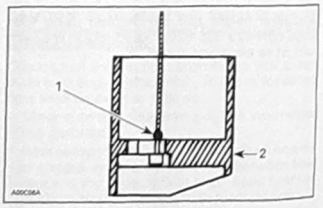
Prior to installing carburetor, adjust air screw and preliminary idle speed as described in *ADJUSTMENTS*.

On applicable models, make sure to align tab of carburetor with notch of intake adapter.

CAUTION: The rubber intake adapter must be checked for cracks and/or damage. At assembly, the intake adapter must be perfectly matched with carburetor and engine otherwise severe engine damage will occur.

440F Models

Hook throttle cable into throttle slide.



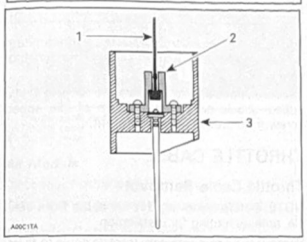
1. Throttle cable
2. Throttle slide

550F and 600 Models

Hook throttle cable into jet needle plate.

⚠ WARNING

Ensure throttle slide return spring is installed.



1. Throttle cable
2. Jet needle plate
3. Throttle slide

All Models

Install throttle slide with spring in carburetor.

CAUTION: Never allow throttle slide to snap shut. Be careful not to bent jet needle.

Tighten carburetor cap.

⚠ WARNING

Ensure throttle lever operates normally.

Carburetor Adjustments

NOTE: Carburetor is calibrated at the factory for a temperature of -20°C (0°F) at sea level. For colder temperature or high altitude applications, carburetor must be recalibrated. A Service Bulletin gives information about carburetor calibration according to altitude and temperature.

Adjustments should be performed following this sequence:

- float height
- jet needle
- air screw
- preliminary idle speed adjustment
- throttle cable and carburetor synchronization (twin carbs)
- choke cable
- final idle speed adjustment.

Float Height

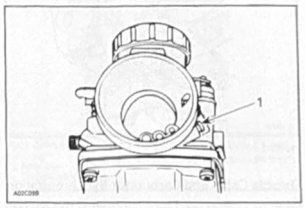
Refer to *ASSEMBLY* to verify float height.

Jet Needle

Refer to *ASSEMBLY* to position E-clip in the proper jet needle groove.

Air Screw

Completely close the **air screw no. 6** (until a slight seating resistance is felt) then back off as specified.



1. Air screw

NOTE: Turning screw in clockwise enriches mixture and conversely, turning it out counterclockwise leans mixture.

MODEL	AIR SCREW
440F	1-1/2 turns
550F	1/2 turn
600	2 turns

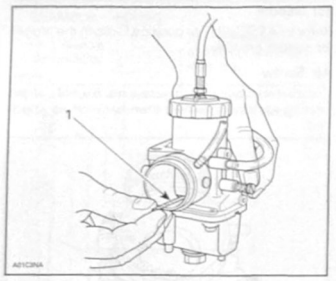
Preliminary Idle Speed Adjustment

Using a drill bit, adjust throttle slide height (see following table) by turning idle speed screw **no. 7**.

Throttle slide height is measured on outlet side of carburetor (engine side).

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly.

MODEL	IDLE THROTTLE SLIDE HEIGHT (drill bit size) ± 0.1 mm (± .004 in)
440F	1.4 (.055)
550F	1.6 (.063)
600	1.5 (.059)



TYPICAL
1. Drill bit used as gauge for throttle slide height

Throttle Cable and Carburetor Synchronization

Refer to *THROTTLE CABLE* further in this section for proper procedure.

Choke Cable

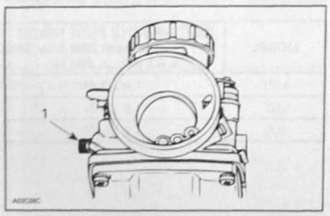
Adjust choke cable. Refer to *CHOKE CABLE* further in this section.

Final Idle Speed Adjustment

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked after each time carburetor idle is adjusted. Refer to *OIL INJECTION SYSTEM.*

Start engine and allow it to warm then adjust idle speed to specifications by turning **idle speed screw** clockwise to increase engine speed or counterclockwise to decrease it.

CAUTION: Do not attempt to set the idle speed by using the air screw. Severe engine damage can occur.



1. Idle speed screw

MODEL	IDLE SPEED (RPM)
440F	1650
550F and 600	1700

NOTE: Turn adjustment screw the same amount on each carburetor to keep carburetors synchronized.

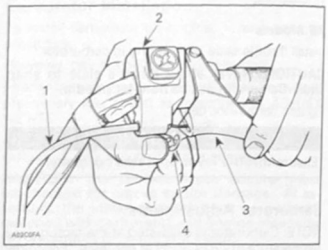
Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

THROTTLE CABLE

Throttle Cable Removal

NOTE: Before removing throttle cable from vehicle, note its routing for installation.

Remove the circlip retaining throttle cable to throttle cable housing.



1. Throttle cable housing
2. Throttle lever housing
3. Throttle lever
4. Circlip

Using long nose pliers to hold cable, push the end of cable out of its location in throttle lever.

Remove cable from throttle cable housing.

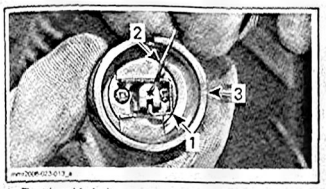
Unscrew carburetor cover then pull out throttle slide from carburetor.

440F Models

Raise spring and hold while removing retaining plate no. 10 then, remove the jet needle no. 3.

550F and 600 Models

Disconnect throttle cable from needle retaining plate.



1. Throttle cable lock
2. Throttle cable
3. Throttle slide

All Models

Disconnect cable end from oil pump.

Cut all locking ties and remove throttle cable.

Throttle Cable Inspection

Inspect throttle cable and housing for any damages. Replace as necessary.

Throttle Cable Installation

The installation is the reverse of the removal procedure.

CAUTION: Check that throttle cable is routed away from sharp edges, hot or vibrating parts.

Throttle Cable Adjustment

⚠ WARNING

Ensure the engine is turned OFF, prior to performing the throttle cable adjustment.

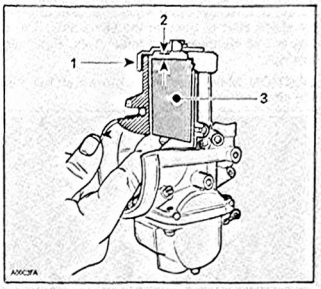
Carburetor(s) must be installed on engine and throttle cable properly routed.

Adjust throttle cable as per following procedure:

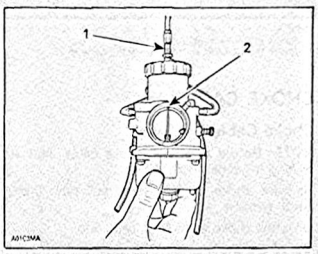
Loosen throttle cable housing adjusting and locking nuts.

While holding throttle lever to wide open throttle position, adjust throttle cable until cut-away lower edge is equal or 1.0 mm (.040 in) lower than the venturi bore on engine side. In this position, turn cable housing adjusting nut and tighten lock nut. Proceed on both carburetors if applicable.

CAUTION: If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. Cover
2. Free play
3. Throttle slide



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. Adjusting nut
2. Throttle slide flush or 1.0 mm (.040 in) lower than carburetor outlet bore (engine side)

Also ensure that, when throttle is released to idle position, the idle adjusting screw end touches its stopper. No tension should be applied to throttle cable.

CAUTION: Oil pump cable must be readjusted whenever throttle cable adjustment or idle speed are changed, otherwise serious engine damage may occur.

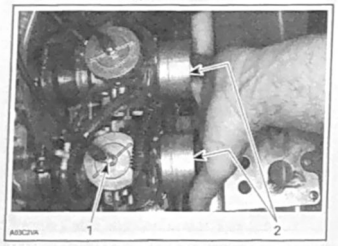
Carburetor Synchronization

550F and 600 Models

When depressing throttle lever, both carburetor slides must start to open at same time.

Screw or unscrew cable adjuster until all carburetor slides start to open at the same time. Cable play will be identical on all carburetors. Retighten jam nut.

CAUTION: Make sure carburetors start to operate simultaneously.



TYPICAL
1. Screw or unscrew adjuster
2. Check that all slides start to open at the same time

CHOKE CABLE

Choke Cable Removal

NOTE: Before removing choke cable, note its routing for installation.

Remove choke cable nut and pull cable underneath console.

Unscrew choke cable from carburetor.

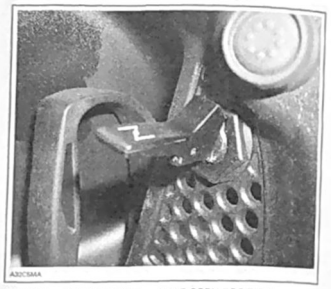
Cut all locking ties retaining cable and remove it from vehicle.

Choke Cable Installation

The installation is the reverse of the removal procedure.

Choke Cable Adjustment

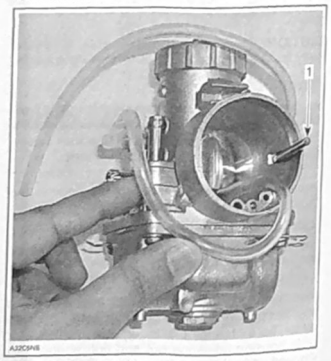
Set choke lever to half open position.



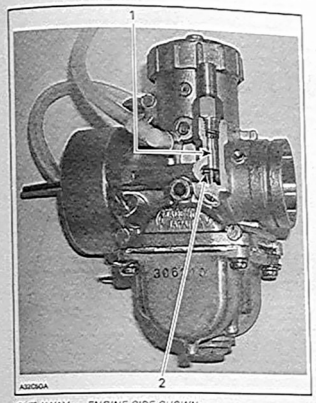
TYPICAL — CHOKE LEVER — HALF OPEN POSITION

Use choke plunger tool (P/N 529 035 602).

Insert the choke plunger tool into choke air inlet of carburetor. Tool stopper may not lean against recess wall.



AIR SILENCER SIDE SHOWN
1. Choke plunger tool



CUT-AWAY — ENGINE SIDE SHOWN
1. Choke plunger
2. Tool properly seated under choke plunger

If tool tip does not seat under choke plunger **no. 12**, adjust as follows:

Make sure choke lever is at half open position.

Turn choke cable adjustment nut by hand until tool properly seats under choke plunger.

NOTE: A light pressure should be needed to position tool under plunger.

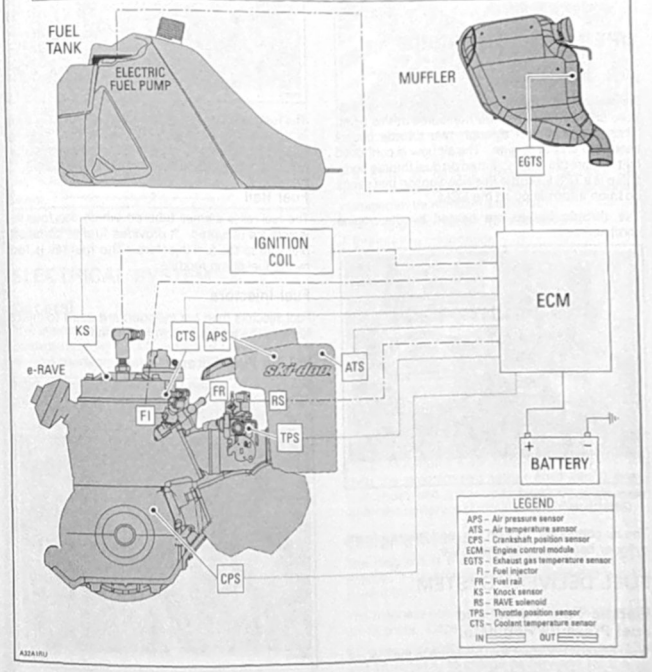
Tighten choke cable lock nut and reinstall protector cap.

Set choke lever to close and open positions and ensure that tool properly seats under plunger **only** when lever is set to half open position.

Set choke lever to close position and, by pulling and pushing choke lever, make sure there is no tension on cable (free play).

OVERVIEW

SEMI-DIRECT INJECTION SYSTEM OVERVIEW



GENERAL

There are 3 main systems in interaction with the engine management system:

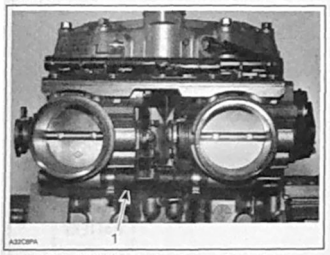
1. air induction system
2. fuel delivery system
3. electrical system.

OPERATING PRINCIPLE

AIR INDUCTION

Air flows through the air intake silencer. Air pressure and temperature are measured at this point. Then, air is drawn through two throttle bodies mounted on the engine. The air flow is controlled by two throttle plates. Fitted on dual throttle body, there is a TPS (Throttle Position Sensor) that sends position information to the ECM.

The throttle bodies are heated by the engine coolant.



THROTTLE BODY ASSEMBLY
1. Coolant hose

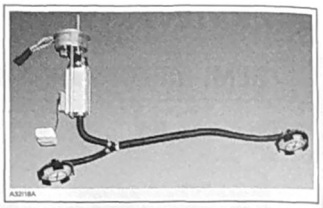
The air continues through the reed valves into the cylinder base then the crankcase.

FUEL DELIVERY SYSTEM

Electric Fuel Pump and Fuel Pressure Regulator

They provide constant fuel pressure to the fuel rail.

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel pressure regulator. The fuel pump inlet includes a filter.



The fuel pressure regulator controls the pressure in the system and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at 400 kPa (58 PSI).

Fuel Rail

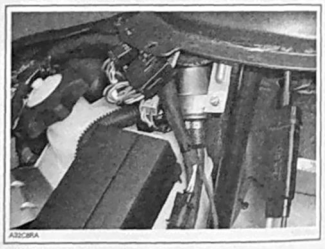
The fuel rail is a small tube on which the four injectors are mounted. It provides fuel at constant pressure to the fuel injectors. The fuel rail is fed by the fuel pump module.

Fuel Injectors

Fuel injectors (two per cylinder) are used to inject fuel into the transfer port of cylinder.

In-Line Fuel Filter

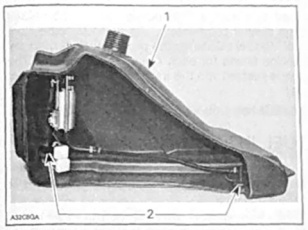
The in-line 10 micron fuel filter is fastened under the steering console. It should be replaced as recommended in *MAINTENANCE CHART*.



TYPICAL

Fuel Pickups

The two fuel pickups come with 70 micron filter. One is located at the front right side of the fuel tank and the other at the rear left side.

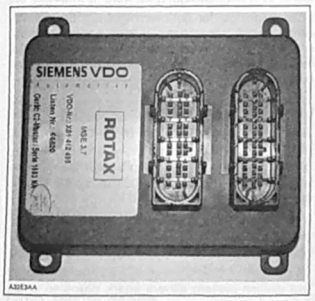


1. Fuel tank
2. Fuel pickups

ELECTRICAL SYSTEM

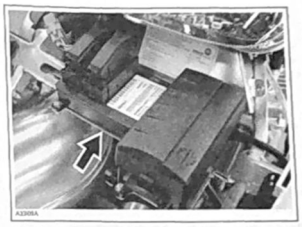
General

The electrical system is managed by the engine control module (ECM), which is the brain of the engine management system (EMS).



TYPICAL — ECM

The ECM is mounted in the front of the vehicle.



TYPICAL

The ECM is directly powered by the battery. It is responsible for the following engine management/electrical functions:

- receiving information from sensors
- interpreting information
- distributing information
- ignition
- fuel injection
- e-Rave
- DESS (Digitally Encoded Security System)
- start/stop function
- RER (Rotax Electronic Reverse)
- monitoring system
- diagnostic mode
- limp home mode
- engine modes of operation.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) code, fault codes and other vehicle information, even when the battery is removed from the vehicle.

Charging System

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 480 watts.

AC current is rectified and regulated between 13.4 and 15 volts DC to charge battery and for the vehicle electrical system. The battery supplies the ECM with DC voltage.

Power Distribution

Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: Engine-related sensors and injectors are continuously powered from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

The system uses 2 relays:

- ignition/injectors, fuel pump and starting system relay (R1)
- headlights and accessories relay (R2).

When the START/RER switch is activated, it wakes up the EMS and power the relay (R1), the ECM, the fuel pump, the ignition coil, the injectors, and the gauges. Then, if the cut-off switch and the DESS switch are in position to allow starting and START/RER switch is held, the starter solenoid relay is activated.

When engine reaches approximately 800 RPM, the ECM activates the headlights and accessory relay (R2).

Gauges Voltage Supply

Gauges are supplied with voltage for 30 seconds when connecting the tether cord cap on its post and momentarily pressing the START/RER switch.

NOTE: Each time the tether cord cap is connected to the post and START/RER switch is depressed, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the tether cord cap is left on the post when the engine is not running for more then 30 seconds. The ECM will remain offline until the START/RER switch or the rewind starter is activated. The ECM will shut down all outputs after 5 seconds when the tether cord cap is removed.

Rotax Electronic Reverse (RER)

Refer to the section in this manual for a complete explanation of the system.

Digitally Encoded Security System (DESS)

Refer to the section in this manual for a complete explanation of the system.

ENGINE MANAGEMENT SYSTEM (EMS)

For this SDI 2-stroke engine, a highly advanced Engine Management System (EMS) has been used to ensure a high power output combined with cleaner combustion. An ECM (Engine Control Module) calculates the proper air/fuel mixture, ignition timing for each cylinder separately. The fuel is injected into the transfer port of each cylinder.

The ECM controls also the e-RAVE via a solenoid.

FUEL INJECTION

The ECM receives the signals from different sensors which indicate engine operating conditions at millisecond intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

IGNITION SYSTEM

Ignition Timing

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

Ignition Coil

Double ignition coil has two separate windings, one for each spark plug.

Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate windings circuits are switched to ground through the ECM. Each winding induces high voltage to its corresponding secondary winding to produce a spark.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Match reference (PTO or MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

Double ignition coil is located underneath air intake silencer.

Knock Sensor

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

E-RAVE

Refer to *TOP END (593/793)* in this manual for a complete explanation of the system.

ENGINE MODES OF OPERATION

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start up, idle, warm up, normal operation, engine speed limiter, flooded engine and limp home (see below).

Engine RPM Limiter

The ECM will limit the maximum engine speed.

Drowned Mode (flooded engine)

If the engine does not start and is fuel-flooded, the drowned mode can be activated to prevent fuel injection and to cut ignition while cranking.

Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Press the START/RER button.

⚠ WARNING

Do not attempt to use the rewind starter. The drowned mode is active only by using the electric starter.

The engine should be cranked for 20 seconds. Release START/RER button and throttle lever.

Restart engine normally.

NOTE: If the engine does not start, it may be necessary to replace the spark plugs.

Limp Home Mode

The ECM may automatically set default parameters to ensure the adequate operation of the vehicle if a component of the engine management system is not operating properly.

NOTE: Sensor failures will not lead automatically to a limp home mode. The check engine LED will turn on and in some cases the beeper.

The engine RPM may be limited if some critical components fail. In this case, releasing throttle and letting the engine returning to idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on DESS post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for a complete chart.

MONITORING SYSTEM

The ECM monitors the electronic components of the engine management system and other components of the electrical system.

When a fault occurs, it sends a signal to the check engine LED or also to the beeper to inform the driver of a particular condition. Refer to the *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The beeper will also be activated intermittently.

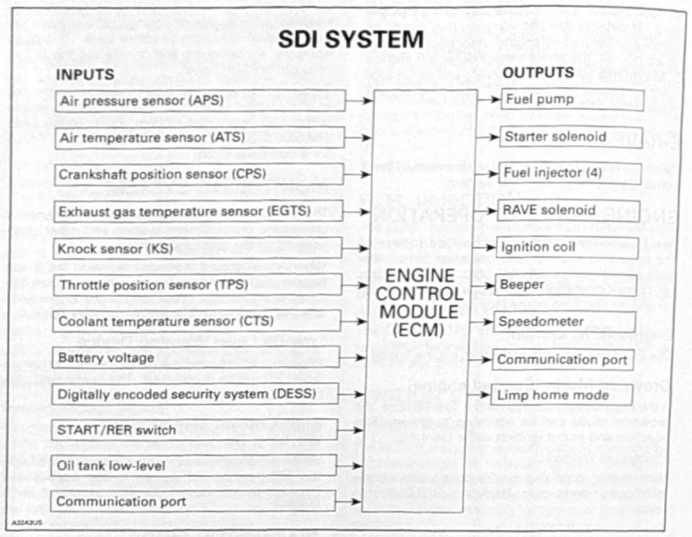
High Coolant Temperature Warning Device

When the coolant temperature is getting too high, the ECM sends out signals to the beeper and the high temperature LED. This occurs at 95°C (203°F).

DIAGNOSTIC MODE

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the B.U.D.S. software to see the fault codes. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* section.

ENGINE MANAGEMENT SYSTEM FUNCTIONS



EMS DIAGNOSTIC AND COMMUNICATION TOOLS

SERVICE TOOLS

Description	Part Number	Page
Communication kit	529 035 981	368
DESS post interface	529 036 019	371–372
MPI-2	529 036 018	371–372
Optional extension cable	529 035 697	371
Optional extension cable	529 035 703	368
supply T-harness	529 035 869	369, 372
Supply T-harness	529 035 869	368, 371

DIAGNOSTIC

GENERAL

Warning lights in speedometer and/or a beeper provide signals as vehicle operation feedback or to indicate a problem. Refer to the following tables for more information.

When there is a problem, the EMS (engine management system) can provide fault codes to ease the troubleshooting. Refer to *EMS FAULT CODE TABLES* in this section. Fault codes can be read with B.U.D.S. software. Refer to *COMMUNICATION TOOLS* further in this section for more information.

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the B.U.D.S. software. This will properly reset their states.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the faults code status and report, refer to B.U.D.S. online help or to the EMS fault code tables.

Here is the basic order suggested to diagnose a suspected engine management related problem:

- Check if the EMS pilot lamp lights up. If so, use the B.U.D.S. software and look for fault codes to diagnose the trouble.
- Check all fuses, relay(s) and battery.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.

EMS FAULT CODE TABLES

FAULT CODE	WARNING SIGNALS					DESCRIPTION
	BEEPER	LED				
		DESS	ENGINE	TEMP	OIL	
P0117	1 short 1 long	—	Blink	—	—	Engine Temperature Sensor fault (voltage too low).
P0118	1 short 1 long	—	Blink	—	—	Engine Temperature Sensor fault (voltage too high).
P0217	1 short 1 long	—	—	Blink	—	High engine temperature detected.
P0336	—	—	—	—	—	High engine RPM detected.
P0513	3 shorts/second repetitive	Blink	—	—	—	Anti theft security: invalid key or key not programmed.
P0605	1 long 3 shorts	—	—	—	—	System fault (calibration checksum).
P0648	—	—	—	—	—	DESS Lamp output fault (shorted to battery/open circuit/shorted to ground).
P0650	—	—	—	—	—	Check Engine Lamp output fault (shorted to battery/open circuit/shorted to ground).
P0654	—	—	—	—	—	Tachometer output fault (shorted to battery/open circuit/shorted to ground).
P0655	—	—	—	—	—	Engine Temperature Lamp output fault (shorted to battery/open circuit/shorted to ground).
P1217	1 short 1 long	—	—	Blink	—	Overheat shutdown occurred.
P1655	—	—	—	—	—	DESS communication link fault (shorted to battery).
P1656	—	—	—	—	—	DESS communication link fault (shorted to ground).
P1670	—	—	—	—	—	Buzzer output fault (shorted to battery).
P1671	—	—	—	—	—	Buzzer output fault (open circuit/shorted to ground).
P1675	—	—	—	—	—	Relay output fault (open circuit/shorted to ground).
P1676	—	—	—	—	—	Relay output fault (shorted to battery).
—	1 long/second repetitive	Blink	—	—	—	Engine running in reverse direction.
—	1 short/ 1.5 second repetitive	Blink	—	—	—	DESS key immobilizer (unable to read key).
—	2 shorts	Blink	—	—	—	DESS key immobilizer (good key).

EMS FAULT CODES SUPPLEMENTAL INFORMATION

Fault Code P0336

This code occurs when engine RPM goes too high which could happen under some mechanical-related circumstances and is not necessarily related to a problem with the engine management system.

Fault Code P0654

If this code occurs and tachometer works normally, disregard this fault code.

TPS (Throttle Position Sensor) Faults

TPS Faults which are reported in B.U.D.S. fall into two groups; out of range and adaptation failure faults.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Reconnect.
Check if sensor is loose	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test)	Replace sensor and reset **Closed Throttle**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaptation Failure":

- Idle speed is out of range.
- Engine stops, when throttle is released quickly.
- Engine runs inconsistent in low partload or low RPM.

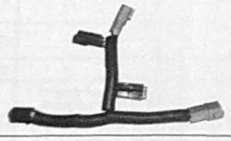
POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
ECM has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle cable too tight	Adjust cable and reset **Closed Throttle**.
Sensor is loose	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose	Fix and reset **Closed Throttle**.
Adjustment screw worn or loose	Adjust idle speed screw using B.U.D.S.

COMMUNICATION TOOLS

Two different MPI (Multi-Purpose Interface) can be used with B.U.D.S. software: MPI and MPI-2. Refer to the following for proper connections.

NOTE: The MPEM programmer does not work on any liquid cooled models.

MPI (Multi-Purpose Interface)

PART REQUIRE	OPERATION	
	– PROGRAMMING KEY(S) – ENTERING CUSTOMER INFORMATION – SETTING IGNITION TIMING/ CLOSED TPS – READING FAULT CODES	– ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
PC computer	X	X
B.U.D.S. software Use latest version available on BOSSWeb	X	X
Communication kit (P/N 529 035 981) 	X	X
Optional extension cable (P/N 529 035 703) 	X	X
Supply T-harness (P/N 529 035 869) 	X	X

MPI Supply

The MPI can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Connections with Vehicle

⚠ WARNING

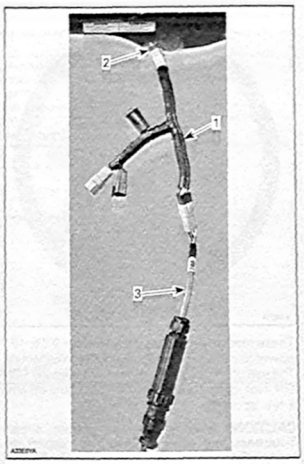
If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

Remove the 6-pin con nector from the protective cap on the right side of the vehicle.



Connect the supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.

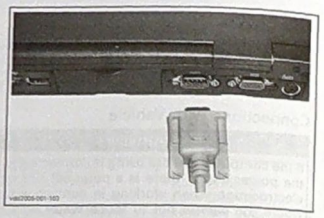
Connect the 6-pin diagnostic cable from MPI to supply T-harness.



TYPICAL
1. Supply T-harness
2. Vehicle 6-pin connector
3. MPI cable

CAUTION: Connecting MPI directly to vehicle connector (without supply T-harness) may prevent proper communication. Always use the proper supply T-harness.





These models do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply T-harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.

CAUTION: Always use the proper supply T-harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

NOTE

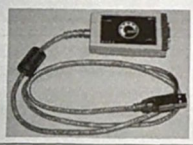
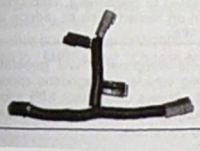
It is suggested to disconnect headlights fuse and to turn off heated grips to reduce battery discharge rate.

NOTE: Some components will generate heat when leaving vehicle in diagnostic mode for a long period. Always disconnect MPI supply harness and supply cable from vehicle/battery when not working on vehicle.

Connect remaining MPI connector to the serial port of a PC (personal computer).

Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

MPI-2 (Multi-Purpose Interface)

PART REQUIRE	OPERATION	
	– PROGRAMMING KEY(S) – ENTERING CUSTOMER INFORMATION – SETTING IGNITION TIMING/ CLOSED TPS – READING FAULT CODES	– ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
PC computer	X	X
B.U.D.S. software Use latest version available on BOSSWeb	X	X
MPI-2 (P/N 529 036 018) 	X	X
Optional extension cable (P/N 529 035 697) 	X	X
DESS post interface (P/N 529 036 019) 	X	X
Supply T-harness (P/N 529 035 869) 	X	X

Power Supply

MPI-2

The MPI-2 uses the PC computer USB port for its power supply.

DESS Post Interface

The DESS post interface can use the vehicle power for its supply. Two AA batteries or an AC/DC power supply can also be used. Make sure to respect the interface specification if a power supply is used.

Connections with Vehicle

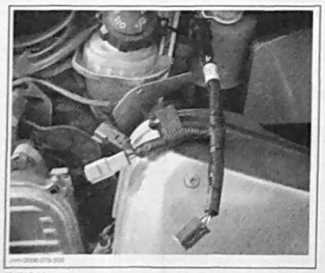
⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

Remove the 6-pin connector from the protective cap on the right side of the vehicle.



Connect the supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.



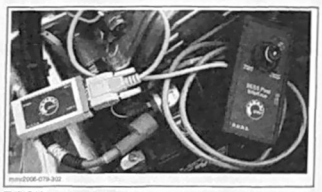
TYPICAL

Connect DESS post interface (P/N 529 036 019), to supply T-harness connector.



TYPICAL

Connect MPI-2 (P/N 529 036 018) to DESS post interface.



TYPICAL

These models do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply T-harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.

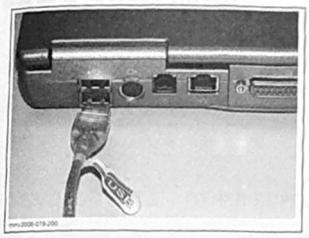
CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

NOTE

It is suggested to disconnect headlights fuse and to turn off heated grips to reduce battery discharge rate.

NOTE: Some components will generate heat when leaving vehicle in diagnostic mode for a long period. Always disconnect MPI supply harness and supply cable from vehicle/battery when not working on vehicle.

Connect remaining MPI-2 connector to the USB port of a PC (personal computer).



B.U.D.S. SOFTWARE

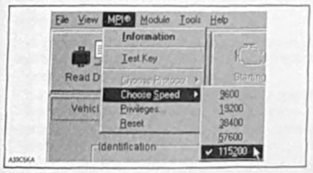
B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow electrical component inspection, diagnostic options and adjustments such as the closed throttle.

For more information pertaining to the use of the B.U.D.S. software, use its help which contains detailed information on its functions.

When using the service action suggested in the Fault section of B.U.D.S., for instance, a system circuit referred to as DA-35, means connector "A" on the ECM and the contact 35.

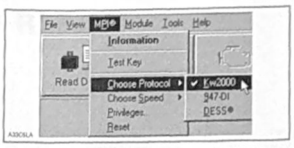
When using the B.U.D.S. software:

- Ensure that 115200 speed is properly selected in "**MPI**" under "**Choose speed**".



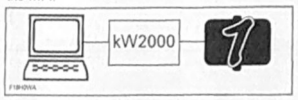
NOTE: If you are using an old PC computer, it may be necessary to use a slower speed so that the communication works.

- Ensure that the protocol "kW2000" is properly selected in "**MPI**" under "**Choose protocol**.



- Ensure the status bar shows the kW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 indicates that the ECM is recognized by the MPI.



CONNECTION SUCCESSFUL

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

- ECM is not powered-up
- wrong protocol is used
- bad connection between MPI and ECM.

ADJUSTMENT AND REPAIR PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	377
Fluke 111 multimeter	529 035 868	377
hose pinchers	295 000 076	386

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
rigid back probe Fluke	TP88	377

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	385
Loctite 243 (blue)	293 800 060	388
Loctite 512 (pipe sealant)	293 800 018	390
Loctite 5910	293 800 081	389, 392
Loctite 767 (antiseize lubricant)	293 800 070	392
pulley flange cleaner	413 711 809	386

GENERAL

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine and drive system are present:

- good transmission system operation
- good engine compression and properly operating mechanical components, no leaks, etc.
- proper fuel pump pressure and fuel system without leaks.

Check the chart in *TROUBLESHOOTING* section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than that of a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

- Use B.U.D.S. to release the fuel pressure in the system. Look in the **Activation** section.

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the B.U.D.S. software to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove 30 A fuse prior to working on the fuel system. After performing a pressure test, release the pressure.

- Always disconnect battery properly or remove 30 A fuse prior to working on the fuel system. Refer to *BATTERY* section.

Fuel Rail and Hose

Pressure at fuel rail is supplied and controlled by the electric fuel pump.

When a repair is completed, ensure that hose between fuel rail and fuel pump is properly secured in the supports. Then, perform a fuel pressure test. Refer to *FUEL SYSTEM*.

To remove fuel rail, refer to *FUEL INJECTORS* in this section.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. The fuel pump is started and pressure quickly builds-up each time the tether cord cap is installed and the START/RER button is depressed (or rewind starter is pulled).

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

- battery
- capacitor (manual start models)
- fuses
- relays
- DESS
- ignition (spark)
- ground connections
- wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (injectors, fuel pump, ignition coils and starter solenoid) are continuously supplied by the battery when the start button is depressed or if engine is rotated (with the rewind starter). Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them prior to assembling as follows:

NOTE: Do not apply dielectric grease or other lubricant on the ECM connectors.

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine – any modification on the wiring harness may lead to generate fault codes or bad operation.

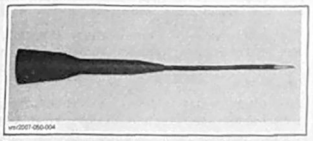
NOTE: For diagnostics purposes, use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

Diagnostic Tools

To perform verifications, the Fluke 111 multimeter (P/N 529 035 868) should be used.



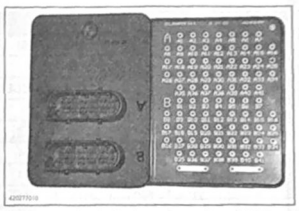
To easily probe wire terminals through the back of their connectors, rigid back probe Fluke (P/N TP88) pins or equivalent can be used.



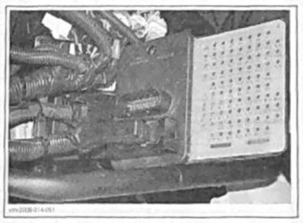
They can be inserted at the end of the standard probes of the Fluke 111 multimeter.



The most recommended and safest method to probe ECM connector terminals is to use the ECM adapter (P/N 420 277 010). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.



Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool holes.



Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The value of a resistor varies with the temperature. The value for common resistor or windings (such as solenoid) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the value **decreases** as the temperature increases. Use this table for sensor resistive values at given temperature.

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			ECM	GAUGE
- 40	- 40	—	72412	—
- 30	- 22	28000	38681	—
- 20	- 4	14500	21529	734
- 10	14	9000	12431	474
0	32	5500	7418	314
10	50	3500	4582	214
20	68	2500	2919	149
30	86	1750	1912	106
40	104	1200	1284	77
50	122	875	883	56
60	140	600	622	42
70	158	450	448	32
80	176	320	328	25
90	194	239	245	19
100	212	180	186	15
110	230	148	143	—
120	248	119	112	—
130	266	90	88	—
135	275	—	79	—
140	284	—	71	—
145	293	—	64	—
150	302	—	57	—

TEMPERATURE SENSOR TABLE		
TEMPERATURE		RESISTANCE (OHMS)
°C	°F	EGTS
- 40	- 40	170
- 20	- 4	185
0	32	201
25	77	220
50	122	239
100	212	276
150	302	313
200	392	349
250	482	385
300	572	420
350	662	454
400	752	488
450	842	521
500	932	554
600	1112	618
700	1292	679
800	1472	738
900	1652	795
1000	1832	849

The resistive value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun (ensure not to heat excessively) while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

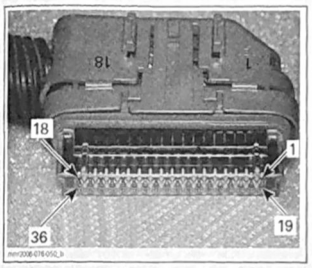
A good test would be to put sensor in a container filled with ice and water and measure resistance. Then, boil water and read resistance again. According to the table above, an ATS value would be approximately 5500 Ω with ice/water (0°C (32°F)) and 180 Ω with boiling water (100°C (212°F)).

ECM Connector

Check ECM connector pin condition. For ECM connector maintenance and repair procedures, refer to *ELECTRICAL CONNECTORS* section.

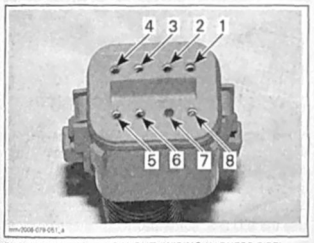
Pin Identification

Use the following illustration to locate the pin numbers on the ECM connector (wiring harness side) when performing tests.



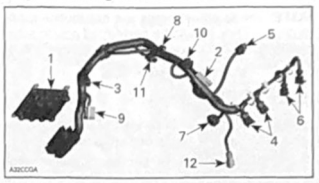
Engine/Vehicle Connector

Use this illustration to locate the pin numbers on the engine connector of the wiring harness when performing tests.



ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

Engine Wiring Harness



1. ECM
2. CTS connector
3. EGTS connector
4. Fuel injector connector (cylinder MAG side)
5. Ignition coil connector
6. Fuel injector connector (cylinder PTO side)
7. TPS connector
8. ATS connector
9. Engine connector
10. APS connector
11. KS connector
12. CPS connector

Resistance Test

Check continuity of the circuits according to the wiring diagram in the *WIRING DIAGRAMS* section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

Removal

Remove air intake silencer.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the connector from the ECM.

Cut all locking tie which are holding the wiring harness in position.

Remove complete wiring harness.

Installation

First connect the connector "A" to the ECM and the engine connector to the vehicle wiring harness.

Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

Install all remaining parts, which have been removed.

BASIC ADJUSTMENTS

NOTE: These adjustments are not routine maintenance. They should be performed only to solve problems when recommended in procedures of this manual.

IDLE SPEED

Idle speed is controlled by the EMS (Engine Management System) and is **not adjustable**.

If idle speed is not as per specification (refer to *TECHNICAL SPECIFICATIONS*), perform the *CLOSED THROTTLE RESET*.

CLOSED THROTTLE RESET

General

This operation performs a reset of the throttle position sensor (TPS) values in the ECM. This reset is very important as the setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

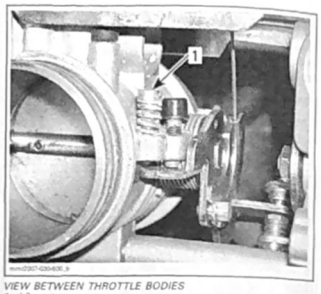
Reset must be done each time TPS is loosened/removed or throttle body or ECM is replaced.

CAUTION: An improperly set TPS may lead to poor engine performance.

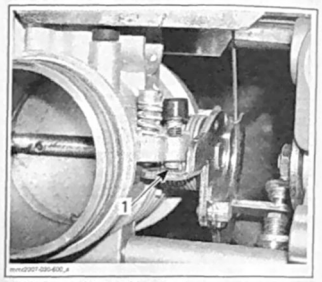
Adjustment

Excessively unscrew idle set screw until there is a contact between stop lever and **zero position screw** (capped).

CAUTION: Do not alter setting of the zero position screw, otherwise throttle body must be replaced.



VIEW BETWEEN THROTTLE BODIES
1. Idle set screw



*1. Contact here (**zero position screw**)*

NOTE: If contact cannot be reached, loosen throttle cable. See *THROTTLE CABLE* further.

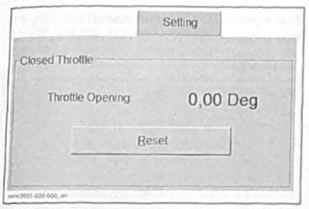
Push throttle lever approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plates.

Use the B.U.D.S. software.

The throttle opening displayed in **Setting** tab of B.U.D.S. must be within the following specification.

THROTTLE OPENING
0.0 - 0.1

Press **Reset** button in **Closed Throttle**. See illustration.

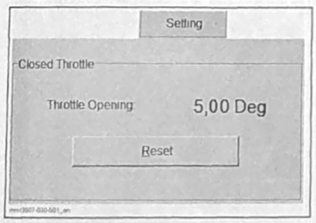


NOTE: If TPS is not within the allowed range, the ECM will generate a fault code and will not accept the setting. Check if stop lever rest against the zero position screw. If so, verify the TPS.

CAUTION: Do not alter setting of the zero position screw, otherwise throttle body must be replaced.

After reset has been accepted, turn in idle set screw until throttle opening value in B.U.D.S. is within the following specification.

THROTTLE OPENING (idle set screw)	
Sea level: below 1800 m (6000 ft)	4.95 - 5.05
High altitude: above 1800 m (6000 ft)	



Procedure is completed.

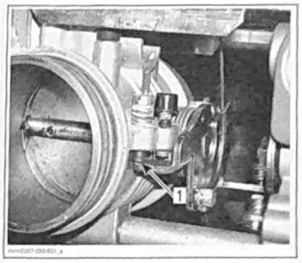
Verify throttle cable adjustment.

THROTTLE CABLE

CAUTION: Do not alter throttle cable routing. It may cause poor startability and erratic idling.

Handlebar and throttle cable must be at their normal position.

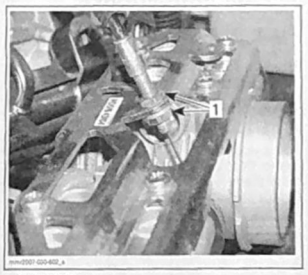
With throttle lever released, ensure there is some free-play in throttle cable to allow a contact between stop lever and **idle set screw**.



VIEW BETWEEN THROTTLE BODIES
*1. Contact here (**idle set screw**)*

Otherwise, loosen throttle cable.

Set cable adjuster nuts accordingly.



1. Cable adjuster nuts

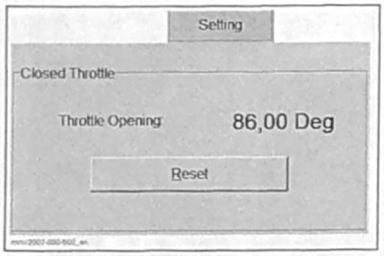
Push throttle lever approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. Recheck adjustment.

Use B.U.D.S. software.

Perform the wide open throttle (WOT) verification.

The throttle opening displayed in **Setting** tab of B.U.D.S. must be within the following specification.

THROTTLE OPENING (wide open throttle)
82 - 86



NOTE: If value is below the minimum, tighten throttle cable. If value is above the maximum value, loosen throttle cable.

IGNITION TIMING

Refer to *IGNITION SYSTEM.*

REPAIR PROCEDURES

FUEL INJECTORS

Leakage Test and Fuel Flow Measurement

Preparation

First ensure fuel pressure is within specifications.

The injectors and fuel rail have to be removed together from the engine. Do not remove injectors from the fuel rail. Refer to *FUEL INJECTOR REPLACEMENT* further in this section as necessary.

To ensure continuous fuel availability for the electric fuel pump, first fill up fuel tank prior to performing the following tests. This is required because engine is not running to activate diaphragm fuel pump with the crankcase pulses.

Leakage Test

Place each injector in a clean bowl.

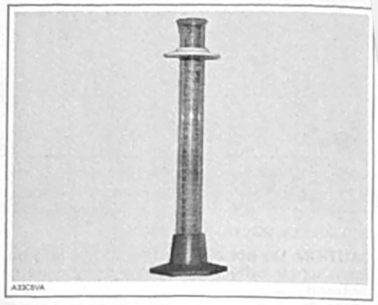
Install the tether cord cap on the DESS post and press the engine START/RER button to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

Fuel Injector Flow Measurement

Use an appropriate burette graduated for 25 m (.85 U.S. oz). The Pyrex® no. 3075 (or equivalen works fine.



Place injector inside top of burette.



Use B.U.D.S. software.

Install the tether cord cap on the DESS post and press the engine START/RER button to wake up the ECM.

Use appropriate wires and connect fuel pump directly to battery posts to continuously supply fuel pump.

Energize the appropriate injector under **Injector Flow Measurement** in **Activation** tab.

Energize each injector individually and measure the fuel volume injected. Quantity of fuel must be within the following specifications.

INJECTOR	VOLUME of FUEL mL (U.S. oz)
BLUE	16 ± 1 (.54 ±.03)

If an injector is out of specification, retest it 2 - 3 times. If it still fails, replace it.

If all injectors fail, it is unlikely a failure of injectors. First ensure your reading from the burette is appropriate (pay attention to the division lines). Ensure fuel tank is full. Test for leaks in fuel system, fuel pump pressure, filter condition (in-line and in tank).

Properly reinstall parts.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Use B.U.D.S. software.

Energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Wake up ECM using START button and measure voltage between pin 1 (of injector on harness side) and battery ground.

If 12 V is read, disconnect connector "A" from the ECM and check continuity of circuit as per following table. If it is good, refer to *ENGINE CONTROL MODULE (ECM)*.

CIRCUIT NUMBER (ECM connector "A")	PIN 2 OF INJECTOR HARNESS
A-15	Injector 1.1 (1) (MAG external)
A-33	Injector 2.1 (1) (PTO external)
A-14	Injector 1.2 (1) (MAG internal)
A-30	Injector 2.2 (1) (PTO internal)

(1) Injector identification on the wiring diagram.

If it does not read 12 V, check the corresponding fuse(s), relay 1 (refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*) and continuity of circuit. If continuity is faulty, repair wiring harness.

Resistance Test

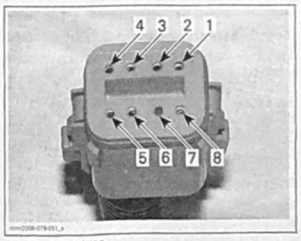
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

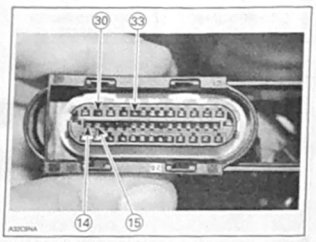
If resistive value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector "A" from the ECM as well as the engine connector.

Using a multimeter, check resistive value between terminals as shown in the table below.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector, MAG external	4 (Engine connector) and A-15 (ECM connector)
Fuel injector, MAG internal	3 (Engine connector) and A-14 (ECM connector)
Fuel injector, PTO external	4 (Engine connector) and A-33 (ECM connector)
Fuel injector, PTO internal	3 (Engine connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

If resistive value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistive value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM connector and fuel injector.

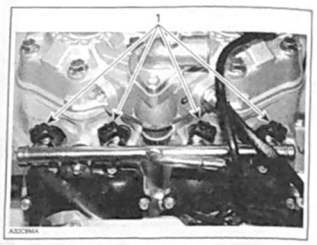
Fuel Injector Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Disconnect fuel hose at the connector.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel injectors

Disconnect wiring harness from the four fuel injectors.

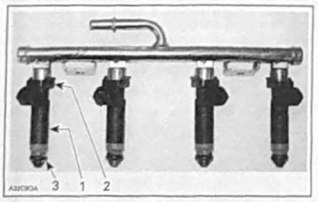
Cut tie raps and remove the wiring harness from the fuel rail.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

Then remove the injector clip.



FUEL RAIL ASSEMBLY
1. Fuel injector
2. Injector clip
3. O-ring

Now the fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

Replace O-rings with new ones.

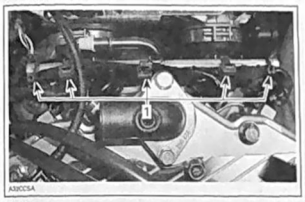
NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail and cylinders.

Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

Attach injector wires with locking tie as shown in following photo.



1. Locking ties

Add dielectric grease (P/N 293 550 004) to injector electrical connector.

Reconnect fuel injector connectors.

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to *FUEL SYSTEM*. Run engine and check for leaks.

ENGINE CONTROL MODULE (ECM)

General

ECM SUPPLY PINOUT	
FUNCTION	PIN
Power (Vdc)	11
Signal from voltage regulator to wake up ECM at cranking (manual start only)	36
Ground	1, 2, 9, 32, 41

NOTE: Ensure also that relay 1 is functional. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES* to test it.

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

IMPORTANT: When the ECM is replaced, the DESS key(s), the ignition timing and the **Closed Throttle** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the B.U.D.S. software. Use **Replace ECM** in the **ECM** menu. Follow instructions provided by the help system.

NOTE: If the old ECM can still communicate, it must be read inside B.U.D.S. prior to removing it from the vehicle to carry vehicle information and history to the new ECM.

ECM Replacement

Prior to replacing a possibly faulty ECM, ensure that all the recommendations in the general introduction of this section have been carried out. Also, check ECM power supply and all grounds for proper contact/cleanliness and tightness.

Disconnect battery cables.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Remove air intake silencer.

Disconnect both connectors from ECM.

Unscrew all retaining screws and remove the engine ECM from its support.

Install the new ECM to the support.

Reconnect ECM connectors to ECM.

Install air intake silencer and connect battery cables.

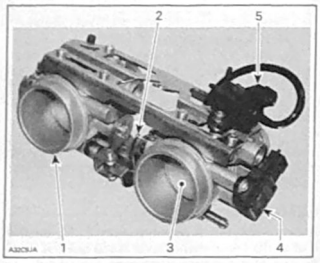
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 6000 RPM to be sure no fault appears.

THROTTLE BODY



TYPICAL
1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS
5. e-RAVE solenoid

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: Do not alter the setting of the zero position screws or synchronization screw, otherwise throttle body must be replaced.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

- Throttle cable adjustment too tight. Not returning fully to idle stop.
- Throttle body idle set screw is loose or worn.
- TPS is loose.
- Corroded or damaged wiring or connectors.
- Throttle body or ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

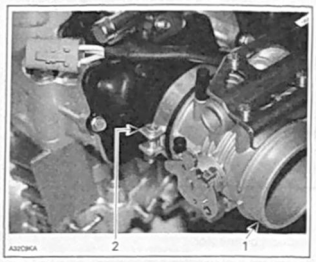
Refer to *THROTTLE POSITION SENSOR (TPS)* below.

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

- Disconnect connectors from ATS (Air Temperature Sensor).
- Disconnect air intake silencer from throttle body. Move boot away.
- Install hose pinchers (P/N 295 000 076) on inlet and outlet coolant hoses connected to throttle body.
- Remove clamps and hoses for throttle body heating from nipples.
- Disconnect connectors and hoses from e-RAVE solenoid and TPS.
- Disconnect throttle cable.
- Unscrew retaining clamps of throttle body.



TYPICAL
1. Throttle body
2. Clamp

- Slightly pull throttle body out.

Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention to the following details.

Before installation, clean throttle plates and bores with pulley flange cleaner (P/N 413 711 809).

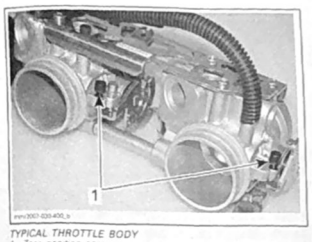
Refill engine coolant. If an important quantity of coolant was spilled, bleed cooling system. Refer to *COOLING SYSTEM* section.

For TPS and e-RAVE solenoid replacement procedures, refer to their paragraphs elsewhere in this section.

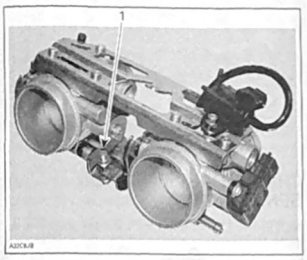
Throttle Body Synchronization

No synchronization is required as it has already been done at the factory.

CAUTION: Do not alter setting of the zero position screws or synchronization screw. Otherwise throttle body must be replaced.



TYPICAL THROTTLE BODY
1. Zero position screws



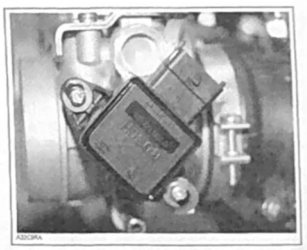
TYPICAL THROTTLE BODY
1. Synchronization screw

THROTTLE POSITION SENSOR (TPS)

General

NOTE: Before replacing a TPS, ensure there is not too much pull on the wires and they are not chaffed or cuts.

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to *THROTTLE BODY* in this section.

The ECM may generate several fault codes pertaining to the TPS. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* section for more information.

Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Use B.U.D.S. software.

Use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Voltage Test

Check the voltage output from ECM to the throttle position sensor.

Disconnect connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab. To see the connector pin-out and its pin numbers, temporarily remove the connector shield joining the harness.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Connect a voltmeter between pin 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on wiring harness TPS connector and pin 24 on wiring harness ECM connector.

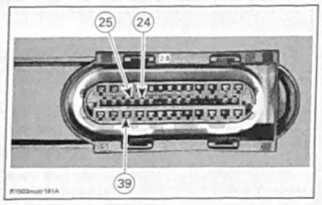
If tests are good, replace the TPS.

If voltage tests are not good, continue to check the resistance of the rest of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector "A" from the ECM.



Using a multimeter, check resistive value as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN	PIN	RESISTANCE Ω	
A-24	A-25	2500	1000
A-25	A-39	1600 - 2400	1600 - 2400
A-24	A-39	1000	2500

NOTE: The resistive value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistive values are correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

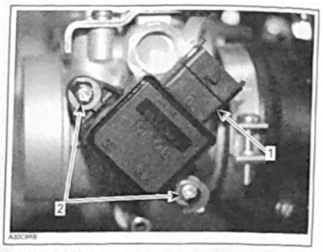
If resistive values are incorrect, repair the connectors or replace the wiring harness between ECM connector and the TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. Throttle position sensor (TPS)
2. Screws

Install the new TPS.

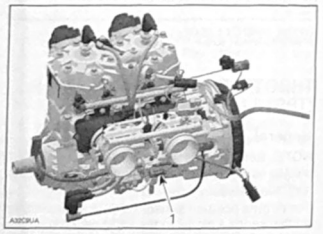
Apply Loctite 243 (blue) (P/N 293 800 060) on the TPS retaining screws, then torque to 3 N•m (27 lbf•in).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is used for forward and reverse.



1. CPS connector

Disconnect CPS wiring harness connector. Probe terminals coming from CPS while cranking engine. Voltage should be within 1 - 2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

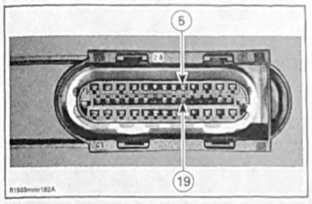
Resistance Test

Disconnect the CPS connector from the wiring harness and check the resistive of the sensor itself.

The resistive value should be between 190 Ω and 300 Ω.

Otherwise, replace the CPS.

If sensor tests good, **reconnect** the CPS and disconnect the connector "A" on the ECM.



Using a multimeter, measure resistive value between terminals 5 and 19.

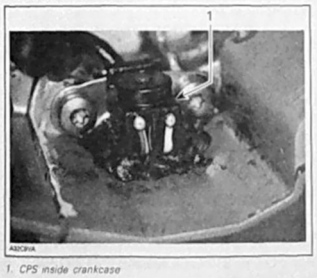
If resistive value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistive value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to *MAGNETO SYSTEM*.

Remove CPS.



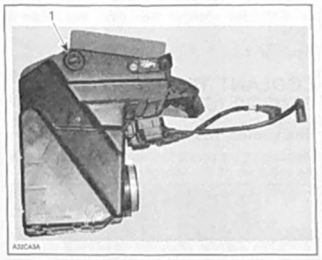
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

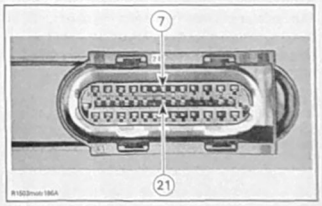
Resistance Test

Disconnect the connector from the ATS and check the resistance of the sensor itself.

Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the ATS and disconnect the connector "A" on the ECM.



Using a multimeter, recheck resistive value between terminals 7 and 21.

If resistive value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistive value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Disconnect ATS connector.

Pull the ATS out of the air intake silencer.

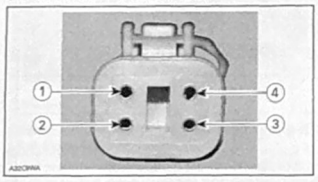
Spray soapy water on grommet. Install grommet on air intake silencer then push the sensor in place.

Reconnect it.

COOLANT TEMPERATURE SENSOR (CTS)

Resistance Test

Disconnect the connector from the CTS and check the resistive of the sensor itself.



The resistance between pin 1 and 2 is used for temperature gauge.

Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this temperature sensor.

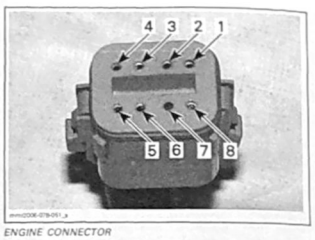
If out of specification, replace the sensor.

The resistor between pin 3 and 4 is used for ECM.

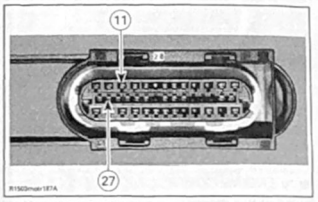
Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this temperature sensor.

If out of specification, replace the sensor.

If sensor tests good, **reconnect** the CTS and disconnect the connector "A" on the ECM as well as the engine connector.



ENGINE CONNECTOR



ECM CONNECTOR "A"

Using a multimeter, measure resistive value between terminals 5 and 6 on engine connector. This resistor is used for temperature gauge.

Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this sensor temperature.

Also measure resistive value between terminals 11 and 27 on ECM connector "A". This resistor is used for ECM.

Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this sensor temperature.

If resistive value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistive value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacement

Drain cooling system.

Disconnect CTS connector and remove CTS.

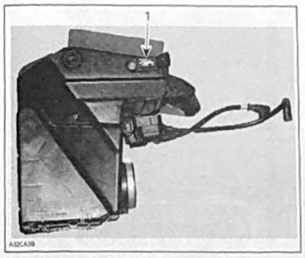
Apply Loctite 512 (pipe sealant) (P/N 293 800 018) on CTS threads.

Install the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant and bleed cooling system. Refer to *LIQUID COOLING SYSTEM* section.

AIR PRESSURE SENSOR (APS)



1. Air pressure sensor (APS)

Ensure sensor is correctly installed on air intake silencer. Otherwise, the APS could generate a fault code. Remove sensor and check for oil or dirt on its end and if problem persists, check the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the APS.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Disconnect connector from APS and connect a voltmeter between pin 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on APS connector and pin 18 on ECM connector.

If tests are good, replace the APS.

If tests are not good, continue to check the continuity of the rest of the APS circuit on the harness.

Disconnect the connector "A" from the ECM.

Using a multimeter, check continuity of circuits as per following table.

CIRCUIT NUMBER (ECM connector "A")	APS CONNECTOR
A-3	Pin 1
A-4	Pin 2
A-18	Pin 3

If wiring harness is good, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

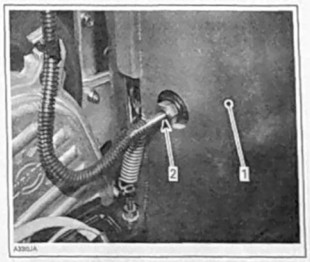
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The APS is retained with a screw.

Install the new APS.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



1. Muffler
2. Exhaust gas temperature sensor (EGTS)

Resistance Test

Disconnect the connector from the EGTS and check sensor resistor.

Refer to *TEMPERATURE SENSOR TABLE* at the beginning of this section to find the corresponding resistive value for this sensor temperature.

If out of specification, replace the sensor.

If resistor tests good, **reconnect** the EGTS and disconnect the connector "A" on the ECM.

Using a multimeter, measure resistive value between terminals 10 and 26.

If resistive value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistive value is incorrect, repair the connector or replace the wiring harness between ECM connector and the EGTS.

Removal

NOTE: If sensor is removed from muffler to then be reinstalled, verify if there is a green dot on sensor. If not, scribe a reference mark on sensor facing the right side of the vehicle.

Disconnect EGTS connector.

Remove EGTS.

Installation

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) over the EGTS threads to prevent possible seizure.

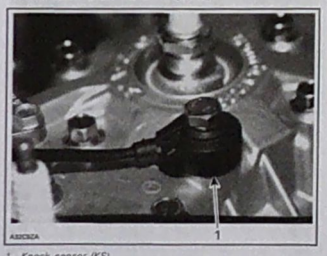
Install sensor and turn it so that its green dot (or reference mark) will be facing the right side of the vehicle.

NOTE: The sensor needs to be oriented in this specific position for optimum efficiency.

Torque the EGTS to 45 N•m (33 lbf•ft) while preventing sensor to turn.

Replug connector.

KNOCK SENSOR (KS)



1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Use B.U.D.S. software.

Monitor the knock sensor using the **Faults** section.

Start the engine and bring engine RPM above 6000 RPM. If no fault code occurs, the knock sensor is good.

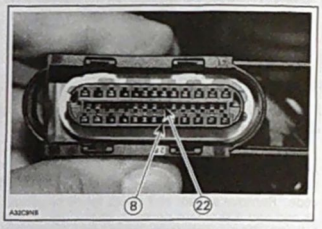
Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector "A" form the ECM and check continuity of circuit as per following table.



CIRCUIT NUMBER (ECM connector "A")	KS CONNECTOR
A-22	Pin 1
A-8	Pin 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

Replacement

Unscrew and remove knock sensor from cylinder head.

Clean contact surface, apply Loctite 5910 (P/N 293 800 081) on both contact surfaces on the knock sensor then install the new sensor.

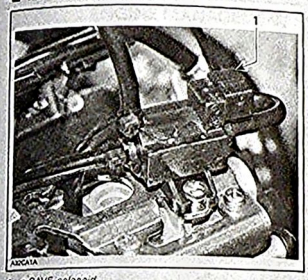
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

Torque screw to 24 N•m (18 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE SOLENOID



1. e-RAVE solenoid

Resistance Test

Disconnect the solenoid connector.

Check resistive value between both terminals of the solenoid.

The resistive value should be approximately 30 Ω.

Voltage Test

Install the tether cord cap and push the START/RER button momentarily to activate ECM.

Battery voltage should be present on GREEN/BLUE wire. If test fail, fuse may be blown.

Continuity Test

WHITE wire must show continuity between solenoid connector and pin 15 on connector "B" from the ECM.

If test fail, repair connector or replace wiring harness between ECM connector and solenoid.

Replacement

Remove the air intake silencer. Unplug the solenoid connector and all hoses.

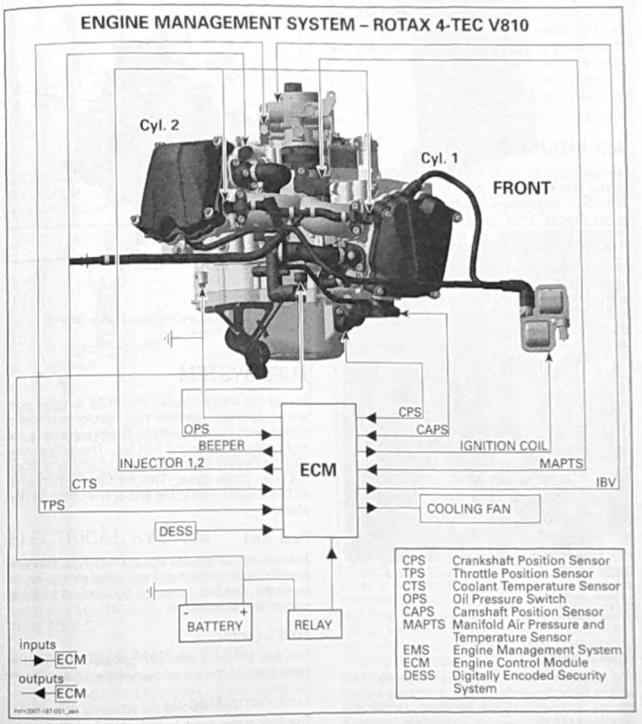
NOTE: Mark hose locations for installation.

Remove solenoid screws then the solenoid.

For installation, reverse the removal procedure.

OVERVIEW

ENGINE MANAGEMENT SYSTEM – ROTAX 4-TEC V810



CPS	Crankshaft Position Sensor
TPS	Throttle Position Sensor
CTS	Coolant Temperature Sensor
OPS	Oil Pressure Switch
CAPS	Camshaft Position Sensor
MAPTS	Manifold Air Pressure and Temperature Sensor
EMS	Engine Management System
ECM	Engine Control Module
DESS	Digitally Encoded Security System

OPERATING PRINCIPLE

A highly advanced engine management system (EMS) has been used to ensure a high power output with cleaner combustion.

There are 3 main systems in interaction with the engine management system (EMS):

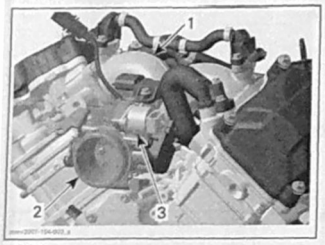
1. air induction
2. fuel system
3. electrical system.

AIR INDUCTION

Air flows through air intake silencer, throttle body, intake manifold and then goes into combustion chamber. Air pressure and temperature are measured directly in the intake manifold.

Throttle Body

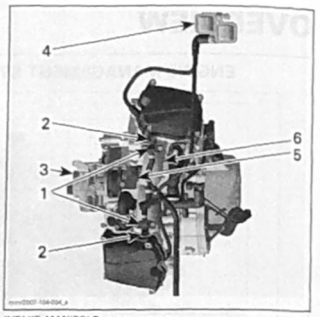
The 46 mm throttle body is mounted on the side of intake manifold. Fitted on the throttle body, there is the TPS and the idle bypass valve which allows the ECM to control the idle speed while the throttle plate is closed.



TYPICAL
1. Intake manifold
2. Throttle body
3. Idle bypass valve

Intake Manifold

The intake manifold is mounted on the top of the engine on both cylinder heads. It provides support for the throttle body, fuel injectors, the fuel rails and the MAPTS (manifold air pressure and temperature sensor).



INTAKE MANIFOLD
1. Fuel rail
2. Injector
3. Throttle body
4. Ignition coil
5. Manifold air pressure and temperature sensor (MAPTS)
6. Intake manifold

FUEL SYSTEM

During the intake stroke, the ECM (engine control module) activates the fuel injector and fuel is sprayed into the intake port. The injector uses the high pressure inside the fuel rail. The air/fuel mixture then enters the combustion chamber through the open intake valve. This mixture is then ignited by the spark plug at the end of the compression stroke.

Fuel Rail

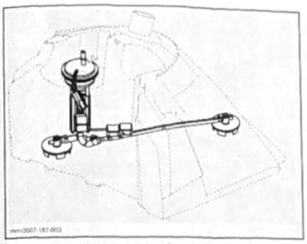
The fuel rail distributes the correct fuel pressure to each injector which are mounted on the intake manifold. The fuel rail is fed by the fuel pump at a specific fuel pressure.

Fuel Injector

Two fuel injectors (one per cylinder) are used to inject fuel into the intake port of the cylinder head.

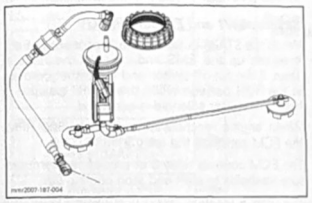
Fuel Pump Module

The fuel pump module is inside fuel tank. The fuel pump inlet includes 2 fuel pickups with nylon filters. Refer to *FUEL SYSTEM*.



rsm2007-187-003

The module includes the fuel pump and the fuel pressure regulator. An inline filter is used.



rsm2007-187-004

Fuel Pressure Regulator

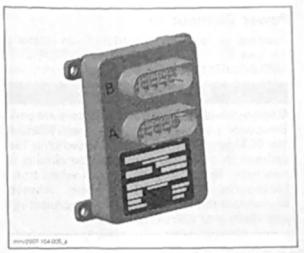
A fuel pressure regulator, inside fuel pump module, controls the pressure in the system. Excess fuel is returned to the fuel tank. Refer to *FUEL SYSTEM*.

ELECTRICAL SYSTEM

A communication link (CAN lines) is used to communicate between the ECM and the B.U.D.S. software. CAN lines consist of a pair of WHITE wires. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Engine Control Module (ECM)

The ECM controls the electrical system and the engine management functions by processing the information given by various sensors.



rsm2007-104-005_a

The ECM is located under fuse box.



rsm2007-187-005_a

The ECM features a permanent memory that will keep the programmed DESS keys, fault codes, customer information and other engine information, even when the battery is removed from the vehicle.

When START button is activated, the ECM initiates a self-diagnostic mode. However, some components need the engine to be running so that they can be monitored. Some problems will turn on a warning lamp and will set the engine in limp home mode. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* section for more information.

Digitally Encoded Security System (DESS)

If there is no DESS key on its post, no cranking is allowed.

If an unprogrammed DESS key is installed on its post, engine may crank and run but drive pulley will not engage. Refer to *DESS SYSTEM*.

Power Distribution

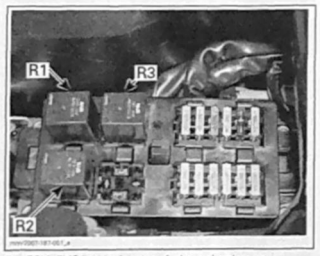
Electrical system is protected by fuses located in the fuse box. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*.

⚠ WARNING

Engine-related sensors and injectors are continuously powered from the battery when the ECM is woken up. The ECM switches the ground to complete the electrical circuits it controls. Take this into account when troubleshooting the electrical system. Always disconnect the battery prior to disconnecting any electric or electronic parts.

Expedition TUV

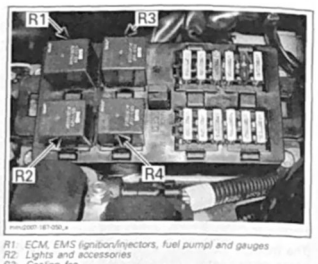
The system uses 3 relays that control different components. See illustration.



R1: ECM, EMS (ignition/injectors, fuel pump) and gauges
R2: Lights and accessories
R3: Cooling fan

Skandic SWT

The system uses 4 relays that control different components. See illustration.



R1: ECM, EMS (ignition/injectors, fuel pump) and gauges
R2: Lights and accessories
R3: Cooling fan
R4: Rear power outlet

Skandic SWT and Expedition TUV

When the START button is briefly pressed or held, it wakes up the EMS and powers the relay 1. Then, if the cut-off switch and the tether cord are in the RUN position while the START position is held, the starter solenoid is activated.

When engine reaches approximately 800 RPM, the ECM activates the relay 2.

The ECM controls relay 3 at predefined temperature tresholds to start and stop cooling fan.

The relay 4 (Skandic SWT) is activated when the rear power outlet switch is turned on.

Gauges Current Supply

Gauges are supplied with current for 30 seconds when briefly pressing START button. At the same moment, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

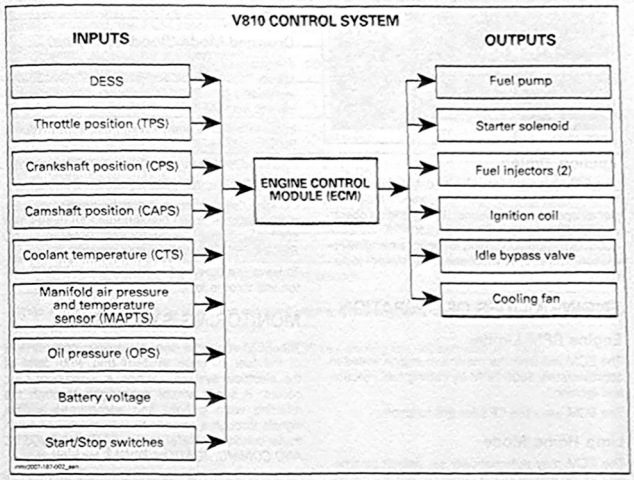
Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from discharging if the ignition key is left in the ON position when the engine is not running for more then 30 seconds. The ECM will remain offline until the START button is pressed.

ENGINE MANAGEMENT SYSTEM

The EMS calculates the proper air/fuel mixture and ignition timing for each cylinder separately.

The ECM is the central point of the engine management system. It reads the inputs, makes computations, uses predetermined parameters and sends the proper signals to the outputs for proper engine management.



ELECTRONIC FUEL INJECTION

The ECM reads the signals from different sensors which indicate engine operating conditions at millisecond intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS, the MAPTS and the TPS are the primary sensors used to control the injection and ignition timing. Other sensors (like temperature sensors, etc.) are used for secondary input.

IGNITION

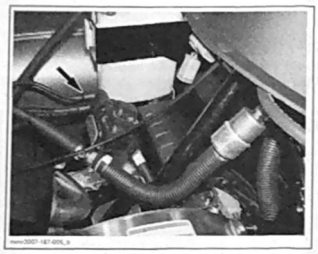
The ignition system is fully managed by the ECM which controls the ignition system parameters, such as spark timing, duration and firing order to achieve the proper engine requirements.

Ignition Coil

A double ignition coil induces voltage to a high level in the secondary winding to produce a spark at each spark plug independently.

The ignition coil receives input from the ECM.

The ignition coil is located next to fuse box.



Ignition Timing

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation. There is no mechanical adjustment to perform.

ENGINE MODES OF OPERATION

Engine RPM Limiter

The ECM will limit the maximum engine speed to approximately 8000 RPM by cutting fuel injection and ignition.

The ECM uses the CPS for this function.

Limp Home Mode

The ECM may automatically set default parameters to the engine management to ensure the adequate operation of the engine if a component of the fuel injection system is not operating properly. The engine will operate with reduced performance to protect the engine. In more severe cases, the engine RPM will be limited, also to protect the engine.

These performance-reduced modes allow the rider to go back home which would not be otherwise possible without this advanced system. Refer to the *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for a complete chart.

In the following situations, engine RPM will be limited.

CONDITION	MAX ALLOWED RPM
High engine temperature	5000
Low oil pressure	4500
Safety fuel cut-off (TPS or internal memory error)	5000

Drowned Mode (flooded engine)

If engine is fuel-flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows to activate it.

Install tether cord and set engine cut-off switch to RUN.

Press and HOLD throttle lever at WOT position.

Press START button. The mode is now on.

If engine does not start, it may be necessary to remove spark plugs and crank engine with rags over spark plug holes. Refer to *ADJUSTMENT AND REPAIR PROCEDURES* subsection.

To leave the drowned mode, release START button and throttle lever.

MONITORING SYSTEM

The ECM monitors the electronic components of the fuel injection system and also parts of the electrical system. When a significant fault occurs, it sends visual messages through the referring warning light and sometimes audible signals through a beeper to inform you of a particular condition. Refer to the *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for a chart.

For some faults; the warning light/beeper may disappear automatically when the condition no longer exists.

Releasing throttle and letting the engine returning at idle speed may allow normal operation to come back. If it does not work, try stopping engine then restarting it. An analysis of occurred faults using B.U.D.S. is recommended. Refer to the *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Battery Voltage Warning Device

When the battery voltage is either too low or too high, the ECM sends out a signal to the check engine light, battery light and beeper will warn. Limp home will be set.

Low Oil Pressure Warning Device

When the oil pressure falls under a certain level, the OPS sends out a signal to the low oil pressure light and to the ECM. The ECM then activates the check engine light. Limp home will be set.

Cooling Fan

The ECM controls the cooling fan. Whenever intake temperature or engine coolant temperature reaches a certain threshold, the ECM triggers the fan relay to start the fan. When temperature cools down to a certain threshold, the ECM stops the fan. See table below.

ENGINE TEMPERATURE	INTAKE TEMPERATURE	COOLING FAN	CHECK ENGINE LIGHT	LIMP HOME MODE
	50°C (122°F)	Turns ON		
	45°C (113°F)	Turns OFF		
100°C (212°F)		Turns ON		
95°C (203°F)		Turn OFF		
118°C (244°F) (1)		ON	Flashes	Engine RPM limited to 4000

(1) Engine will automatically shut down after idling 30 seconds.

When engine is stopped by using the cut-out switch and the engine temperature is high, the cooling fan will remain on approximately 30 seconds.

NOTE: If engine is stopped by removing the DESS key, cooling fan will immediately stop.

EMS DIAGNOSTIC AND COMMUNICATION TOOLS

SERVICE TOOLS

Description	Part Number	Page
Communication kit	529 035 981	403
DESS post interface	529 036 019	406–407
Diagnostic cable	710 000 851	406, 408
MPI-2	529 036 018	405, 407–408
Optional extension cable	529 035 697	405
Optional extension cable	529 035 703	403
supply T-harness	529 035 869	404, 407
Supply T-harness	529 035 869	403, 406

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

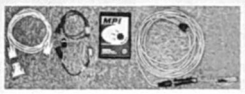
- Check the chart in the *TROUBLESHOOTING* section to have an overview of problems and suggested solutions.
- Check if the engine management system (EMS) pilot lamp blinks. If so, use the B.U.D.S. software and look for fault codes to diagnose the trouble.
- Check all fuses.
- Check relay 1.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.
- Refer to *ADJUSTMENT AND REPAIR PROCEDURES* section for procedures.

When using the service action suggested in the **Fault** section of B.U.D.S., the system circuits are referred to as A-41, which means connector "A" on the ECM and pin 41.

COMMUNICATION TOOLS

Two different MPI (Multi-Purpose Interface) can be used with B.U.D.S. software: MPI and MPI-2.

MULTI-PURPOSE INTERFACE (MPI)

PART REQUIRED
PC computer
B.U.D.S. software Use latest version available on BOSSWeb
Communication kit (P/N 529 035 981) 
Optional extension cable (P/N 529 035 703) 
Supply T-harness (P/N 529 035 869) 

MPI Supply

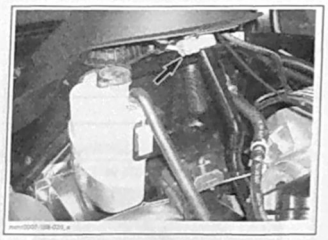
The MPI can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Connections with Vehicle

⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electric shock when working in contact with water. Be careful not to touch water while working with the computer.

Remove the 6 pin connector from its receptacle on the right side of the vehicle.



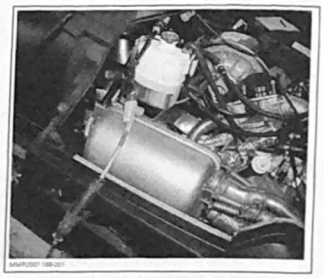
Connect supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.



NOTE: The use of the supply T-harness will keep the ECM ON. Not using it will allow the ECM shutting-off after some time.

CAUTION: Connecting MPI directly to vehicle connector (without supply T-harness) may lead to an incomplete data transfer to the ECM if it shuts down during the transfer. If this occurs during a reflashing of the ECM, it could become unusable. Always use the proper supply T-harness to allow continuous communication.

Connect the 6 pin diagnostic cable from MPI to supply to T-harness.

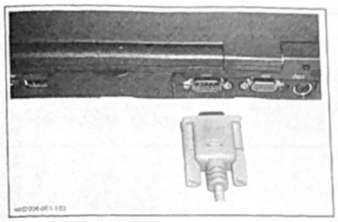


Connect the other diagnostic cable connector to MPI connector.

Connect serial cable to MPI connector.

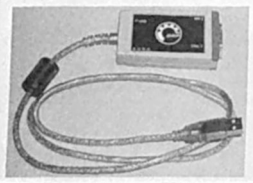
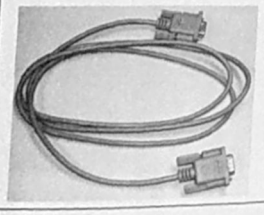


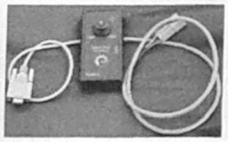
Connect remaining MPI connector to the serial port of a PC (personal computer).



Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

MULTI-PURPOSE INTERFACE-2 (MPI-2)

PART REQUIRED	OPERATION	
	– PROGRAMMING KEY(S) – ALL FUNCTIONS LISTED IN NEIGHBORHOOD COLUMN	– ENTERING CUSTOMER INFO – CLOSED TPS AND IDLE ACTUATOR RESET – READING FAULT CODES – ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
PC computer	X	X
B.U.D.S. software Use latest version available on BOSSWeb	X	X
MPI-2 (P/N 529 036 018) 	X	X
Optional extension cable (P/N 529 035 697) 	X	X

PART REQUIRED	OPERATION	
	- PROGRAMMING KEY(S) - ALL FUNCTIONS LISTED IN NEIGHBORHOOD COLUMN	- ENTERING CUSTOMER INFO - CLOSED TPS AND IDLE ACTUATOR RESET - READING FAULT CODES - ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
Diagnostic cable (P/N 710 000 851) 		X
DESS post interface (P/N 529 036 019) 	X	
Supply T-harness (P/N 529 035 869) 	X	X

MPI-2 Supply

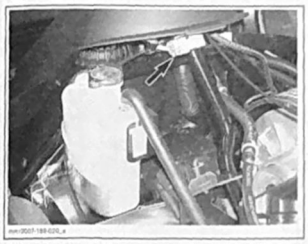
The MPI uses the PC computer USB port power for its supply.

Connections with Vehicle

⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electric shock when working in contact with water. Be careful not to touch water while working with the computer.

Remove the 6 pin connector from its receptacle on the right side of the vehicle.



Connect supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.



NOTE: The use of the supply T-harness will keep the ECM ON. Not using it will allow the ECM shutting-off after some time.

CAUTION: Connecting MPI directly to vehicle connector (without supply T-harness) may lead to an incomplete data transfer to the ECM if it shuts down during the transfer. If this occurs during a reflashing of the ECM, it could become unusable. Always use the proper supply T-harness to allow continuous communication.

Connection to Program DESS Key(s)

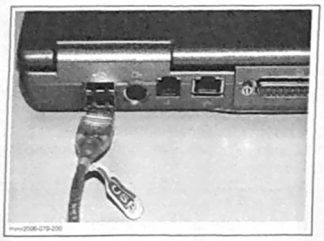
Connect DESS post interface (P/N 529 036 019) to T-harness.



Connect MPI-2 (P/N 529 036 018) to DESS post interface.

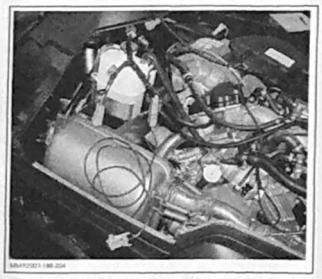


Connect remaining MPI-2 connector to the USB port of a PC (personal computer).

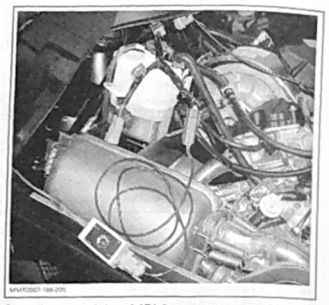


Connection to Perform all Operations except Programming DESS Key(s)

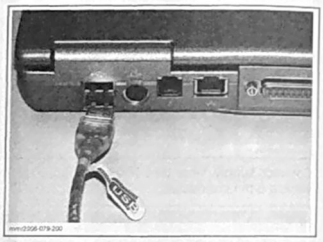
Connect Diagnostic cable (P/N 710 000 851) to T-harness.



Connect MPI-2 (P/N 529 036 018) to diagnostic cable.



Connect remaining MPI-2 connector to the USB port of a PC (personal computer).



B.U.D.S. SOFTWARE

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow electrical component inspection, diagnostic options and adjustments such as the closed throttle.

For more information pertaining to the use of the B.U.D.S. software, use its help which contains detailed information on its functions.

When using the service action suggested in the Fault section of B.U.D.S., for instance, a system circuit referred to as DA-35, means connector "A" on the ECM and the contact 35.

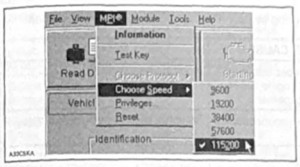
When using the B.U.D.S. software:

Ensure all connections have been made before starting B.U.D.S. to allow proper operation.

Install DESS key on vehicle post.

MPI Only

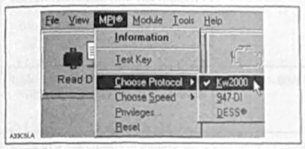
- Ensure that 115200 speed is properly selected in "MPI" under "Choose speed".



NOTE: If you are using an old PC computer, it may be necessary to use a slower speed so that the communication works.

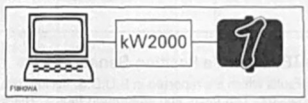
MPI and MPI-2

- Ensure that the protocol "kW2000" is properly selected in "MPI" under "Choose protocol.



- Ensure the status bar shows the kW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 indicates that the ECM is recognized by the MPI.



CONNECTION SUCCESSFUL

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

- ECM is not powered-up
- wrong protocol is used
- bad connection between MPI and ECM.

Changes in ECM

Anytime a change is brought in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove DESS key from vehicle DESS post and wait untilthe message disapears. Then, the operation will be completed.

DIAGNOSTIC

MONITORING SYSTEM

When one of the below conditions occurs, the monitoring system emits the following beep signals.

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above pulley engagement.	Normal condition.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection.	Reinstall tether cord cap correctly over post.
	Defective tether cord cap.	Use another programmed tether cord cap.
	Dirt or snow in tether cord cap.	Clean tether cord cap.
	Defective DESS post.	Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into electronic module.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
3 short beeps per second and EMS lamp flashing. Oil pilot lamp also lights up.	Low oil pressure.	Stop engine immediately and check oil level and top it. Check lubrication system.
3 short beeps per second. Battery pilot and EMS lamps lights up.	Low battery voltage. No charging.	Check battery and charging system.

FAULT CODES

General

The faults saved in the ECM (Engine Control Module) are kept even if the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the B.U.D.S. software. This will properly reset the appropriate counter(s) and will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s) or a faulty relay.

For more information pertaining to the fault codes (state, count, first, etc.) and report, refer to B.U.D.S. online help.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups: TPS faults and adaptation faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTATION FAILURE.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Fix.
Check if sensor is loose	Tighten and reset **Closed Throttle and Idle Actuator**.
Inspect sensor for damage or corrosion	Replace and reset **Closed Throttle and Idle Actuator**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle and Idle Actuator**.
Test sensor operation (wear test)	Replace and reset **Closed Throttle and Idle Actuator**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaptation Failure":

- Idle speed is out of range.
- Engine stops when throttle is released quickly.
- Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
ECM has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
Throttle cable too tight	Tighten and reset **Closed Throttle and Idle Actuator**.
Sensor is loose	Tighten and reset **Closed Throttle and Idle Actuator**.
Throttle bracket is loose	Tighten and reset **Closed Throttle and Idle Actuator**.
Idle speed screw (tamper proof) worn or loose	Change throttle body.
Idle bypass valve replaced but not reset	Reset **Closed Throttle and Idle Actuator** using B.U.D.S.

Fault Code P0654

If this code occurs and tachometer works normally, disregard this fault code.

FAULT CODE TABLE

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P0106	Air pressure sensor voltage out of range	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of intake manifold.	Make sure sensor's connector is fully inserted. Check for voltage within 0 and 5 volts between sensor connector pins 1 and 4. Check system circuits DA-12, DA-28 and DA-40.
P0107	Air pressure sensor voltage too low	Damaged circuit wires, damaged or disconnected sensor, sensor shorted to ground.	Make sure sensor's connector is fully inserted. Check for approximately 5 volts between sensor connector pins 1 and 2. Check system circuits DA-12, DA-28 and DA-40.
P0108	Air pressure sensor voltage too high	Damaged circuit wires, damaged or disconnected sensor, sensor shorted to a supply.	Make sure sensor's connector is fully inserted. Check for approximately 5 volts between sensor connector pins 1 and 2. Check system circuits DA-12, DA-28 and DA-40.
P0111	Air temperature sensor functional problem	Intermittent air temperature sensor reading or circuit wires shorted to ground.	Check system circuits DA-7 and DA-21. Replace the sensor if necessary.

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P0112	Air temperature sensor voltage too low	Air temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check system circuits DA-7 and DA-21.
P0113	Air temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected air temperature sensor on the airbox. Check the air temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuits DA-7 and DA-21.
P0116	Engine temperature sensor functional problem	Intermittent engine temperature sensor reading or circuit wires shorted to ground.	Check system circuits DA-11 and DA-27. Replace the sensor if necessary.
P0117	Engine temperature sensor voltage too low	Engine temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check for leakage between sensor's connection and ground. Check system circuits DA-11 and DA-27.
P0118	Engine temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected engine temperature sensor. Check the engine temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuits DA-11 and DA-27.
P0122	Throttle position sensor voltage too low	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check system circuits DA-24, DA-25 and DA-39. Refer to the *SHOP MANUAL* for complete throttle position sensor testing procedure.
P0123	Throttle position sensor voltage too high	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check system circuits DA-24, DA-25 and DA-40. Refer to the *SHOP MANUAL* for complete throttle position sensor testing procedure.
P0231	Fuel pump open circuit or shorted to ground	Damaged or disconnected fuel pump, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check for approximately 1 ohm between pins PE-3 and PE-4 of the fuel pump connector. Check for approximately 1 ohm between pins F3 and DB-29.
P0232	Fuel pump shorted to battery	Damaged fuel pump, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check for approximately 1 ohm between pins PE-3 and PE-4 of the fuel pump connector. Check for approximately 1 ohm between pins F3 and DB-29. Check if system circuit DB-29 is shorted to 12 V.
P0261	MAG injector open circuit or shorted to ground	Blown fuse, damaged or disconnected injector, damaged or disconnected circuit wires, damaged ECM output pins.	Check fuse F1. Check connections on injector. Check for approximately 14.5 ohms on injector. Check system circuit DA-15. Check connector CJ connecting the two harnesses together.

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P0262	MAG injector shorted to battery	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 14.5 ohms on injector. Check if system circuit DA-15 is shorted to 12 V.
P0264	PTO injector open circuit or shorted to ground	Blown fuse, damaged or disconnected injector, damaged or disconnected circuit wires, damaged ECM output pins.	Check fuse F2. Check connections on injector. Check for approximately 14.5 ohms on injector. Check system circuit DA-33. Check connector CJ connecting the two harnesses together.
P0265	PTO injector shorted to battery	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DA-33 is shorted to 12 V.
P0344	Cam phase sensor signal missing	Blown fuse, damaged circuit wires or damaged sensor.	Check fuse F5. Check for 12 volts between sensor's connector pins 1 and 3. Check system circuits DA-20, DA-34 and F5.
P0351	No MAG ignition output stage	Blown fuse, damaged circuit wires, damaged connector or damaged ignition coil.	Check fuse F1. Check for 0.85 to 1.15 ohm between ignition coil pins. Check connector CJ connecting the two harnesses together. Check system circuit DA-41.
P0352	No PTO ignition output stage	Blown fuse, damaged circuit wires, damaged connector or damaged ignition coil.	Check fuse F2. Check for 0.85 to 1.15 ohm between ignition coil pins. Check connector CJ connecting the two harnesses together. Check system circuit DA-1.
P0505	Idle air control valve output stage cutoff memory difference	Damaged actuator, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 50 ohms between pins A and D and also between pins B and C of the idle air control valve. Check for damaged circuit wires. Check system circuits DA-35, DA-36, DA-37 and DA-38. Check for damaged connector or damaged ECM output pins.
P0505	Idle air control valve output stage fault	Damaged actuator, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 50 ohms between pins A and D and also between pins B and C of the idle air control valve. Check for damaged circuit wires. Check system circuits DA-35, DA-36, DA-37 and DA-38. Check for damaged connector or damaged ECM output pins.
P0520	Oil pressure switch functional problem	Low oil level, engine leak, oil pump failure, damaged sensor, damaged or shorted circuit wires.	Check oil level. Check oil pressure switch resistance. With engine stopped, the resistance should be less than 1 ohm. With engine running, the resistance should be infinitely high (0L). Check system circuit DA-10.
P0562	Battery voltage too low	Blown fuse, battery failure, damaged circuit wires, damaged or disconnected alternator, damaged alternator drive system.	Check fuses F4 and F12. Check battery voltage for 11 to 13 volts with engine stopped. Check battery voltage for 14.1 to 14.7 volts with engine idling. Check connections on alternator. Check ground and positive connections near the starter relay.

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P0563	Battery voltage too high	Blown fuse, damaged circuit wires or damaged alternator. An external battery charger may have been used.	Check fuse F12. Check battery voltage for 14.1 to 14.7 volts with engine idling. Check connections on alternator. Check ground and positive connections near the starter relay.
P0601	Throttle position sensor adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no initialisation after ECM replacement.	Check cable adjustment. Check idle stop for wear. Make sure throttle plate is against throttle stop. Reset closed TPS.
P0601	Module call monitoring	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0602	ECM not coded	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0604	RAM fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0605	EEPROM fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0605	EEPROM checksum fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0605	Coding ID checksum fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0605	Coding checksum fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0605	Programming checksum fault	Damaged ECM or faulty programmation.	Try updating the ECM. If the problem persists, replace the ECM.
P0608	Sensor's power supply voltage too low	Inverted connectors between air pressure sensor and TPS. Damaged circuit wires, shorted air pressure sensor or shorted TPS.	Check system circuits DA-12, DA-28, DA-40, DA-24, DA-25 and DA-39.
P0608	Sensor's power supply voltage too high	Damaged circuit wires, TPS or air pressure sensor shorted to a supply.	Check system circuits DA-12, DA-28, DA-40, DA-24, DA-25 and DA-39.
P0616	Starter relay open circuit or shorted to ground	Blown fuse, damaged or disconnected starter relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse F4. Disconnect the starter relay and check for approximately 7.3 ohms between the small starter relay terminals. Check for approximately 12 volts between starter relay RD/GY wire and ground. Check system circuit DB-31.
P0617	Starter relay shorted to battery	Damaged solenoid, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect the starter relay and check for approximately 7.3 ohms between the small starter relay terminals. Check if system circuit DB-31 is shorted to 12 V.
P0648	DESS® lamp shorted to battery	Damaged or wrong speedometer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-3 is shorted to 12 V. Check if the right speedometer part number is installed.

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P0648	DESS® lamp open circuit or shorted to ground	Blown fuse, damaged speedometer, damaged or disconnected circuit wires, disconnected connector on speedometer or cab, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between pins 8 and 11 of the speedometer connector. Check system circuit DB-3.
P0650	Engine lamp shorted to battery	Damaged speedometer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-33 is shorted to 12 V.
P0650	Engine lamp open circuit or shorted to ground	Blown fuse, damaged speedometer, damaged or disconnected circuit wires, disconnected connector on speedometer or cab, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between pins 8 and 11 of the speedometer connector. Check system circuit DB-33.
P0654	Tachometer RPM signal shorted to battery	Damaged or wrong speedometer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-4 is shorted to 12 V. Check if the right speedometer part number is installed.
P0654	Tachometer RPM signal open circuit or shorted to ground	Blown fuse, damaged speedometer, damaged or disconnected circuit wires, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between pins 8 and 11 of the speedometer connector. Check system circuit DB-4.
P0655	Engine temperature lamp shorted to battery	Damaged speedometer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-5 is shorted to 12 V.
P0655	Engine temperature lamp open circuit or shorted to ground	Blown fuse, damaged speedometer, damaged or disconnected circuit wires, disconnected connector on speedometer or cab, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between pins 8 and 11 of the speedometer connector. Check system circuit DB-5.
P1102	Throttle position sensor adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no initialisation after ECM replacement.	Check cable adjustment. Check idle stop for wear. Make sure throttle plate is against throttle stop. Reset closed TPS.
P1104	Throttle position sensor adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no initialisation after ECM replacement.	Check cable adjustment. Check idle stop for wear. Make sure throttle plate is against throttle stop. Reset closed TPS.
P1148	Safety fuel cut off detected	TPS adaptation failure, TPS failure, damaged ECM memory or battery voltage out of range.	Check cable adjustment. Check idle stop for wear. Make sure throttle plate is against throttle stop. Reset closed TPS.
P1202	Oil pressure switch still closed	Low oil level, engine leak, oil pump failure, damaged sensor, damaged or shorted circuit wires.	Check oil level. Check oil pressure switch resistance. With engine stopped, the resistance should be less than 1 ohm. With engine running, the resistance should be infinitely high (0L). Check system circuit DA-10.
P1203	Oil pressure switch leakage	Low oil level, engine leak, oil pump failure, damaged sensor, damaged or shorted circuit wires.	Check oil level. Check oil pressure switch resistance. With engine stopped, the resistance should be less than 1 ohm. With engine running, the resistance should be infinitely high (0L). Check system circuit DA-10.

FAULT CODE	DESCRIPTION	CAUSE	ACTION
P1502	T.O.P.S. functional problem	Damaged circuit wires or damaged ECM output pins.	Check for continuity between pin DB-9 and ground.
P1611	P+ Test of idle air control valve output signal failed	Damaged actuator, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 50 ohms between pins A and D and also between pins B and C of the idle air control valve. Check for damaged circuit wires. Check system circuits DA-35, DA-36, DA-37 and DA-38. Check for damaged connector or damaged ECM output pins.Replace the idle air control valve if necessary.
P1646	Engine temperature lamp shorted to battery	Damaged speedometer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-5 is shorted to 12 V.
P1647	Engine temperature lamp open circuit or shorted to ground	Blown fuse, damaged speedometer, damaged or disconnected circuit wires, disconnected connector on speedometer or cab, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between pins 8 and 11 of the speedometer connector. Check system circuit DB-5.
P1652	Engine temperature gauge signal shorted to battery	Damaged circuit wires or damaged gauge.	Check system circuit DB-30.
P1653	Engine temperature gauge signal open circuit or shorted to ground	Damaged or disconnected circuit wires, disconnected connector on gauge or cab, damaged ECM output pins. Improper temperature gauge installation.	Make sure YL/BK wire (center terminal) is disconnected from gauge. Check system circuit DB-30.
P1655	DESS® line shorted to battery	Damaged circuit wires or mixed up connections.	Check system circuits DB-26, DB-38 and DB-39.
P1656	DESS® line shorted to ground	Damaged circuit wires or mixed up connections.	Check system circuits DB-26, DB-38 and DB-39.
P1670	Buzzer shorted to battery	Damaged buzzer, damaged circuit wires, damaged connector or damaged ECM output pins.	Check if system circuit DB-18 is shorted to 12 V. Refer to the *SHOP MANUAL* for complete buzzer testing procedure.
P1671	Buzzer open circuit or shorted to ground	Blown fuse, damaged buzzer, damaged or disconnected circuit wires, disconnected connector on buzzer or cab, damaged ECM output pins.	Check fuse F4. Check for approximately 12 volts between connector pin AR-A and negative battery terminal. Check system circuit DB-18. Refer to the *SHOP MANUAL* for complete buzzer testing procedure.
P1675	Relay 2 shorted to battery	Damaged relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 100 ohms between relay pins 85 and 86. Check if system circuit DB-16 is shorted to 12 V.
P1676	Relay 2 open circuit or shorted to ground	Blown fuse, damaged or disconnected relay, damaged or disconnected circuit wires, damaged ECM output pins.	Check fuse F4. Check for approximately 100 ohms between relay pins 85 and 86. Check system circuit DB-16.

ADJUSTMENT AND REPAIR PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	419
Fluke 111 multimeter	529 035 868	418
hose pincher	295 000 076	429
pliers	295 000 070	427, 431
tachometer	529 014 500	420

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
rigid back probe Fluke	TP88	419

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	433, 437, 439

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

- good transmission system operation
- good engine compression and properly operating mechanical components, no leaks etc.
- fuel pump connection and fuel lines without leaks.

Check the chart in *TROUBLESHOOTING* section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

⚠ WARNING

Always disconnect battery prior to working on the fuel system. Always disconnect battery exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

⚠ WARNING

The components of a fuel injection system holds much more pressure than on a carbureted engine. Prior to disconnecting a hose or removing a component from the fuel system, follow the recommendation described here.

- Use the B.U.D.S. software to release the fuel pressure in the system (refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*). Look in the **Activation** section of the software B.U.D.S.

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses. Proceed with care when removing/installing pressure test equipment or disconnecting fuel line connections. Use the B.U.D.S. software to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Never use a hose pincher on injection system high pressure hoses. Replace any damaged or deteriorated fuel lines.

When the repair is completed, ensure that all hoses are connected and secured. Perform the *FUEL PRESSURE TEST* and the *FUEL TANK LEAK TEST* as explained in *FUEL TANK AND FUEL PUMP* section. A fuel pressure drop indicates a leak. Check for leaking fuel.

⚠ WARNING

Always perform the fuel pressure test if any component has been removed. A pressure test must be done before turning the ignition key to START. The fuel pump is activated each time ignition key is turned to START. After performing a fuel pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

- battery
- fuses
- relay 1
- DESS
- ignition (spark)
- ground connections
- wiring connectors
- speedometer.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

Some EMS components are continuously powered when ignition key is turned to START. The ECM switches the circuit to the ground to complete the electrical circuits it controls. Take this into account when troubleshooting. Always disconnect the battery prior to disconnecting any electric or electronic parts.

Pay particular attention to ensure that pins are not out of their connectors or out of shape.

When probing terminals, pay attention not to bend the terminal as this could bring a loose connection that would be difficult to troubleshoot.

⚠ WARNING

Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure terminals are properly crimped on wires and fastened in housing, and that they are free of corrosion or moisture. Check if wiring harness shows any signs of scoring. Ensure proper electrical connection. Particularly check ECM ground connections. A "defective module" could possibly be "repaired" simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins.

Ensure that all electronic components are genuine. Any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use B.U.D.S. software. See *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* subsection.

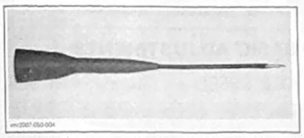
After a problem has been solved, ensure to clear the fault(s) in the ECM using the B.U.D.S. software. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* subsection.

Diagnostic Tools

To perform verifications, use Fluke 111 multimeter (P/N 529 035 868).



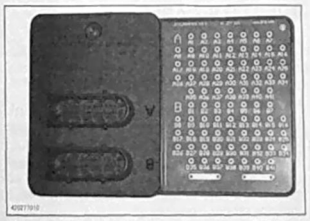
To easily probe wire terminals through the back of their connectors, rigid back probe Fluke (P/N TP88) pins or equivalent can be used.



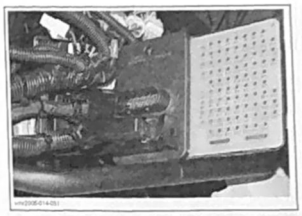
They can be inserted at the end of the standard probes of the Fluke 111 multimeter.



The most recommended and safest method to probe ECM connector terminals is to use the ECM adapter (P/N 420 277 010). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.



Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool holes.



Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE SENSOR TABLE			
TEMPERATURE		RESISTANCE (ohms)	
°C	°F	MAPTS	CTS
- 40	- 40	—	45000
- 30	- 22	28000	28000
- 20	- 4	15000	15000
0	32	5500	5500
20	68	2500	2500
40	104	1200	1200
60	140	600	600
80	176	320	320
100	212	180	180
130	266	90	90

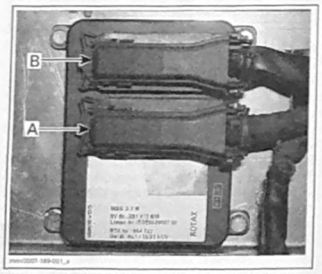
CONVERSION CHART FOR TEMPERATURE SENSORS

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

ECM Connectors

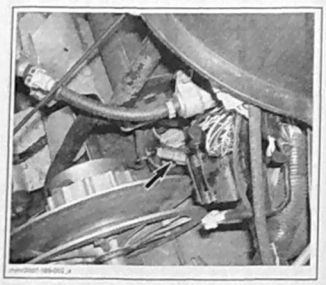
The ECM connectors are identified by the letter "A" and "B".



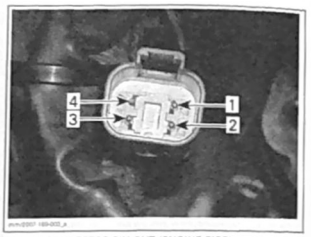
NOTE: Do not apply dielectric grease or any other lubricant in ECM connectors.

Engine Connector

Engine connector is located besides ECM.



Use this illustration to locate the pin numbers on the engine connector when performing tests.



ENGINE CONNECTOR PIN-OUT (ENGINE SIDE)

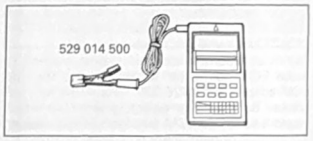
BASIC ADJUSTMENTS

IDLE SPEED

The idle speed is not adjustable. The ECM controls the idle speed of the engine.

CAUTION: Never attempt to adjust the sealed idle stop screw. It is calibrated at the factory. If the screw adjustment is changed, the throttle body must be replaced.

If desired, the engine RPM can be verified with the tachometer (P/N 529 014 500).



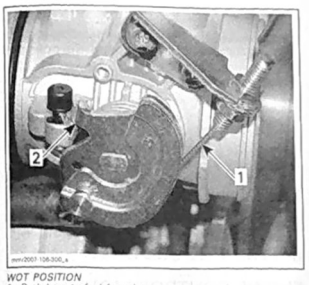
THROTTLE CABLE

Handlebar and throttle cable must be at their normal position.

Wide Open Throttle Position Verification

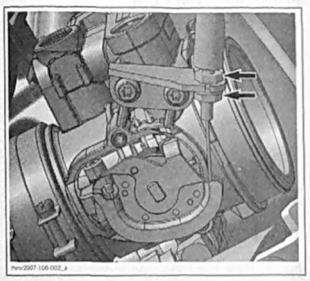
Squeeze throttle lever and hold it at wide open throttle (WOT).

There must be free-play in throttle cable. Push against throttle cable to see if cam stopper will move just a little to touch throttle body. If so, it confirms proper free-play.



WOT POSITION
1. Push here to feel free-play
2. Stopper just close to touching throttle body

If adjustment is needed, use adjuster nuts.

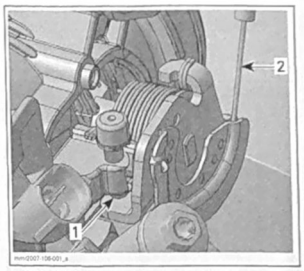


When done, turn handlebar side to side and ensure there is still free-play in each position while at WOT.

CAUTION: Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

Idle Position Verification

Activate throttle lever a few times. Make sure throttle cam of throttle body rests against set screw with some free-play in the cable.



1. Contact here
2. Free-play here

CAUTION: If there is no free-play at idle position, it may cause poor idling and startability problems.

⚠ WARNING

Make sure idle speed stopper contacts throttle cam when throttle lever is fully released at handlebar.

CLOSED THROTTLE AND IDLE ACTUATOR RESET

NOTE: This operation performs a reset of the values in the ECM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened, removed or replaced, and also if throttle body or ECM are replaced.

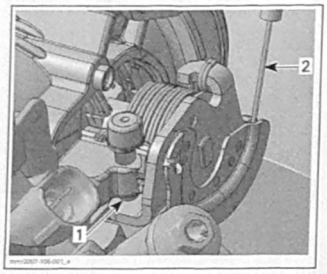
CAUTION: An improperly set TPS may lead to poor engine performance and emission compliance could possibly be affected.

Reset

Use the B.U.D.S. software to perform this adjustment.

Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate.

Ensure the throttle cam of throttle body rests against set screw without any tension in the cable. Otherwise, perform the throttle cable adjustment.



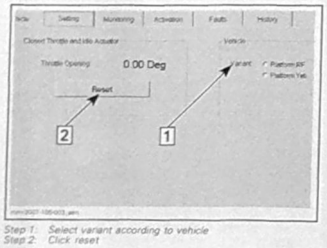
1. Contact here
2. Free-play here

Select the **Setting** tab of B.U.D.S.

Ensure the proper variant according to vehicle is selected.

V800 MODEL	VARIANT
Legend, Expedition Sport and Tundra	Platform RF
Skandic SWT and Expedition TUV	Platform Yeti

Click on the **Reset** button.



Step 1: Select variant according to vehicle
Step 2: Click reset

Reset is completed.

NOTE: No message will be displayed if operation is successful. If TPS is not within the allowed range while resetting the **Closed Throttle and Idle Actuator**, the ECM will generate a fault code and will not accept the setting.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* section for more information.

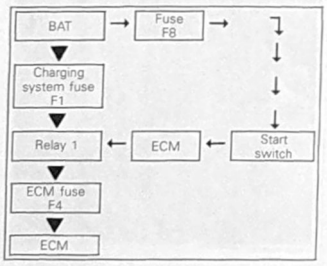
IGNITION TIMING

The ignition timing is not adjustable.

REPAIR PROCEDURES

ENGINE CONTROL MODULE (ECM)

Power Supply to ECM



ECM Power Supply and Ground Pinout

FUNCTION	CONNECTOR PIN
Power 12 Vdc	B-11
Grounds	B1, B2, B9, B32 and B41

Troubleshooting ECM

Briefly push START button.

NOTE: This will wake up the ECM for approximately 15 seconds then it will automatically shut down.

QUICK INDICATION THAT ECM IS NOT WORKING (assuming the observed component is working)
Speedometer does not turn on.
Fuel pump does not turn on for approx. 5 seconds.

NOTE: It is not required that DESS key be installed on its post or engine cut-out switch be in RUN position to allow ECM power-up.

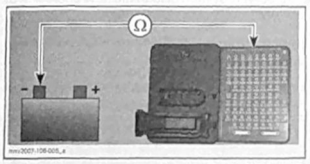
If ECM does not turn on, check the following.

Check charging system fuse F1 and fuse F4. If they test good, check relay 1. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES.*

Check fuse F8 and start switch. Refer to *STARTING SYSTEM.*

If switch tests good, check ECM grounds.

ECM GROUND TEST		MEASUREMENT
ECM connector B-1, B-2, B9, B-32, B-41	Battery ground	Close to 0 Ω (continuity)



mmv3007-108-005_a

If everything is good, refer to *ECM REPLACEMENT.*

ECM Replacement

Prior to replacing a possibly faulty ECM, ensure that all the recommendations in the general introduction of this section have been carried out. Also, check ECM power supply and all grounds for proper contact/cleanliness and tightness.

IMPORTANT: When the ECM is replaced, the **Closed Throttle and Idle Actuator** must be reset. Refer to *BASIC ADJUSTMENTS.*

To allow transferring the previous recorded information from the old ECM to the new one, use the B.U.D.S. software. Use **Replace** ECM in the ECM menu. Follow instructions in its help system.

NOTE: If the old ECM still works, its information must be read by B.U.D.S. before being removed from the vehicle in order to transfer vehicle information and history to the new ECM.

Disconnect battery cables.

⚠ WARNING

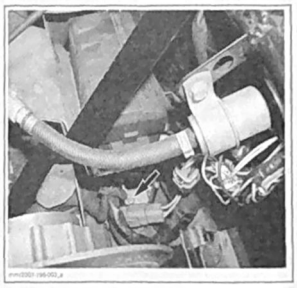
Battery BLACK negative cable must always be disconnected first and connected last.

Open hood.

Remove muffler. Refer to *EXHAUST SYSTEM.*

Release fuel hose from fuse box support.

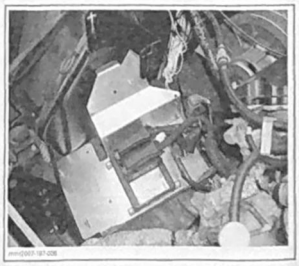
Remove fuse box support.



mmv3007-196-003_a

Remove front plate of fuse box support.

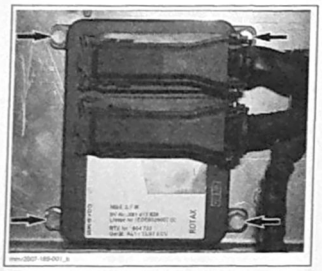
Lay down support.



mmv3007-197-008

Disconnect both connectors from ECM.

Remove ECM.



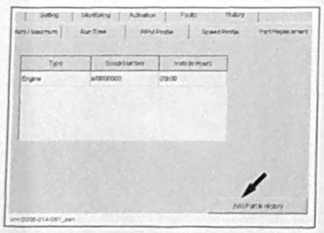
Install the new ECM to the vehicle.

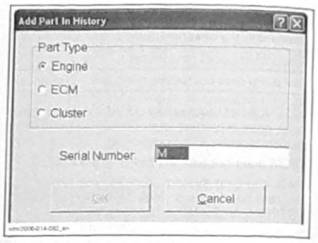
Reconnect connectors to ECM, and then battery cables.

Reinstall remaining removed parts.

Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram ignition key(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab and **Engine Serial Number** in **History, Part Replacement**.





After performing the required resets, ensure to clear all faults from the newly replaced ECM.

FUEL INJECTOR

Injector Leakage Test

The leakage test is validated when performing the "fuel delivery system diagnostic flow chart" in *FUEL TANK AND FUEL PUMP (V800)*.

Injector Electrical Test

Briefly push START button.

Using the B.U.D.S. software, energize the fuel injector from the **Activation** section.



You should hear the injector working.

CAUTION: While doing fuel injector electrical test, do not apply continuous voltage for more than 10 seconds. This can damage the injector.

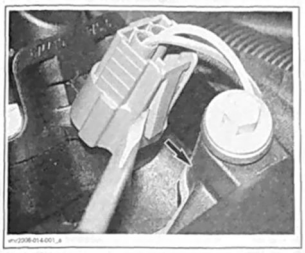
This will validate the injector mechanical and electrical operation.

If the injector does not work, check injector power supply.

Injector Voltage Test

Disconnect the connector from the injector.

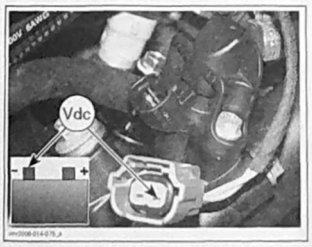
NOTE: If connector is hard to unlock, gently use a screwdriver to release connector.



Briefly push START button.

Use a multimeter and set it to Vdc. Read voltage.

CYLINDER	INJECTOR CONNECTOR		MEASUREMENT
	WIRE		
FRONT	BROWN/ RED	Battery ground	12 Vdc
REAR			



If supply voltage is good, check ground circuit between injector and ECM (see *WIRING DIAGRAMS*).

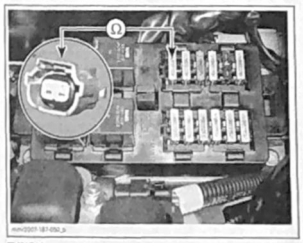
- If ground circuit is faulty, repair/replace.
- If ground circuit is good, refer to *ECM REPLACEMENT*.

If supply voltage is not good, check continuity between fuse F6 and injector (see *WIRING DIAGRAMS*).

NOTE: Probe fuse exactly as shown. This validates fuse at the same time.

Use a multimeter and set it to Ω. Read resistance.

CYLINDER	INJECTOR CIRCUIT		MEASUREMENT
	WIRE		
FRONT	VIOLET/ BLUE	Fuse F6	Close to 0 Ω
REAR			



TYPICAL

- If continuity is good, check relay 1 and wiring from battery.
- If continuity is faulty, check fuse; if OK, repair/replace wiring going to injector.

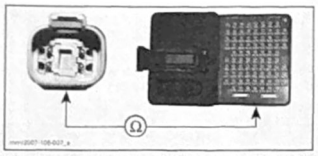
Injector Resistance Test

Reconnect the injector connector.

Disconnect the connector "A" from the ECM and the engine connector.

Using a multimeter, check resistance value between terminals as follows.

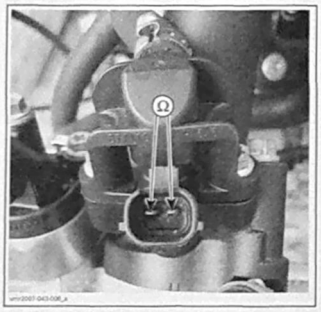
INJECTOR	ENGINE CONNECTOR PIN	ECM CONNECTOR "A"	RESISTANCE @ 20°C (68°F)
FRONT	1	A-15	13.8 - 15.2 Ω
REAR		A-33	



If resistance value is correct, refer to *ECM REPLACEMENT*.

If resistance value is incorrect, remove injector connector and check resistance value between injector pins as follows.

INJECTOR	INJECTOR PIN		RESISTANCE @ 20°C (68°F)
FRONT	1	2	13.8 - 15.2 Ω
REAR			



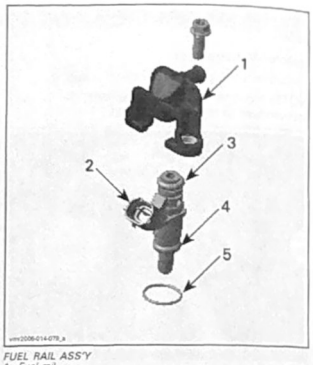
If readings are out of specifications, replace injector.

If readings are good, repair/replace wiring going to injector.

Fuel Injector Replacement

Injector Removal

Before removing the injector, the fuel rail has to be removed from the engine. Refer to *FUEL RAIL* for the procedure.



FUEL RAIL ASS'Y
1. Fuel rail
2. Fuel injector
3. Injector top O-ring
4. Injector bottom O-ring
5. Manifold O-ring

The fuel injector can be easily pulled out of the fuel rail.

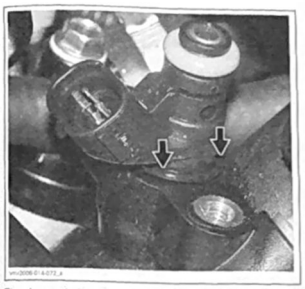
Injector Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

Apply a thin film of engine oil to O-rings to ease insertion in rail.

Install new O-rings, if you reinstall a used injector then insert the fuel injector in place with your hand. Do not use any tool.

Carefully insert injector in manifold. Gently push in evenly all around while inserting injector. O-ring must be completely inserted and not visible, before finishing pushing injector.



Firmly push injector until it bottoms.

Reinstall fuel rail.

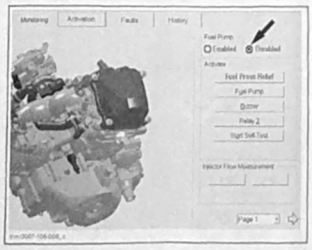
FUEL RAIL

Pressure at fuel rails is supplied and controlled by the fuel pump module. Refer to *FUEL TANK AND FUEL PUMP (V800)* for pressure test.

Fuel Rail Replacement

Rail Removal

Disable fuel pump using B.U.D.S. Look in the **Activation** tab.



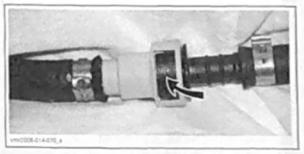
Release fuel pressure by running engine until it runs out of gas.

Remove relay 1.



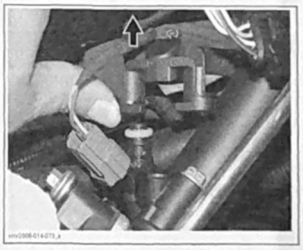
TYPICAL

Wrap a rag around the inlet hose and release the quick fitting.



Unscrew rail retaining screws.

Gently pull rail up by hand.



To disconnect fuel rail, cut clamp on fuel hose using pliers (P/N 295 000 070). Refer to *FUEL TANK AND FUEL PUMP (V800)* for clamp removal/installation procedures.

NOTE: If fuel rail is removed purposely to access fuel injector, it is not necessary to cut hose clamp. Only to replace fuel rail.

Rail Installation

For installation, reverse the removal process but pay attention to the following.

Install new clamps using pliers as per removal (if fuel rail was replaced).

A thin film of oil should be applied to O-rings of fuel injector to ease installation of fuel rail.

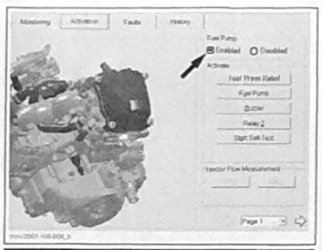
Install new O-rings.

Install fuel rail and evenly tighten screws a little at a time each side.

Tightening torque of the rail retaining screws is 6 N•m (53 lbf•**in**).

Reinstall relay 1.

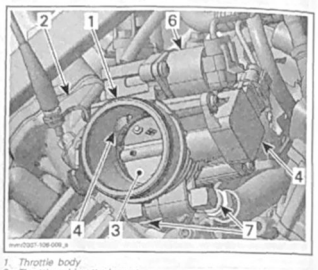
After securing inlet hose at quick fitting, re-enable fuel pump using B.U.D.S.



⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to *FUEL TANK AND FUEL PUMP (V800)*. Run engine and check for leaks.

THROTTLE BODY

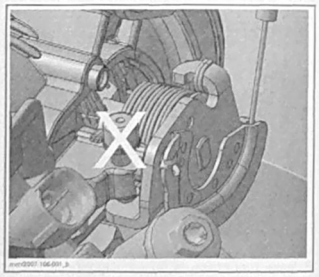


1. *Throttle body*
2. *Throttle cable attachment*
3. *Throttle plate*
4. *TPS*
5. *Idle bypass channel*
6. *Idle bypass valve*
7. *Coolant hoses*

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: Never attempt to adjust the sealed idle stop screw. It is calibrated at the factory. If the screw adjustment is changed, the throttle body must be replaced.



Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is off.

– Throttle cable adjustment too tight. Not returning fully to idle stop.

- Throttle body idle set screw is loose or worn (throttle body must be replaced).
- TPS is loose.
- Idle bypass valve is loose.
- Corroded or damaged wiring or connectors.
- Throttle body has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.
- ECM has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.

Electrical Inspection

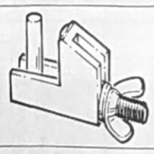
Refer to *THROTTLE POSITION SENSOR (TPS)* and *IDLE BYPASS VALVE* in this section.

Throttle Body Replacement

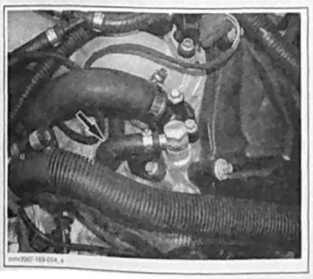
Throttle Body Removal

To remove the throttle body from engine, proceed as follows:

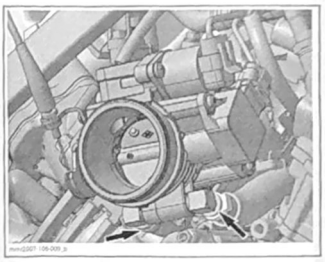
- Open hood.
- Remove pulley guard. Refer to *DRIVE SYSTEM AND BRAKE*.
- Remove air intake silencer. Refer to *AIR INTAKE SYSTEM*.
- Install a hose pincher (P/N 295 000 076) on the indicated coolant hose connected to throttle body.



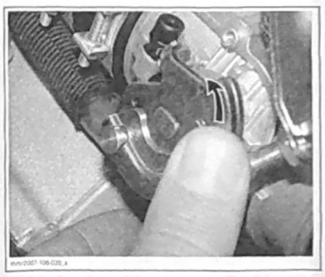
295 000 076



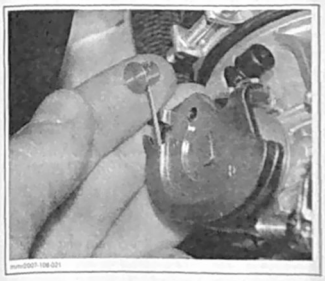
- Disconnect coolant hoses from throttle body.



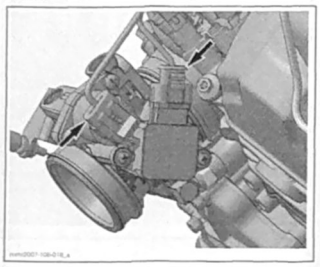
- Turn throttle lever cam to increase throttle cable free-play.



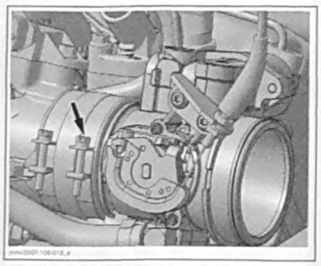
- Hold cam in this position and pull out cable barrel. Detach throttle cable.



– Disconnect TPS and idle bypass valve connectors.



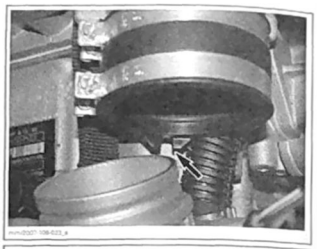
– Detach throttle body from intake manifold.



Throttle Body Installation

Installation of the throttle body is the reverse of the removal procedure. Pay attention for the following details.

Install throttle body on intake manifold. Ensure to index throttle body tab with boot notches.



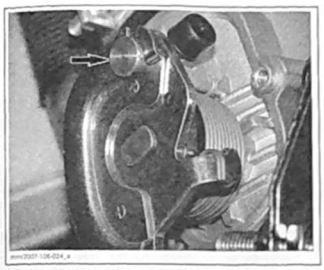


Insert throttle cable in lever cam.

Properly install cable barrel to throttle cable end.



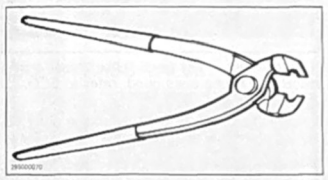
Turn cam to loosen throttle cable and insert barrel in cam.



Release cam and ensure throttle cable is properly locked. Activate throttle lever several times.

Perform the throttle cable adjustment and the **Closed Throttle and Idle Actuator** reset. Refer to *BASIC ADJUSTMENTS* in this section.

To install coolant hose clamps, use pliers (P/N 295 000 070).

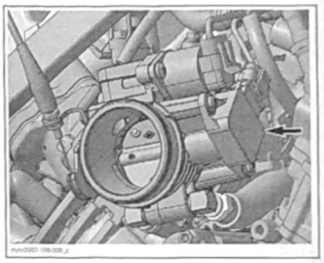


Refill and bleed cooling system if necessary. Refer to *COOLING SYSTEM*.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



Open hood.

NOTE: Air intake silencer may be removed to ease access.

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments of throttle body are adequate.

The EMS may generate several fault codes pertaining to the TPS. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* section for more information.

TPS Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.



Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates that the TPS needs to be replaced or the computer used may be too slow to transfer data fast enough for real time display.

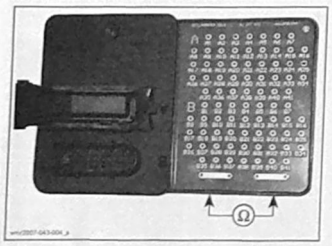
TPS Resistance Test

Ensure TPS is connected to wiring harness.

Disconnect the "A" connector from the ECM.

Using a multimeter, check resistance values on ECM connector as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN		RESISTANCE Ω @ 20°C (68°F)	
A-24	A-25	710 - 1300	2600 - 2700
A-25	A-39	1600 - 2400	1600 - 2400
A-24	A-39	2600 - 2700	710 - 1300



NOTE: The resistance value should change smoothly and proportionally to throttle movement. Otherwise, replace TPS.

If resistance values are correct, perform the *VOLTAGE TEST* below.

If resistance values are incorrect, check wiring harness. If wiring is faulty, repair/replace. If wiring is good, replace TPS.

Reconnect ECM connector.

TPS Voltage Test

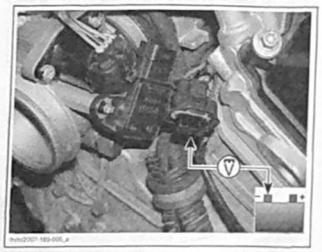
Check the ECM voltage output to the TPS.

Disconnect connector from TPS.

Briefly push START button.

Check the voltage readings from harness connector as follows.

CONNECTION	VOLTAGE
Pin 1 with battery ground	5.0 V
Pin 2 with battery ground	0 V
Pin 3 with battery ground	4.75 - 5 V



If voltage test is not good, check/repair wiring harness. If wiring tests good, refer to *ECM REPLACEMENT*.

If voltage test is good, everything is in order (assuming resistance test was performed).

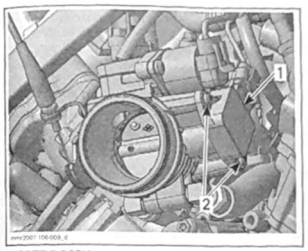
TPS Replacement

Open hood.

Remove air intake silencer. Refer to *AIR INTAKE SYSTEM*.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. Throttle position sensor (TPS)
2. Screws

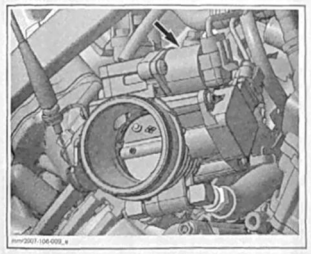
Install the new TPS.

Apply Loctite 243 (P/N 293 800 060) on the TPS retaining screws, then torque to 3 N•m (27 lbf•in).

Reinstall remaining removed parts.

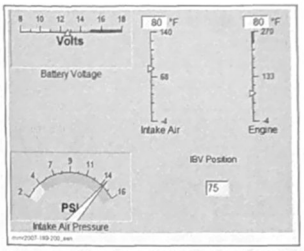
Proceed with the **Closed Throttle and Idle Actuator Reset**. See *BASIC ADJUSTMENTS* at the beginning of this section.

IDLE BYPASS VALVE



IBV Information in B.U.D.S. Software

The IBV position (Idle By-pass Valve) is displayed for information purposes only.



This value implies no maintenance, it is not adjustable. The value is given in steps, with 0 being fully closed, and 150 being fully open. The ECM constantly controls the IBV to maintain its target idle speed when the throttle is closed.

Typical IBV position at idle for a warm engine ranges from 25 to 50 steps, depending on altitude, air temperature and production tolerances.

NOTE: An engine giving an IBV position outside of this range is not necessarily faulty. It may only give clues if poor idle or light throttle behavior is experienced. Lower values may indicate a leakage in the air intake system; higher values can suggest a dirty throttle body, obstructed idle by-pass valve passage, friction between the drive pulley and the belt, etc.

Resistance Test

Open hood.

Remove pulley guard. Refer to *DRIVE SYSTEM AND BRAKE*.

NOTE: Air intake silencer may be removed to ease access.

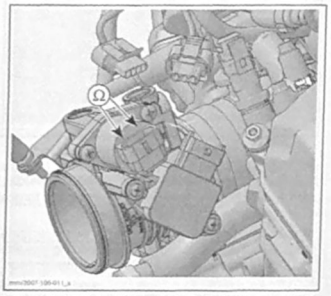
An idle bypass valve with good resistance measurement can still be faulty. It is also possible that a mechanical failure occurs which is not detectable without measuring the air flow. Replacing the idle bypass valve may be necessary as a test.

Disconnect idle bypass valve from the wiring harness.

Using a multimeter, check the resistance in both windings.

Check the resistance between pins as shown.

IDLE BYPASS VALVE		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	4	50
2	3	

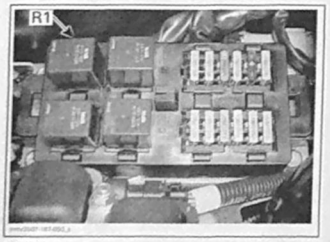


If the resistance of one or both windings is not good, replace the idle bypass valve.

If resistance test of valve windings is good, check continuity of circuits A-35, A-36, A-37, A-38. If not good, check/repair wiring/connectors.

Visual Inspection

NOTE: Make sure to remove relay 1 before the following procedure.



TYPICAL

Remove idle bypass valve from throttle body.

Check the piston and bypass channel for dirt/deposits which can cause a sticking piston.

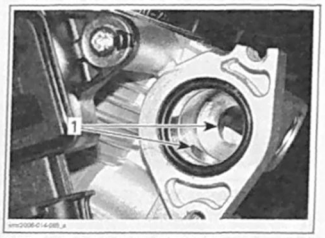
CAUTION: Always make sure relay 1 is removed while the idle bypass valve is removed.

CAUTION: Do not try to operate the piston of the idle bypass valve when it is dismounted. Also do not move the piston by hand. The drive screw is very sensitive and may be destroyed.

Using a part cleaner, clean idle bypass in throttle body from contamination then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

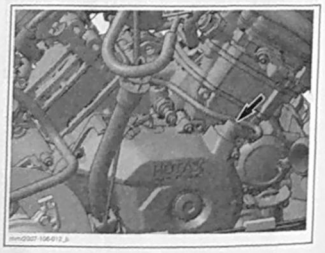


TYPICAL — IDLE BYPASS VALVE REMOVED
1. Clean bore from contamination

Clean all remaining parts and install the idle bypass valve on the throttle body.

Reinstall relay 1.

CRANKSHAFT POSITION SENSOR (CPS)



NOTE: Take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth. First check fault codes (refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*) then check the teeth condition if necessary (refer to *MAGNETO SYSTEM*).

Open hood.

Remove pulley guard. Refer to *DRIVE SYSTEM AND BRAKE*.

NOTE: Air intake silencer may be removed to ease access.

CPS Voltage Test

Disconnect CPS wiring harness connector. Probe pins while cranking engine, as shown.

⚠ WARNING

Be careful of the rotating drive pulley while working.

CPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1	2	Approximately 2 Vac

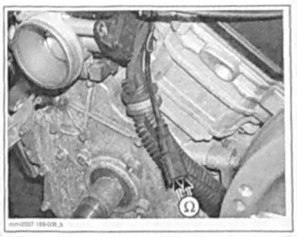


If voltage is not within specifications, inspect wiring and replace CPS if wiring is good.

CPS Resistance Test

Disconnect CPS wiring harness connector. Probe terminals as shown.

CPS CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	700 - 900 Ω

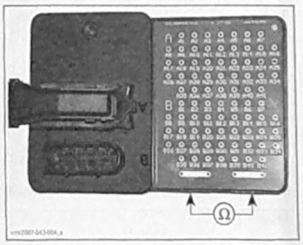


If resistance is not within specifications, replace the CPS.

If resistance tests good, reconnect the CPS connector and disconnect the connector "A" on the ECM.

Using a multimeter, recheck resistance as per table.

ECM CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
A-5	A-19	700 - 900 Ω



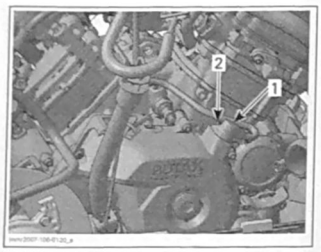
If resistance value is correct, refer to *ECM REPLACEMENT*.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

CPS Replacement

Unplug CPS connector.

Remove CPS.

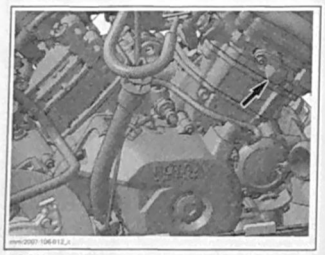


TYPICAL
1. CPS
2. Retaining screw

Install new CPS and secure harness with a locking tie.

Torque CPS retaining screws to 10 N•m (89 lbf•**in**).

CAMSHAFT POSITION SENSOR (CAPS)



TYPICAL

Open hood.

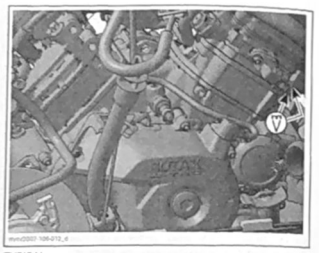
CAPS Voltage Test

Briefly push START button.

Use a multimeter and set it to Vdc.

Back-probe connector and read voltage as follows.

CAPS CONNECTOR		VOLTAGE
ORANGE/GREEN	BLACK/GREEN	Battery voltage



TYPICAL

If voltage is not good, Check fuse F1 and relay 1. If good, check/repair wiring/connectors.

If voltage is good, do the following test.

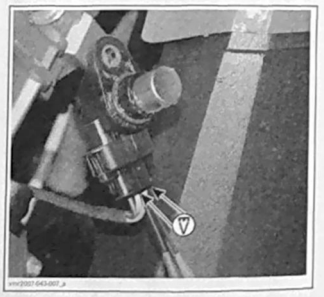
Remove CAPS sensor from engine.

Ensure connector is plugged.

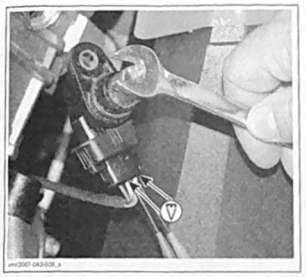
Use a multimeter and set it to Vdc.

Back-probe connector and read voltage as follows.

CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Free	ORANGE/ GREEN	YELLOW/ GREEN	Close to 0 Vdc



CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Metallic object on sensor	ORANGE/ GREEN	YELLOW/ GREEN	Battery voltage will appear briefly

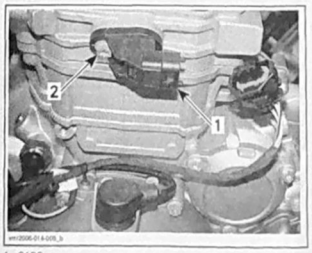


If voltage is appropriate, check/repair wiring/ connector between sensor and ECM. If it is good, refer to *ECM REPLACEMENT*.

If voltage is wrong, try a new CAPS.

CAPS Replacement

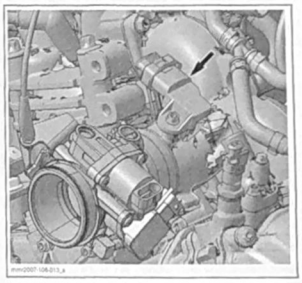
Unscrew the retaining screw and replace the CAPS. Ensure to reinstall O-ring.



1. CAPS
2. Retaining screw

Apply Loctite 243 (P/N 293 800 060) on thread and torque to 10 N•m (89 lbf•in).

MANIFOLD AIR PRESSURE AND TEMPERATURE SENSOR (MAPTS)



NOTE: This sensor is a multifunction device. It measures ambient pressure, intake manifold air pressure and temperature for air flow calculations.

Open hood.

Sensor Pressure Function

Ensure sensor is correctly installed on intake manifold. Otherwise, the MAPTS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

MAPTS Voltage Test

Check the voltage output from ECM to the pressure sensor.

Briefly push START button.

Disconnect plug connector from MAPTS and connect a voltmeter as shown.

MAPTS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1	3	5 Vdc



If voltage test is good, replace the MAPTS.

If voltage test is not good, check the continuity of the MAPTS circuit. See below.

MAPTS Resistance Test

Disconnect the connector "A" from the ECM.

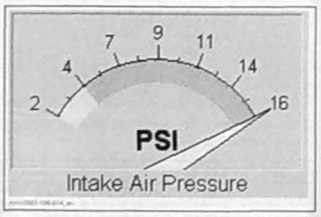
Using a multimeter, check continuity of circuits 12, 28 and 40.

If wiring harness is good, refer to *ECM REPLACEMENT*.

Otherwise, repair the connectors or replace the wiring harness between ECM connector and the MAPTS.

MAPTS Test with B.U.D.S.

Using B.U.D.S. software, look the MAPTS from the **Monitoring** section and read out the pressure value while engine is stopped.



Perform the same test with a new MAPTS and compare both readings.

Values have to be within ± 3.4 kPa (0.5 PSI).

If old MAPTS's value is out of this range, replace it.

Sensor Temperature Function

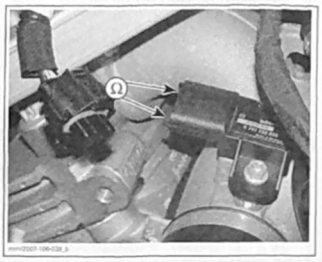
The sensor also monitors the temperature at manifold.

MAPTS Resistance Test

Disconnect the connector from the MAPTS.

Using a multimeter, check the resistance of the sensor itself as shown.

MAPTS		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	2280 - 2740

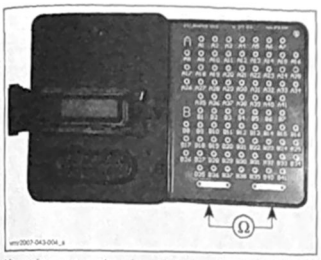


If resistance is not within specification, replace the MAPTS.

If resistance tests good, **reconnect** the MAPTS and disconnect the connector "A" from the ECM.

Using a multimeter, recheck resistance value between pins as shown.

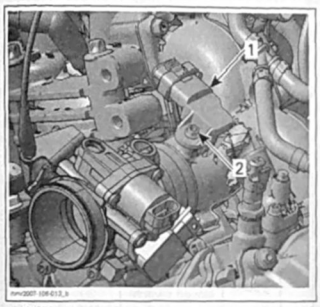
ECM CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
A-7	A-28	2280 - 2740



If resistance value is correct, refer to *ECM REPLACEMENT*.

If resistance value is incorrect, inspect/repair/replace wiring harness between ECM connector and the MAPTS.

MAPTS Replacement

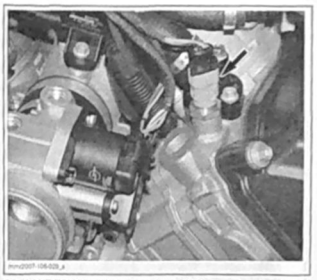


1. MAPTS
2. Retaining screw

Disconnect MAPTS connector and remove the MAPTS.

Apply Loctite 243 (P/N 293 800 060) on screw then torque to 6 N•m (53 lbf•**in**).

COOLANT TEMPERATURE SENSOR (CTS)



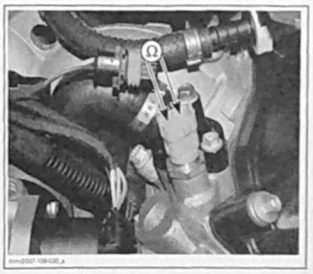
COOLANT TEMPERATURE SENSOR (CTS)

Remove hood and LH side panel. Refer to *BODY*.

CTS Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.

CTS SENSOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	2280 - 2740

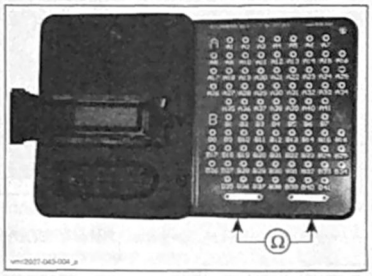


If resistance is out of specification, replace the CTS.

If resistance tests good,**reconnect** the CTS and disconnect the ECM connector "A" from the ECM.

Using a multimeter, recheck resistance on the ECM connector as per table.

ECM CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
A-11	A-27	2280 - 2736



If resistance value is correct, refer to *ECM REPLACEMENT*.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

CTS Replacement

Disconnect CTS connector and remove CTS.

Install the new CTS and torque to 16 N•m (142 lbf•**in**).

Reinstall remaining removed parts.

Refill and bleed the cooling system, refer to *COOLING SYSTEM* subsection.

OIL PRESSURE SWITCH (OPS



Oil Pressure Test

To check the function of the oil pressure switc an oil pressure test has to be performed. Refer *OIL PRESSURE TEST* in *LUBRICATION SYSTE* section.

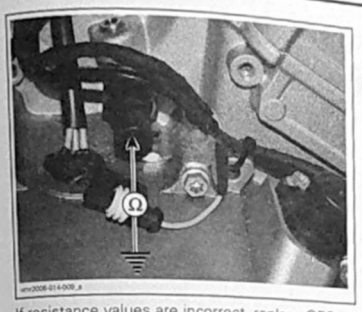
If the engine oil pressure is good, check the r sistance of the OPS while engine is off and whi engine is running.

OPS Resistance Test

Disconnect the connector from the OPS.

Use a multimeter to check the resistance shown.

OPS CONNECTOR		ENGINE NOT RUNNING	ENGINE RUNNING
PIN		RESISTANCE (Ω)	
1	Engine ground	Close to 0 Ω (normally closed switch)	Infinitely high when pressure reache 30 - 60 kPa (4.4 - 8.7 PSI)



If resistance values are incorrect, replace OPS.

If the values are correct, check the continuity of the wiring harness.

Disconnect the connector "A" from the ECM and check continuity of circuit 10.

If wiring harness is good, refer to *ECM REPLACEMENT*.

Otherwise, repair the connector or replace the wiring harness between ECM connector and OPS.

OPS Dynamic Test

First, ensure an oil pressure test has been performed and the pressure is within specifications.

Start the engine.

Ground the OPS connector. Oil pilot lamp should turn on.

Wait approximately 5 seconds. EMS light should begin to flash and beeper should be heard.

If the test succeeded, try a new sensor.

Otherwise, check wiring continuity between sensor and ECM.

OPS Replacement

Refer to *LUBRICATION SYSTEM* section.

COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE (600 MODELS)

SERVICE TOOLS

Description	Part Number	Page
9-volt adapter	529 035 675	443–444, 446–447
communication kit	529 035 981	443
DESS adapter	529 035 904	446–447
DESS post interface	529 036 019	446–447
MPI-2	529 036 018	446–447
optional extension cable	529 035 697	446–447
optional extension cable	529 035 703	443–445
supply T-harness	529 035 869	443, 446–447

COMMUNICATION TOOLS

Two different MPI (Multi-Purpose Interface) can be used with B.U.D.S. software: MPI and MPI-2.

NOTE: This section applies to 600 models. For 600 HO SDI and V800 models, refer to their respective *ENGINE MANAGEMENT* section.

MULTI-PURPOSE INTERFACE (MPI)

PARTS REQUIRED (MPI)
PC computer
B.U.D.S. software (Use latest version available on BOSSWeb)
communication kit (P/N 529 035 981) 
supply T-harness (P/N 529 035 869) 
optional extension cable (P/N 529 035 703) 
9-volt adapter (P/N 529 035 675) 

MPI Supply

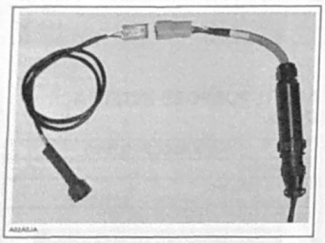
Four AA batteries or an AC/DC power supply must be used. Make sure to respect MPI specification if a power supply is used.

Connections with Vehicle

Two procedures are possible. First procedure with engine running and the second using a 9 volt adapter to power the MPEM.

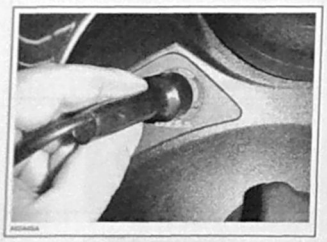
Procedure with Engine Running

Connect the connector of the DESS adapter onto the 6-pin adapter of MPI cable.

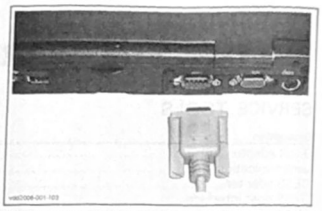


NOTE: If necessary, install the optional extension cable (P/N 529 035 703) between the DESS adapter and the MPI cable.

Connect the other end of DESS adapter to the DESS post of the vehicle.



Connect remaining MPI connector to the serial port of a PC (personal computer).



Start B.U.D.S. and select the vehicle's protocol in **Choose Protocol** from the MPI menu. The protocol is **DESS**.

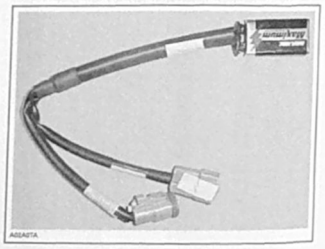
Set parking brake.

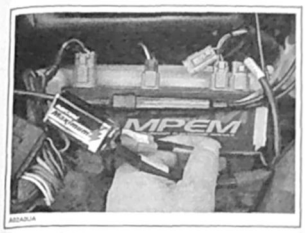
Start vehicle and bring engine to approximately 2000 RPM.

Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

Procedure with 9-Volt Battery

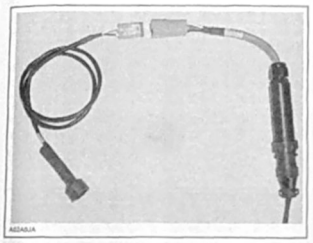
Disconnect the 3-pin MPEM connector and connect the 9-volt adapter (P/N 529 035 675).





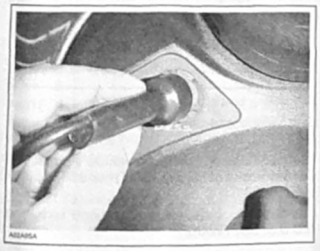
A02A0JA

Connect the connector of the DESS adapter onto the 6-pin adapter of MPI cable.


A02A0JA

NOTE: If necessary, install the optional extension cable (P/N 529 035 703) between the DESS adapter and the MPI cable.

Connect the other end of DESS adapter to the DESS post of the vehicle.


A02A95A

Start B.U.D.S. and select the vehicle's protocol in **Choose Protocol** from the MPI menu. The protocol is **DESS**.

Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

MULTI-PURPOSE INTERFACE MPI-2

PARTS REQUIRED **(MPI-2)**
PC computer
B.U.D.S. software (Use latest version available on BOSSWeb)
MPI-2 (P/N 529 036 018) 
DESS post interface (P/N 529 036 019) 
DESS adapter (P/N 529 035 904) 
optional extension cable (P/N 529 035 697) 
supply T-harness (P/N 529 035 869) 
9-volt adapter (P/N 529 035 675) 

MPI-2 Supply

The MPI-2 uses the PC computer USB port power for its supply.

Connections with Vehicle

Two installations are possible. For the first installation type , the engine will run during operation. In the second, a 9-volt adapter is used to supply the MPEM instead of magneto.

First Installation Type (with engine running)

Connect the connector of the DESS adapter (P/N 529 035 904) onto the 6-pin adapter of supply T-harness (P/N 529 035 869).

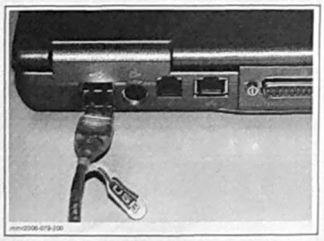
Connect the other end of supply T-harness onto the 6-pin adapter of the DESS post interface (P/N 529 036 019).

Connect the serial connector of the DESS post interface to the serial port of the MPI-2 (P/N 529 036 018).

NOTE: If necessary, install the optional extension cable (P/N 529 035 697) between the DESS post interface and the MPI-2.

Connect the DESS connector of the DESS adapter (P/N 529 035 904) to the DESS post of the vehicle.

Connect remaining MPI-2 connector to the USB port of a PC (personal computer).



Set parking brake.

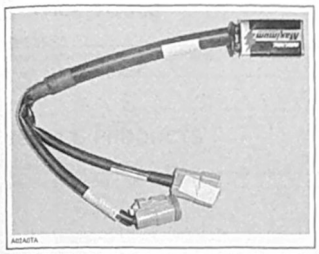
Start vehicle and bring engine to approximately 2000 RPM.

Start B.U.D.S. and select the vehicle's protocol in **Choose Protocol** from the MPI menu. The protocol is **DESS**.

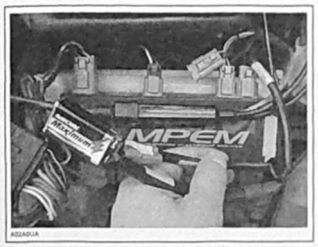
Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

Second Installation Type (with 9-volt adapter)

Disconnect the 3-pin MPEM connector and connect the 9-volt adapter (P/N 529 035 675).



A02A07A



A02A0UA

Connect the connector of the DESS adapter (P/N 529 035 904) onto the 6-pin adapter of supply T-harness (P/N 529 035 869).

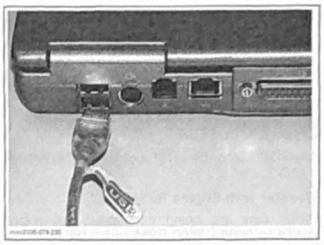
Connect the other end of supply T-harness onto the 6-pin adapter of the DESS post interface (P/N 529 036 019).

Connect the serial connector of the DESS post interface to the serial port of the MPI-2 (P/N 529 036 018).

NOTE: If necessary, install the optional extension cable (P/N 529 035 697) between the DESS post interface and the MPI-2.

Connect the DESS connector of the DESS adapter (P/N 529 035 904) to the DESS post of the vehicle.

Connect remaining MPI-2 connector to the USB port of a PC (personal computer).



mm2006-079-200

Start B.U.D.S. and select the vehicle's protocol in **Choose Protocol** from the MPI menu. The protocol is **DESS**.

Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

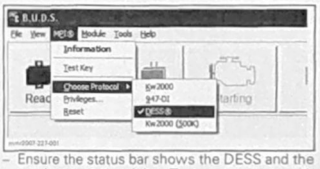
B.U.D.S. SOFTWARE

On 600 models, B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow DESS key programming and modify ignition timing.

For more information pertaining to the use of the B.U.D.S. software, use its help which contains detailed information on its functions.

When using the B.U.D.S. software:

- Ensure that the protocol "DESS" is properly selected in "**MPI**" under "**Choose protocol**.



mm0907-227-001

- Ensure the status bar shows the DESS and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 indicates that the ECM is recognized by the MPI.



mm0907-227-002

CONNECTION SUCCESSFUL

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:
- ECM is not powered-up
- wrong protocol is used
- bad connection between MPI and ECM.

Changes in ECM

Anytime a change is brought in ECM through B.U.D.S. .

Transfer with Engine Running

When data are being transferred, rev engine speed to 2000 - 2500 RPM and make sure connection between B.U.D.S. and vehicle is good.

CAUTION: Engine must run for the entire procedure.

Engine will misfire while vehicle information is being transferred. If engine stalls, restart it and keep engine speed at 2000 - 2500 RPM.

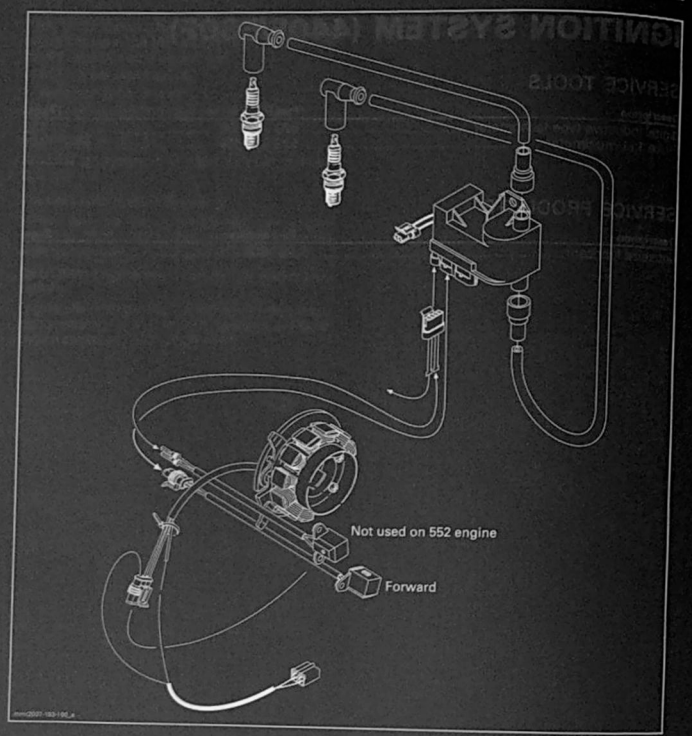
IGNITION SYSTEM (440F/550F)

SERVICE TOOLS

Description	Part Number	Page
digital inductive type tachometer	529 014 500	458
Fluke 111 multimeter	529 035 868	451

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	452


Not used on 552 engine
Forward

GENERAL

Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile engine type.

The CDI system features an ignition coil integrated to the MPEM.

NOTE: For information pertaining to RER on 440F models, refer to *ROTAX ELECTRONIC REVERSE (RER)*.

Multi-Purpose Electronic Module (MPEM) Connector Identifications



MPEM
1. Reverse switch, reverse indicator and reverse trigger coil (440F only)
2. Trigger coil (forward rotation)
3. Ignition generator coil and cut-off switches

Electrical Connectors

Before replacing a component, always check electrical connections. The voltage and current might be too weak to go through dirty wire terminals. Clean as required. Make sure terminals are properly crimped on wires and fastened in housing, and that they are free of corrosion or moisture. Check MPEM ground connections. A MPEM problem can be resolved simply by unplugging and replugging the module, indicating a connection problem.

IGNITION SYSTEM TESTING SEQUENCE

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1. spark plug
2. ignition switch
3. tether cut-out switch
4. engine cut-out switch
5. wiring harness
6. ignition coil
7. ignition generator coil
8. trigger coil
9. MPEM.

Testing Tool

For best results, use the Fluke 111 multimeter (P/N 529 035 868).



529 035 868

Testing Conditions

Voltage measurements are always taken upon engine cranking using the rewind starter. Readings when the engine is running would be higher than specified range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise readings could be distorted.

CAUTION: When taking measurements, it is useless to try to run the engine since readings would then be distorted.

Analysis of Readings

Voltage Readings

Take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, replace the part.

Resistance Readings

Readings must be within the indicated range. Otherwise, replace the part.

Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

Multiple Problems

More than one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

PROCEDURES

SPARK PLUG

Spark Plug Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

Spark Testing

Use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

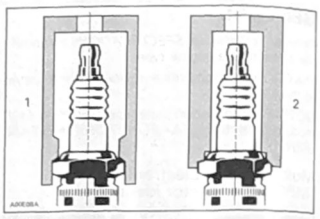
If there is still no spark, continue testing.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

Using a feeler gauge, set electrode gap (except if spark plug is an ECS type) as per *TECHNICAL SPECIFICATIONS*.

1. Apply antiseize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
2. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



TYPICAL
1. Proper socket
2. Improper socket

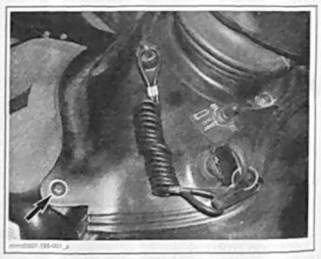
Use the following table to torque the spark plug.

ENGINE TYPE	SPARK PLUG	TORQUE N•m (lbf•ft)
443/552	NGK	27 (20)

IGNITION SWITCH

Ignition Switch Resistance Test

Remove LH screw and raise side of console.

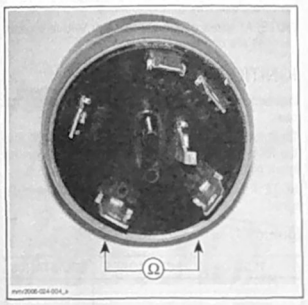


Unplug ignition switch connector.



Check switch as follows:

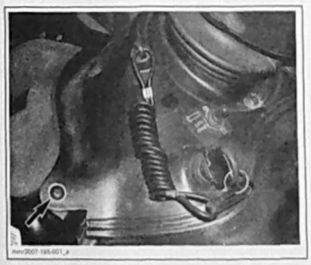
POSITION	TERMINAL		RESISTANCE
OFF	MAG	GRD	0.2 Ω (closed)
	BAT	ACC	Infinite (0L)
	BAT	SOL	
ON	MAG	GRD	Infinite (0L)
	BAT	ACC	0.2 Ω (closed)
	BAT	SOL	Infinite (0L)
START	BAT	SOL	0.2 Ω (closed)



TETHER CUT-OUT SWITCH

Tether Cut-Out Switch Resistance Test

Remove LH screw and raise side of console.



Unplug tether cut-out switch connector.

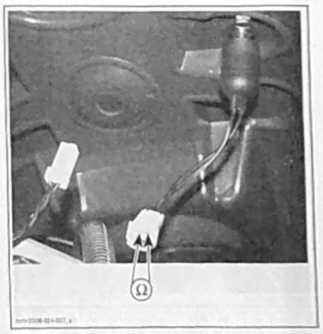


TYPICAL

Check switch as follows.

NOTE: When checking switch in the RUN position, use the tether cap. This validates its ability to remain on switch to make proper electrical contact.

SWITCH POSITION	TEST PROBES	RESISTANCE
Run	BLACK/YELLOW and BLACK wires	0L
Stop	BLACK/YELLOW and BLACK wires	0 to 0.5 Ω



TYPICAL

If readings do not correspond to the above specifications, replace switch.

ENGINE CUT-OUT SWITCH

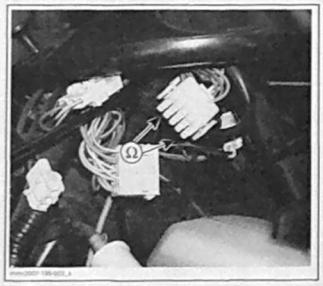
Engine Cut-Out Switch Resistance Test

Unplug connector from engine compartment.



Check the condition of engine cut-out switch as follows.

SWITCH POSITION	TEST PROBES	RESISTANCE
Run	BLACK/YELLOW and BLACK wires	0L
Stop	BLACK/YELLOW and BLACK wires	0 to 0.5 Ω



If readings do not correspond to the above-mentioned indications, check switch wires/connector and if good, replace switch.

WIRING HARNESS

Check if wiring harness shows any signs of scoring, chaffing or other damage.

Check wiring harness as follows.

No spark problem: Disconnect all switches from the main wiring harness and ensure BLACK/YELLOW wire is completely isolated from ground. Otherwise, repair/replace wiring.

No engine stop problem: Disconnect all switches from the main wiring harness and ensure there is continuity between each end of wires of the same color related to ignition. Otherwise, repair/replace wiring.

NOTE: All wires of the same color within a given harness are connected together.

IGNITION COIL

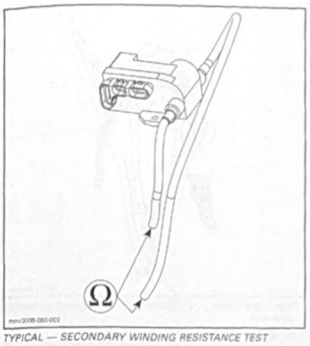
Disconnect spark plug cables and remove each cap.

Take measurements and compare readings with the following tables. Proceed with each cylinder spark plug cable.

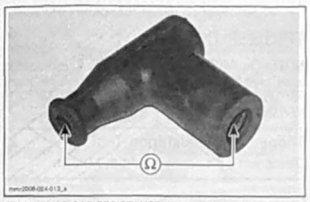
NOTE: Primary side of ignition coil cannot be measured.

Ignition Coil Resistance Test

TEST	TEST PROBES	RESISTANCE
Secondary winding resistance (WITHOUT spark plug cap)	Each spark plug cable end	900 - 1000 Ω
Spark plug cap resistance	Each side of cap	4 - 6 kΩ



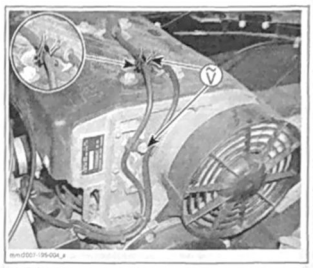
TYPICAL — SECONDARY WINDING RESISTANCE TEST



SPARK PLUG CAP RESISTANCE TEST

Ignition Coil Voltage Test

TEST PROBES	VOLTAGE
On spark plug cable (with a clip) and on engine	.100 - .250 Vac



IGNITION COIL VOLTAGE TEST

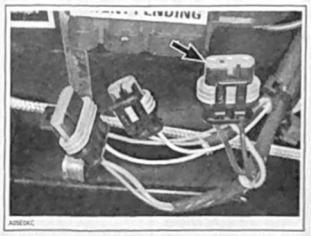
If ignition coil is out of specification, replace it.

NOTE: Keep in mind that even if these static tests are good, voltage requirement is higher to produce a spark in the combustion chamber when engine is running. Ignition coil may be faulty. Replacing ignition coil/MPEM may be necessary as a test.

IGNITION GENERATOR COIL

Ignition Generator Coil Resistance Test

Disconnect 3-pin connector from MPEM.

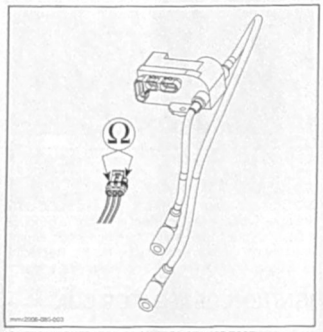


TYPICAL

Take measurements and compare readings with the following table.

NOTE: The term engine refers to the engine metal parts connected to the magneto housing.

TEST PROBES	RESISTANCE
RED and BLACK/RED wires	6.5 to 8.5 Ω
BLACK/RED wire and engine	0 to 0.5 Ω



IGNITION GENERATOR COIL — RESISTANCE TEST

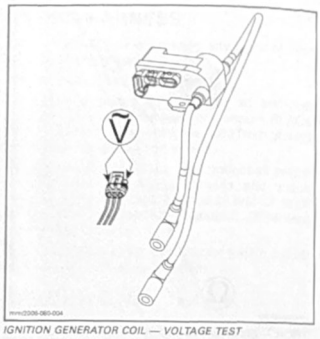
Ignition Generator Coil Voltage Test

Disconnect MPEM connector as per the resistance test.

Take measurements and compare readings with the following table.

NOTE: When manually cranking the engine with the spark plug installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output. Always repeat the procedure 3 times.

TEST PROBES	VOLTAGE
RED and BLACK/RED wires	7.0 to 15.0 Vac



IGNITION GENERATOR COIL — VOLTAGE TEST

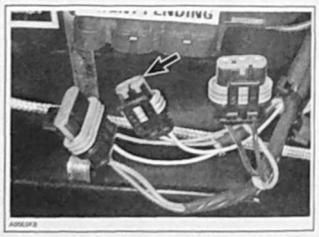
If generator coil is out of specification, replace it.

TRIGGER COIL

NOTE: On **440F models**, the RER trigger coil is used only when engine is in reverse operation. For testing, refer to *ROTAX ELECTRONIC REVERSE*.

Trigger Coil Resistance Test

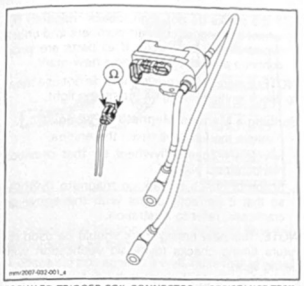
Disconnect 2-pin connector from MPEM.



TYPICAL — 440F SHOWN

Check the resistance for forward trigger coil.

TEST PROBES	RESISTANCE
BLUE/YELLOW and WHITE/YELLOW wires	160 to 180 Ω



FORWARD TRIGGER COIL CONNECTOR — RESISTANCE TEST

Trigger Coil Voltage Test

Check the voltage for forward trigger coil.

NOTE: Manually crank engine with the spark plug installed. Always repeat the procedure 3 times.

TEST PROBES	VOLTAGE
BLUE/YELLOW and WHITE/YELLOW wires	0.35 to 1.0 Vac

If trigger coil is out of specification, replace it.

MPEM

When other components have been tested above and are good, the electronic module can be suspected.

NOTE: It is not possible to test MPEM with accuracy.

ADJUSTMENT

IGNITION TIMING

If for any reason, ignition timing accuracy is suspected, it can be verified as follows.

PROCEDURE OVERVIEW
Verify timing mark position
Scribe a new mark if existing mark is not good
Check ignition timing with a timing light

Verifying Timing Mark Position

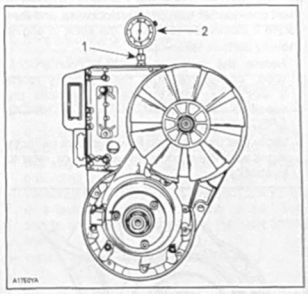
General

Verification of the position of the timing mark on the magneto flywheel is required for the following reasons:

- To detect a missing or broken magneto flywheel Woodruff key.
- To correctly locate and mark a timing mark on a new service magneto flywheel.
- To verify the correct location of the factory timing mark.
- To detect a wrong magneto flywheel corresponding to a different engine type.

TDC Gauge Installation

- Clean the area around the spark plugs, and remove them.
- Remove the rewind starter from the engine.
- Install the TDC gauge in the MAG spark plug hole, and adjust as follows:
  - Position the magneto flywheel at approximately TDC.



TYPICAL — INSTALLATION OF TDC GAUGE
1. Adaptor lock nut
2. Gauge on MAG side cylinder

  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
  - Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.

- Position the dial face toward the MAG side. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.

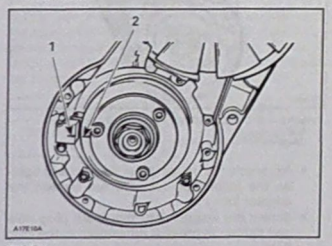
– Locate the piston TDC position as follows:
- Slowly rotate the magneto flywheel back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
- Rotate the dial face so that «0» is in line with the needle when it stops moving.
- Again, slowly rotate the magneto flywheel back and forth across TDC and adjust the dial face to «0», until the needle always stops exactly at «0» before changing direction.
- «0» now indicates exact TDC.

Verification of Timing Mark

NOTE: When checking timing, certain procedures require that the magneto flywheel be turned in a clockwise direction, viewed facing the MAG side. If it is necessary to turn back (counterclockwise) for any reason, rotate the magneto flywheel at least one-quarter turn counterclockwise, and then rotate it clockwise to ensure the slack in engine moving parts is taken-up.

– Rotate the magneto flywheel counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement. Refer to *TECHNICAL SPECIFICATIONS*.

– Verify that the magneto flywheel mark perfectly aligns with the mark on the trigger coil, refer to illustration.



TYPICAL
1. Trigger coil mark
2. Magneto flywheel mark

– If the marks align, check ignition timing using those marks.

– If the marks do not align, check magneto flywheel and trigger coil part numbers and check Woodruff key condition. If all parts are good continue procedure to scribe a new mark.

NOTE: If marks were not aligned, do not use them to check ignition timing with a timing light.

Scribing a Mark on Magneto Flywheel

– Remove the fan cover from the engine.

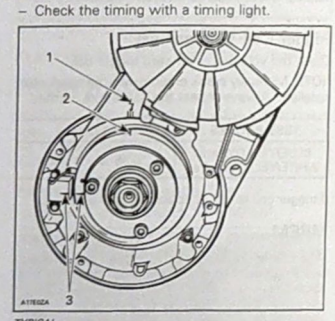
– Maintain magneto flywheel so that previous marks remain aligned.

– Scribe or punch a mark on magneto flywheel so that it perfectly aligns with the arrow on crankcase, refer to illustration.

NOTE: This new timing mark should be used for future timing checks (dynamic verification with timing light).

– Reinstall rewind starter.

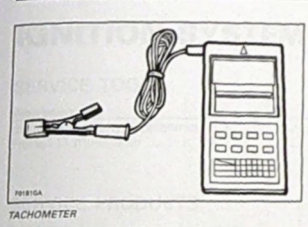
– Check the timing with a timing light.



TYPICAL
1. Crankcase arrow
2. Scribe a mark here
3. Maintain verified timing marks aligned (static timing)

Checking Ignition Timing

Use a timing light and the digital inductive type tachometer (P/N 529 014 500).



TACHOMETER

To check the ignition timing, refer to illustration and proceed as follows:

- Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground.

⚠ WARNING

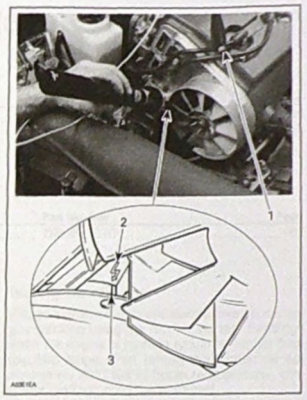
Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

- Connect the timing light pick-up to a spark plug cable.

NOTE: To avoid an incorrect reading due to parallax, view the magneto flywheel and the crankcase timing marks in a straight line.

- Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.
- Start the engine and raise the engine speed within 3000 - 4000 RPM while observing the timing marks, refer to illustration.

NOTE: If a mark was scribed previously, use it.



1. Timing light pick-up on MAG side
2. Crankcase arrow
3. Magneto flywheel mark

The magneto flywheel mark and the crankcase arrow must be perfectly aligned.

- If marks do not align, ignition timing is incorrect. Since there is no ignition timing adjustment on this engine, a faulty trigger coil (check proper grounding of coil), a faulty flywheel, a faulty Woodruff key, a misaligned (twisted) crankshaft or a faulty MPEM could be the cause. Substitute one part at a time and recheck timing marks.
- Install parts which were removed.

IGNITION SYSTEM (600)

SERVICE TOOLS

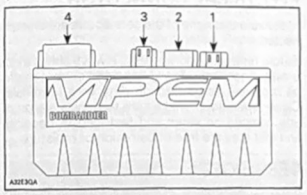
Description	Part Number	Page
digital inductive type tachometer	529 014 500	466
Fluke 111 multimeter	529 035 868	461

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 (antiseize lubricant)	293 800 070	462

GENERAL

Multi-Purpose Electronic Module (MPEM) Connections



1. Trigger coil
2. Coolant temperature sensor
3. Ignition coil
4. DESS, ignition and engine cut-out switches, DESS pilot lamp

IGNITION SYSTEM TESTING SEQUENCE

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1. spark plugs
2. electrical connectors
3. DESS post
4. engine cut-out switch
5. wiring harness
6. ignition coil
7. trigger coil
8. MPEM (Multi-Purpose Electronic Module).

Testing Conditions

Voltage measurements are always taken upon engine cranking using the rewind starter. Readings when the engine is running would be higher than specified range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise readings could be distorted.

CAUTION: When taking measurements, it is useless to try to run the engine since readings would then be distorted.

Diagnostic Tool

For best results, use the Fluke 111 multimeter (P/N 529 035 868).



Analysis of Readings

Voltage Readings

Take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, replace the part.

Resistance Readings

Readings must be within the indicated range. Otherwise, replace the part.

Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

Multiple Problems

More that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

PROCEDURES

SPARK PLUG

Spark Plug Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

Spark Testing

Use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

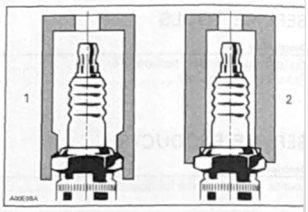
If there is still no spark, continue testing.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

Using a feeler gauge, set electrode gap as per *TECHNICAL SPECIFICATIONS*.

1. Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
2. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



TYPICAL
1. Proper socket
2. Improper socket

Torque the spark plugs to 27 N•m (20 lbf•ft).

ELECTRICAL CONNECTOR

Make sure that none of the connectors are disconnected.

Before replacing a component, always check electrical connections. The voltage and current might be too weak to go through dirty wire terminals. Clean as required. Make sure terminals are properly crimped on wires and fastened in housing and that they are free of corrosion or moisture.

DESS POST

Refer to *DIGITALLY ENCODED SECURITY SYSTEM (DESS)* section.

ENGINE CUT-OUT SWITCH

Unplug connector under console.

Check the condition of engine cut-out switch as follows.

SWITCH POSITION	TEST PROBES	RESISTANCE
Run	BLACK/YELLOW and BLACK wires	OL
Stop		0 to 0.5 Ω

If readings do not correspond to the above mentioned indications, check switch wire connector and if good, replace switch.

WIRING HARNESS

Check if wiring harness shows any signs of scoring or other damage.

Check wiring harness as follows.

No spark problem: Disconnect all switches from the main wiring harness and ensure BLACK/YELLOW wire is completely isolated from ground. Otherwise, repair/replace wiring.

No engine stop problem: Disconnect all switches from the main wiring harness and ensure there is continuity between each end of wires of the same color related to ignition. Otherwise, repair/replace wiring.

NOTE: All wires of the same color within a given harness are connected together.

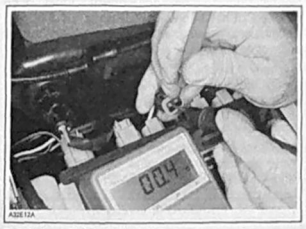
IGNITION COIL

Resistance Test

NOTE: Keep in mind that an ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

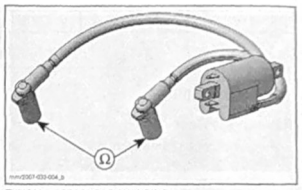
Unplug connector between ignition coil and MPEM.

Connect multimeter probes to WHITE/BLUE and BLACK wires and measure primary winding resistance.



TYPICAL — PRIMARY WINDING

Measure the secondary winding resistance.



TYPICAL — SECONDARY WINDING

If resistances are out of specification, replace ignition coil.

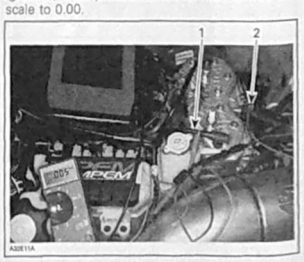
TEST	TEST PROBES	RESISTANCE
Primary winding resistance	WHITE/BLUE and BLACK wires	00.0 to 00.9 Ω
Secondary winding resistance with cap	Between both spark plug caps	19 to 27 KΩ

Voltage Test

Disconnect spark plug cable from spark plug.

Fasten multimeter probe with an alligator clip to spark plug cable, near the spark plug.

Connect other multimeter probe to engine (ground), then place selector switch to Vac and scale to 0.00.



1. MAG side spark plug cable
2. Connected to ground

Activate the manual starter and check values indicated by the multimeter.

Repeat operation 3 times.

TEST	TEST PROBES	VOLTAGE
Secondary winding voltage	Spark plug cable and engine	0.1 to 1.4 Vac

TRIGGER COIL

Resistance Test

Unplug connector between trigger coil and MPEM.

Connect multimeter probes to WHITE/YELLOW and BLUE/YELLOW wires and measure resistance.

TEST PROBES	RESISTANCE
WHITE/YELLOW and BLUE/YELLOW wires	190 to 300 Ω

If the trigger coil is out of specification, replace it.

Voltage Test

Unplug connector between trigger coil and MPEM.

Connect multimeter probes to WHITE/YELLOW and BLUE/YELLOW wires and measure resistance.

Manually start engine and check values indicated by the multimeter.

TEST PROBES	VOLTAGE
WHITE/YELLOW and BLUE/YELLOW wires	.200 to .350 Vac

Repeat test 3 times.

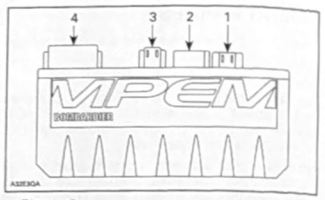
If the trigger coil is out of specification, replace it.

MULTI-PURPOSE ELECTRONIC MODULE (MPEM)

When other components have been tested above and are good, The MPEM can be suspected. Ensure wiring and connectors are in good condition and perform the following tests prior to replacing the MPEM.

Install tether cap on DESS post and place engine cut-out switch in run position.

Disconnect the connector between module and ignition coil.



1. Trigger coil
2. Coolant temperature sensor
3. Ignition coil
4. DESS, ignition and engine cut-out switches, DESS pilot lamp

Install probes on WHITE/BLUE and BLACK wires.

Manually start engine and check values indicated by the multimeter.

TEST PROBES	VOLTAGE
WHITE/BLUE and BLACK wires	25.0 to 100.0 Vac

Repeat test 3 times.

If the MPEM is out of specification, replace it.

ADJUSTMENT

IGNITION TIMING

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable.

The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the trigger coil or the MPEM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to *ENGINE MEASUREMENT*.

PROCEDURE OVERVIEW
Scribe a timing mark
Check ignition timing with a timing light
Adjust timing if necessary using B.U.D.S. software

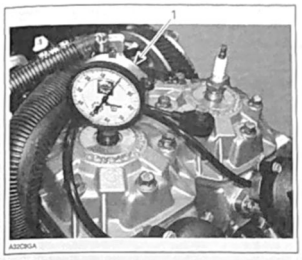
Scribing a Timing Mark

TDC Gauge Installation

Clean the area around the MAG spark plug, and remove it.

Install a TDC gauge in the MAG spark plug hole, and adjust as follows:

– Position the MAG piston at approximately TDC.



TYPICAL
1. TDC gauge on MAG side

– Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
– Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
– Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.

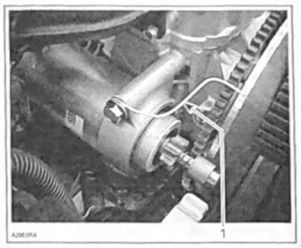
Locate the piston TDC position as follows:

– Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
– Rotate the dial face so that «0» is in line with the needle when it stops moving.
– Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to «0», until the needle always stops exactly at «0» before changing direction.
– «0» now indicates exact TDC.

Rotate the drive pulley clockwise, one-quarter turn then carefully rotate it counterclockwise until the needle indicates the specified measurement.

MODEL	TIMING MARK (BTDC)
600	3.0 mm (.118 in)

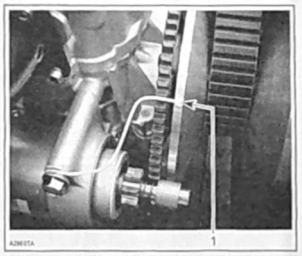
Twist a wire as shown and use it as a pointer. Install the wire on upper starter bolt.



1. Pointer

Scribing the Mark

With the TDC gauge indicating specified timing (refer to *TECHNICAL SPECIFICATIONS*), scribe a mark on drive pulley inner half in line with pointer end.



1. Timing mark in line with pointer end

Checking Ignition Timing

The ignition timing can be checked with either the engine hot or cold at the specified RPM.

ENGINE SPEED TO CHECK IGNITION TIMING	
MODEL	ENGINE RPM
600	3500 (1)

(1) Within 3000 and 4000 RPM, the spark advance does not change. Therefore, at 3500 RPM, a change in engine speed of ± 500 RPM will not affect the timing mark.

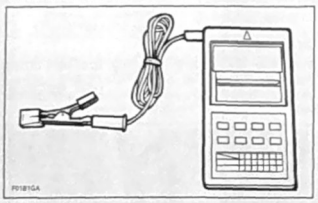
To check the ignition timing proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

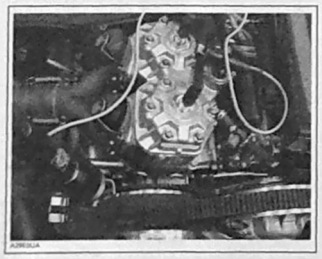
Connect the timing light pick-up to a spark plug cable.

Connect the digital inductive type tachometer (P/N 529 014 500).



TACHOMETER

Start the engine and point timing light on timing mark. Bring engine to the specified RPM for a brief instant.



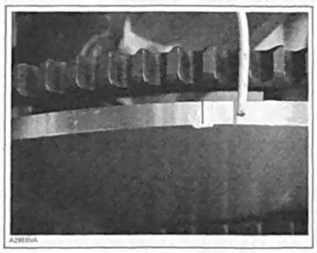
TYPICAL

The timing mark must be aligned with pointer end within the specified tolerance.

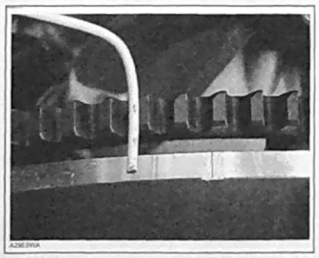
MODEL	TOLERANCE
600	± 1°

If marks are aligned, no adjustment is required.

If marks are not aligned, note if timing is retarded or advanced as shown. Then, adjust timing as described below.



TIMING RETARDED BY ABOUT 1°



TIMING ADVANCED BY ABOUT 2°

Adjusting Timing

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE* for proper connection instructions.

Uses the **Setting** tab to change the ignition timing.

Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

IGNITION SYSTEM (V800)

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	467
Fluke 111 multimeter	529 035 868	467

GENERAL

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

The EMS controls the ignition system. For more information, refer to *ENGINE MANAGEMENT*.

The battery supplies the primary side of ignition coil through a relay (R1) while the ECM completes the circuit for each cylinder by switching it to the ground at the right moment. Upon engine starting, the ECM can detect open and short circuit in the primary winding but it does not check the secondary winding.

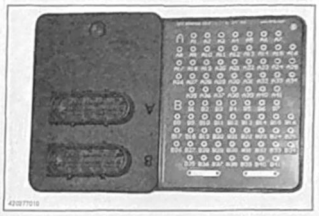
Diagnostic Tools

For most accurate measurements, use the Fluke 111 multimeter (P/N 529 035 868).



529 035 868

NOTE: To probe the ECM connector terminals, use the ECM adapter (P/N 420 277 010) to prevent damaging terminals. Refer to *ENGINE MANAGEMENT* for more information.



PROCEDURES

DESS SWITCH

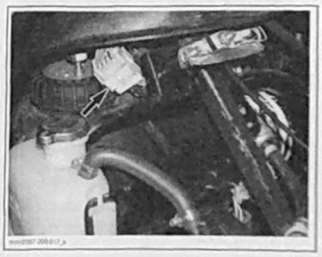
NOTE: DESS switch failure does not prevent ECM power-up. It is mainly used for key recognition and to stop engine.

Refer to *DESS SYSTEM*.

ENGINE CUT-OUT SWITCH

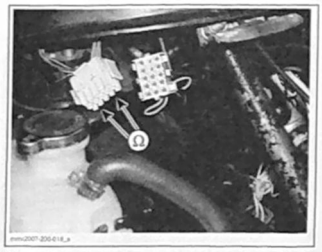
Resistance Test

Unplug connector under console.



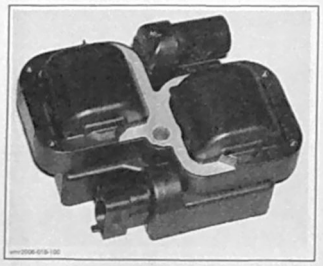
Check the condition of engine cut-out switch as follows.

SWITCH POSITION	RUN	STOP
TEST PROBES	BLACK/YELLOW and BLACK wires	
RESISTANCE	Open circuit (OL)	0 to 0.5 Ω



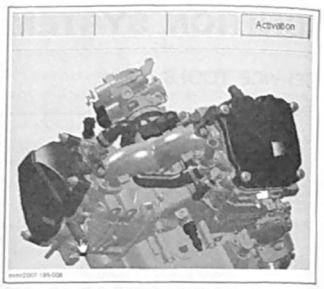
If readings do not correspond to the above-mentioned indications, check switch wires and connector. If good, replace switch.

IGNITION COIL



Quick Test with B.U.D.S.

Using the B.U.D.S. software, energize the ignition coil for each spark plug.



You should hear the spark occurring. In doubt, use an inductive spark tester. If there is no spark, perform the following checks.

NOTE: Keep in mind that even if there is a spark during this static test, voltage requirement is higher to produce a spark in the combustion chamber when engine is running. Ignition coil could be not working in real operation. Replacing ignition coil may be necessary as a test.

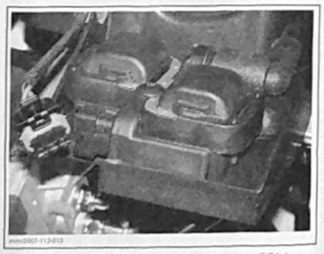
NOTE: Ensure spark plug cable is on the appropriate cylinder.

Ignition Coil Power Supply

Ensure ignition coil is properly powered as follows.

Open hood.

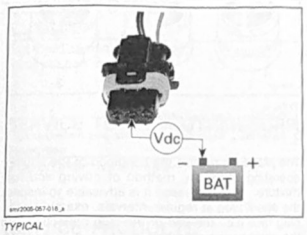
Disconnect the 3-pin connector from the ignition coil and check the voltage supplied by the relay R1.



Briefly press START button to wake up ECM.

Using a multimeter, read voltage.

IGNITION COIL CONNECTOR	VOLTAGE
Pin 2 with battery ground	12 Vdc

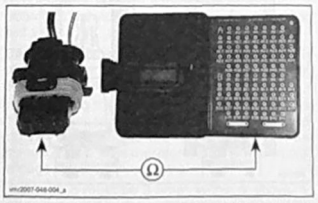


TYPICAL

If proper voltage is NOT read, check continuity of ignition coil supply circuit (charging system fuse, relay R1 and fuse F2 and wiring/connectors).

If adequate voltage is read, disconnect the ECM connector "A" and check the continuity of appropriate circuit.

COMPONENT	CIRCUIT NUMBER (ignition coil connector)	CIRCUIT NUMBER (ECM connector)
Cylinder 1 (front)	1	A-1
Cylinder 2 (rear)	3	A-41



If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

If wiring harness is good, refer to ECM in *ENGINE MANAGEMENT*.

Resistance Test

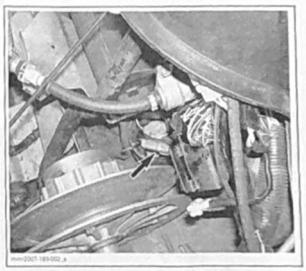
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Disconnect ignition cable from spark plug.

Primary Windings

Reconnect connector to ignition coil.

Locate engine connector besides fuse box.

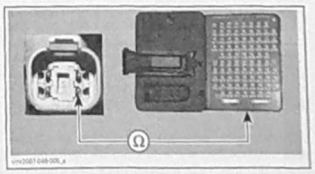


Disconnect connector "A" from ECM (under fuse box).

Disconnect engine connector.

Using a multimeter, check resistance in primary windings as follows.

PRIMARY CIRCUIT	ENGINE CONNECTOR	ECM CONNECTOR "A"	RESISTANCE @ 20°C (68°F)
Front	Pin 2	A-1	.3 - .6 Ω
Rear		A-41	



If any resistance is not good, replace ignition coil.

If the windings test good, check wiring/connectors and if adequate, try a new ECM.

Reinstall ECM and plug connectors.

Secondary Windings

Due to the integrated diode, it is not possible to take any resistance measurement of the secondary winding.

IGNITION TIMING

Ignition timing is not adjustable.

SPARK PLUG

Spark Plug Removal

Unplug the spark plug cable.

Clean the spark plug area with pressurized air.

Unscrew spark plug.

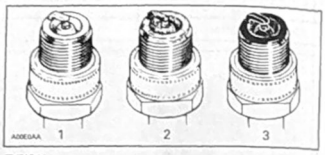


TYPICAL
1. Spark plug cable
2. Spark plug

Troubleshooting Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is could due to a loss of compression. Other possible causes are: a clogged air filter, incorrect spark plug gap, lubricating oil entering the combustion chamber, or too cold spark plug. The plug face of a fouled spark plug has either a wet black deposit or a black carbon fouling. Such coatings form a conductive connection between the center electrode and ground.

Spark Plug Analysis



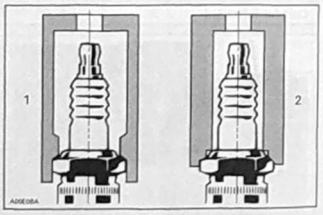
TYPICAL
1. Overheated (light grey, white)
2. Normal (light brown, brown)
3. Fouled (black, wet or dry, dark deposits, grey, melted coating)

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

- Using a wire feeler gauge, set electrode gap as per *TECHNICAL SPECIFICATIONS*.
- Apply antiseize lubricant over the spark plug threads to prevent possible seizure.
- Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

- Torque spark plug to 20 N•m (15 lbf•ft).

CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
Fluke 111 multimeter	529 035 868	471
magneto harness adapter	529 036 021	476

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on inductive ammeter	MT110	474

SERVICE PRODUCTS

Description	Part Number	Page
silicone dielectric grease	293 550 004	481–482

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Voltage measurements are always taken upon engine cranking. Readings when the engine is running would be higher than specified range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise readings could be distorted.

CAUTION: When taking measurements, it is useless to try to run the engine since readings would then be distorted.

When testing the different magneto components, it is important to take into consideration that reading vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

For best results, use the Fluke 111 multimeter (P/N 529 035 868).



529 035 868

Place the selector switch of the multimeter to the appropriate position for the tests. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

It is difficult to make a diagnostic in the case of intermittent problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

Current Type (AC and DC)

Refer to the following chart to identify the current type used on the snowmobile.

Pay attention that both AC (alternating current) and DC (direct current) can be used.

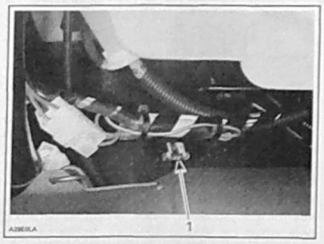
NOTE: For power distribution diagrams, refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES.*

MODEL	SYSTEM	CURRENT TYPE
440F and 550F	Lights and accessories	AC
	Starting system Power outlet	DC
600	Lights and accessories	AC
	Starting system Power outlet	DC
600 HO SDI	All	DC
V800	All	DC

PROCEDURES

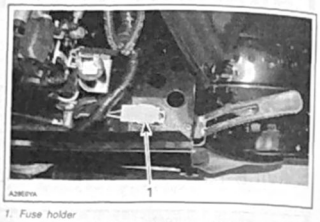
CHARGING FUSE

440F and 550F Models



1. Fuse holder

600 Models



1. Fuse holder

600 HO SDI Models

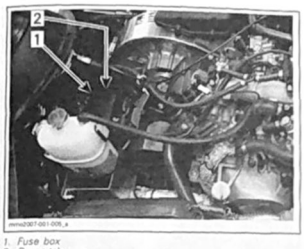
To open fuse box push on cover tab and tilt cover. A fuse description decal is inside the cover. Charging system uses fuse F1.



1. Cover tab

V800 Models

Charging system uses fuse F1.



1. Fuse box
2. Cover tab

VOLTAGE REGULATOR

NOTE: The voltage regulator could be the culprit of a blown charging system fuse. To check, simply disconnect the regulator from the circuit. If the fuse still burns, check for a defective wire.

Continuity Test

Due to internal circuitry, there is no static test available to check continuity.

AC Voltage Test

440F, 550F and 600 Models

Proceed as follows:

- Set multimeter to Vac scale.
- Disconnect headlamp connector.
- Set headlamp switch to LOW beam and connect multimeter to headlamp connector.
- Start engine.

MODEL	TEST ENGINE SPEED	WIRE COLOR		VOLTAGE
440F	5000 RPM	WHITE/ GREY	YELLOW/ GREEN	13.8 Vac ± 0.4
550F, 600		GREY/ RED		

- Read voltage.



TYPICAL

- If voltage is above specification, replace voltage regulator.
- If voltage is below specification, check charging generator coil and wiring/connections. If good, try a new voltage regulator.

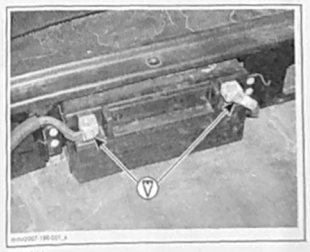
DC Voltage Test

Proceed as follows:

- Set multimeter to Vdc scale.
- Connect multimeter to battery posts.
- Start engine.

MODELS	TEST ENGINE SPEED	VOLTAGE
440F, 550F and 600	5000 RPM	14.7 Vdc ± 0.4
V800	4000 RPM	
600 HO SDI	5000 RPM	14.1 Vdc ± 0.5

- Read voltage.



TYPICAL

- If voltage is above specification, replace voltage regulator.
- If voltage is below specification, check charging generator coil and wiring/connections.

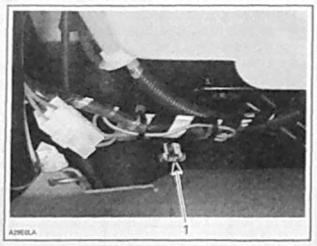
NOTE: If the battery will not stay charged, the problem can be any of the charging system components. If these all check good, try a new voltage regulator.

DC Current Test

440F and 550F Models

Proceed as follows:

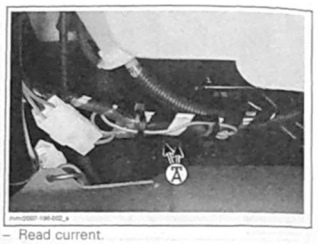
- Ensure to turn OFF heated grips and heated throttle lever.
- Remove charging system fuse.



1. Fuse holder

- Set multimeter to Adc.
- Start engine by manually cranking engine.
- Connect multimeter probes between fuse holder terminals.

TEST ENGINE SPEED	CURRENT
5000 RPM	Approx. 1 - 4 A



- Read current.
- If current is below specification, check magneto (stator) output prior to concluding that voltage regulator is faulty.
- Reinstall fuse.

600, 600 HO SDI and V800 Models

Use a Snap-on inductive ammeter (P/N MT110) and place it over the RED wire going to charging system fuse (connected to starting solenoid).

Proceed as follows:

- Ensure to turn OFF heated grips and heated throttle lever.
- Set multimeter to Adc.
- Start engine.
- Read current.

MODEL	TEST ENGINE SPEED	CURRENT
600 600 HO SDI	5000 RPM	Approx. 1 - 4 A
V800	4000 RPM	Approx. 3 - 7 A

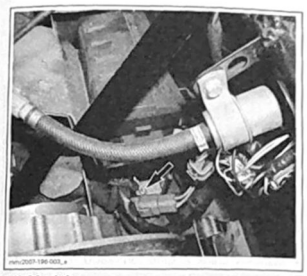
- If current is below specification, check magneto (stator) output prior to concluding that voltage regulator is faulty.

Voltage Regulator Removal

Disconnect battery.

V800 Models

Remove fuse block retaining support from frame then move it away to get access to voltage regulator.



All Models

Unplug the voltage regulator connector.

Remove retaining screws.

Voltage Regulator Installation

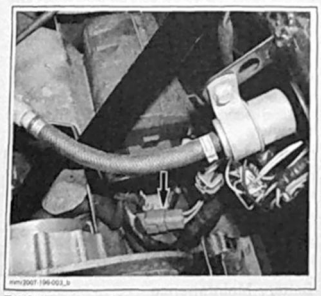
The installation is the reverse of the removal procedure.

Torque voltage regulator screws to 5 N•m (44 lbf•**in**).

STATOR

Continuity Test

Disconnect engine connector.



TYPICAL

Set multimeter to Ω.

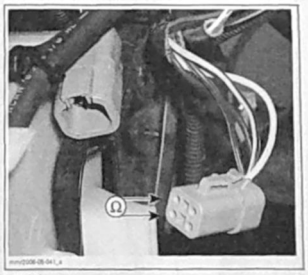
Read the resistance between wires as follows.

440F and 550F Models

MODEL	WIRE		RESISTANCE @ 20°C (69°F)
440F	YELLOW	YELLOW	0.17 - 0.21 Ω
550F			0.15 - 0.18 Ω

600, 600 HO SDI and V800 Models

MODEL	TERMINAL	RESISTANCE @ 20°C (69°F)
600	1 and 2	0.1 - 0.4 Ω
	1 and 3	
	2 and 3	
600 HO SDI	1 and 2	0.1 - 0.18 Ω
	1 and 3	
	2 and 3	
V800	1 and 2	0.1 - 0.5 Ω
	1 and 3	
	2 and 3	



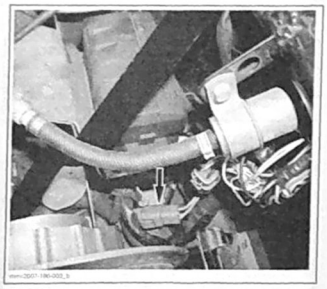
TYPICAL

If resistance is out of specification, replace stator.

Replug connector properly.

Insulation Test

Disconnect engine connector.

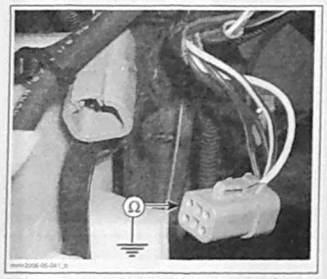


TYPICAL

Set multimeter to Ω.

Read resistance as follows.

WIRE		RESISTANCE @ 20°C (69°F)
Any YELLOW wire	Engine ground	0L (open circuit)



TYPICAL

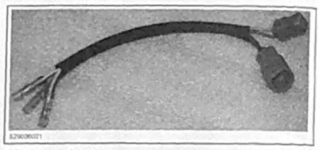
- If results are out of specification, the generator coil and/or the wiring need to be repaired/replaced.
- Replug connector properly.

AC Voltage Test

- Disconnect the voltage regulator connector.

V800 Models

Install the magneto harness adapter (P/N 529 036 021) on magneto connector. Leave the other connector unplugged.



All Models

- Set multimeter to Vac scale.
- Manually crank engine (on V800, use electric start) and read the voltage as follows. Repeat the test 3 times.

MODELS	WIRE		VOLTAGE
440F/550F	YELLOW	Remaining YELLOW	3 - 7 Vac
600/600 SDI V800	Any YELLOW	Any other YELLOW	3.5 - 7.5 Vac

- If voltage is lower than specification, replace generator coil.
- Re-plug connector properly.

Stator Replacement

Refer to appropriate *MAGNETO* section.

BATTERY

440F Models

General

These models are equipped with a conventional lead acid battery. A ventilation tube is attached to the battery.

MODEL	BATTERY
440F	12N14-3A

Battery Removal

Refer to removal information in VRLA battery below.

Battery Maintenance

When electrolyte level is too low, refill to upper level line using distilled water only.

Battery Inspection

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

⚠ WARNING

Battery caps do not have vent holes. Make sure that vent tube is not obstructed.

Battery Cleaning

Clean the battery, battery casing, vent tube, caps, cables and battery posts using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery interior since it will destroy the electrolyte.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Battery Testing

There are 2 preferred types of battery test: electrolyte reading and load test. An electrolyte reading is made on a battery without discharging current. A load test gives more accuracy of the battery condition.

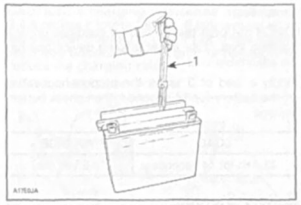
Electrolyte Reading

Check charge condition using either a hydrometer.

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte.

BATTERY CONDITION	SPECIFIC GRAVITY
Fully charged	1.265 - 1.280

Most hydrometers give a true reading at 21°C (70°F).



1. Specific gravity 1.265

In order to obtain correct readings, adjust the initial reading by adding .004 points to the hydrometer readings for each 5.5°C (10°F) above 21°C (70°F) and by subtracting .004 point for every 5.5°C (10°F) below 21°C (70°F).

This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM	
°C	°F		
38	100	.012	Add to the reading
32	90	.008	
27	80	.004	
21	70	CORRECT READING	
16	60	.004	Subtract from the reading
10	50	.008	
4	40	.012	
- 1	30	.016	

EXAMPLE NO. 1
TEMPERATURE ABOVE 21°C (70°F)
Hydrometer reading: 1.250
Electrolyte temperature: - 1°C (30°F)
Subtract .016 Sp. Gr.
Corrected Sp. Gr. is 1.234

EXAMPLE NO. 2
TEMPERATURE ABOVE 21°C (70°F)
Hydrometer reading: 1.235
Electrolyte temperature: 38°C (100°F)
Add .012 Sp. Gr.
Corrected Sp. Gr. is 1.247

SPECIFIC GRAVITY READING USING A HYDROMETER		
STATE OF CHARGE	ELECTROLYTE TEMPERATURE	
	27°C (80°F)	4°C (40°F)
100%	1.26 - 1.27	1.27 - 1.28
75%	1.21 - 1.22	1.22 - 1.23
50%	1.16 - 1.17	1.17 - 1.18
25%	1.12 - 1.13	1.13 - 1.14
0%	1.10 or less	1.11 or less

Load Test

This is the best test of battery condition under a starting load. Use a load testing device that has an adjustable load.

Apply a load of 3 times the ampere-hour rating of the battery for 14 seconds, then check battery voltage.

LOAD	VOLTAGE
42 A•h for 14 seconds	10.5 Vdc min.

Battery Storage

CAUTION: Battery storage is critical for battery life. Regularly charging the battery during storage will prevent cell sulfation. Keeping the battery in vehicle for storage may lead to contacts degradation/corrosion and case damage if freezing occurs. A discharged battery will freeze and break in area where freezing point is experienced. Electrolyte leakage will damage surrounding parts. Always remove battery from vehicle for storage and regularly charge to keep an optimal condition.

Disconnect and remove battery from vehicle as explained in *REMOVAL*.

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Do not overfill.

The battery must always be stored in fully charged condition. If required, charge until specific gravity of 1.265 is obtained.

CAUTION: Battery electrolyte temperature must not exceed 50°C (122°F). The casing should not feel hot.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of dielectric grease on terminals.

Clean battery casing and caps using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery.

Rinse battery with clear water and dry well using a clean cloth.

Store battery in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum. Keep battery away from dew, high moisture and direct sunlight.

During the storage period, recheck electrolyte level and specific gravity readings at least every month. If necessary, keep the battery at its upper level line and near full charge as possible (trickle

Activation of a New Battery

⚠ WARNING

Never charge or boost battery while installed in vehicle.

Perform the following operations anytime a new battery is to be installed.

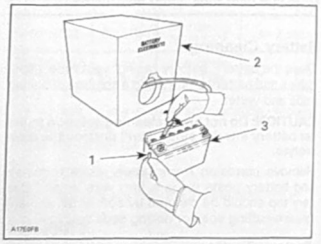
– Remove the sealing tube from the vent elbow.

⚠ WARNING

Failure to remove the sealing tube could result in an explosion.

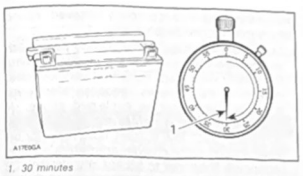
– Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity: 1.265 at 21°C (70°F)).

NOTE: This battery may fill slower than others due to the anti-spill check ball design.



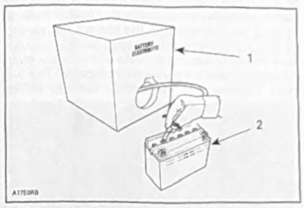
1. Sealing tube removed
2. Battery electrolyte
3. Upper level line

– Allow the battery to stand for 30 minutes MINIMUM so that electrolyte soak through battery cells.



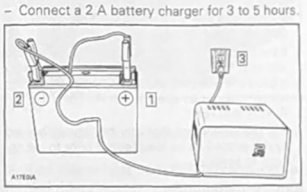
1. 30 minutes

– Readjust the electrolyte level to the UPPER LEVEL line.



1. Battery electrolyte
2. Upper level line

– Connect a 2 A battery charger for 3 to 5 hours.



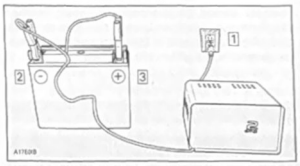
Step 1: Connect + lead to battery + post
Step 2: Connect - lead to battery - post
Step 3: Plug battery charger

⚠ WARNING

Gases given off by a battery being charged are highly explosive. Always charge in a well ventilated area. Keep battery away from cigarettes or open flames. Always turn battery charger off prior to disconnecting cables. Otherwise a spark will occur and battery might explode.

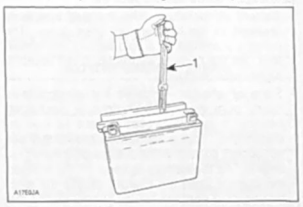
CAUTION: If charging rate raises higher than 2.4 A reduce it immediately. If cell temperature rises higher than 50°C (122°F) or if the casing feels hot, discontinue charging temporarily or reduce the charging rate.

– Disconnect battery charger.



Step 1: Unplug battery charger
Step 2: Disconnect - lead
Step 3: Disconnect + lead

– Test battery state of charge. Use a hydrometer.



1. Specific gravity 1.265

– If electrolyte level has dropped after charging, fill with distilled water to UPPER LEVEL line. After water is added, continue charging for 1 to 2 hours to mix water with electrolyte.
– Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.

NOTE: Hand tighten caps then tighten an additional 1/4 turn using a 20 mm (3/4 in) socket. Using other tool could damage the plastic battery caps.

⚠ WARNING

Battery electrolyte is caustic. To prevent spillage, battery cell cap should be sufficiently tight to properly seal.

Charging a Used Battery

⚠ WARNING

Never charge battery while installed in vehicle.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging begun.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

⚠ WARNING

Always charge battery in a well ventilated area.

The time required to charge a battery will vary depending on some factors such as:

- Battery temperature: The charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
- State of charge: Because the electrolyte is nearly pure water in a completely discharged battery, it cannot accept current as well as electrolyte. This is the reason the battery will not accept current when the charging cycle first begins. As the battery remains on the charger, the current from the charger causes the electrolytic acid content to rise which makes the electrolyte a better conductor and then, the battery will accept a higher charging rate.
- Type of charger: Battery chargers vary in the amount of voltage and current that they can supply. Therefore, the time required for the battery to begin accepting measurable current will also vary.

Charging a Very Flat or Completely Discharged Battery

The battery charger should have an adjustable charging rate. Variable adjustment is preferred, but a unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than 1 ampere.

Unless this procedure is properly followed, a good battery may be needlessly replaced.

- Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in term of milliamperes, because electrolyte is nearly pure water as explained above. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
- Exceptionally for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

- Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
- If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.
- If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in *ACTIVATION OF A NEW BATTERY*.
- It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

Battery Installation

Refer to installation information in VRLA battery below.

BATTERY (VRLA)

550F, 600, 600 HO SDI and V800 Models

General

These models are equipped with a sealed valve regulated lead acid (VRLA) battery. They are non-spillable and require low maintenance — no electrolyte level to be checked and readjusted. No ventilation tube is attached to the battery.

MODEL	BATTERY
550F, 600, 600 HO SDI	YTX20L-BS
V800	YTX24HL-BS

Battery Removal

⚠ WARNING

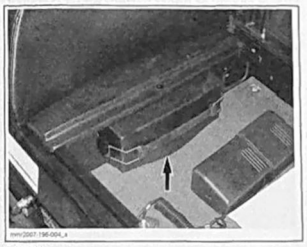
Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

NOTE: According to model, battery is located either between fuel tank and air intake silencer or under seat.

Remove battery protector.



TYPICAL

Disconnect BLACK (–) cable end from the terminal.

Slide off rubber boot from RED (+) cable and disconnect it.

Unfasten battery.

Remove battery.

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

Battery Cleaning

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Battery Inspection

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casing is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Battery Charge Testing

Voltmeter Test

Use a multimeter and set it to Vdc.

BATTERY CHARGE TESTING		
PREREQUISITE	VOLTAGE READ	ACTION
Voltage stabilized with battery disconnected for 1 - 2 hours before test	12.8 V and above	Nothing required
	Below 12.8 V	Charge battery
		Refer to *BATTERY CHARGING* below

Battery Storage

CAUTION: A discharged battery will freeze and it may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at temperature **below** 15°C (60°F).

Charge the battery every two week if stored at temperature above 15°C (60°F).

Activation of New Battery

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

CAUTION: If battery becomes hot, stop charging and allow it to cool before continuing.

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Perform *BATTERY CHARGE TESTING* above then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5 V

STANDARD CHARGING (recommended)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4-9 hours	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX24HL-BS	50 minutes	10 A

Battery Voltage Below 11.5 V

Batteries with voltage below 11.5 V requires special procedures to recharge. In charging an over discharged battery, its internal resistance may be too high to charge at a normal charging voltage. Therefore, it may be necessary to raise the voltage of the battery initially to 25 V as a maximum, and charge for approximately 5 minutes.

If the charger ammeter shows no change in current after 5 minutes, you need a new battery. Current flowing into the battery at high voltage can become excessive. Monitor amperage and adjust voltage as necessary to keep current at the battery's standard amp rating. Charge for approximately 20 hours.

Battery Installation

Reinstall battery and secure properly.

Connect RED (+) cable it to positive battery terminal. If applicable connect the small RED wire.

Connect BLACK (–) cable LAST.

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

Cover the RED (+) terminal with rubber boot.

STARTING SYSTEM

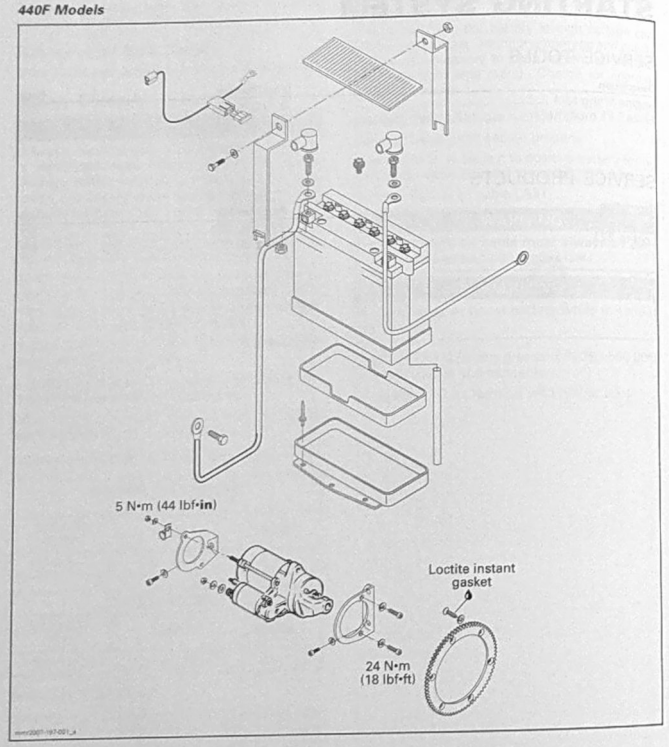
SERVICE TOOLS

Description	Part Number	Page
engine lifting tool	529 036 022	498
Fluke 111 multimeter	529 035 868	489

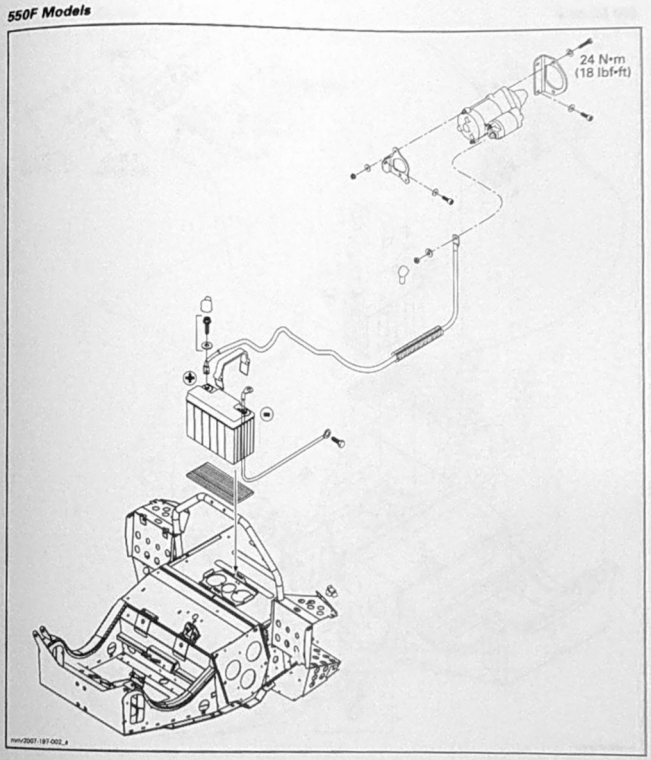
SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	500
Loctite 271	293 800 005	499

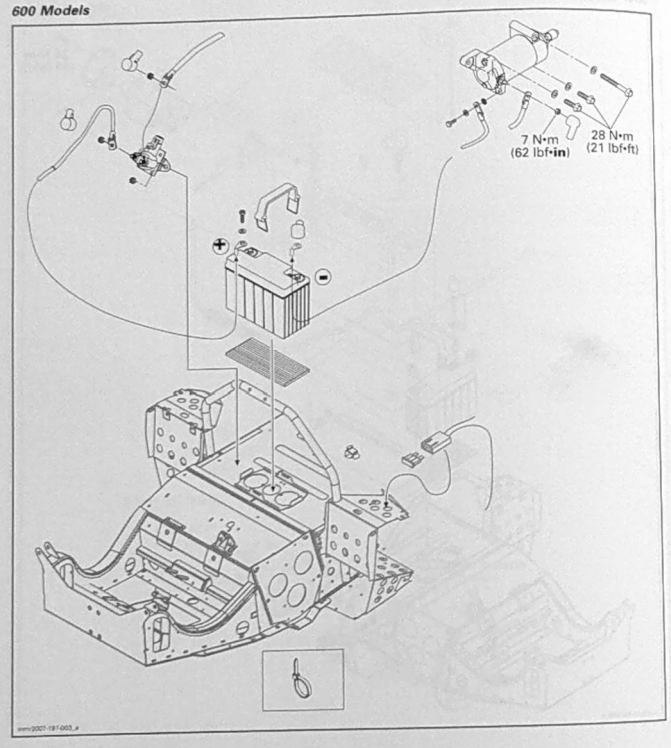
440F Models



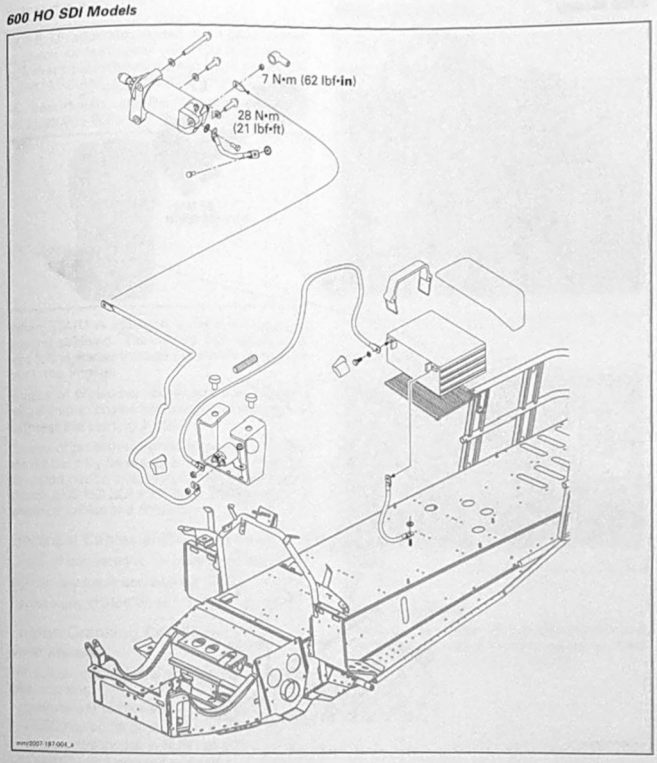
550F Models



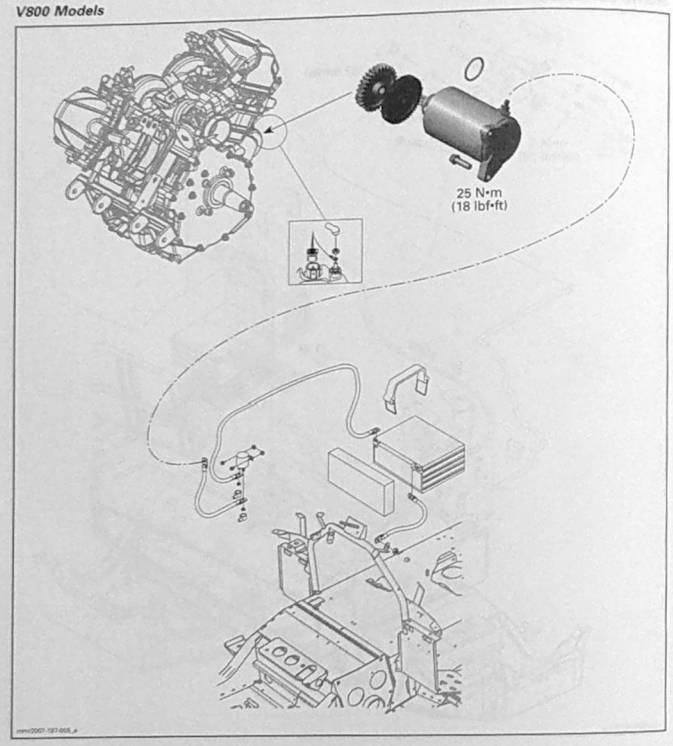
600 Models



600 HO SDI Models



V800 Models



GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

For best results, use the Fluke 111 multimeter (P/N 529 035 868).



When START is activated, a signal is sent to the starting solenoid. The battery then supplies current to the starter through the starting solenoid to crank the engine.

In case of problems, first ensure the problem is not related to engine mechanical components. If not, test the starting system.

Causes of problems are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start button or ignition switch, engine cut-out switch (600 HO SDI and V800), starting solenoid, electrical cables and connections.

Electrical Cables and Connections

Check all connections, harnesses and wires.

Tighten any loose connections.

Replace any chafed wires.

Engine Cranking Conditions

V800 Models

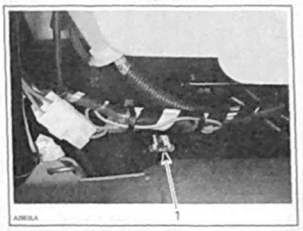
The following conditions must be met to allow engine cranking:

- gearbox set to forward,
- DESS key on its post
- engine stop switch in RUN position
- START button pressed and held.

PROCEDURES

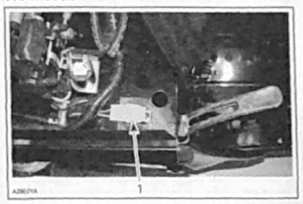
FUSES

440F and 550F Models



1. Fuse holder

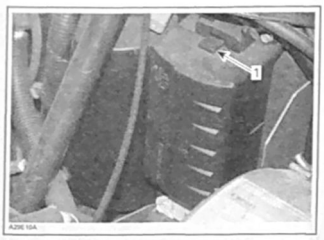
600 Models



1. Fuse holder

600 HO SDI Models

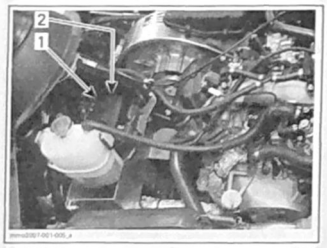
To open fuse box push on cover tab and tilt cover. A fuse description decal is inside the cover. Starting system uses fuses F1, F3 and F8.



1. Cover tab

V800 Models

Starting system uses fuses F1, F3 and F8.



1. Fuse box
2. Cover tab

BATTERY

Refer to *CHARGING SYSTEM* to check battery condition. If the test is good, continue with the next tests.

REVERSE SWITCH

All Models except 440F

Check reverse switch. Refer to *GEARBOX*.

IGNITION SWITCH

440F and 550F Models

Refer to *IGNITION SYSTEM*.

If the switch works correctly, continue with the next tests.

DESS SWITCH

600, 600 HO SDI and V800 Models

NOTE: DESS switch failure does not prevent ECM power-up. It is mainly used for key recognition and to stop engine.

Refer to *DESS SYSTEM*.

If the DESS switch works correctly, continue with the next tests.

ENGINE CUT-OUT SWITCH

600 HO SDI and V800 Models

Refer to *IGNITION SYSTEM*.

START SWITCH

600 HO SDI and V800 Models

Switch Resistance Test

Open steering padding.

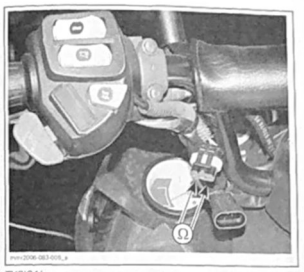
Disconnect the 3-pin connector of switch harness.



TYPICAL

Measure resistance of switch as follows.

SWITCH POSITION	WIRES		RESISTANCE
Released	PINK	WHITE/PINK	High value or infinite (0L)
Pressed and held	PINK	WHITE/PINK	0.2 Ω (closed)



TYPICAL

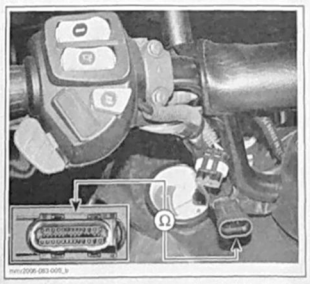
If resistance test fails, replace switch.

Check resistor in WHITE/PINK circuit (see *WIRING DIAGRAMS*). It should be approximately 48 - 59 Ω.

If resistor is good, check continuity of WHITE/PINK wire going to ECM. Replace connector or wiring if test fails.

If connector and wiring tests good, refer to *ENGINE CONTROL MODULE (ECM)* in *ENGINE MANAGEMENT* section.

STEERING CONNECTOR WIRE	ECM CONNECTOR WIRE	RESISTANCE
WHITE/PINK	Pin 19	Continuity (0.2 Ω max.)



Reconnect all connectors and reinstall steering padding.

STARTING SOLENOID (440F/550F/600)

General

Inspect connections and clean as necessary.

Power Supply to Solenoid Winding

Disconnect connector with RED/GREEN wire from solenoid.

Check voltage as follows.

Either set engine cut-out switch to STOP or remove tether cord to prevent engine to run.

Activate START and hold to take the measurement.

Read voltage.

SOLENOID CONNECTOR (harness side)	VOLTAGE
RED/GREEN with battery ground	Battery voltage

If voltage is not adequate, check continuity of wiring as follows.

Disconnect ignition switch connector.

CONNECTIONS		RESISTANCE
RED/GREEN wire at solenoid	RED/GREEN wire at ignition switch connector	Close to 0 Ω
RED wire at ignition switch connector	RED wire (small wire) at battery post	

Check ground connections of solenoid and starter. If good, test solenoid itself.

Static Test: Continuity

Disconnect the solenoid small terminal from solenoid.

With a multimeter, check primary winding resistance as follows.

CONNECTOR		MEASUREMENT
TERMINAL		RESISTANCE @ 20°C (68°F)
Solenoid small terminal	Engine ground	Approximately 7.5 Ω

Check for stuck solenoid plunger. Disconnect battery ground cable and measure resistance as follows.

SOLENOID CONNECTOR		MEASUREMENT
Battery post	Starter post	Open circuit

If any measurement is out of specification, replace solenoid.

Dynamic Test

Reconnect battery ground cable and solenoid terminal.

Either set engine cut-out switch to STOP or remove tether cord to prevent engine to run.

Activate START and hold. While engine is cranking, measure the voltage drop as follows.

SOLENOID CONNECTOR		VOLTAGE
Post coming from battery	Post going to starter	0.2 Vdc max.

If voltage is out of specification, replace solenoid.

If solenoid tests good, check the electric starter.

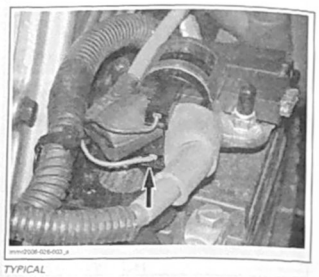
STARTING SOLENOID (600 HO SDI)

General

Inspect connections and clean as necessary.

Power Supply to Solenoid Winding

Disconnect connector with YELLOW/RED wire from solenoid.



TYPICAL

Check voltage as follows.

Remove spark plug cables to prevent engine starting for the test.

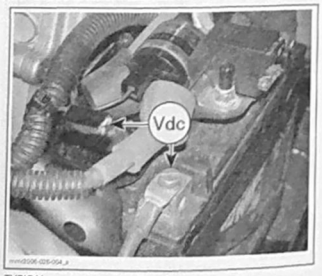
⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Press START button and hold to take the measurement.

Read voltage.

SOLENOID CONNECTOR (harness side)	VOLTAGE
YELLOW/RED with battery ground	Battery voltage



TYPICAL

If voltage is not adequate, check continuity of wiring from START switch.

If wiring is good, do the following test.

Reconnect spark plug cables.

Reconnect terminal to solenoid.

Disconnect WHITE terminal from solenoid.



TYPICAL

Connect a jumper wire between solenoid terminal and battery ground.



TYPICAL

Press START button.

If solenoid works, check wiring and connectors for continuity of WHITE wire.

Reconnect wire to solenoid.

If solenoid does not work, test solenoid.

Static Test: Continuity

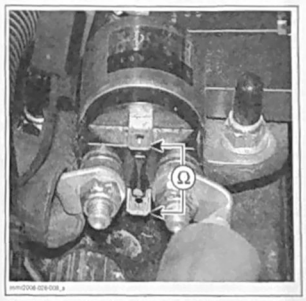
Disconnect terminals from solenoid.



TYPICAL

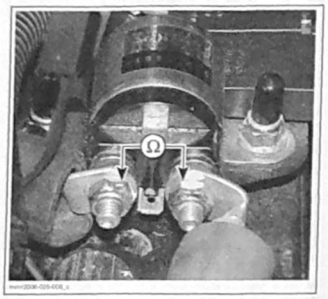
With a multimeter, check primary winding resistance as follows.

SOLENOID CONNECTOR		MEASUREMENT
TERMINAL		RESISTANCE @ 20°C (68°F)
A	B	Approximately 7.5 Ω



Check for stuck solenoid plunger. Disconnect battery ground cable and measure resistance as follows.

SOLENOID CONNECTOR		MEASUREMENT
Battery post	Starter post	Open circuit



If any measurement is out of specification, replace solenoid.

Dynamic Test

Reconnect battery ground cable and solenoid connectors.

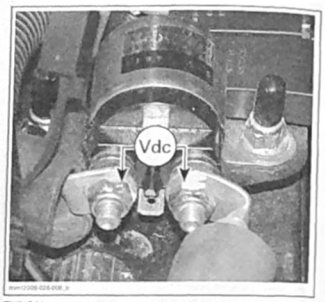
Remove spark plug cables to prevent engine starting for the test.

⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Press START button and hold. While engine is cranking, measure the voltage drop as follows.

SOLENOID CONNECTOR		VOLTAGE
Post coming from battery	Post going to starter	0.2 Vdc max.



TYPICAL

Reconnect spark plug cables.

If voltage is out of specification, replace solenoid.

If solenoid tests good, check the electric starter.

STARTING SOLENOID (V800)

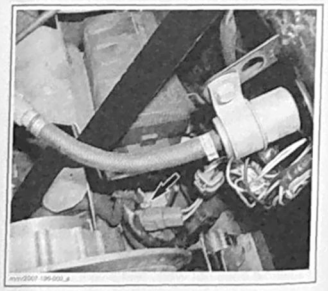
General

Inspect connections and clean as necessary.

Power Supply to Solenoid Winding

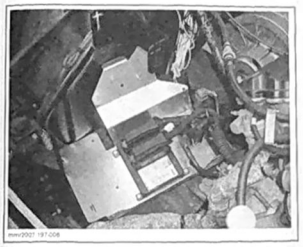
To gain access to starter solenoid, do the following:

- Remove muffler. Refer to *EXHAUST SYSTEM*.
- Release fuel hose from fuse box support.
- Remove fuse box support.

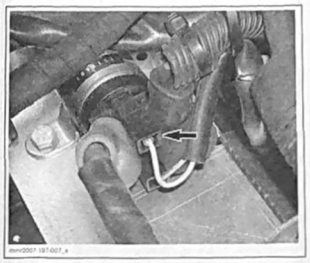


- Remove front plate of fuse box support.

– Lay down support.



Disconnect connector with YELLOW/RED wire from solenoid.



Check voltage as follows.

Remove spark plug cables to prevent engine starting for the test.

⚠ WARNING

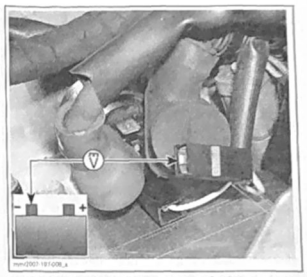
Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Install DESS key.

Press START button to activate ECM.

Read voltage.

SOLENOID CONNECTOR (harness side)	VOLTAGE
YELLOW/RED with battery ground	Battery voltage



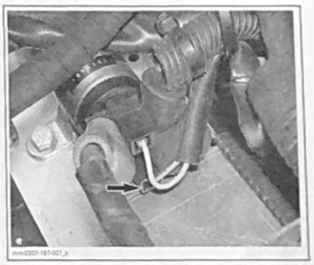
If voltage is not adequate, check supply circuit: Fuses F1, F3 and F8 and relay R1. If good, check wiring and connectors.

If supply circuit is good, do the following test.

Reconnect spark plug cables.

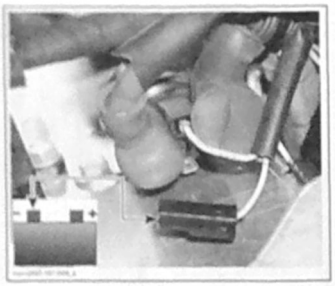
Reconnect terminal to solenoid.

Disconnect WHITE terminal from solenoid.



CAUTION: Be careful in the following test. As soon as jumper wire will be connected, engine will crank and will keep on cranking until jumper wire will be removed.

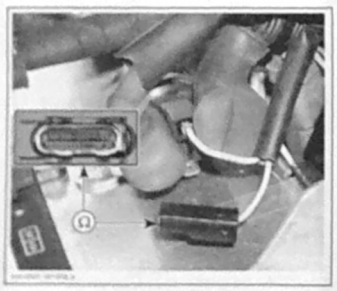
Connect a jumper wire between solenoid terminal and battery ground.



If solenoid does not work, test solenoid.

If solenoid works, check wiring and connectors for continuity of wire as follows.

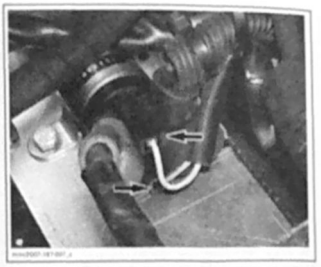
SOLENOID CONNECTOR (harness side)	ECM CONNECTOR B	RESISTANCE @ 20°C (68°F)
WHITE wire	Pin 31	Close to 0 Ω



If wire and connectors are good, refer to *ENGINE CONTROL MODULE (ECM)* in *ENGINE MANAGEMENT (V800)* section.

Static Test: Continuity

Disconnect terminals from solenoid.



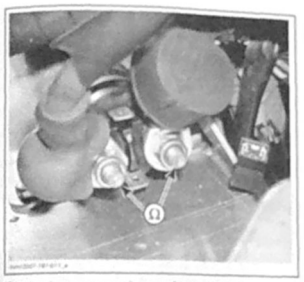
With a multimeter, check primary winding resistance as follows.

SOLENOID PRIMARY WINDING		RESISTANCE @ 20°C (68°F)
Terminal A	Terminal B	Approximately 7.5 Ω



Check for stuck solenoid plunger. Disconnect battery ground cable and measure resistance as follows.

SOLENOID PLUNGER		RESISTANCE
Battery post	Starter post	Open circuit (OL)



If any measurement is out of specification, replace solenoid.

Reconnect battery ground cable and solenoid connectors.

Dynamic Test

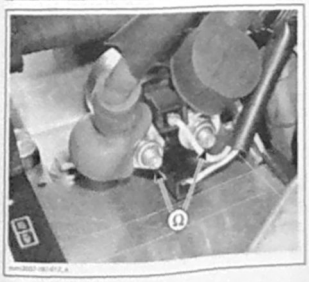
Remove spark plug cables to prevent engine starting for the test.

⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Press START and hold. While engine is cranking, measure the voltage drop as follows.

SOLENOID		MEASUREMENT
Battery post	Starter post	0.2 Vdc max.



If voltage is out of specification, replace solenoid.

If solenoid tests good, check the electric starter.

Properly reinstall removed parts.

ELECTRIC STARTER

Starter Test

440F, 550F and 600 Models

Either set engine cut-out switch to STOP or remove tether cord to prevent engine to run.

600 HO SDI and V800 Models

Disconnect spark plug cables.

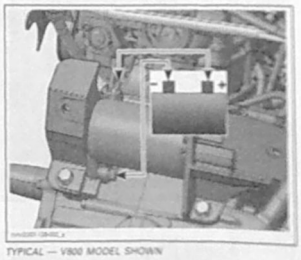
⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

All Models

Remove tuned pipe if necessary.

Using booster cable, carefully supply current from the battery directly to the starter. Connect the BLACK cable first. Connect the remaining booster cable from the battery then to the starter.



TYPICAL — V800 MODEL SHOWN

If the starter does not turn, check for mechanical problem in the starter.

If the starter turns, ensure wiring harness and connectors between battery and starter are in good condition. If they test good, the ECM can be suspected (600 HO SDI and V800). Refer to *ENGINE MANAGEMENT*.

Starter Removal

- Turn off ignition switch or remove DESS key.
- Disconnect BLACK (-) cable from battery.

– Disconnect RED (+) cable from battery.

⚠ WARNING

Always disconnect BLACK (-) cable first and connect last.

All except V800 Models

– Remove tuned pipe.

440F, 550F and 600 Models

– Disconnect RED cable from starter and wire from small terminal.

600 HO SDI Models

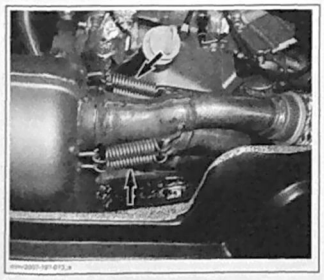
– Disconnect RED cable and RED/GREEN wire from starter solenoid.
– Disconnect ground cable from starter.

All Models except V800

– Remove starter from engine.

V800 Models

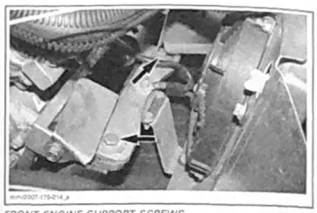
Unhook muffler springs. Refer to *EXHAUST SYSTEM*.



Unscrew engine supports screws.



REAR ENGINE SUPPORT SCREWS



FRONT ENGINE SUPPORT SCREWS

Move engine forward to unhook the rear support.



Remove air intake silencer. Refer to *AIR INTAKE SYSTEM*.

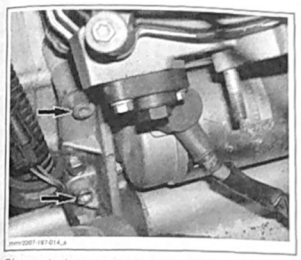
Install engine lifting tool (P/N 529 036 022).





Slightly raise engine to support its weight.

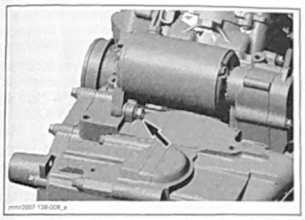
Remove LH rear engine mount.



Clean starter area.

Disconnect starter cable.

Remove starter mount screw.



TYPICAL — SOME PARTS REMOVED FOR CLARITY PURPOSE ONLY

Pull out starter.

Starter Installation

440F and 550F Models

Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.

CAUTION: Make sure that both starter brackets are well seated against engine crankcase and starter before torquing all retaining bolts.

Torque all M8 bolts to 24 ± 4 N•m (18 ± 3 lbf•ft).

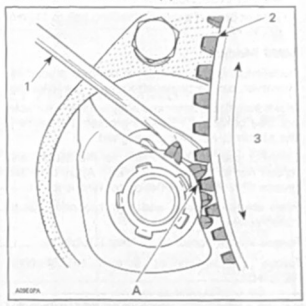
Torque all M5 bolts to 5 ± 0.5 N•m (44 ± 5 lbf•**in**).

CAUTION: Before checking engaging depth of starter pinon teeth, make sure that battery cables are disconnected.

Install starter.

NOTE: Check proper engaging depth of starter pinion teeth to ring gear teeth (see illustration). Install hardened washers (P/N 503 007 900) between engine and starter supports accordingly.

CAUTION: All starter bracket fasteners must be secured with Loctite 271 (P/N 293 800 005).



1. Screwdriver pulling starter pinion
2. Ring gear
3. No excessive backlash
A. 0.5 to 1.5 mm (.020 to .060 in)

Connect the RED battery cable and the RED wire to the large terminal of the relay. Connect RED/GREEN wire to small terminal of relay.

Connect BLACK cable to battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

600 and 600 HO SDI Models

- Use new teflon washers on the 3 bolts retaining starter to engine.
- Torque the bolts to 28 ± 1 N•m (21 ± 1 lbf•ft).
- Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
- Connect the RED battery cable and the RED wire to the large terminal of the starter.
- Torque large terminal nut to 7 N•m (62 lbf•**in**).

⚠ WARNING

Always disconnect ground cable first and connect last.

- Connect ground cable to the starter with star washer in between.
- Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

V800 Models

Installation is the reverse of removal procedure. However, pay particular attention to the following.

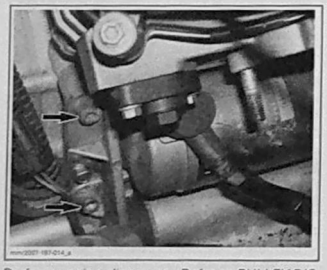
Make sure that starter and engine mating surfaces are free of debris. Serious problem may arise if the starter is not properly aligned.

Connect the RED (+) cable to the starter and torque nut to 6 N•m (53 lbf•**in**). Apply dielectric grease (P/N 293 550 004) on terminal and nut.

Push starter in place and align mounting ear to install screw.

Torque starter screw to 25 N•m (18 lbf•ft).

Torque engine mount screws to 24 N•m (18 lbf•ft).



Perform engine alignment. Refer to *PULLEY DISTANCE AND ALIGNMENT.*

Properly torque engine support screws. Refer to *ENGINE REMOVAL AND INSTALLATION.*

Last connect BLACK cable to battery.

⚠ WARNING

Always connect BLACK (-) cable last. Whenever connecting the RED (+) cable to the starter motor, make sure the battery cables are disconnected to prevent electric shock.

Test starter operation.

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

SERVICE TOOLS

Description	Part Number	Page
Fluke 111 multimeter	529 035 868	502

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

The following components are specially designed for this system: ECM, DESS key and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed DESS key is installed on DESS post.

The DESS key contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the DESS key. This is achieved with B.U.D.S. SOFTWARE.

The system is quite flexible. Up to 8 DESS keys may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a DESS key can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When starting the engine with a DESS key on the post, the DESS is activated and will emit audible signals:

- 2 short beeps indicate a working DESS key. Vehicle can be driven.
- 1 short beep indicates a wrong DESS key is being used or that something is defective. Vehicle can not be driven.

Engine Starting

If the ECM recognizes a valid DESS key, it allows engine to rev above 3000 RPM.

The ECM will shut down immediately after stopping the engine.

KEY PROGRAMMING

Use the latest B.U.D.S. software available from BOSSWeb.

For proper connection instructions, refer to the appropriate section according to the following table.

MODEL	SECTION
600	*COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE (600)*
600 HO SDI	*EMS DIAGNOSTIC AND COMMUNICATION TOOLS (SDI)*
V800	*EMS DIAGNOSTIC AND COMMUNICATION TOOLS (V800)*

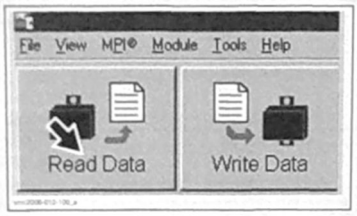
The B.U.D.S. software is designed to allow, among other things, the programming of DESS key(s) and entering customer information.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

⚠ WARNING

If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

Read ECM using READ DATA button.



600 Models

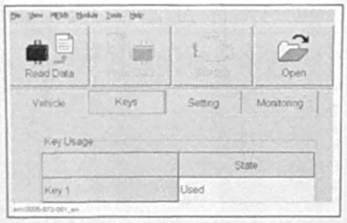
Install the new key to be programmed on vehicle DESS post.

600 HO SDI and V800 Models

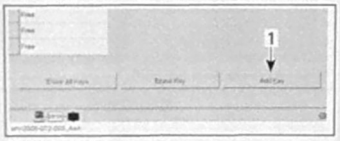
Install the new key to be programmed on DESS post interface.

All Models

Click on KEYS tab.



Click on ADD KEY button on bottom of screen.

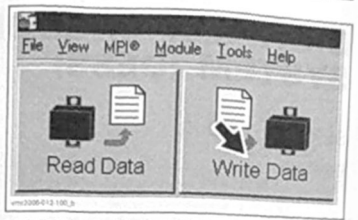


1. Click on this tab

A new key is now saved in the computer.

NOTE: To program other key(s), install a new key and click again on ADD KEY tab.

Ensure to save new data in ECM using WRITE DATA button.



NOTE: There will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, wait until the speedometer turns off, then, click the "Ignore" button and exit B.U.D.S. The change is complete.

TROUBLESHOOTING

If no beep is heard when starting the engine, test beeper operation. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*.

DESS Post

The following continuity tests can be performed using an ohmmeter.

For best results, use the Fluke 111 multimeter (P/N 529 035 868).

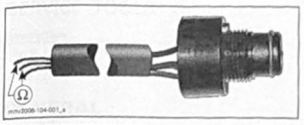


Disconnect DESS post wires.

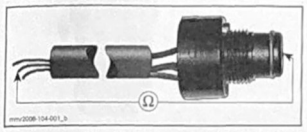
DESS Key Removed from Post

Connect test probes to DESS post as per tables and measure resistance.

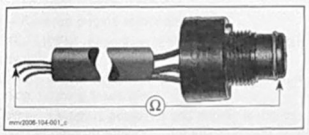
DESS POST WIRE		RESISTANCE Ω @ 20°C (68°F)
BLACK/ GREEN	BLACK/ WHITE	Open circuit



DESS POST WIRE		RESISTANCE Ω @ 20°C (68°F)
WHITE/ GRAY	Post terminal	Close to 0 Ω



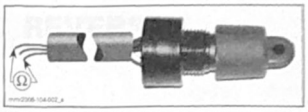
DESS POST WIRE		RESISTANCE Ω @ 20°C (68°F)
BLACK/ GREEN	Post ring	Close to 0 Ω



DESS Key on Post

Connect test probes to DESS post as per table and measure resistance.

DESS POST WIRE		RESISTANCE Ω @ 20°C (68°F)
BLACK/ GREEN	BLACK/ WHITE	Close to 0 Ω



If any resistance test fails, replace DESS post.

ROTAX ELECTRONIC REVERSE (440F)

SERVICE TOOLS

Description	Part Number	Page
Fluke 111 multimeter	529 035 868	505

GENERAL

For best results, use the Fluke 111 multimeter (P/N 529 035 868).



529 035 868

There is 3 main components used for the RER system : the RER switch, the MPEM and the RER trigger coil.

The MPEM receives signals from the trigger coils for the following functions:

- Forward engine rotation.
- Reverse engine rotation.

The MPEM recognizes a signal sent by the RER switch.

When switch is activated and engine is not running, nothing takes place.

When switch is activated and engine is running, MPEM cuts off ignition. Therefore, engine RPM gradually drops. When engine reaches a low threshold RPM, MPEM sends an ignition spark at a great advance creating a thrust which reverses engine rotation.

In reverse operation, the RER trigger coil is used to give the ignition signal to the MPEM.

NOTE: On the **443 engine**, RER trigger coil is used only when engine is in reverse operation.

Under a threshold low RPM or above drive pulley engagement speed, the RER function is disabled. Nothing takes place when pressing RER button.

TROUBLESHOOTING

RER Does Not Respond When Depressing RER Button

Check if engine RER switch works properly.

Engine Stops after Pressing RER Button

This confirms that RER switch works.

Check trigger coil.

RER Works Erratically

Check engine compression. A low compression engine may result in RER working erratically making you think the problem is an electronic problem.

Check piston condition. Verify piston condition through the intake and exhaust ports. Look for scoring on piston skirts. Scored piston skirts may result in RER working erratically making you think the problem is an electronic problem.

Check RER switch.

TESTING PROCEDURES

RER SWITCH

Switch Resistance Test

Unplug terminals on RER switch.

Check switch as follows.

SWITCH	TERMINAL	RESISTANCE
Released	1 and 2	Infinite (OL)
Pushed and held		2.8 MΩ

If any reading is out of specification, replace switch.

If switch is good, check wiring/connectors.

A switch may pass the test and still cause erratic or no operation of RER because of moisture/water in switch. To check, perform the following voltage test.

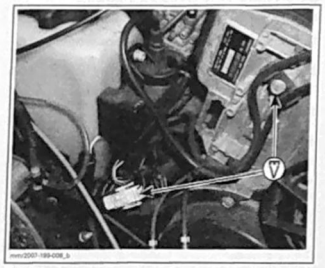
Switch Voltage Test

NOTE: This test validates if any moisture/water in switch could cause RER malfunction.

Reconnect connector besides MPEM.

Start engine and check voltage as follows.

WIRE		VOLTAGE
BLUE/BLACK	Engine ground	5 Vdc



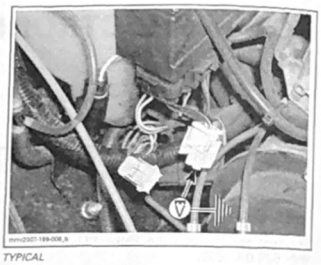
TYPICAL

If voltage is within specification, there is no moisture/water in switch.

If voltage is lower than specification, there is moisture/water in the switch. Do the following test.

NOTE: If voltage is less than approximately 3.5 Vdc the RER system will not work.

Unplug connector besides MPEM and restart engine to read voltage again.



TYPICAL

If voltage is now within specification, problem is in switch or wiring/connectors going to switch.

Reconnect connectors.

RER TRIGGER COIL

Trigger Coil Resistance Test

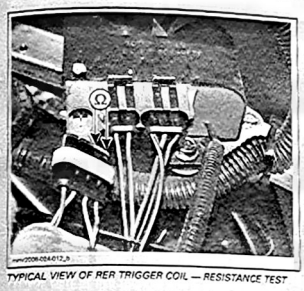
Disconnect 4-pin connector from MPEM.



TYPICAL VIEW OF RER TRIGGER COIL CONNECTOR

Check the resistance for RER trigger coil as follows.

TEST PROBES	RESISTANCE
BLUE/YELLOW and WHITE/YELLOW wires	160 to 180 Ω

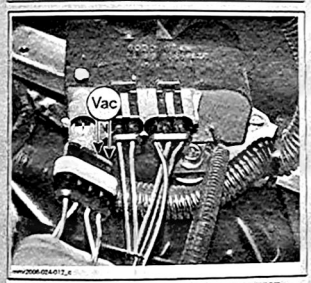


TYPICAL VIEW OF RER TRIGGER COIL — RESISTANCE TEST

Trigger Coil Voltage Test

With the MPEM connector disconnected as for the resistance test, check the voltage for RER trigger coil as follows.

TEST PROBES	VOLTAGE
BLUE/YELLOW and WHITE/YELLOW wires	0.15 to 0.89 Vac
NOTE: Manually crank engine with the spark plug installed. Always repeat the procedure 3 times.	



TYPICAL VIEW OF RER TRIGGER COIL — VOLTAGE TEST

If trigger coil is out of specification, replace it.

LIGHTS, INSTRUMENTS AND ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
Fluke 111 multimeter	529 035 868	509, 514
supply harness	529 035 869	512, 516, 520–522

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Fluke rigid back probe	TP88	509

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

⚠ WARNING

It is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Do not place tools on battery.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

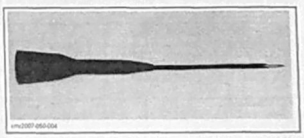
Diagnostic Tools

To perform verifications, use the Fluke 111 multimeter (P/N 529 035 868).

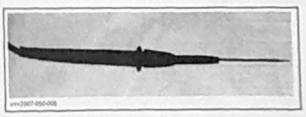


529 035 868

To easily probe wire terminals through the back of their connectors, Fluke rigid back probe (P/N TP88) or equivalent can be used.

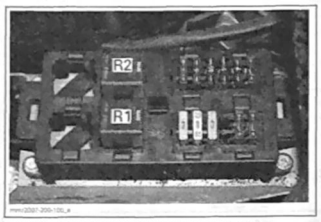


They can be inserted at the end of the standard probes of the Fluke 111 multimeter.

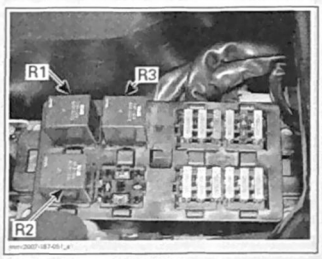


RELAY LOCATION

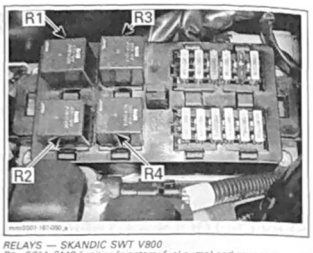
600 HO SDI and V800 Models



RELAYS — TYPICAL EXPEDITION TUV 600 HO SDI
R1: ECM, EMS (ignition/injectors, fuel pump) and gauges
R2: Lights and accessories



RELAYS — EXPEDITION TUV V800
R1: ECM, EMS (ignition/injectors, fuel pump) and gauges
R2: Lights and accessories
R3: Cooling fan



RELAYS — SKANDIC SWT V800
R1: ECM, EMS (ignition/injectors, fuel pump) and gauges
R2: Lights and accessories
R3: Cooling fan
R4: Rear power outlet

CURRENT TYPE (AC AND DC)

Refer to the following chart to identify the current type used on the snowmobile.

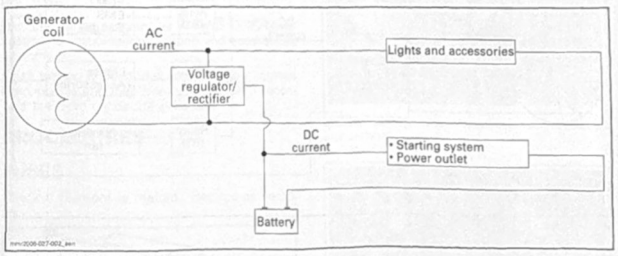
Pay attention that both AC (alternating current) and DC (direct current) can be used.

MODEL	SYSTEM	CURRENT TYPE
440F and 550F	Lights and accessories	AC
	Starting system Power outlet	DC
600	Lights and accessories	AC
	Starting system Power outlet	DC
600 HO SDI	All	DC
V800	All	DC

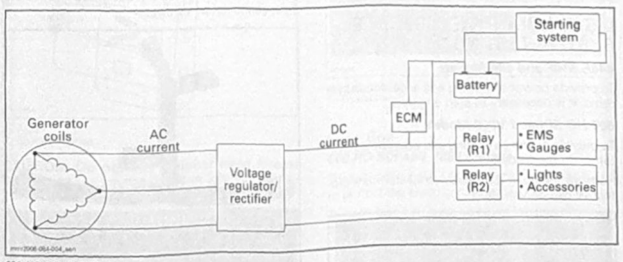
POWER DISTRIBUTION

NOTE: The following diagrams show how the electrical current is distributed to the lights and accessories.

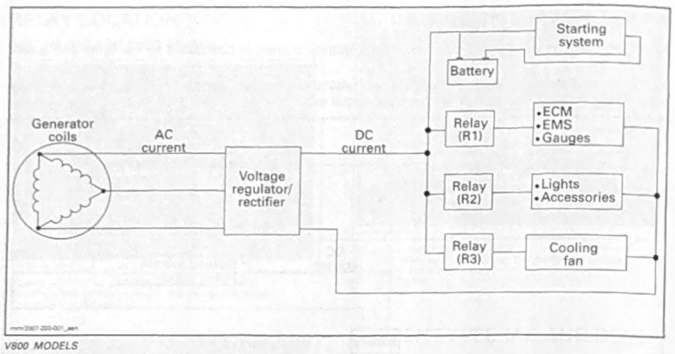
NOTE: When there is no power, check fuse(s), relay(s) and battery, generator coil(s), voltage regulator and wiring harness. Also ensure to check the circuit ground wires.



440F, 550F AND 600 MODELS



600 HO SDI MODELS



V800 MODELS

DIAGNOSTIC

LIGHTING AND ACCESSORIES SYSTEM TESTING

440F, 550F and 600 Models

To provide power to lighting and accessories systems, it is necessary to start engine.

600 HO SDI and V800 Models

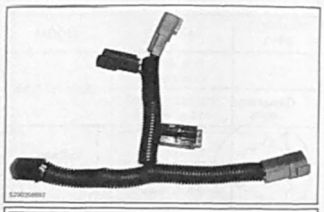
To provide power to lighting and accessories systems, do the following.

Remove the 6-pin diagnostic connector from protective cap on vehicle.



TYPICAL

Connect supply harness (P/N 529 035 869) to the 6-pin connector of vehicle.





TYPICAL

NOTE: It is suggested to disconnect headlamp or to connect a battery charger to reduce battery discharge rate.

NOTE: The use of the supply harness will keep the ECM ON to give you more time to work. Not using it will make the ECM shut-off after approximately 30 seconds.

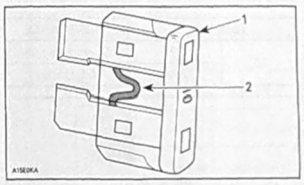
Use the wiring diagram in *WIRING DIAGRAMS* section to troubleshoot lighting and accessories systems.

Once testing is done, disconnect supply harness from vehicle and then from supply cable. Reconnect the 6-pin connector in its cap.

PROCEDURES

FUSES

Check if filament is melted. Replace as necessary.



1. Fuse
2. Check if melted

CAUTION: Do not use a higher rated fuse as this can cause severe damage to electric components and/or fire.

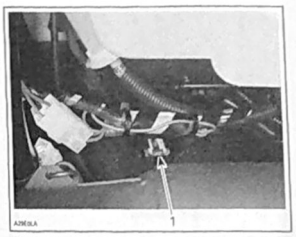
⚠ WARNING

If fuse has burnt out, source of malfunction should be determined and corrected before restarting.

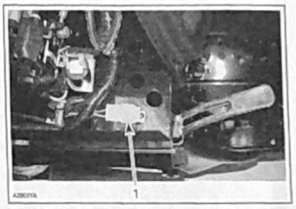
Electric Power Outlet Fuse

550F and 600 Models

Electric power outlet is protected with a 20 amperes rated fuse.



550F MODELS
1. Fuse holder



600 MODELS
1. Fuse holder

Fuse Box

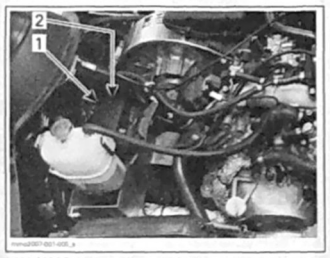
600 HO SDI and V800 Models

These models have a fuse box that contains fuses to protect the electrical system.

To open fuse box push on cover tab and tilt cover. A fuse description decal is inside the cover.



600 HO SDI MODELS
1. Cover tab



V800 MODELS
1. Fuse box
2. Cover tab

RELAY R1

Voltage Test

TEST	WIRE COLOR	VOLTAGE	NOTE
COIL side	PINK and WHITE	10.5 to 13.5 Vdc	Engine idling (1500 to 1600 RPM)
CONTACT side	BLUE/RED and GRAY/RED	00.0 to 0.10 Vdc	Engine idling (1500 to 1600 RPM)

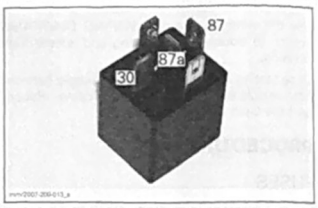
Continuity Test

Remove the relay from vehicle.

Use the Fluke 111 multimeter (P/N 529 035 868), and select the ohms position.

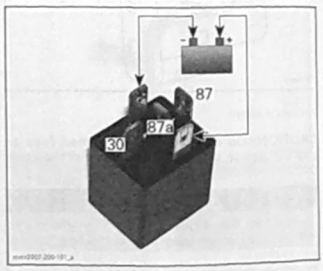
Probe relay as follows.

TERMINAL		RESISTANCE
30	87	0.5 Ω max.
	87a	Open circuit (OL)



Connect battery as shown and probe relay as follows.

TERMINAL		RESISTANCE
30	87	Open circuit (OL)
	87a	0.5 Ω max.



RELAY R2

600 HO SDI and V800 Models

Voltage Test

TEST	WIRE COLOR	VOLTAGE	NOTE
COIL side	YELLOW/RED and WHITE	10.5 to 13.5 Vdc	Engine idling (1500 to 1600 RPM)
CONTACT side	BLUE/RED and RED/BLACK	00.0 to 0.10 Vdc	Engine idling (1500 to 1600 RPM)

Test with B.U.D.S.

Use B.U.D.S. software.

Energize **relay 2** from **Activation** tab.

Headlamp should turn on.

If the relay does not work, remove the relay to test the input side of relay coil.

Connect a voltmeter as indicated in the following table.

TEST PROBE (+)	TEST PROBE (-)	VOLTAGE
YELLOW/GRAY wire	Battery ground	Battery voltage

If proper voltage is read, check continuity of WHITE wire between relay connector and pin B-16 of ECM connector. If faulty, repair wire/connector.

If voltage is not appropriate, check fuse F3 (instruments will not turn on) and continuity of wire on supply side of relay through relay 1. If faulty, repair wire/connector. If wire/connectors test good, test output side or relay.

Continuity Test

Refer to *RELAY R1* for procedure.

RELAY R4

Skandic SWT V800 Models

Voltage Test

TEST	WIRE COLOR	VOLTAGE
COIL side	YELLOW/RED and BLACK	10.5 to 13.5 Vdc
CONTACT side	RED/BLACK and BLUE/RED	00.0 to 0.10 Vdc

Continuity Test

Refer to *RELAY R1* for procedure.

HEADLAMP

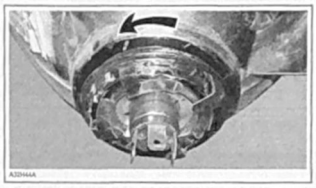
Bulb Replacement

If any headlamp bulb is burnt, proceed as follows.

Remove air duct or protector if applicable.

Unplug burnt bulb connector. Remove the rubber boot.

Turn bulb retainer ring counterclockwise to unlock. Detach the bulb and replace.



A32H4A

TYPICAL

CAUTION: Never touch glass portion of an halogen bulb with bare fingers, as it shortens its operating life. If by mistake glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb. After locking ring installation, ensure bulb is properly secured in place.

Properly reinstall removed parts.

Headlamp Test

If the new bulbs do not work correctly or if the headlamp is dimmed, proceed as follows.

440F, 550F and 600 Models

For proper operation, the AC system must be isolated from DC system.

If for instance, an AC accessory was added and grounded to frame or to engine, the headlamp will be dimmed.

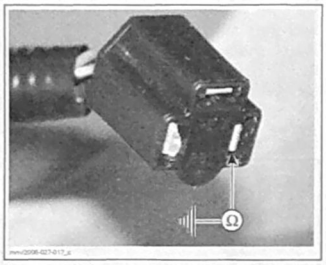
NOTE: For proper operation the AC accessory needs to be "grounded" to the YELLOW/GREEN.

Use a digital multimeter and set it to ohms.

Disconnect connector at headlamp.

Measure resistance as follows.

WIRES		RESISTANCE (Ω)
YELLOW/GREEN	Frame	Must be open circuit (0L)

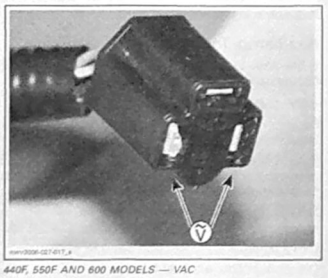


If any resistance value is found, there is an improper interconnection between AC and DC circuit. Disconnect one accessory at a time and recheck to find the faulty circuit.

If no resistance is found (open circuit), start engine.

Read voltage at headlamp connector as follows. Refer to *WIRING DIAGRAMS*.

MODELS	VOLTAGE
440F, 550F and 600	13.8 Vac



440F, 550F AND 600 MODELS — VAC

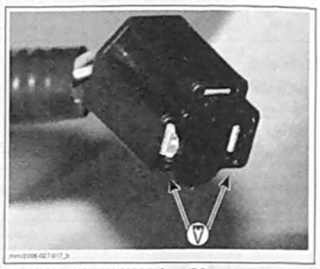
If voltage is inadequate, proceed as in *ALL MODELS* below to find the source of the problem.

600 HO SDI and V800 Models

Install supply harness (P/N 529 035 869) to continuously feed electrical system. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in this section for proper installation.

Read voltage at headlamp connector as follows. Refer to *WIRING DIAGRAMS*.

MODELS	VOLTAGE
600 HO SDI and V800	Battery voltage



600 HO SDI AND V800 MODELS — VDC

If voltage is inadequate, proceed as in *ALL MODELS* below to find the source of the problem.

All Models

Check appropriate fuse. Refer to *FUSE* in this section.

Check appropriate relay (if applicable). Refer to *POWER DISTRIBUTION* in this section.

Check headlamp dimmer switch.

Check wiring harness and connectors.

Check voltage regulator/rectifier. Refer to *CHARGING SYSTEM*.

Check generator coils. Refer to *CHARGING SYSTEM*.

Headlamp Beam Aiming

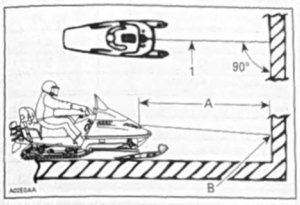
Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

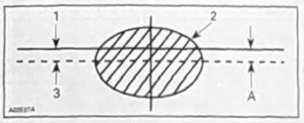
Rider or equivalent weight must be on the vehicle.

Select **high** beam.

Measure headlamp center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



TYPICAL
1. Headlamp center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



1. Headlamp horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

TAILLIGHT

Bulb Replacement

Unscrew lens screws to expose bulb.

Push the bulb in and hold while turning counterclockwise to release.

Install the new bulb by first pushing in while turning clockwise.

Taillight Removal

Disconnect taillight connector.

Remove the wires from connector.

NOTE: Note the location of each wire.

Pull wires.

Taillight Installation

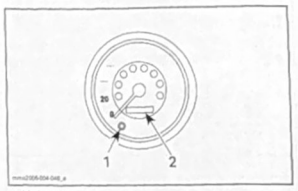
The installation is the reverse of the removal procedure.

Install wires in connector as noted previously.

ELECTRONIC SPEEDOMETER

600 HO SDI and V800 Models

These models are equipped with an electronic speedometer.



1. Mode button
2. Multifunction display

Mode Button

Depress mode button to change multifunction display. Each time engine is started, display shows odometer. From that point depressing mode button will change display for the trip meter.

Depressing mode button again will change display for the resetable hourmeter. Push mode button again to return to odometer.

Push and hold mode button for 2 seconds to reset the tripmeter or the resetable hourmeter depending on the one displayed.

Multifunction Display

Odometer

Odometer records the total distance travelled and displays it either in miles or kilometers. Refer to *CHANGE FROM ONE UNIT TO THE OTHER* for changing units.

Trip Meter

Records distance travelled since it has been reset. Distance travelled is displayed either in miles or kilometers. Refer to *CHANGE FROM ONE UNIT TO THE OTHER* for changing units.

Resetable Hourmeter

Records engine running time in hours and minutes since it has been reset.

Push and hold mode button for 2 seconds to reset the hourmeter.

Multifunction Display Code

If your speedometer shows SCALE in the multifunction display, it means that the display selector button is stuck in the down position or depressed when the electrical system was activated.

Change from One Unit to the Other

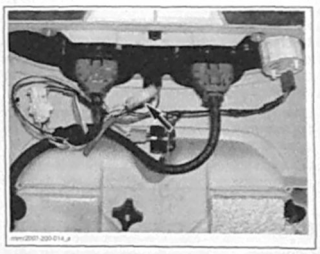
NOTE: Speedometer, odometer and trip meter will have their units (kilometer or miles) changed all together.

Stop engine and open engine compartment.

Remove air duct or protector if applicable.

Choose the desired unit as follows.

UNIT	CONNECTORS
Kilometers	Plugged
Miles	Unplugged



mxm2007-220-014_a

Speedometer Pinout

600 HO SDI Models

FUNCTION	PIN
Power 12 Vdc (+)	8, 22
Ground	10, 11
Speed sensor signal	6
MPH/Km/h setting	5
Tachometer RPM signal	7
Tachometer control wires	18, 19, 20, 21
HI beam signal	15
Low injection oil level signal	14
Park brake pilot lamp	16
DESS pilot lamp	9
Temperature pilot lamp	2
Engine pilot lamp (EMS)	1
Battery pilot lamp	12

V800 Models

FUNCTION	PIN
Power 12 Vdc (+)	8, 22
Ground	10, 11
Speed sensor signal	6
MPH/Km/h setting	5
Tachometer RPM signal	7
Tachometer control wires	18, 19, 20, 21
HI beam signal	15
EMS signal	1
Engine overheat signal	2
Engine oil pressure signal	14
Low battery voltage signal	12
Park brake pilot lamp	16
DESS pilot lamp	9

Troubleshooting Speedometer

SCALE Appears in Multifunction Display

The display selector button is stuck in the down position or was depressed while the speedometer initialized.

Press/release button several times to unstick it.

Retry.

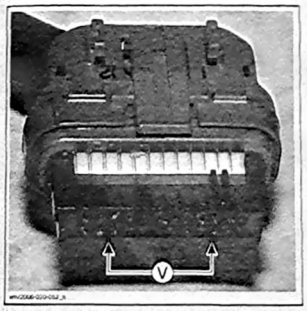
NO LIGHTS in Speedometer and Needle Does not Move

QUICK CHECK	
OBSERVATION	POSSIBLE CAUSE
Speedometer does not turn on	No power from battery
	Fuse F3, relay 1
	Wiring/connectors
	Defective speedometer

Disconnect speedometer connector.

Read voltage from vehicle harness as follows.

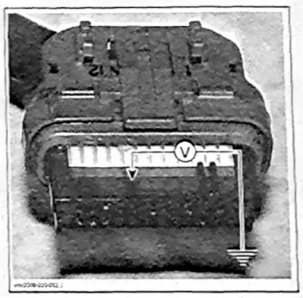
SPEEDOMETER CONNECTOR (harness side)		MEASUREMENT
Pin 8	Pin 11	12 Vdc
Pin 22		
Pin 10		Close to 0 Ω



If there is voltage, replace speedometer.

If there is no voltage, recheck voltage as follows.

SPEEDOMETER CONNECTOR (harness side)		VOLTAGE
Pin 8	Engine ground	12 Vdc
Pin 22		



If voltage is not good, check/repair wiring/or connectors from magneto. If good, check generator coil.

If voltage is good, check ground circuit (pin 10 and 11) wiring/connectors.

LIGHTS ARE LIT in Speedometer and Needle Does not Move

Check speed sensor. See below.

If speed sensor tests good, replace speedometer.

Reconnect connector.

Calibration of a New Speedometer

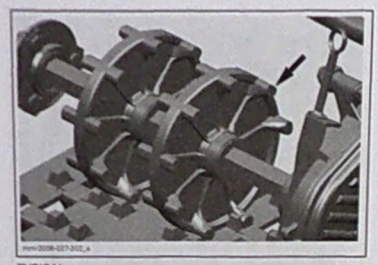
When installing a new speedometer, it is necessary to set it in accordance with the drive axle sprocket used on the vehicle.

CAUTION: If the following operation is not done right the first time, it cannot be repeated. Speedometer calibration can be set only once. Learn the procedure thoroughly before doing it.

Proceed as follows:

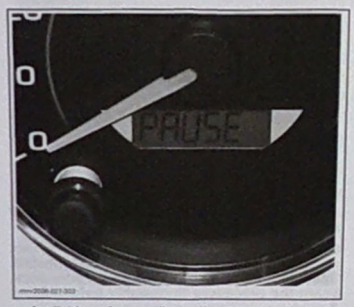
IMPORTANT: The following illustrations are examples only. Enter the exact value required for the specific model you are working on.

– First count number of teeth on sprocket and note it.

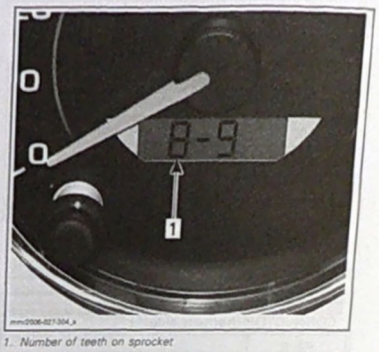


TYPICAL

- Ensure speedometer connector is installed.
- Install supply harness (P/N 529 035 869) to continuously feed electrical system. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* for proper installation.
- Look at speedometer ► Speedometer lights flash and PAUSE appears.

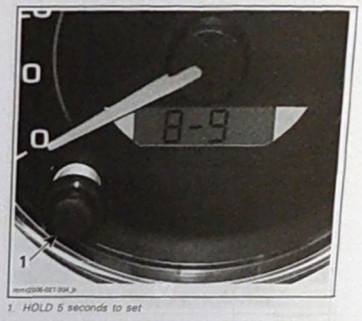


- Available values will scroll automatically ► 1st digit indicates the number of teeth on sprocket.



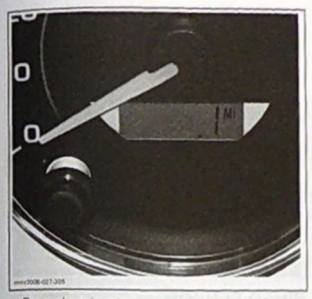
1. Number of teeth on sprocket

- When the proper number is displayed ► Press MODE button and HOLD 5 seconds to set that value.



1. HOLD 5 seconds to set

- Lights flashing will stop. ► Speedometer now begins to operate normally.



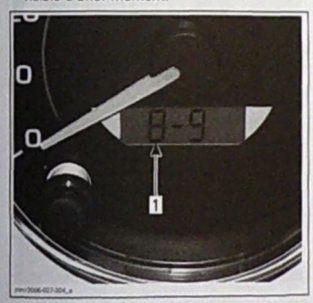
– Procedure is over.

NOTE: At some point, 0 - 0 will be displayed. Do not use, it is intended for manufacturer only. If inadvertently used, speedometer will exit programming mode without causing problems. Restart procedure.

Speedometer Calibration Information

To know the actual calibration of a speedometer, proceed as follows.

– Ensure speedometer connector is installed.
– Install supply harness (P/N 529 035 869) to continuously feed electrical system. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* for proper installation.
– Look at speedometer ► The calibration will be visible a brief moment.



1. Number of teeth on sprocket

NOTE: Speedometer calibration cannot be set to a different value.

Zeroing Needle on Electronic Speedometer or Tachometer

If needle is not pointing to zero on any electronic speedometer or tachometer, adjust it as follows.



MISALIGNED NEEDLE

IMPORTANT: First ensure gauges are OFF.

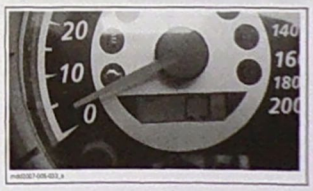
Push and hold MODE button on speedometer **while** installing supply harness (P/N 529 035 869). Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* for proper installation.

In a few seconds "SCALE" should be displayed on gauge.



Release mode button then, SCALE will disappear.

A set of brackets will be displayed along with a dash going in a circle clockwise then counterclockwise.



Then, the brackets and moving dash will revert their position. The moving dash will go clockwise then counterclockwise.



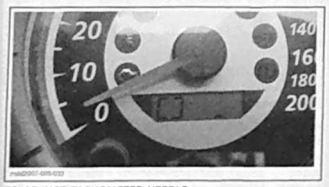
This cycle will repeat.

To adjust the **speedometer** needle, push MODE button while the moving dash is on left side.



TO ADJUST SPEEDOMETER NEEDLE

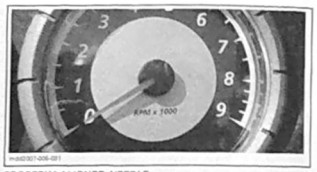
To adjust the **tachometer** needle, push MODE button while the moving dash is on right side.



TO ADJUST TACHOMETER NEEDLE

To move needle **clockwise**, wait until the moving dash is going clockwise then push and hold mode button until needle is properly aligned.

To move needle **counterclockwise**, wait until the moving dash is going counterclockwise then push and hold mode button until needle is properly aligned.



PROPERLY ALIGNED NEEDLE

Release mode button. After a few seconds, gauge will return to normal operation. The new needle position is now set.

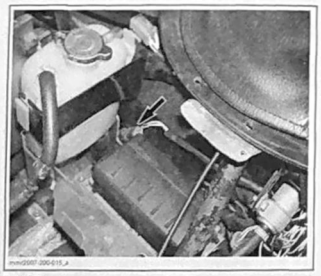
Remove supply harness.

SPEED SENSOR

600 HO SDI and V800 Models

Sensor Static Test

Locate speed sensor connector.



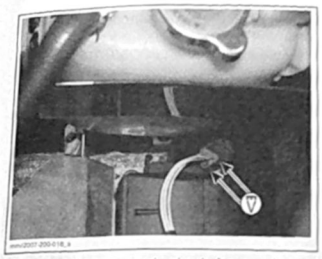
TYPICAL

Install supply harness (P/N 529 035 869) to continuously feed electrical system. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* for proper installation.

Use a multimeter and set it to Vdc.

Back-probe connector and read voltage as follows.

SPEED SENSOR CONNECTOR (sensor side)		VOLTAGE
YELLOW/RED	VIOLET/BLACK	Battery voltage



If voltage is not good, check fuses, relay and wiring/connectors.

If voltage is good, do the following test.

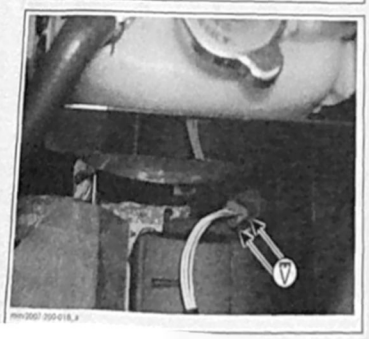
Lift rear of vehicle and safely block.

⚠ WARNING

Before starting engine, ensure track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

Start engine and slightly accelerate engine so that track rotates SLOWLY. Back-probe connector and read voltage.

SPEED SENSOR CONNECTOR (harness side)		VOLTAGE
YELLOW/ RED	WHITE	Pulsating voltage: battery voltage, then approx. 0 Vdc, battery voltage and so on



NOTE: Since we measure pulsating voltage, the numeric display will continuously change. The analog display may be easier to follow.



1. Analog display

If voltage is appropriate, check/repair wiring/ connector between sensor and speedometer. If it is good, try a new speedometer.

If voltage is wrong, try a new sensor.

TACHOMETER

Tachometer Pinout

600 Models

FUNCTION	WIRE
Power 12 Vac to bulb	YELLOW
RPM signal from magneto	
Grounds	YELLOW/GREEN

600 HO SDI and V800 Models

FUNCTION	PIN
Power 12 Vdc (+)	9
Ground	10
Control wires from speedometer	18, 19, 20, 21

Tachometer Test

600 Models

No Light but the Needle Moves

The tachometer light is supplied through the main wiring harness from magneto. Check the voltage between YELLOW and YELLOW/GREEN of bulb.

The obtained value should be 12 Vac. Otherwise, check connections and wiring harness.

If the voltage is good, replace the bulb.

The Needle Does not Move

The tachometer is supplied through the main wiring harness from magneto. Check the voltage between YELLOW and YELLOW/GREEN of tachometer.

The obtained value should be 12 Vac. Otherwise, check connections and wiring harness.

If they test good, try a new tachometer.

600 HO SDI and V800 Models

No Light but the Needle Moves

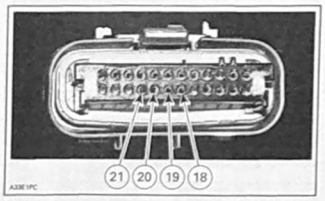
The tachometer power is supplied through the main wiring harness. Check the voltage between pins 9 and 10 of tachometer.

The Needle Does not Move

The speedometer receives AC (RPM signal) from magneto, converts it to DC and then controls the tachometer.

No lights in tachometer: see above.

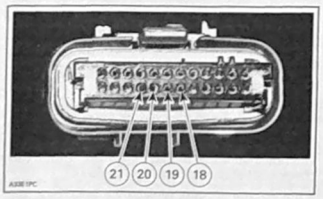
Lights in tachometer: check wire connections on pins 18, 19, 20 and 21.



If they test good, try a new tachometer.

Crazy Needle

Check wire connections on pin 18, 19, 20 and 21.



If they test good, try a new tachometer.

Zeroing Needle on Electronic Tachometer

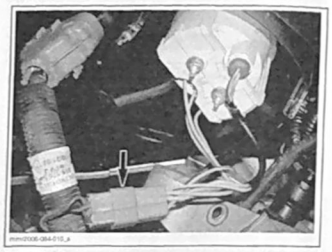
Refer to procedure in *SPEEDOMETER*.

ENGINE TEMPERATURE GAUGE

Modèles 600, 600 HO SDI et V800

Gauge Test

Disconnect gauge connector and measure voltage as follows.



TYPICAL

MODELS	TEMPERATURE GAUGE CONNECTOR (harness side)		VOLTAGE
600	YELLOW	YELLOW/ GREEN	12 Vac
600 HO SDI	YELLOW/ RED	VIOLET/ BLACK	12 Vdc
V800	GREEN/RED		



TYPICAL

If voltage is not good, check gauge supply. Refer to *POWER SUPPLY* in this section.

If voltage is good, check temperature sensor on engine as follows.

Reconnect gauge connector.

Jump VIOLET wire on gauge to ground. Pointer should move to "H" zone.



TYPICAL

- If so, ensure wiring/connectors going to sensor are good and if correct, replace sensor.
- Otherwise, replace temperature gauge.

HEATING ELEMENTS

NOTE: All measurements must be performed at 21°C (70°F).

Throttle Lever

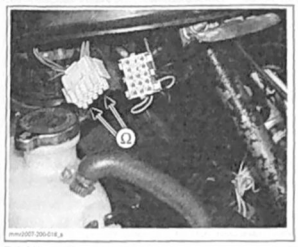
Unplug the 3-pin connector (440F, 550F and 600) or the 12-pin connector (V800 and 600 HO SDI) under console.



TYPICAL

Check heating element as follows.

INTENSITY	ELEMENT TERMINAL		RESISTANCE @ 20°C (68°F)
LOW	BROWN/ YELLOW	YELLOW/ BLACK	18.5 Ω
HIGH	BROWN		4.2 Ω



TYPICAL

If readings are out of specifications, check/repair wiring and if good, replace throttle lever.

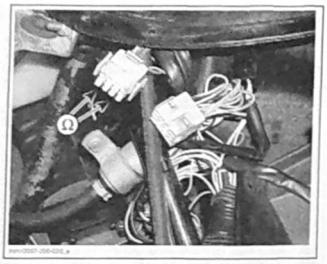
If readings are within specifications, check switch continuity as follows.

440F, 550F and 600 Models

SWITCH POSITION	3-PIN CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	YELLOW	BROWN/ YELLOW	0.5 Ω max.
HIGH		BROWN	

600 HO SDI and V800 Models

SWITCH POSITION	12-PIN CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	GREEN/ RED	BROWN	0.5 Ω max.
HIGH		YELLOW/ BROWN	



TYPICAL

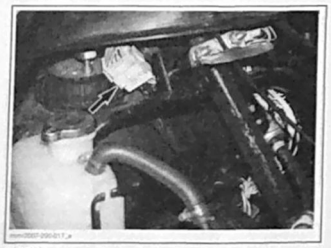
If switch is out of specifications, replace switch.

If switch test good, refer to *POWER SUPPLY*.

Reconnect connectors.

Handlebar Grip

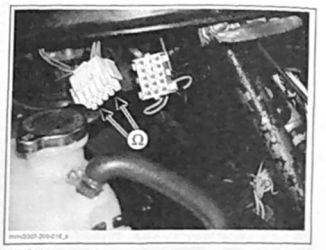
Unplug the 15-pin connector (440F, 550F and 600) or the 12-pin connector (V800 and 600 HO SDI) under console.



TYPICAL

Check heating element on each side as follows.

INTENSITY	WIRE OF ELEMENT CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	ORANGE/ VIOLET	YELLOW/ BLACK	15.2 Ω
HIGH	ORANGE		7.6 Ω



TYPICAL

If readings are out of specifications, check/repair wiring going to heating grip and if good, replace handlebar grip.

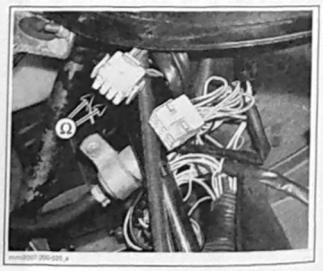
If readings are within specifications, check switch continuity as follows.

440F, 550F and 600 Models

SWITCH POSITION	15-PIN CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	YELLOW	ORANGE/ VIOLET	0.5 Ω max.
HIGH		ORANGE	

600 HO SDI and V800 Models

SWITCH POSITION	12-PIN CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	GREEN/ RED	ORANGE	0.5 Ω max.
HIGH		ORANGE/ BLUE	



If switch is out of specifications, check wiring/connectors going to switch. If they are good, replace switch.

If switch test good, refer to *POWER SUPPLY* in this section.

Reconnect connectors.

Rear Passenger Grips

If so Equipped

Unplug connector.

Check heating element on each side as follows.

INTENSITY	WIRE OF ELEMENT CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	ORANGE/BLUE	BLACK	19 Ω
HIGH	ORANGE		9.5 Ω

If readings are out of specifications, check/repair wiring going to heating grip and if good, replace grip.

If readings are within specifications, check switch.

If switch tested good, refer to *POWER SUPPLY* in this section.

Reconnect connectors.

12-VOLT POWER OUTLET

All Models except 440F

Power Outlet Removal

Remove the console.

Remove connectors from the power outlet housing.

Unscrew the large nut then remove the 12-volt power outlet.

Power Outlet Test

First, try another accessory (DC current), if it does not work, check outlet supply.

Remove power outlet.

Unplug the power outlet connectors.

Turn ignition key to ON or install DESS key as per models.

Measure the voltage as follows.

MODELS	WIRES		VOLTAGE
550F	RED/BLUE	BLACK	12 - 14.5 Vdc
All others	YELLOW/RED		

– No voltage:
  • Check accessories fuse (20 A) and relay 1 (if applicable), connectors and wiring harness.
– Voltage is good:
  • After checking the accessories, change the power outlet.

Installation

The installation is the reverse of the removal procedure.

12-VOLT REAR POWER OUTLET

Skandic SWT V800 Models

Rear Power Outlet Test

First, try another accessory (DC current), if it does not work, check outlet supply.

Unplug the power outlet connectors.

Turn on rear power outlet switch (test both positions).

Measure the voltage as follows.

WIRES		VOLTAGE
RED/BLACK	BLACK	12 - 14.5 Vdc

– No voltage:
  • Check fuse F9 and relay 4, connectors and wiring harness.
– Voltage is good:
  • After checking the accessories, change the power outlet.

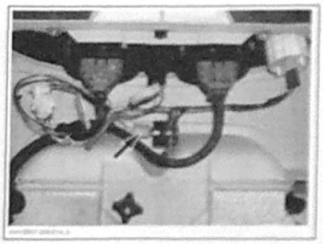
BEEPER

Beeper Test (reverse function)

440F, 600 HO SDI and V800 Models

NOTE: This beeper works with DC current.

Disconnect connector from beeper.



Use a multimeter and set it to Vdc.

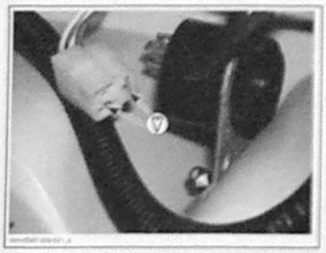
Set gearbox to reverse.

Install DESS cap.

On **440F models**, start engine.

Read voltage as follows.

MODEL	TERMINAL		VOLTAGE
440F	GRAY/ BLACK	BLACK	Battery voltage
600 SDI and V800	YELLOW/ RED	WHITE (see photo)	



Stop engine on **440F models**.

If voltage is as per specification, replace beeper.

If voltage is out of specification, check reverse switch for mechanical and electrical operation. If switch is good, check fuse, relay 1 (if applicable) and wiring/connectors.

When everything else has been tested and voltage is still inappropriate, MPEM can be suspected on 440F models.

550F and 600 Models

NOTE: This beeper works with AC current from magneto. Wires can be installed in any position on beeper.

Disconnect connectors from beeper.

Use a multimeter and set it to Vac.

Set gearbox to reverse.

Start engine and read voltage as follows.

WIRES		VOLTAGE
YELLOW	RED/YELLOW	Approx. 13.8 Vac

Stop engine.

If voltage is as per specification, replace beeper.

If voltage is out of specification, check reverse switch for mechanical and electrical operation. If switch is good, check wiring/connectors.

Beeper Test (EMS functions)

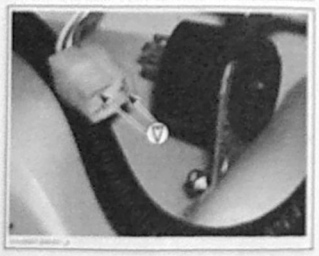
600 HO SDI and V800 Models

Disconnect connector from beeper.

Install DESS cap.

Read voltage as follows.

TERMINAL		VOLTAGE
YELLOW/RED	WHITE (see photo)	Pulsating battery voltage according to beeps



If voltage is as per specification, replace beeper.

If voltage is out of specification, check fuse, relay 1 and wiring/connectors.

When everything else has been tested and voltage is still inappropriate, ECM can be suspected.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	531
drive belt tension adjuster	529 008 700	531
driven pulley opening tool	529 017 200	529

APPLICATION CHART

MODEL	P/N	MINIMUM WIDTH (wear limit)
440F	414 633 800	32.00 mm (1.260 in)
550F	414 633 800	32.30 mm (1.272 in)
600	417 300 155	34.9 mm (1.374 in)
600 HO SDI	605 348 425	34.9 mm (1.374 in)
V800	605 348 425	35.5 mm (1-13/32 in)

DRIVE BELT

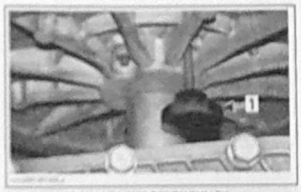
Drive Belt Removal

Open the hood and remove the belt guard.

Screw the driven pulley opening tool (P/N 529 017 200) in any threaded holes of driven pulley and tighten to fully open the pulley.



TYPICAL — LPV 27 DRIVEN PULLEY
1. Driven pulley opening tool



TYPICAL — IBC 5100/VSA 4000 DRIVEN PULLEY
1. Driven pulley opening tool

To remove belt, slip the belt over the top of driven pulley.



TYPICAL

Drive Belt Inspection

Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt.

Check drive belt width. Replace the drive belt if width is under minimum recommended width (see *APPLICATION CHART* above).

Drive Belt Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

NOTE: The drive belt height and deflection must be checked each time a new drive belt is installed and should be rechecked after 50 km (30 miles).

The maximum drive belt life span is obtained when the drive belt is installed as shown. This will ensure that correct direction of rotation is respected.



CORRECT



INCORRECT

CAUTION: Do not force or use tools to pry the belt in place, as this could cut or break the cords in the belt.

Install the drive belt between drive pulley sheaves.

Insert, by the top, the belt between driven pulley sheaves. Finish with the bottom.

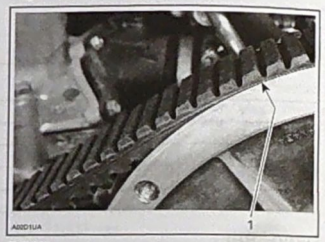
Adjust belt then install belt guard and close hood.

Drive Belt Height Adjustment

Before checking the belt height, ensure that a good-condition proper belt (refer to the *APPLICATION CHART*) is installed.

Check pulley alignment. Refer to *PULLEY ALIGNMENT*.

To obtain maximum vehicle performance, the drive belt cord should be flush with driven pulley edge. Adjust as required.



TYPICAL
1. Flush

Adjust drive belt height using Allen screws. Loosen jam nuts then turn Allen screws.



LPV 27 DRIVEN PULLEY



IBC 5100/VSA 6000 DRIVEN PULLEY

– To lower belt in driven pulley: turn Allen screws clockwise.
– To raise belt in driven pulley: turn Allen screws counterclockwise.

NOTE: Turn Allen screws 1/4 turn at a time, then rotate driven pulley to allow drive belt to settle in pulley. Check height, repeat as required.

Allen screws must be restrained while tightening jam nut to prevent throwing adjustment out. Use drive belt tension adjuster (P/N 529 008 700).

Drive Belt Deflection (reference only)

Before checking the belt deflection, ensure vehicle has the proper belt (refer to the *APPLICATION CHART*).

Adjust pulley belt height. Refer to *DRIVE BELT HEIGHT*.

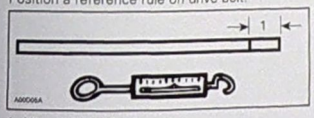
To obtain maximum vehicle performance, the belt deflection must be adjusted according to specifications shown in the accompanying chart.

ENGINE	DEFLECTION† mm (in)	FORCE kg (lb)
440F 550F 600 HO SDI	32 ± 5 (1.260 ± .197)	11.3 (25)
600 V800	40 to 50 (1.575 to 1.969)	7.3 (16)

† FOR REFERENCE ONLY

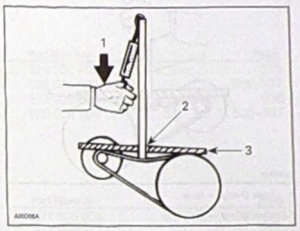
Wooden Stick and Spring Scale Method

Position a reference rule on drive belt.



1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.

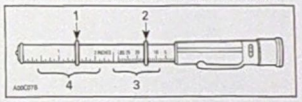


1. Force
2. Read deflection here
3. Reference rule

Belt Tension Tester Method

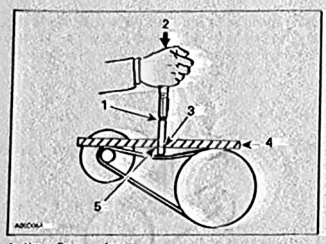
Position a reference rule on drive belt.

Use the belt tension tester (P/N 414 348 200).



1. Lower O-ring
2. Upper O-ring
3. Force (read down)
4. Deflection (read up)

1. Slide lower O-ring of deflection scale to specified measure.
2. Slide upper O-ring to 0 (zero) on the force scale.
3. Apply pressure until lower O-ring is flush with edge of rule and read force on the upper scale at top edge of O-ring.



1. Upper O-ring — force
2. Force
3. Lower O-ring — deflection
4. Reference rule
5. Deflection

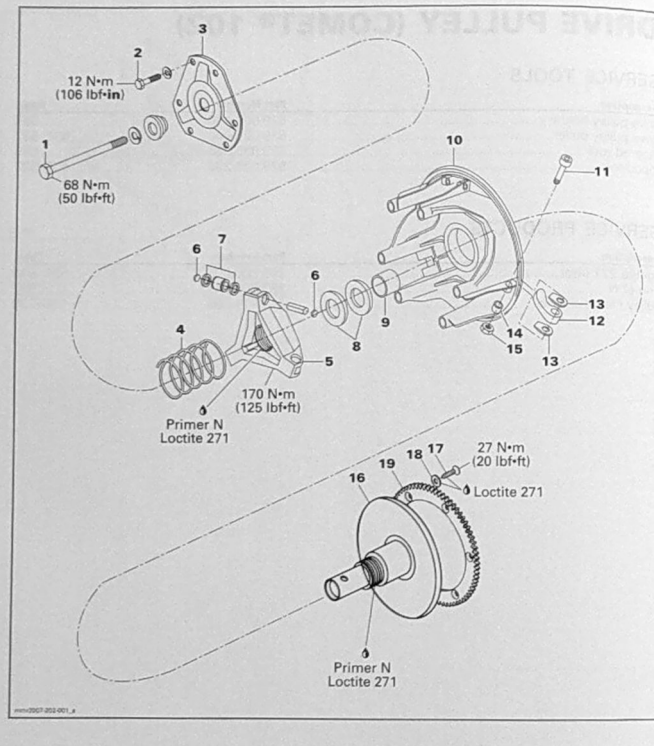
DRIVE PULLEY (COMET® 102)

SERVICE TOOLS

Description	Part Number	Page
drive pulley holder	529 006 400	535
drive pulley puller	529 025 000	535, 537
tapered tool	529 035 826	536
tripod tool	529 025 200	536–537

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	537, 539
Primer N	293 800 041	537
pulley flange cleaner	413 711 809	536–538


3
2
12 N•m
(106 lbf•in)
1
68 N•m
(50 lbf•ft)
10
11
6
7
6
9
8
13
12
14
15
13
4
5
170 N•m
(125 lbf•ft)
Primer N
Loctite 271
16
19
18
17
27 N•m
(20 lbf•ft)
Loctite 271
Primer N
Loctite 271

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile drive pulley type.

⚠ WARNING

Never start engine when the pulley guard is removed.

Some drive pulley components can be changed to improve vehicle performance in high altitude regions. A Service Bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experience mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

⚠ WARNING

Never use an impact wrench to remove or install the drive pulley.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

During assembly/installation, use the torque values and the service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

FIXED AND SLIDING SHEAVES

Sheave Removal (drive pulley)

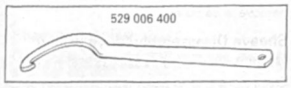
⚠ WARNING

Never use an impact wrench to remove or install the drive pulley.

Unfasten center and rear bottom pan attachments on left hand side. Remove belt guard.

Remove drive belt. Refer to *DRIVE BELT* for procedure.

Use the drive pulley holder (P/N 529 006 400). Make sure holder hook is positioned on top of tower.



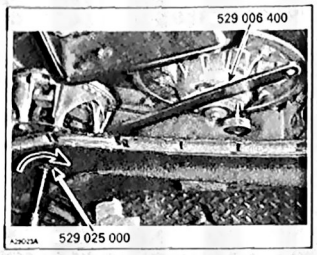


1. Holder hook on top of tower

Remove drive pulley screw no. 1.

Install the drive pulley holder (P/N 529 006 400) in a way to limit pulley clockwise rotation.

Insert the drive pulley puller (P/N 529 025 000) then turn puller clockwise to free drive pulley from crankshaft taper.



Remove driven pulley to make room for drive pulley removal (refer to *DRIVEN PULLEY*).

Remove drive pulley.

Sheave Disassembly (drive pulley)

Mount tapered tool (P/N 529 035 826) in a vise.

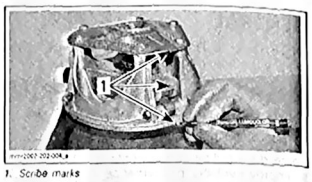
Clean tool and inner pulley taper with pulley flange cleaner (P/N 413 711 809).

Install drive pulley over tapered tool then, fasten drive pulley screw **no. 1** and torque to 68 N•m (50 lbf•ft). Now drive pulley is locked on tapered tool.



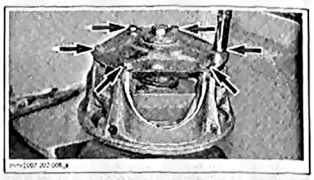
1. Drive pulley screw
2. Flat washer
3. Pivot washer

Scribe pen marks on sliding sheave **no. 10**, governor cup **no. 5** and spring cover **no. 3** for proper indexing at reassembly.



1. Scribe marks

Remove spring cover screws **no. 2**.



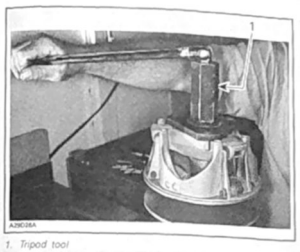
Hold spring cover **no. 3** by hand then, unscrew drive pulley screw.



Remove spring cover.

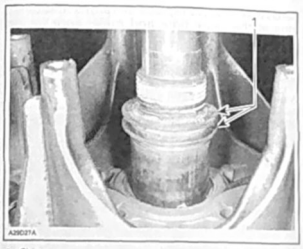
Heat governor cup **no. 5** to melt threadlocker.

Install the tripod tool (P/N 529 025 200) then, unscrew governor cup.



1. Tripod tool

Note shim **no. 8** quantity.



1. Shims

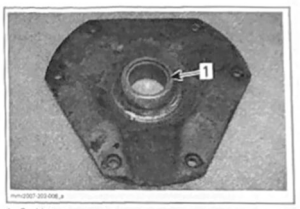
Lift sliding sheave to separate it from fixed sheave.

Sheave Inspection

Check surfaces of fixed and sliding sheave for scratches, excessive wear or other damages. Replace as required.

Check sliding sheave for excessive lateral play and fixed sheave shaft for scratches. Replace if necessary.

Check spring cover bushing. Replace cover if bushing is completely bronze instead of the original teflon coating.



1. Bushing

Check slider shoes **no. 6** for proper sliding action. Replace as required.

Check rollers **no. 7** for free action. Replace as required.

Sheave Cleaning

Clean pulley faces and shaft with fine steel wool and clean dry cloth.

Clean sliding sheave bushing and spring cover bushing with a clean dry cloth.

Remove grease or oil with pulley flange cleaner (P/N 413 711 809).

Sheave Assembly (drive pulley)

Clean governor cup and fixed sheave threads.

Install shims **no. 8** on fixed sheave shaft.

Apply Primer N (P/N 293 800 041) on fixed sheave threads and governor cup threads, allow to dry for 10 minutes. Apply Loctite 271 (red) (P/N 293 800 005) to threads.

Using the tripod tool (P/N 529 025 200), torque governor cup to 170 N•m (125 lbf•ft).

Install spring **no. 4**, and spring cover **no. 3**.

Install the drive pulley screw to compress the spring and position spring cover on sliding sheave towers.

Tighten spring cover screws to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

Remove the drive pulley screw.

Use the drive pulley puller (P/N 529 025 000) to unlock drive pulley from tapered tool.



Sheave Installation (drive pulley)

Clean crankshaft taper and inner pulley taper with pulley flange cleaner (P/N 413 711 809).

Install drive pulley on crankshaft.

Install the drive pulley screw with a new lock washer.

Torque drive pulley screw to 68 N•m (50 lbf•ft).

Reinstall driven pulley, drive belt and belt guard. Refasten bottom pan center and rear attachments on left hand side.

Raise the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Recheck the torque of 68 N•m (50 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

RAMPS

Ramp Replacement

With drive pulley installed on vehicle, loosen one turn the spring cover screws **no. 2**.

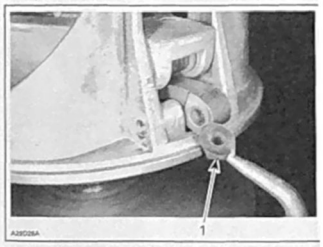
Remove ramp **no. 12** with washers **no. 13** and bushing **no. 14**.

Check ramp and bushing for wear. Replace as required.

CAUTION: Always replace all ramps and bushings at the same time and make sure to use identical ramps.

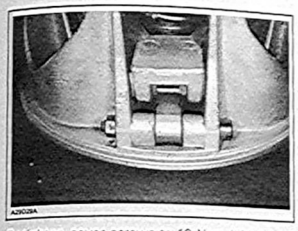
Install ramp.

With square end facing sliding sheave, install a washer **no. 13** on each side of ramp.



1. Square end facing sliding sheave

Tighten pivot bolt nut **no. 15** to 5.6 N•m (50 lbf•**in** maximum. Make sure ramp can still move on pivot bolt **no. 11**.



Retighten cover screws to 12 N•m (106 lbf•in). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

RING GEAR

Ring Gear Removal

Remove drive pulley from vehicle. Refer to *FIXED AND SLIDING SHEAVES*.

Using a heat gun, heat ring gear screws **no. 17** to melt threadlocker.

Remove ring gear screws, washers **no. 18** and ring gear **no. 19**.

Ring Gear Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Clean threaded holes of fixed sheave.

Apply Loctite 271 (red) (P/N 293 800 005) on threads of ring gear screws and between screw heads and thick flat washers. Torque screws in a criss-cross sequence to 27 N•m (20 lbf•ft).

NOTE: It is of the utmost importance to use thick flat washers with ring gear screws in order not to pierce inner fixed sheave with the screws.

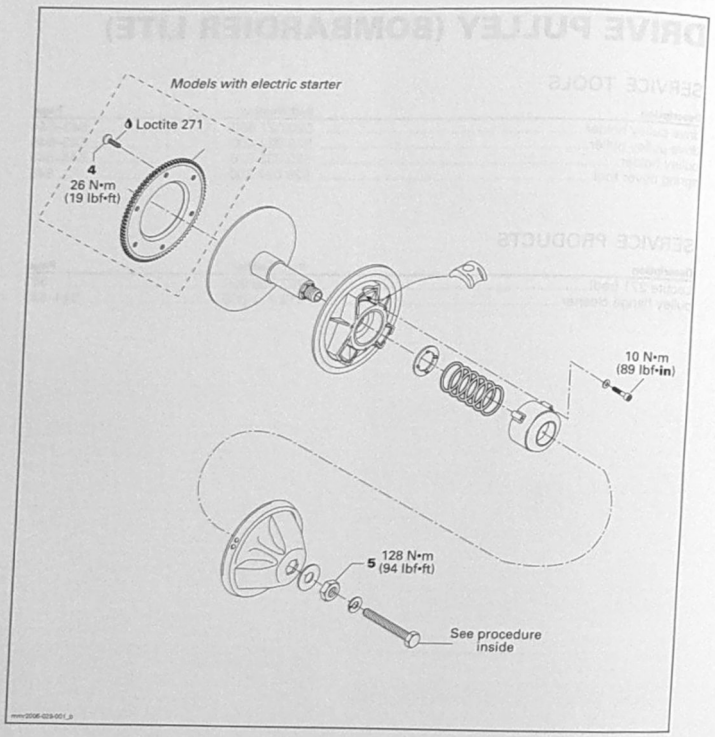
DRIVE PULLEY (BOMBARDIER LITE)

SERVICE TOOLS

Description	Part Number	Page
drive pulley holder	529 027 600	543–544
drive pulley puller	529 022 400	543–546
pulley holder	529 035 826	544–545
spring cover tool	529 027 300	546

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	547
pulley flange cleaner	413 711 809	544–545


Models with electric starter
4 Loctite 271
4
26 N•m
(19 lbf•ft)
10 N•m
(89 lbf•in)
5 128 N•m
(94 lbf•ft)
See procedure
inside

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile drive pulley type.

⚠ WARNING

Never start engine when the pulley guard is removed.

Some drive pulley components (return spring, calibration disk) can be changed to improve vehicle performance in high altitude regions. A Service Bulletin gives information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experience mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

⚠ WARNING

Never use an impact wrench to remove or install the drive pulley.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

During assembly/installation, use the torque values and the service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

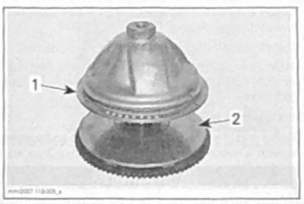
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

FIXED AND SLIDING SHEAVES

Sheave Inspection

Check surface of sliding sheave and fixed sheave for scratches, excessive wear or other damages. Replace if necessary.



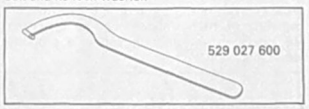
1. Sliding sheave
2. Fixed sheave

Check sliding half for excessive lateral play and fixed half shaft for scratches. Replace as required.

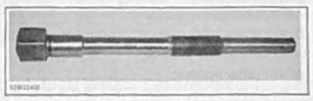
Sheave Removal (drive pulley)

Open the hood to remove the belt guard and the drive belt.

Using the drive pulley holder (P/N 529 027 600), hold the drive pulley to remove the drive pulley bolt and its lock washer.



With the drive pulley holder still installed, install the drive pulley puller (P/N 529 022 400) through the drive pulley.



Hold the drive pulley and screw in the puller then remove drive pulley.

Sheave Cleaning

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding sheave bushing with clean dry cloth.

Remove grease or oil with pulley flange cleaner (P/N 413 711 809).

Sheave Installation (drive pulley)

Clean crankshaft taper and inner pulley taper with pulley flange cleaner (P/N 413 711 809).

Install the drive pulley bolt and its lock washer.

Hold the drive pulley with the drive pulley holder (P/N 529 027 600) then torque bolt to 90 N•m (66 lbf•ft).

Install drive belt and belt guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Make sure the track is free of particles that could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque bolt to 95 N•m (70 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

GOVERNOR CUP

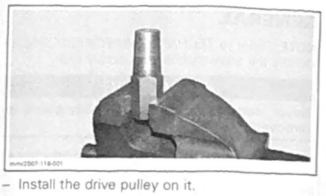
Governor Cup Removal

Remove drive pulley from engine. Refer to *FIXED AND SLIDING SHEAVES.*

Remove governor cup nut. Two methods can be used to unscrew the nut.

With Pulley Holder:

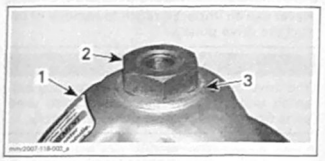
– Install the pulley holder (P/N 529 035 826) in a vice.



– Install the drive pulley on it.



– Unscrew nut on the top of drive pulley. Remove washer.



1. Governor cup
2. Nut
3. Washer

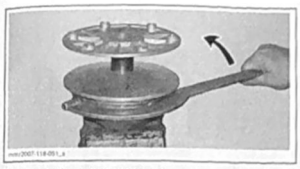
– To remove the pulley holder from fixed sheave, use the drive pulley puller (P/N 529 022 400).

Without Pulley Holder:

– Install the governor cup nut in a vice.



– Use the drive pulley holder (P/N 529 027 600) to loosen nut.



Remove the governor cup.

Governor Cup Inspection

Check the hexagonal opening of governor cup for excessive wear or looseness.

Governor Cup Installation

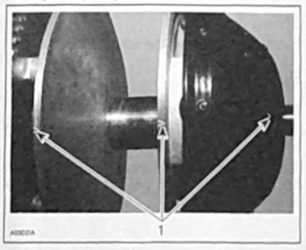
NOTE: Even if two methods can be used to unscrew the governor cup nut, the following procedure is the only one (the one and only) method to tighten governor cup nut properly.

Install the pulley holder (P/N 529 035 826) in a vice.

Clean pulley holder taper and the inner taper of fixed sheave with pulley flange cleaner (P/N 413 711 809).

Install fixed sheave on tool and sliding sheave on fixed sheave shaft.

When assembling pulleys, align marks on governor cup and pulley sheaves.



1. Alignment marks

Install washer and nut.

Tighten nut to 128 N•m (94 lbf•ft).

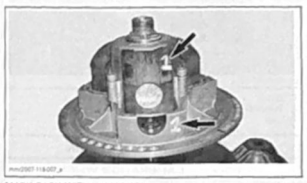
To remove the pulley holder from fixed sheave, use the drive pulley puller (P/N 529 022 400).

CENTRIFUGAL WEIGHT

Centrifugal Weight Removal

Remove governor cup, see above for procedure.

Identify blocks and their respective positive positions for reassembly.



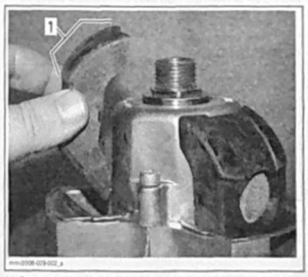
MARK EACH WITH A MARKER

Remove blocks with their calibration weights.

Centrifugal Weight Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

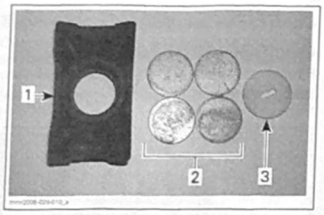
Make sure to install blocks at their original position and with their curved end toward governor cup. See following illustration.



1. Curved end of block

Centrifugal Weight Calibration

Use the following table to calibrate this drive clutch properly.



1. Block
2. Weights
3. Cap

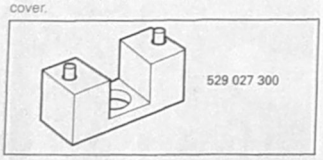
FACTORY CALIBRATION			
ENGINE TYPE	CALIBRATION WEIGHT		
	WASHERS BY BLOCK	WASHER P/N	WEIGHT PER WASHER
550F	1	417 120 400	21 gr
	4	417 114 400	3.4 gr

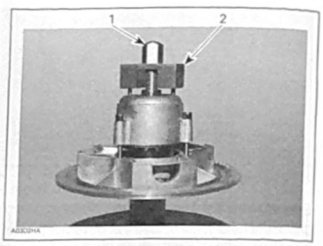
SPRING

Spring Removal

Remove governor cup and centrifugal weights.

Install the spring cover tool (P/N 529 027 300) with the drive pulley puller (P/N 529 022 400) on spring cover.





1. Drive pulley puller tool
2. Spring cover tool

Screw puller (hand tight) to hold spring cover and remove screws holding spring cover.

Slowly unscrew puller to release spring pressure.

Remove spring cover, spring and spring seat.

Spring Inspection

Check the free length of spring. Replace spring if it is out of specification.

SPRING FREE LENGTH	
SERVICE LIMIT	94.61 ± 1.5 mm (3.725 ± .060 in)

Spring Installation

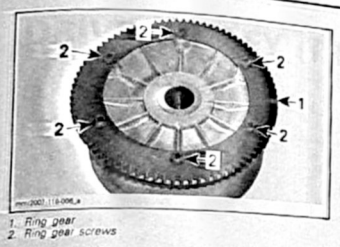
Install spring seat then the spring and its cover.

RING GEAR

Ring Gear Removal

Remove drive pulley from engine. Refer to *FIXED AND SLIDING SHEAVES*.

To remove the ring gear, use a heat gun to break the threadlocker on ring gear screws before unscrewing.



1. Ring gear
2. Ring gear screws

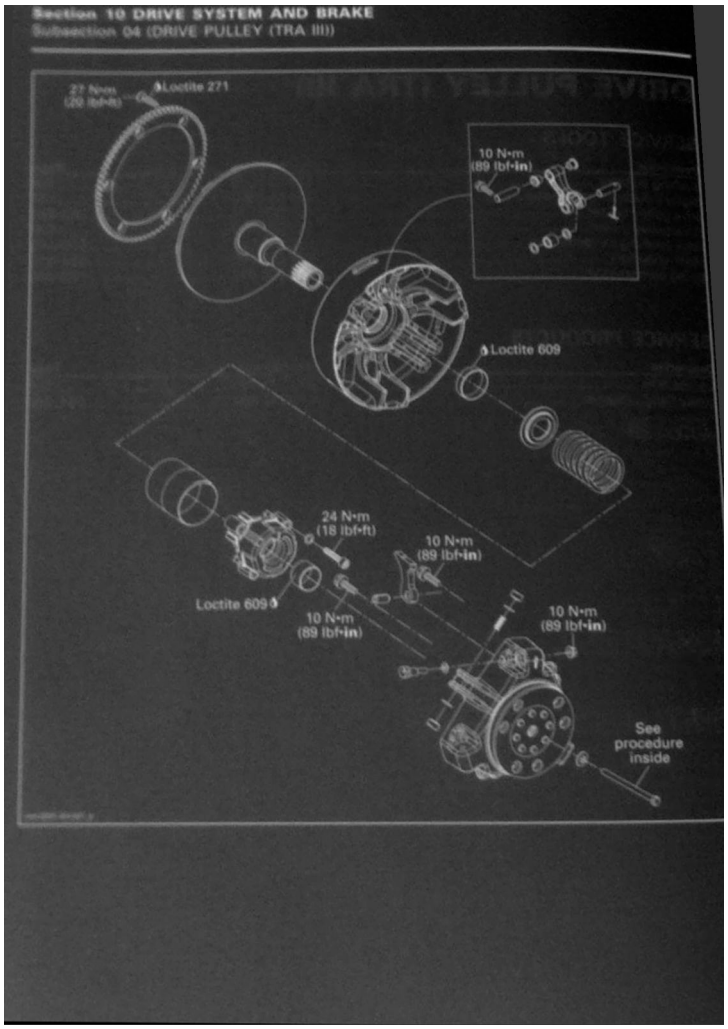
CAUTION: If a tool other than a heat gun is used, do not exceed 150°C (300°F).

Unscrew ring gear screws.

Ring Gear Installation

To assemble ring gear on drive pulley, clean threads on back of fixed sheave and threads of screws.

Apply Loctite 271 (red) (P/N 293 800 005) on screw threads and torque them to 26 N•m (19 lbf•ft).


27 N•m (20 lbf•ft)
Loctite 271
10 N•m (89 lbf•in)
Loctite 609
24 N•m (18 lbf•ft)
10 N•m (89 lbf•in)
Loctite 609
10 N•m (89 lbf•in)
10 N•m (89 lbf•in)
See procedure inside

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile drive pulley type.

⚠ WARNING

Never start engine when the pulley guard is removed.

TRA drive pulley stands for Total Range Adjustable drive pulley.

NOTE: This is a lubrication free drive pulleys. Always refer to appropriate *PARTS CATALOG* for replacement part. Most parts of TRA IV are not interchangeable with those of the other TRA pulley type.

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A Service Bulletin will give information about calibration according to altitude.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Sub-component installation and assembly tolerances require strict adherence to procedures detailed.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

During assembly/installation, use the torque values and the service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

CALIBRATION SCREWS

Calibration Screw Adjustment

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

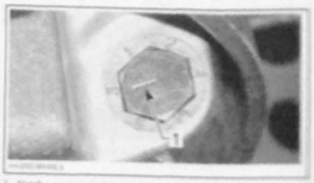
NOTE: Use the digital inductive tachometer (P/N 529 014 500) for engine RPM adjustment.

Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in *TECHNICAL SPECIFICATIONS*.

NOTE: The adjustment has an effect on high RPM only.

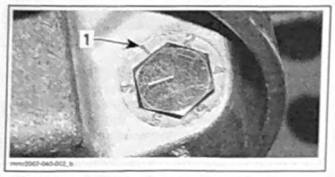
To adjust, modify ramp end position by turning calibration screws.

Calibration screw has a notch on top of its head.



1. Notch

Governor cup has 6 positions numbered 1 to 6.



1. Position 1

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

See the following table for original setting.

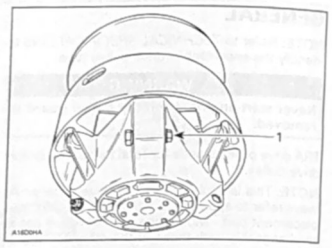
CALIBRATION SCREW	
600	Position 3
600 HO SDI	Position 5

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

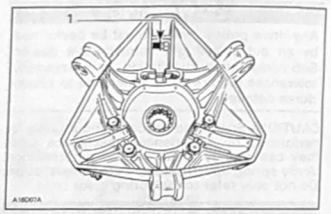
CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



TYPICAL
1. Loosen just enough to permit rotating of calibration screw

Calibration Screw Replacement

When installing calibration screw, make sure to install washer as shown.



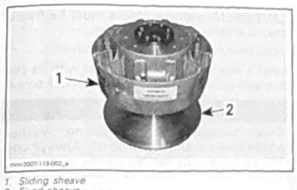
TYPICAL
1. Washer

Torque locking nut to 10 N•m (89 lbf•**in**).

FIXED AND SLIDING SHEAVES

Sheave Inspection

Check surface of sliding sheave and fixed sheave for scratches, excessive wear or other damages. Replace if necessary.



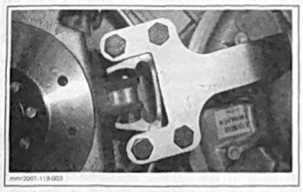
1. Sliding sheave
2. Fixed sheave

Check fixed sheave shaft for scratches. Replace as required.

Sheave Removal (drive pulley)

Open the hood to remove the belt guard and the drive belt.

Secure drive pulley holder (P/N 529 035 674) over a sliding sheave tower.



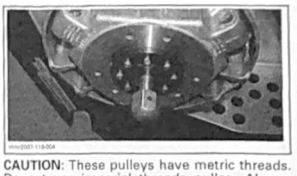
Remove the access cover on the LH side of bottom pan and unscrew the drive pulley screw.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

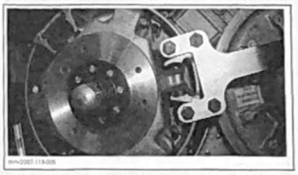
Install the drive pulley puller (P/N 529 022 400).





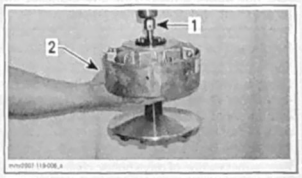
CAUTION: These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.

Retain drive pulley with the drive pulley holder (P/N 529 035 674) and screw in the puller then remove drive pulley.



Sheave Disassembly

To separate fixed sheave from sliding sheave, screw puller into fixed sheave shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding sheave while knocking on puller head to disengage fixed sheave.



TYPICAL
1. Puller
2. Holding sliding sheave

NOTE: If the separation of fixed sheave from sliding sheave is hard, use a heat gun and slightly heat the governor cup to expand its taper.

CAUTION: Never use any type of torch to heat governor cup.

Sheave Cleaning

Clean pulley sheaves and shaft with fine steel wool and dry cloth.

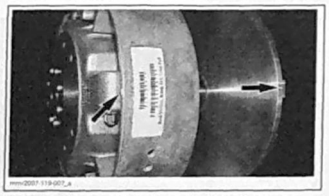
Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: Do not use any other type of abrasive.

Sheave Assembly

The assembly is the reverse of the disassembly procedures. However pay attention to the following.

Make sure to align the sliding sheave mark with the fixed sheave mark.



Using a plastic hammer, strike hub firmly 2 or 3 times to ensure proper seating of cones.

Sheave Installation (drive pulley)

⚠ WARNING

Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

Parts must be at room temperature before cleaning.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed sheave of the drive pulley, crankshaft threads and retaining screw threads.

Before installation of drive pulley, clean also crankshaft threads and retaining screw threads.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

Install drive pulley on crankshaft extension.

Install a new conical spring washer with its concave side towards drive pulley then install screw.

⚠ WARNING

Never substitute conical spring washer and/or screw with jobber ones. Always use BRP genuine parts for this particular case.

Using the drive pulley holder (P/N 529 035 674), torque screw to 90 N•m (66 lbf•ft).

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque screw to 95 N•m (70 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

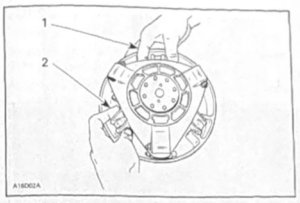
GOVERNOR CUP

Governor Cup Removal

Remove drive pulley. Refer to *FIXED AND SLIDING SHEAVES* at the beginning of this section.

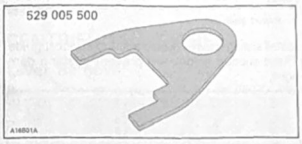
Carefully lift governor cup until slider shoes come to their highest position into guides.

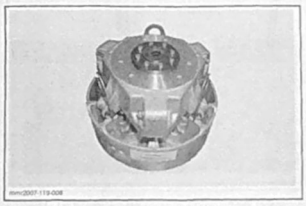
Hold a slider shoe set then carefully lift its housing and install a slider shoe fork (P/N 529 005 500). Procceed the same way for other housings lifting one at a time.



1. Hold slider shoes
2. Lift one housing at a time

Install a slider shoe fork (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.





When all slider shoes are held with the forks, remove the governor cup.

Governor Cup Inspection

Check the governor cup for cracks or other visible damages. Replace if necessary.

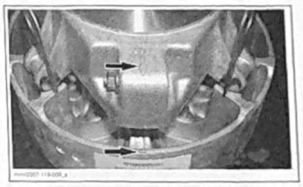
Check slider shoes for wear. Replace if groove is not apparent on top.

Check if O-rings are cracked, cut or crushed. Replace as required.

Governor Cup Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Align governor cup mark with the one on the sliding sheave.



RAMPS

Ramp Removal

Remove the drive pulley. Refer to *FIXED AND SLIDING SHEAVES*.

Remove governor cup from sliding sheave.

Unscrew bolts holding ramps on governor cup.

Ramp Inspection

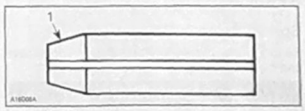
Check ramps for wear. Replace as required.

Ramp Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

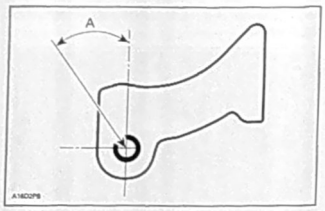
CAUTION: Always replace all ramps and all dowel tubes at the same time and make sure to use identical ramps.

Insert dowel tube from chamfered side. Make sure ramp is centered on dowel tube.

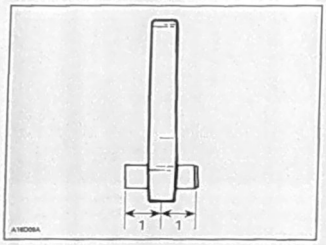


1. Chamfered side

Position dowel tube split at the angle "A".



MODEL	ANGLE (A)
TRA III	45 ± 3°



1. Equal distance

Torque screws to 10 N•m (89 lbf•**in**).

SPRING

Spring Removal

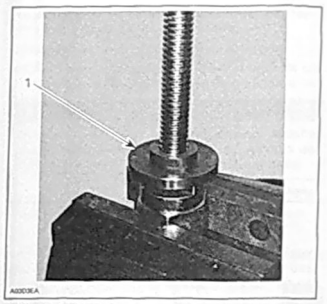
Remove drive pulley and separate sliding sheave and fixed sheave.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

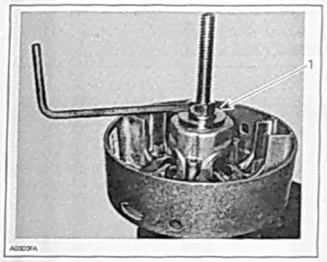
Use spring compressor (P/N 529 036 012).

Install support guide.



1. Support guide

Install sliding sheave then a second support guide. These support guides will prevent bushing damages.



1. Support guide

Completely remove all 3 Allen screws retaining spring cover then unscrew compressor.

Spring Inspection

Check spring color code and its free length. Replace if necessary.

COLOR CODE	FREE LENGTH
YELLOW/RED	101.8 mm (4.008 in)
BLUE/YELLOW/GREEN	115 mm (4.53 in)

Spring Installation

For installation, reverse the removal procedure.

To install spring cover, use the spring compressor (P/N 529 036 012).

Align balance marks before installing spring cover.



ALIGN BALANCE MARKS

Tighten screws to proper torque as mentioned in exploded view.

CENTRIFUGAL LEVERS

Lever Removal

Remove the drive pulley. Refer to *FIXED AND SLIDING SHEAVES*.

Remove governor cup from sliding sheave.

Remove screws securing centrifugal levers on sliding sheave.



Lever Inspection

Check centrifugal lever for crack, distortion or other damages.

Check roller for roundness of external diameter.

Check if the roller turns freely.

Check thrust washers for wear (thickness).

Check lever screw heads for wear.

Check ramp bushings for wear.

Lever Installation

Always use the same roller pin as originally installed when servicing. Different types have different weights for calibration purpose. Refer to *TECHNICAL SPECIFICATIONS*.

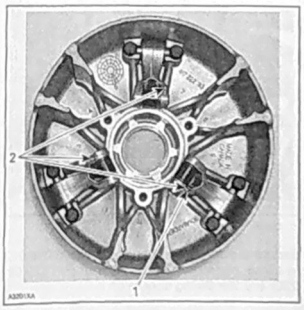
While installing levers, make sure that the curved sides of the levers are outwards as shown.



Always install levers so that cotter pins are on the side shown here. Besides install cotter pin head on top when lever is sat at bottom of sliding sheave. Bend cotter pin ends to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, the drive pulley will be unbalanced (because of lever differences).



1. Head on top
2. All on the same side

CAUTION: Lever assemblies must be installed so that cotter pins are on the same side.

Torque screws as per the exploded view.

CAUTION: Lever and rollers must move easily after installation.

BUSHINGS

Bushing Cleaning

Only use petroleum based cleaner when cleaning bushings.

CAUTION: Do not use acetone to clean bushing.

Bushing Inspection

Visually inspect coating. Replace if worn.

Bushing Removal

Spring Cover Bushing

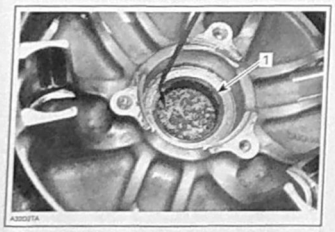
Under normal use there is no need to replace this bushing.

In case of replacement, it's recommended to replace spring cover.

Sliding Sheave Bushing

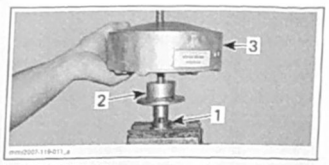
NOTE: In case of worn out bushing, it is advisable to replace complete whole sliding sheave assembly as replacing just the bushing may reduce the drive pulley performance.

Remove circlip from the sliding sheave.



1. Circlip

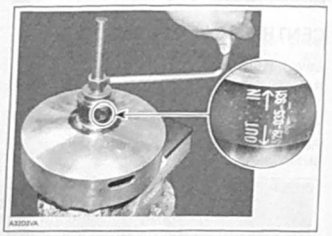
Secure the spring compressor (P/N 529 036 012) in a vise, place the bushing installer (P/N 529 031 200) and the sliding sheave on it.



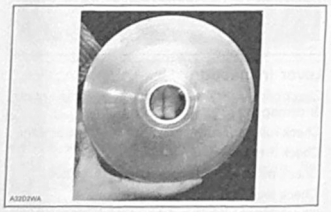
1. Spring compressor
2. Bushing installer
3. Sliding sheave

Use the large bushing extractor tool (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the large bushing extractor tool (P/N 529 035 931) as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.



Use a soft sand paper to clean sliding sheave bushing mounting surface.



Clean sliding sheave bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

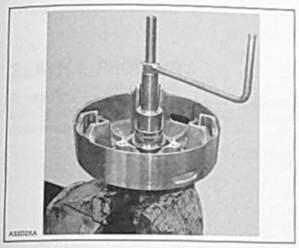
Bushing Installation

To install a new bushing, secure the spring compressor (P/N 529 036 012) in a vise and mount the sliding sheave.

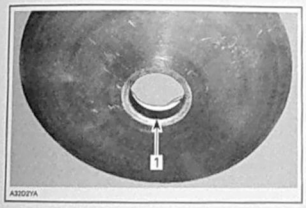
Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Insert the bushing from inner side of sliding sheave.

Mount the large bushing extractor tool (P/N 529 035 931) with side marked "IN" to press in a new bushing.

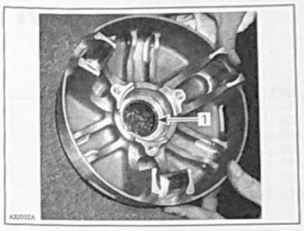


NOTE: Make sure that the bushing is well seated on the sliding sheave.



1. Bushing

Install the circlip.



1. Circlip

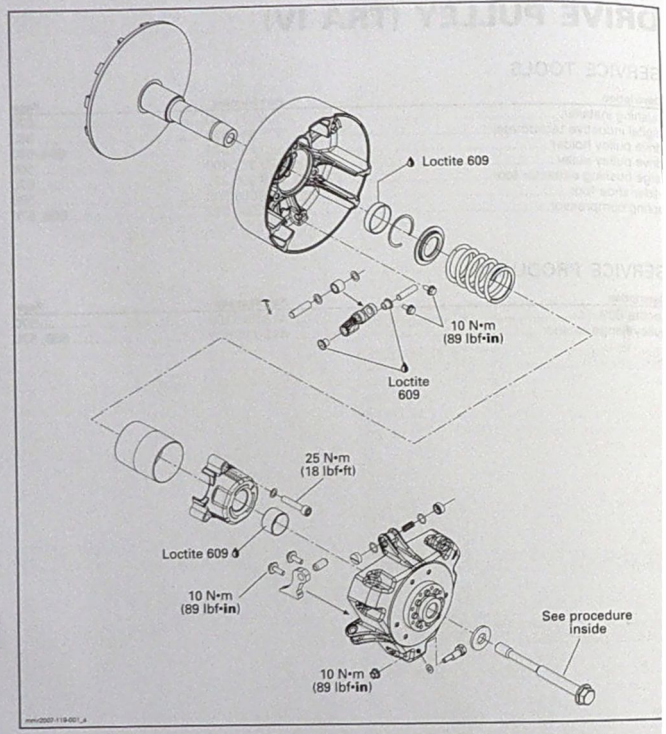
DRIVE PULLEY (TRA IV)

SERVICE TOOLS

Description	Part Number	Page
bushing installer	529 031 200	570
digital inductive tachometer	529 014 500	563
drive pulley holder	529 035 674	564–566
drive pulley puller	529 022 400	565
large bushing extractor tool	529 035 931	570
slider shoe fork	529 005 500	566
spring compressor	529 036 012	568, 570

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 609	413 703 100	570
pulley flange cleaner	413 711 809	566, 570


Loctite 609
10 N•m
(89 lbf•in)
Loctite
609
25 N•m
(18 lbf•ft)
Loctite 609
10 N•m
(89 lbf•in)
See procedure
inside
10 N•m
(89 lbf•in)

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile drive pulley type.

⚠ WARNING

Never start engine when the pulley guard is removed.

TRA drive pulley stands for Total Range Adjustable drive pulley.

NOTE: This is a lubrication free drive pulleys. Always refer to appropriate *PARTS CATALOG* for replacement part. Most parts of TRA IV are not interchangeable with those of the other TRA pulley type.

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A Service Bulletin will give information about calibration according to altitude.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Sub-component installation and assembly tolerances require strict adherence to procedures detailed.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

During assembly/installation, use the torque values and the service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

CALIBRATION SCREWS

Calibration Screw Adjustment

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

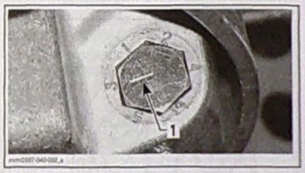
NOTE: Use the digital inductive tachometer (P/N 529 014 500) for engine RPM adjustment.

Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in *TECHNICAL SPECIFICATIONS*.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

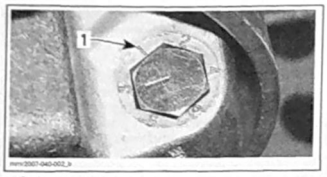
Calibration screw has a notch on top of its head.



mmr2007-040-002_a

1 Notch

Governor cup has 6 positions numbered 1 to 6.



1. Position 1

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

See the following table for original setting.

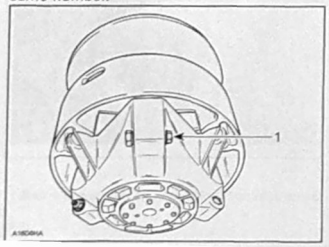
CALIBRATION SCREW	
V800	Position 3

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

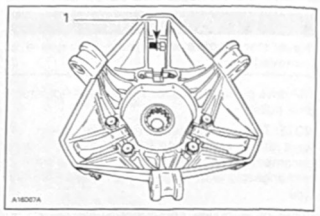
CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



Calibration Screw Replacement

When installing calibration screw, make sure to install washer as shown.



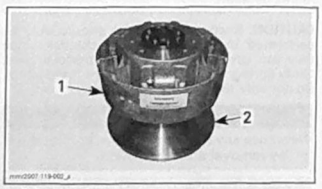
TYPICAL
1. Washer

Torque locking nut to 10 N•m (89 lbf•**in**).

FIXED AND SLIDING SHEAVES

Sheave Inspection

Check surface of sliding sheave and fixed sheave for scratches, excessive wear or other damages. Replace if necessary.



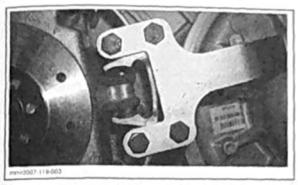
1. Sliding sheave
2. Fixed sheave

Check fixed sheave shaft for scratches. Replace as required.

Sheave Removal (drive pulley)

Open the hood to remove the belt guard and the drive belt.

Secure drive pulley holder (P/N 529 035 674) over a sliding sheave tower.



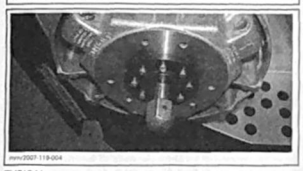
Remove the access cover on the LH side of bottom pan and unscrew the drive pulley screw.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Install the drive pulley puller (P/N 529 022 400).

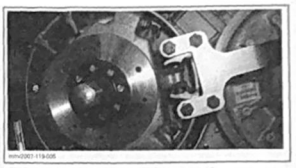




TYPICAL

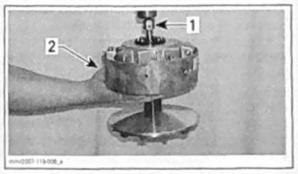
CAUTION: **These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.**

Retain drive pulley with the drive pulley holder (P/N 529 035 674) and screw in the puller then remove drive pulley.



Sheave Disassembly

To separate fixed sheave from sliding sheave, screw puller into fixed sheave shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding sheave while knocking on puller head to disengage fixed sheave.



TYPICAL
1. Puller
2. Holding sliding sheave

NOTE: If the separation of fixed sheave from sliding sheave is hard, use a heat gun and slightly heat the governor cup to expand its taper.

CAUTION: **Never use any type of torch to heat governor cup.**

Sheave Cleaning

Clean pulley sheaves and shaft with fine steel wool and dry cloth.

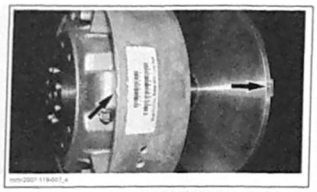
Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: **Do not use any other type of abrasive.**

Sheave Assembly

The assembly is the reverse of the disassembly procedures. However pay attention to the following.

Make sure to align the sliding sheave mark with the fixed sheave mark.



Using a plastic hammer, strike hub firmly 2 or 3 times to ensure proper seating of cones.

Sheave Installation (drive pulley)

⚠ WARNING

Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

Parts must be at room temperature before cleaning.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed sheave of the drive pulley, crankshaft threads and retaining screw threads.

Before installation of drive pulley, clean also crankshaft threads and retaining screw threads.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

Install drive pulley on crankshaft extension.

Install a new conical spring washer with its concave side towards drive pulley then install screw.

⚠ WARNING

Never substitute conical spring washer and/or screw with jobber ones. Always use BRP genuine parts for this particular case.

Using the drive pulley holder (P/N 529 035 674), torque screw to 90 N•m (66 lbf•ft).

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque screw to 95 N•m (70 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

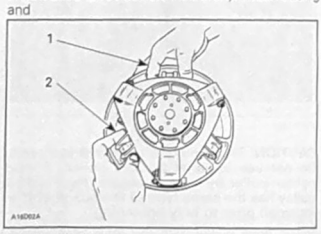
GOVERNOR CUP

Governor Cup Removal

Remove drive pulley. Refer to *FIXED AND SLIDING SHEAVES* at the beginning of this section.

Carefully lift governor cup until slider shoes come to their highest position into guides.

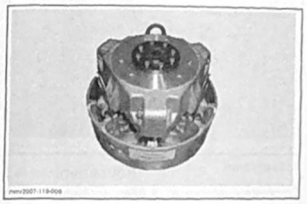
Hold a slider shoe set then carefully lift its housing and



1. Hold slider shoes
2. Lift one housing at a time

Install a slider shoe fork (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.





When all slider shoes are held with the forks, remove the governor cup.

Governor Cup Inspection

Check the governor cup for cracks or other visible damages. Replace if necessary.

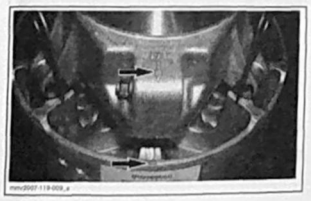
Check slider shoes for wear. Replace if groove is not apparent on top.

Check if O-rings are cracked, cut or crushed. Replace as required.

Governor Cup Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Align governor cup mark with the one on the sliding sheave.



RAMPS

Ramp Removal

Remove the drive pulley. Refer to *FIXED AND SLIDING SHEAVES*.

Remove governor cup from sliding sheave.

Unscrew bolts holding ramps on governor cup.

Ramp Inspection

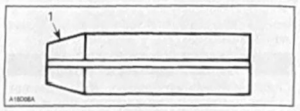
Check ramps for wear. Replace as required.

Ramp Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

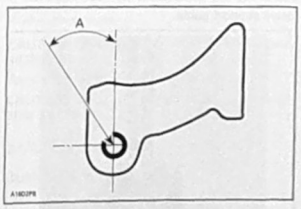
CAUTION: Always replace all ramps and all dowel tubes at the same time and make sure to use identical ramps.

Insert dowel tube from chamfered side. Make sure ramp is centered on dowel tube.

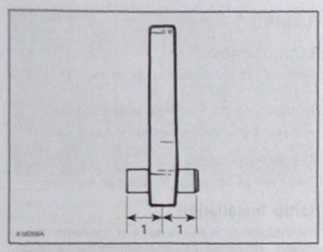


1. Chamfered side

Position dowel tube split at the angle "A".



MODEL	ANGLE (A)
TRA IV	45 ± 3°



1. Equal distance

Torque screws to 10 N•m (89 lbf•**in**).

SPRING

Spring Removal

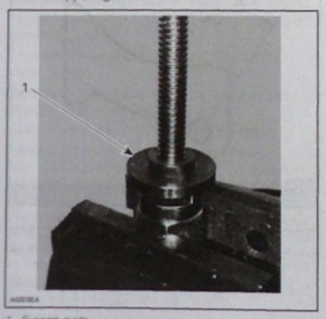
Remove drive pulley and separate sliding sheave and fixed sheave.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

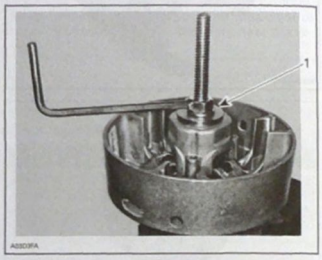
Use the spring compressor (P/N 529 036 012).

Install support guide.



1. Support guide

Install sliding sheave then a second support guide. These support guides will prevent bushing damages.



1. Support guide

Completely remove all 3 Allen screws retaining spring cover then unscrew compressor.

Spring Inspection

Check spring color code and its free length. Replace if necessary.

COLOR CODE	FREE LENGTH
RED/RED	97.00 mm (3.819 in)

Spring Installation

For installation, reverse the removal procedure.

To install spring cover, use the spring compressor (P/N 529 036 012).

Align balance marks before installing spring cover.



ALIGN BALANCE MARKS

Tighten screws to proper torque as mentioned in exploded view.

CENTRIFUGAL LEVERS

Lever Removal

Remove the drive pulley. Refer to *FIXED AND SLIDING SHEAVES*.

Remove governor cup from sliding sheave.

Remove screws securing centrifugal levers on sliding sheave.



Lever Inspection

Check centrifugal lever for crack, distortion or other damages.

Check roller for roundness of external diameter.

Check if the roller turns freely.

Check thrust washers for wear (thickness).

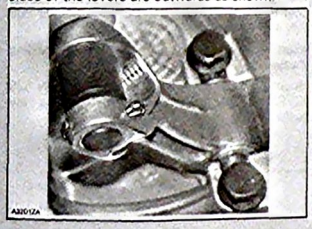
Check lever screw heads for wear.

Check ramp bushings for wear.

Lever Installation

Always use the same roller pin as originally installed when servicing. Different types have different weights for calibration purpose. Refer to *TECHNICAL SPECIFICATIONS*.

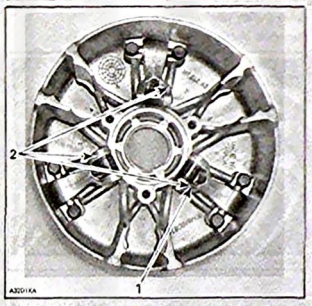
While installing levers, make sure that the curved sides of the levers are outwards as shown.



Always install levers so that cotter pins are on the side shown here. Besides install cotter pin head on top when lever is sat at bottom of sliding sheave. Bend cotter pin ends to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, the drive pulley will be unbalanced (because of lever differences).



1. Head on top
2. All on the same side

CAUTION: Lever assemblies must be installed so that cotter pins are on the same side.

Torque screws as per the exploded view.

CAUTION: Lever and rollers must move easily after installation.

BUSHINGS

Bushing Cleaning

Only use petroleum based cleaner when cleaning bushings.

CAUTION: Do not use acetone to clean bushing.

Bushing Inspection

Visually inspect coating. Replace if worn.

Bushing Removal

Spring Cover Bushing

Under normal use there is no need to replace this bushing.

In case of replacement, it's recommended to replace spring cover.

Sliding Sheave Bushing

NOTE: In case of worn out bushing, it is advisable to replace complete whole sliding sheave assembly as replacing just the bushing may reduce the drive pulley performance.

Remove circlip from the sliding sheave.



1. Circlip

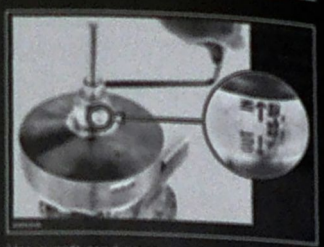
Secure the spring compressor (P/N 529 036 012) in a vise, place the bushing installer (P/N 529 031 200) and the sliding sheave on it.



1. Spring compressor
2. Bushing installer
3. Sliding sheave

Use the large bushing extractor tool (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the large bushing extractor tool (P/N 529 035 931) as marked, to remove the bushing press using the side marked "OUT", as shown below in the picture.



Use a soft sand paper to clean sliding sheave bushing mounting surface.



Clean sliding sheave bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

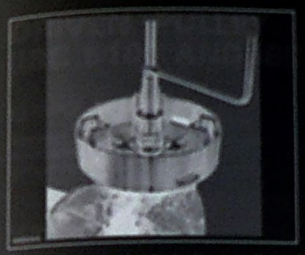
Bushing Installation

To install a new bushing, secure the spring compressor (P/N 529 036 012) in a vise and mount the sliding sheave.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Insert the bushing from inner side of sliding sheave.

Mount the large bushing extractor tool (P/N 529 035 931) with side marked "IN" to press in a new bushing.

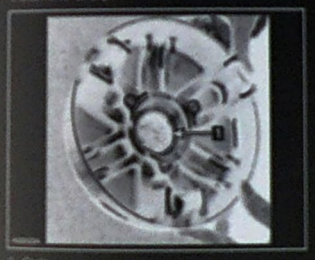


NOTE: Make sure that the bushing is well seated on the sliding sheave.



1. Bushing

Install the circlip.



1. Circlip

DRIVEN PULLEY (IBC 5100 AND IBC VSA 6000)

SERVICE TOOLS

Description	Part Number	Page
clutch spring compressor	529 036 012	575
spring scale hook	529 030 900	576

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 (antiseize lubricant)	293 800 070	576
pulley flange cleaner	413 711 809	575

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile driven pulley type.

During assembly/installation, use the torque values and the service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Never start engine when the pulley guard is removed.

⚠ WARNING

The driven pulley is a precisely balanced unit. Never replace parts with used parts from another driven pulley.

PROCEDURES

DRIVEN PULLEY

Driven Pulley Cleaning

Use pulley flange cleaner (P/N 413 711 809) to clean pulley sheaves.

Driven Pulley Removal

Remove guard and drive belt from vehicle.

550F and 600 Models

Remove air intake silencer and carburetors.

600 HO SDI Models

Remove air intake silencer and throttle body.

V800 Models

Unscrew and move the ECM/fuse box support on RH side.



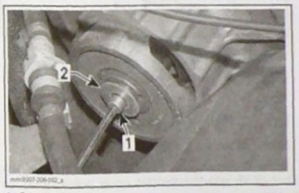
1. ECM/fuse box support
2. Muffler
3. Fuse box

Unscrew the top and the bottom nuts securing steering column.

Move the steering column toward the RH side.

All Models

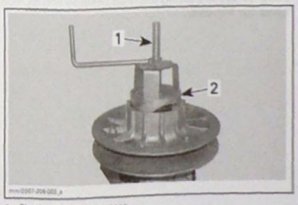
Remove driven pulley screw, lock washer and the shaft extension then pull the driven pulley from shaft.



1. Driven pulley screw
2. Shaft extension

Driven Pulley Disassembly

Using the clutch spring compressor (P/N 529 036 012), push the cam.



1. Clutch spring compressor
2. Cam

Remove the snap ring.

NOTE: On **550F models**, remove snap ring and washer.

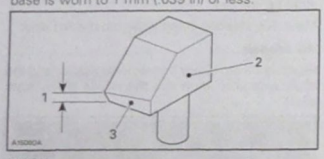
⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

Driven Pulley Inspection

Slider Shoe

Check cam slider shoes for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



TYPICAL
1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

Driven Pulley Assembly

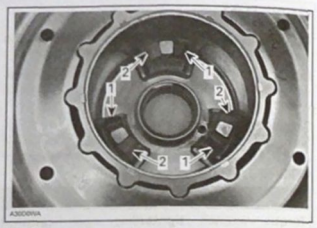
Slider Shoes

When replacing slider shoes, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

IBC 5100

Install slider shoes as per following photo. RED slider shoes are being used for reverse and BLACK ones for forward.



TYPICAL
1. BLACK slider shoe
2. RED slider shoe

Driven Pulley Installation

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on shaft end.

Reinstall the driven pulley on the shaft by reversing the removal procedure.

Cam

Coat cam interior with Loctite 767 (antiseize lubricant) (P/N 293 800 070).

Make sure to install proper cam. Refer to *TECHNICAL SPECIFICATIONS*.

Cam angle is identified on cam.



NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude.

Spring

It is usual to experience spring setting during breaking period of a new spring. The factory spring preload is slightly higher (about 1 kg (2 lbl) to compensate for spring setting. Specifications in *TECHNICAL SPECIFICATIONS* are applicable after break-in period (about 10 hours of use).

To check spring preload adjustment, use the spring scale hook (P/N 529 030 900) and a spring scale.

Remove drive belt.

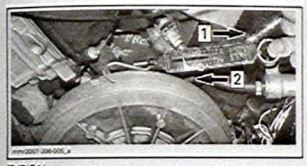
Install the hook on the sliding sheave. Preventing fixed sheave from turning, pull sliding sheave with the spring scale perpendicularly with pulley axle.

Take 1st measurement when sliding sheave begins to turn. Rotate sliding sheave to 10 mm (3/8 in) of rotation. Hold fish scale at this position. Slowly release tension from fish scale and take 2nd measurement when sliding sheave begins to return. Spring preload is the average measurement between these 2.

$$\frac{\text{1st measurement (when opening)} + \text{2nd measurement (when closing)}}{2} = \text{Spring preload}$$

Example:

$$\frac{\text{3.8 kg (8.4 lb) (when opening)} + \text{3.4 kg (7.5 lb) (when closing)}}{2} = \text{3.6 kg (8 lb) Actual spring preload}$$



TYPICAL
Step 1: 1st measurement
Step 2: 2nd measurement

To adjust spring preload, relocate spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to *TECHNICAL SPECIFICATIONS*.

NOTE: Always recheck torsional preload after adjusting.

Driven Pulley Adjustment

Refer to *PULLEY ALIGNMENT* and *DRIVE BELT* to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

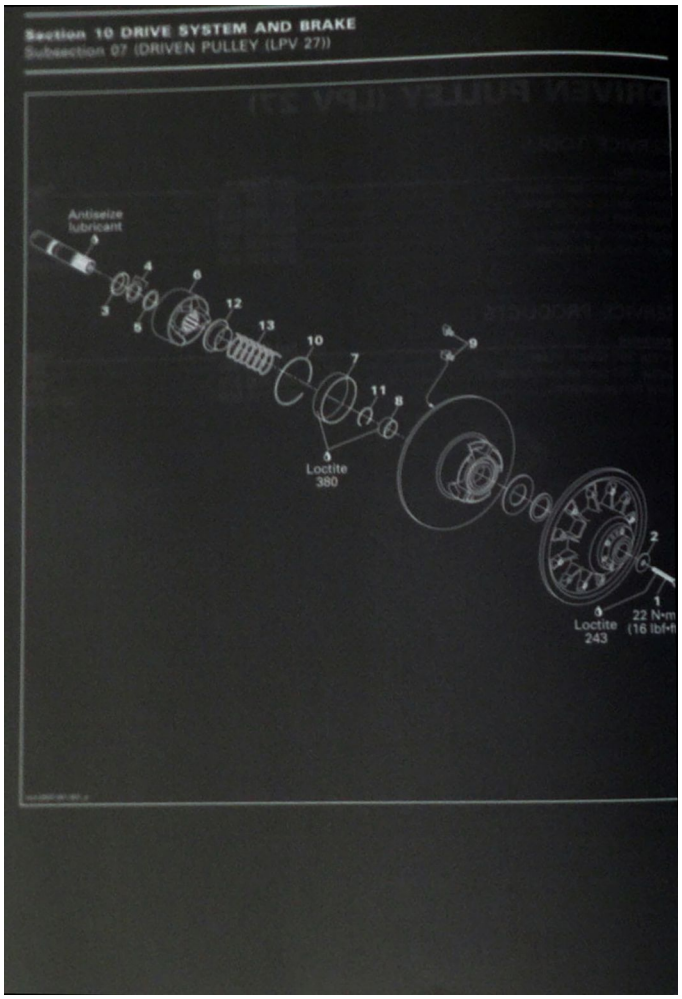
DRIVEN PULLEY (LPV 27)

SERVICE TOOLS

Description	Part Number	Page
bushing extractor/installer	529 031 300	583
clutch spring compressor	529 036 012	581–585
crankshaft protector	420 876 552	583
large bushing extractor	529 031 100	582
large bushing extractor	529 035 575	582–583

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 380 (Black Max)	413 408 300	583
Loctite 767 (antiseize lubricant)	293 800 070	585
pulley flange cleaner	413 711 809	581–582


Antiseize lubricant
Loctite 380
Loctite 243
22 N•m (16 lbf•ft)

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile driven pulley type.

During assembly/installation, use the torque values and the service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Never start engine when the pulley guard is removed.

⚠ WARNING

The driven pulley is a precisely balanced unit. Never replace parts with used parts from another driven pulley.

PROCEDURES

DRIVEN PULLEY

Driven Pulley Cleaning

Sheaves

Use pulley flange cleaner (P/N 413 711 809) to clean pulley sheaves.

Bushings

During break-in period (about 10 hours of use), teflon from bushing **no. 7** and **no. 8** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

Driven Pulley Removal

Remove guard and drive belt from vehicle.

Remove pulley retaining screw **no. 1** and shouldered washer **no. 2** then pull the driven pulley from the countershaft.

Take care not to lose spacer **no. 3**.

Driven Pulley Disassembly

Sheaves

Use clutch spring compressor (P/N 529 036 012).



TYPICAL

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool. Make sure the cam follows the compressor while unscrewing. If cam gets stuck, leave 1 mm (1/32 in) gap between cam and compressor and carefully free up cam by rotating the sliding sheave back and forth. Resume unscrewing once the cam is free to follow the compressor.

Remove half keys **no. 4** and spacer **no. 5** to disassemble the cam **no. 6** and pulley sheaves.

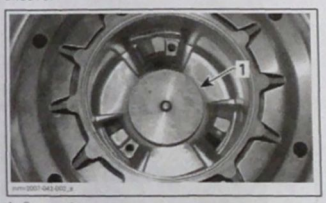
Large Bushing

Remove circlip **no. 10**.

Remove two slider shoes.

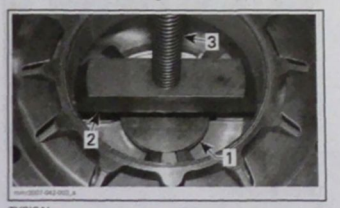


Install the support plate included in the large bushing extractor (P/N 529 031 100) inside sliding sheave.



1. Support plate

Place the large bushing extractor (P/N 529 035 575) below bushing and screw the threaded rod of the clutch spring compressor (P/N 529 036 012) in the large bushing extractor hole until the end of threaded rod reaches against the support plate.



TYPICAL
1. Support plate
2. Large bushing extractor
3. Threaded rod of spring compressor

Mount the clutch spring compressor head in a vise.

Using a heat gun, heat bushing to break the adhesive product.

Turn pulley sheave by hand to extract old bushing.

Clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

Small Bushing

Remove circlip **no. 11**.

Using a press, extract the small bushing. Push the bushing out of its location by using a pipe with proper diameter.

Clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

Driven Pulley Inspection

Sheaves

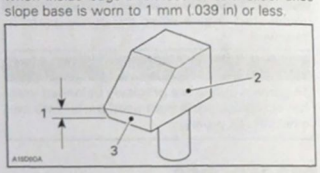
Inspect sheaves for abnormal wear or cracks.

Slider Shoe

BLACK slider shoe = forward.

RED slider shoe = reverse.

Check cam slider shoes **no. 9** for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

Bushings

Check the bushings **no. 7** and **no. 8** for cracks, scratch and for free movement when assembled to fixed sheave **no. 12**.

Using a dial bore gauge measure bushing diameter. Measuring point must be at least 5 mm (1/4 in) from bushing edge.


A09D10A

Replace bushing(s) if worn more than specified.

DRIVEN PULLEY BUSHING WEAR LIMIT mm (in)	
Small bushing	38.30 (1.508)
Large bushing	108.2 (4.260)

Driven Pulley Assembly

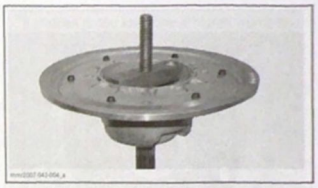
Large Bushing

On threaded rod install both sleeves and one spacer included with the clutch spring compressor (P/N 529 036 012).


A30D19A

Coat bushing outside diameter with Loctite 380 (Black Max) (P/N 413 408 300). Place new bushing on sliding sheave and slightly tap to engage squarely the bushing in the sliding.

Install the sliding pulley on threaded rod and screw in the large bushing extractor (P/N 529 035 575).


mmr2007-042-004_a

Turn pulley sheave by hand to insert the new bushing.

IMPORTANT: Change the position of extractor often to push the bushing straight.

Install circlip.

Small Bushing

Coat bushing outside diameter with Loctite 380 (Black Max) (P/N 413 408 300).

Using a press and the bushing extractor/installer (P/N 529 031 300) with crankshaft protector (P/N 420 876 552), insert small bushing in its location.

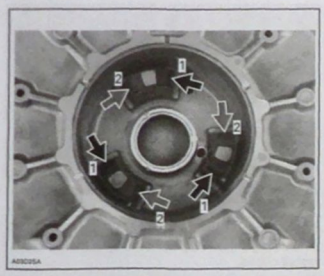

A30D18A

Install circlip.

Slider Shoe

When replacing slider shoes **no. 9**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. RED slider shoes are being used for reverse and BLACK ones for forward.

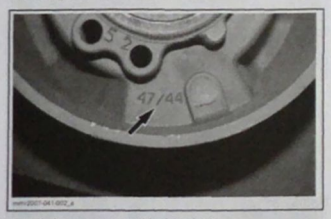


1. BLACK slider shoe
2. RED slider shoe

Cam and Spring

Make sure to install proper cam. Refer to *TECHNICAL SPECIFICATIONS*.

Cam angle is identified on cam.



Install the recommended spring.

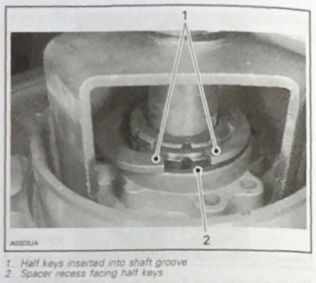
Single-Stud Spring

If a single-stud spring is used, the stud must be inserted in one of the 3 sliding sheave's holes.

Enter the other end of the spring in the sliding sheave location hole.

Compress cam using the clutch spring compressor (P/N 529 036 012).

Install spacer **no. 5** then secure cam with half keys **no. 4**, as shown in the next photo.

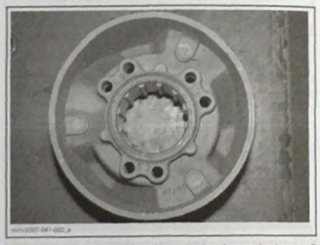


1. Half keys inserted into shaft groove
2. Spacer recess facing half keys

Double Opened Ends Spring

If a spring opened at both ends is used, do the following:

1. Select the appropriate spring locating hole on the cam to enter one end of the spring.

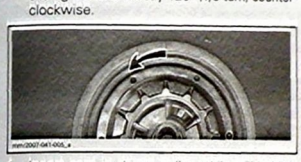


NOTE: When no preload is required, use hole no. 6 and DO NOT rotate the sheave (skip operation no. 3). When applying 6.8 kg (15 lb) of preload on a PINK spring, use hole no. 4 and DO rotate the sheave (perform operation no. 3).

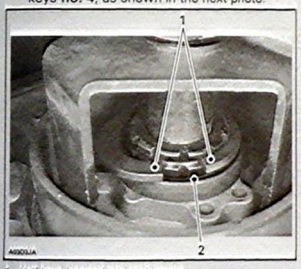
2. Enter the other end of the spring in the sliding sheave location hole.



3. When torsion preload is required, turn the sliding sheave exactly 120° (1/3 turn) counterclockwise.



4. Insert cam in driven pulley while still holding preload, using the clutch spring compressor (P/N 529 036 012).
5. Install spacer **no. 5** then secure cam with half keys **no. 4**, as shown in the next photo.



1. Half keys inserted into shaft groove
2. Spacer recess facing half keys

6. Using a fish scale hooked to a sliding sheave balancing hole, measure the force required to turn the sliding sheave counterclockwise. Also measure the force required by the sheave to return to its original position. Calculate the average of both forces.
7. If preload is too low, use a higher number. If preload is too high, use a smaller number.

Driven Pulley Installation

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on countershaft splines.

Reinstall the pulley on the countershaft by reversing the removal procedure.

Torque pulley retaining screw **no. 1** to 22 N•m (16 lbf•ft).

Driven Pulley Adjustment

Refer to *PULLEY ALIGNMENT* and *DRIVE BELT* to perform adjustments.

CAUTION: Drive belt and pulley alignment must always be checked whenever pulleys have been removed, replaced or disassembled.

PULLEY ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
universal alignment tool	529 035 831	588

GENERAL

Both pulley distance adjustment and pulley alignment must be carried out to ensure the highest efficiency of the transmission system. Furthermore, optimum drive belt operation and minimal wear will be obtained only with proper pulley alignment.

This basic distance is provided as an assembly guide and indicates the dimensions between which satisfactory belt deflection will be obtained.

The pulley distance we will refer to in this section, is the space separating the drive and driven pulley outside diameters (Z measurement).

⚠ WARNING

Failure to correctly perform pulley alignment may cause the vehicle to creep forward at idle.

All pulley alignment specifications refer to:

X = Distance between straight bar and drive pulley fixed half edge, measured between pulleys.

Y = Distance between straight bar and drive pulley fixed half edge, measured at the end of straight bar.

Z = Distance between outside diameter of pulleys.

PULLEY ALIGNMENT SPECIFICATIONS

MODEL	PULLEY DISTANCE	OFFSET	
	Z	X	Y - X
440F	39.0 ± 0.75 mm (1.535 ± .030 in)	37.0 ± 0.75 mm (1.457 ± .030 in)	0.75 to 1.5 mm (.030 to .060 in)
550F	41.8 ± 0.75 mm (1.647 ± .030 in)	35.0 ± 0.75 mm (1.380 ± .030 in)	0.75 to 1.5 mm (.030 to .060 in)
600	35.5 ± 0.75 mm (1.398 ± .030 in)	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 1.5 mm (.030 to .060 in)
600 HO SDI V800	67.0 ± 0.75 mm (2.638 ± .030 in)	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 1.5 mm (.030 to .060 in)

NOTE: When pulley distance and alignment are adjusted to specifications, refer to *DRIVE BELT* to adjust drive belt height.

PROCEDURES

Preparation

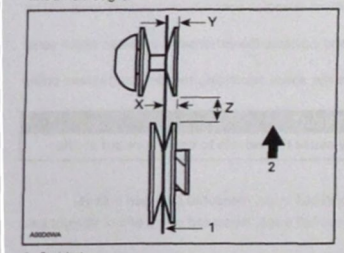
Remove drive belt guard.

Remove drive belt.

Insert the universal alignment tool (P/N 529 035 831) into the opened driven pulley.

Measuring Procedure

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).

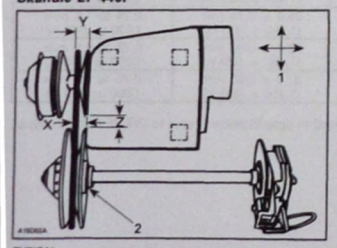


1. Straight bar
2. Front of vehicle

The distance Y must exceed distance X to compensate for the twist due to the engine torque.

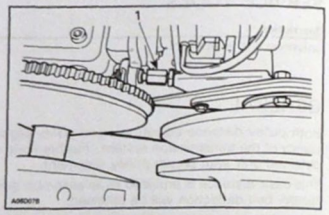
Pulley Distance Adjustment

Skandic LT 440F



TYPICAL
1. Engine movement
2. Contact

NOTE: Prior to performing pulley distance adjustment, loosen torque rod nut to allow engine movement. Engine supports have tendency to stick to frame, work engine loose prior to aligning.



1. Loosen

Engine Movement

The engine support has slotted mounting holes. Move engine to obtain specified distance between pulleys.

Skandic WT/SWT/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws and move gearbox accordingly.

Retighten screws.

Pulley Alignment

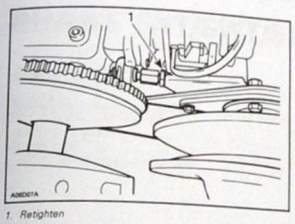
SKkandic LT 440F

When engine slotted mounting holes do not allow to set proper pulley offset X, adjust with shims (P/N 504 108 200) between pulley and countershaft bearing support (pulley pushed toward brake disc).

Engine Movement

Loosen the 4 bolts retaining engine support to the frame. Position engine to obtain the specified alignment.

NOTE: After alignment, adjust torque rod so it slightly contacts stopper plate. Do not over tighten, it will disalign pulleys.



1. Retighten

Skandic WT/SWT/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws.

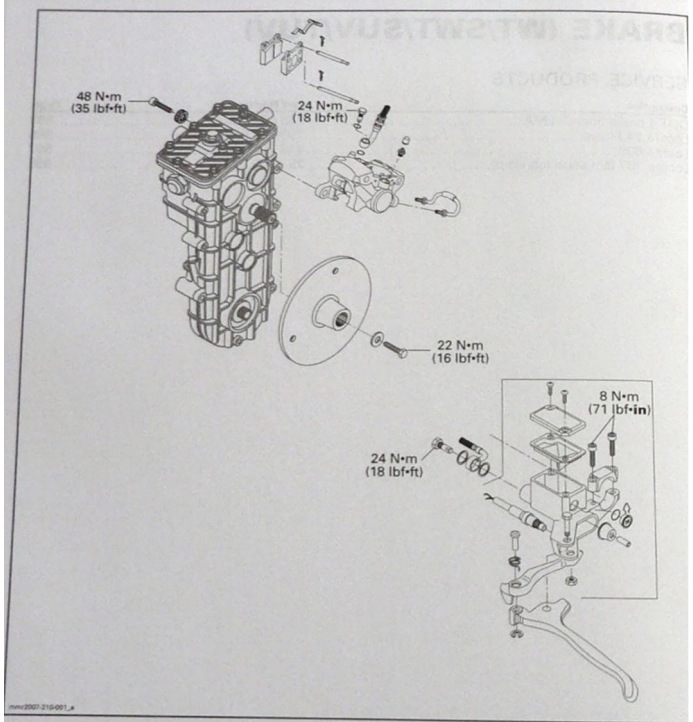
Install or remove shims accordingly.

Retighten screws.

BRAKE (WT/SWT/SUV/TUV)

SERVICE PRODUCTS

Description	Part Number	Page
DOT 4 brake fluid GTLMA	293 600 062	593
Loctite 243 (blue)	293 800 060	595
Loctite 609	413 703 100	597
Loctite 767 (antiseize lubricant)	293 800 070	595


1
1
48 N•m
(35 lbf•ft)
24 N•m
(18 lbf•ft)
22 N•m
(16 lbf•ft)
8 N•m
(71 lbf•in)
24 N•m
(18 lbf•ft)

GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

A contaminated brake disc or pad reduces stopping power. Discard contaminated pads and clean contaminated disc with a high quality brake degreasing agent.

CAUTION: Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing brake system.

CAUTION: To avoid serious damage to the brake system, use only DOT 4 brake fluid from a sealed container. Do not use brake fluid taken from old or already opened containers, nor mix different fluids for topping off.

CAUTION: Sealing washers must be discarded and replaced with new ones every time a Banjo fitting is unscrewed.

PROCEDURES

BRAKE FLUID

The brake fluid must be changed in accordance with the maintenance chart.

Recommended Fluid

Always use brake fluid meeting the specification DOT 4 such as DOT 4 brake fluid GTLMA (P/N 293 600 062) sold by BRP.

Fluid Level Verification

With the vehicle on a level surface, position steering in straight-ahead position to ensure reservoir is level. Check brake fluid level, the reservoir is full when the fluid reaches the top of window.

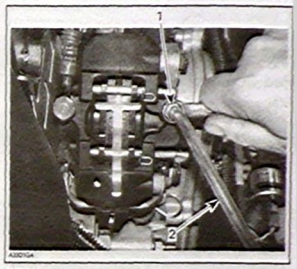
Brake Fluid Replacement

Draining

Remove reservoir cover with its diaphragm.

Connect a clear hose to caliper bleeding screw.

Loosen bleeding screw and pump brake lever until no more fluid flows out of bleeding screw.



TYPICAL
1. Open bleeding screw
2. Clear hose to catch used brake fluid

Filling and Bleeding

Close bleeding screw.

Fill reservoir with DOT 4 brake fluid.

Install a clear hose to bleeding screw. Route this hose to a container. Unscrew bleeding screw until brake fluid freely flows out of hose. Close bleeding screw. Refill reservoir when the fluid level is low to prevent air into system.

Pump up system pressure with brake lever until resistance is felt.

Squeeze brake lever and open bleeding screw. When lever touches the handlebar, do not release lever and close bleeding screw.

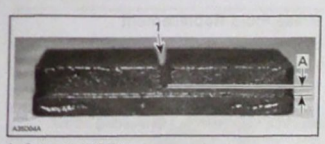
Repeat the procedure until no more air bubbles appear in the hose and brake lever is not spongy.

BRAKE PADS

Pad Inspection

Brake pads must be replaced when lining is 1 mm (1/32 in) thick or less or if the groove, on lining pad, is not visible.

CAUTION: Brake pads must always be replaced in pairs.



1. Groove on pad lining
A. Brake pad minimum thickness 1 mm (1/32 in)

Inspect brake disc at the same time.

Pad Removal

Brake pads removal procedure is as follows:

- Remove clips that retain pad pins.



TYPICAL
1. Clips

- Hold pad spring and pull pad pins out of caliper.



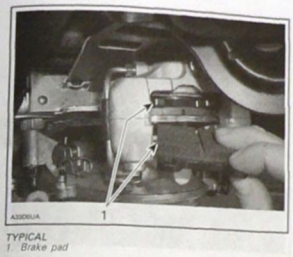
TYPICAL
1. Pad pins

- Remove pad spring.



TYPICAL
1. Pad spring

- Insert a flat screwdriver between brake disc and brake pad to compress caliper piston. Pay attention to avoid scratching brake disc.
- Remove the brake pads.



TYPICAL
1. Brake pad

Pad Installation

Install:
- new brake pads
- pad spring and push 2 pins to lock the brake pads
- both clips in the pin holes.

⚠ WARNING

Avoid getting fluid, oil or grease on brake pads. Contaminated brake pads can affect stopping capacities.

Press the brake lever until both new pads are touching the brake disc.

Center the brake disc into the caliper. Refer to *CALIPER*.

BRAKE DISC

Brake Disc Inspection

The brake disc can be inspected without removing it from the vehicle.

Check for scoring, cracking or bending, replace as required.

Measure brake disc thickness. The minimum thickness should be 4.3 mm (.169 in). If the brake disc is out of specification, replace it with a new one.

CAUTION: Brake disc should never be machined.

Brake Disc Removal

Apply parking brake and remove the brake disc screw.

Remove caliper. Refer to *CALIPER*.

Remove brake disc.

Brake Disc Installation

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on shaft.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of brake disc screw and torque it to 22 N•m (16 lbf•ft).

Reinstall all removed parts.

CALIPER

Caliper Removal

Procedure to Remove Caliper from Disc Brake

Unscrew M10 Allen screws that attach caliper to gearbox.

Pull caliper.

Hang the caliper with a piece of wire to take the weight off the brake hose after removing M10 Allen screws that attach caliper to gearbox.

CAUTION: Do not let the caliper hang by the hose and do not stretch or twist the hose.

Procedure to Replace Caliper

Drain brake system (refer to *BRAKE FLUID REPLACEMENT*).

Loosen bolt and disconnect brake hose. Discard sealing washers.

Catch spilled fluid with a rag. Attach the brake hose in a position to prevent the remaining fluid from flowing out.

Unscrew M10 Allen screws that attach caliper to gearbox.

Remove caliper.

Caliper Inspection

Check pistons for scratches , rust or other damages. If so, replace the caliper as an assembly.

NOTE: Only brake pads are available as spare parts.

Caliper Installation

Push pistons all the way in to allow caliper installation over brake disc.

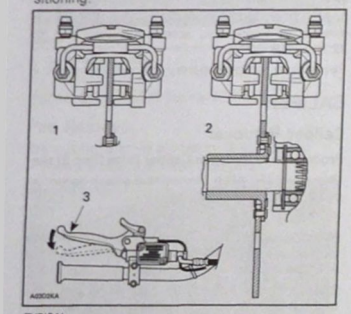
Install the Banjo fitting with two new sealing washers.

Fasten caliper on gearbox.

Fill the brake system and bleed it. Refer to *BRAKE FLUID REPLACEMENT* in this section.

The brake disc must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



TYPICAL
1. Brake disc not centered
2. Brake disc centered
3. Apply brake before checking

Apply brake then recheck.

MASTER CYLINDER

Master Cylinder Removal

The master cylinder is located on the LH side of handlebar.

Empty the master cylinder reservoir. Refer to *DRAINING* in *BRAKE FLUID REPLACEMENT*.

Place a container under master cylinder Banjo fitting then unscrew it. Discard the sealing washers.

Catch spilled fluid with a rag. Attach the brake hose in a position to prevent the remaining fluid from flowing out.

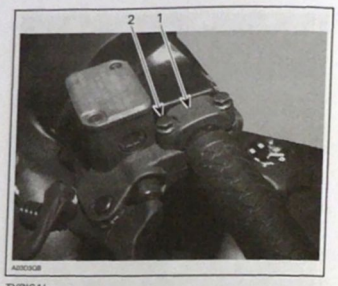
To remove master cylinder, unscrew both screws retaining the brake lever to the handlebar.

Master Cylinder Installation

The installation is the reverse of removal procedure. Pay attention to the following.

Always use new sealing washers during installation.

Install clamp with its arrow pointing at front of vehicle. Tighten to 8 N•m (71 lbf•**in**) front screw before rear one.



TYPICAL
1. Arrow on upper clamp pointing at the front of vehicle
2. Tighten front screw first

Bleed the brake system. Refer to *BRAKE FLUID REPLACEMENT* in this section.

BRAKE LIGHT SWITCH

Switch Resistance Test

Disconnect steering connector.

Validate switch operation with an ohmmeter.

SWITCH	TERMINAL		RESISTANCE
Released	WHITE	WHITE/RED (small terminal)	Infinite (0L)
Pushed and held			0.2 Ω (closed)

If readings do not correspond to the above specifications, check wiring/connectors going to switch. If they are good, replace switch.

Switch Removal

The brake light switch is located near the brake lever. To remove the switch, do the following.

Disconnect the switch.

Take out the master cylinder from the handlebar.

Fix the master cylinder in a rigid way preferably in a vise.

Pull out the switch wire and rubber cover.

Activate the parking brake.

Unscrew the switch body pay attention to apply a torque in axial direction with steps of little torque angles and pay attention to not apply a force in radial direction (flexion). The switch is delicate and can be easily snapped.

NOTE: In case of accidental breakage while removing switch body from master cylinder ensure to thoroughly restore and clean threads as needed before installing new switch.

Switch Installation

NOTE: The brake light switch is not adjustable.

Remove the glue remaining with alcohol on a piece of cotton and then clean the seat threads.

Put the switch on the seat, rotating it only for 1 or 1.5 turns.

Put one drop of Loctite 609 (P/N 413 703 100) on the free switch threads.

Screw the switch by hand until it is in a correct position.

For safety reasons, check the activation of the switch by pulling the brake lever. In case of no switch activation, repeat all the procedure replacing a new switch.

NOTE: If parking brake releases during the mounting operations, set the master cylinder in a sloping position (with lever on the top) and hold the master cylinder lever for 45 minutes.

Reinstall the master cylinder on the handlebar taking it in a horizontal position avoiding the risk of glue contamination for the switch rod.

Release the parking brake.

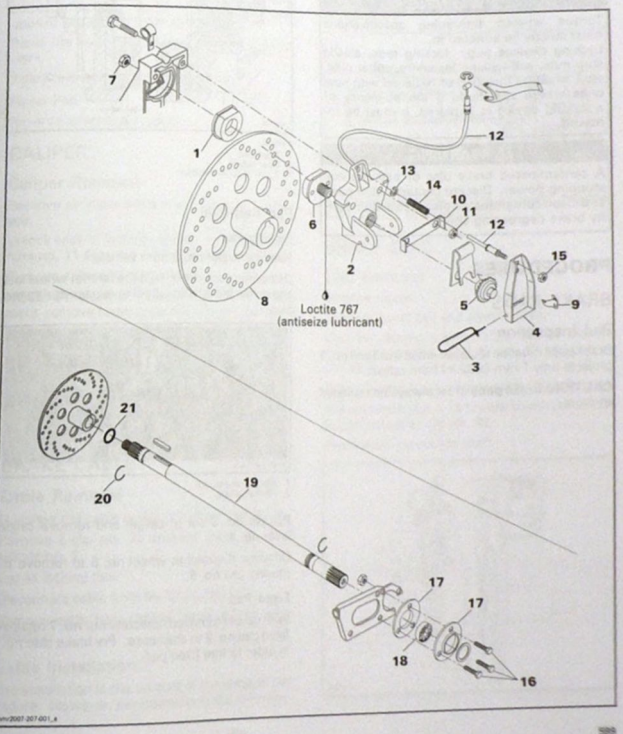
Wait 24 hours to allow glue to set.

Recheck if switch is working properly.

COUNTERSHAFT AND BRAKE (LT 440F)

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 (antiseize lubricant)	293 800 070	601–602



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

A contaminated brake disc or pad reduces stopping power. Discard contaminated pads and clean contaminated disc with a high quality brake degreasing agent.

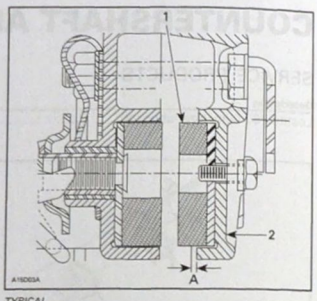
PROCEDURES

BRAKE PADS

Pad Inspection

Brake pads must be replaced when fixed pad **no. 1** projects only 1 mm (1/32 in) from caliper.

CAUTION: Brake pads must always be replaced in pairs.



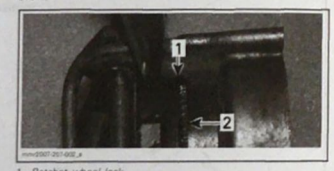
TYPICAL
1. Fixed pad
2. Inner caliper
A. 1 mm (1/32 in) minimum

Pad Removal

Moving Pad

Remove caliper **no. 2** from vehicle.

Using long nose pliers, hold the ratchet wheel lock and screw the ratchet wheel to release spring tension.



1. Ratchet wheel lock
2. Ratchet wheel

Pull pin **no. 3** out of caliper and remove caliper lever **no. 4**.

Unscrew the ratchet wheel **no. 5** to remove the moving pad **no. 6**.

Fixed Pad

With caliper removed, unscrew nut **no. 7** retaining fixed pad **no. 2** to chaincase. Pry brake disc **no. 8** in order to free fixed pad.

Pad Installation

Moving Pad

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on threads of moving pad.

Install moving pad **no. 6** in the caliper and screw the ratchet wheel **no. 5** completely.

Install caliper lever **no. 4**, ratchet wheel lock **no. 9** and pin **no. 3**. Make sure that lock is positioned correctly. Install pin so that it can only be removed upward and ensure it is properly locked.

Press the lever 2 or 3 times to test the mechanism.

Install caliper after replacing fixed pad.

Fixed Pad

Reverse removal procedure.

CALIPER

Caliper Removal

Remove air intake silencer and injection oil reservoir.

Unlock ends of locking plate **no. 10** then unscrew nuts **no. 11** securing caliper **no. 2** to chaincase.

Remove caliper from chaincase.

NOTE: If the caliper is being removed for replacement, remove brake cable **no. 12** from the caliper lever.

Caliper Installation

Reverse the removal procedure. However, pay attention to the following.

Torque caliper nuts **no. 11** to 24 N•m (18 lbf•ft). Bend locking plate over a flat of each nut.

BRAKE CABLE

Cable Removal

Unscrew the cable end from caliper lever **no. 4**.

Remove E-clip **no. 13** retaining cable **no. 12** to caliper **no. 2**.

Cut all locking ties.

Disconnect cable from the brake handle.

Remove cable from vehicle. Note routing for installation.

Cable Installation

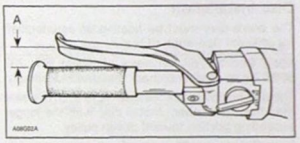
The installation is the reverse of the removal procedure. However, pay attention to the following.

Insert brake cable in the upper hole in brake lever and in caliper lever.

Install spring **no. 14** and cable nut **no. 15**. Tighten nut until 5 to 7 threads exceed.

Cable Adjustment

Fully depress the brake handle several times to obtain a gap of 13 mm (1/2 in) between the end of brake handle and handlebar grip when brake is fully applied.



A. 13 mm (1/2 in)

If this measurement is hard to reach, retighten cable nut **no. 15** as needed.

BRAKE DISC

Disc Removal

Remove caliper.

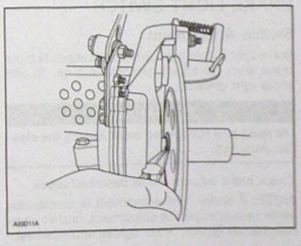
Remove guard, belt and driven pulley.

Unscrew bearing support bolts **no. 16** then remove both bearing supports **no. 17** and bearing **no. 18**.

Open chaincase and remove upper sprocket.

Pull countershaft **no. 19** toward driven pulley side to gain access to clip **no. 20**.

Remove clip on countershaft.



Pull countershaft toward driven pulley side to free from chaincase and disc **no. 8**.

Remove disc.

Disc Inspection

Check for scoring, cracking or heat discoloration, replace as required.

CAUTION: Brake disc should never be machined.

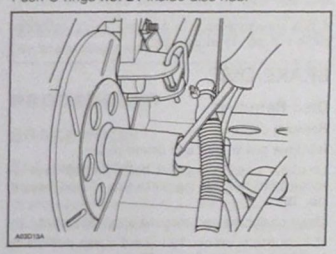
Disc Installation

The brake disc must be floating on countershaft for efficient operation of brake.

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on shaft and check that disc slides freely.

The disc hub exceeds the disc more from one side than from the other. Install disc with the longer exceeding portion toward driven pulley.

Push O-rings **no. 21** inside disc hub.



Install all other removed parts.

BRAKE LIGHT SWITCH

Switch Adjustment

Brake light should light up before brake pads touch brake disc. To adjust, unscrew nut **no. 15** until brake light goes on.

⚠ WARNING

At least one full thread must exceed the elastic stop nut.

Check brake adjustment as described above.

NOTE: If brake light adjustment is unattainable while respecting brake adjustment, ratchet wheel may be too far out. If so, tighten ratchet wheel.

COUNTERSHAFT

Countershaft Removal

To remove countershaft **no. 19**, use the same procedure as for brake disc. Refer to *BRAKE DISC*.

Pull the countershaft by the LH side of vehicle.

Countershaft Inspection

Check countershaft for bending, rust or other damages. Replace if necessary.

Check condition of countershaft splines and threads. Replace countershaft if necessary.

Check the Woodruff key and its location for wear or other damages. Replace key or countershaft if necessary.

Countershaft Installation

The installation is the reverse of removal procedure.

NOTE: Always install a new bearing when countershaft is removed.

COUNTERSHAFT BEARING

Bearing Removal

Remove the driven pulley, refer to *DRIVEN PULLEY*.

Unscrew bearing support bolts **no. 16** then remove both bearing supports **no. 17** and bearing **no. 18**.

Bearing Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Ensure that countershaft is properly aligned, then tighten the 3 retaining bolts **no. 16** to 15 N•m (133 lbf•**in**).

NOTE: A misaligned countershaft will result in difficulty to center the bearing in its support.

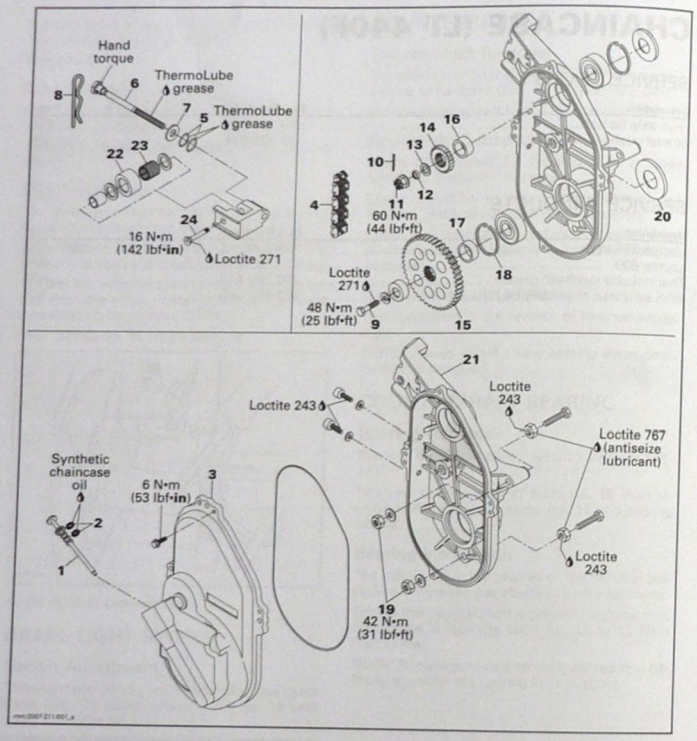
CHAINCASE (LT 440F)

SERVICE TOOLS

Description	Part Number	Page
drive axle holder	529 007 200	606
oil seal pusher	529 035 584	606

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	607–608
Loctite 609	413 703 100	606
ThermoLube synthetic grease	293 700 417	607
XP-S synthetic chaincase oil	413 803 300	605


Hand torque
ThermoLube grease
ThermoLube grease
16 N•m (142 lbf•in)
Loctite 271
60 N•m (44 lbf•ft)
Loctite 271
48 N•m (25 lbf•ft)
Loctite 243
Loctite 243
Loctite 767 (antiseize lubricant)
Loctite 243
Synthetic chaincase oil
6 N•m (53 lbf•in)
42 N•m (31 lbf•ft)

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAINTENANCE

CHAINCASE OIL

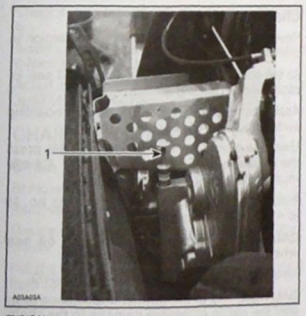
Recommended Oil

NOTE: Do not mix different oil (mineral and synthetic) for topping off.

Use XP-S synthetic chaincase oil (P/N 413 803 300).

Oil Level Verification

With the vehicle on a level surface, check the oil level by removing dipstick **no. 1**. Oil level must be between lower and upper marks.



TYPICAL
1. Dipstick

NOTE: It is normal to find metallic particles stuck to dipstick magnet. If bigger pieces of metal are found, remove the chaincase cover and inspect the chaincase parts.

Remove metal particles from magnet.

Check O-rings **no. 2**. If the O-rings are brittle, hard or otherwise damaged, replace them.

Draining Procedure

Place a drain pan under chaincase area.

Remove tuned pipe and muffler. Refer to *EXHAUST SYSTEM*.

Remove the chaincase cover **no. 3** to drain chaincase.

Filling Procedure

Place the vehicle on a level surface.

Using a funnel, pour 250 mL (8.5 U.S. oz) of chaincase oil.

Refill to upper mark. See *RECOMMENDED OIL* for the proper chaincase oil to use.

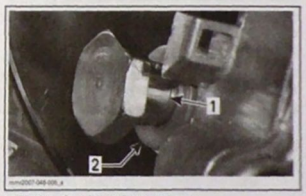
CAUTION: Use only the recommended types of oil when servicing. Do not mix synthetic oil with other types of oil.

DRIVE CHAIN ADJUSTMENT

NOTE: Brake disc key must be in good condition before checking if chain **no. 4** is loose.

Before performing the drive chain adjustment, check the tensioner adjustment screw O-rings **no. 5** and replace if necessary.

Fully tighten tensioner adjustment screw **no. 6 BY HAND**. The tensioner adjustment screw shoulder and the washer **no. 7** must be in contact with the chaincase housing.



1. Shoulder of tensioner adjustment screw
2. Washer

When done, back off only far enough for hair pin **no. 8** to engage in locking hole.

This initial adjustment should provide 3 - 5 mm (1/8 - 13/64 in) free-play when measured at the outer circumference of the brake disc.

CAUTION: Free-play must not exceed 5 mm (13/64 in), readjust if necessary.

⚠ WARNING

If the specified free-play is not reached with the tensioner screw fully tightened, replace chain and check the condition of sprockets.

PROCEDURES

CHAINCASE

Chaincase Removal

Apply parking brake.

Remove exhaust pipe and muffler. Refer to *EXHAUST SYSTEM*.

Place a drain pan under chaincase area and remove chaincase cover.

Remove the lower sprocket bolt **no. 9**.

Remove cotter pin **no. 10**.

Upper sprocket nut **no. 11**, conical spring washer **no. 12** and washer **no. 13**.

Remove hair pin **no. 8** from tensioner adjustment screw.

Release drive chain tension by unscrewing tensioner adjustment screw **no. 6**.

Remove the upper socket **no. 14** and the lower sprocket **no. 15** as well as chain **no. 4** simultaneously.

Remove the countershaft spacer **no. 16**.

Then remove the drive axle spacer **no. 17**.

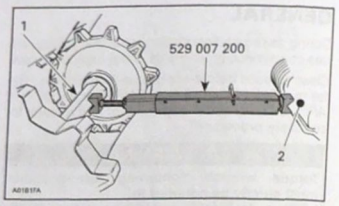
Near drive axle, remove the circlip **no. 18** from chaincase housing.

Release parking brake.

Remove nuts **no. 19** that retain chaincase to frame.

Remove caliper from chaincase. Refer to *COUNTERSHAFT AND BRAKE*.

Release track tension, use drive axle holder (P/N 529 007 200).



TYPICAL
1. Drive axle
2. Suspension cross shaft

Pry out drive axle oil seal **no. 20** from chaincase.

Pull chaincase from drive axle and countershaft.

Using 2 prybars inserted between chaincase housing **no. 21** and frame, pry complete assembly from vehicle.

Chaincase Inspection

Visually inspect the chain and sprockets for wear, cracked, damaged or missing links. If a problem is detected, replace drive chain and sprockets as an assembly.

Check the drive chain deflection. If the deflection is greater than 38 mm (1-1/2 in) without the chain tensioner, replace the chain.

Check for worn or defective bearings.

Check chain tensioner roller **no. 22** for wear or other damages. If the roller does not turn smoothly, replace the needle bearing **no. 23**.

Chaincase Installation

Reverse removal procedure and pay attention to the following.

At the bottom of chaincase, clean the oil seal location with a cleaning solvent.

Apply Loctite 609 (P/N 413 703 100) on mounting surface (outside) of oil seal **no. 20**.

Using the oil seal pusher (P/N 529 035 584), press the oil seal **no. 20** into chaincase hole. Oil seal must fit flush with the chaincase edge.

Install chaincase housing and torque nuts **no. 19** to 42 N•m (31 lbf•ft).

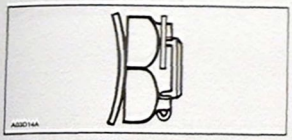
CAUTION: Take care not damaging oil seal when inserting drive shaft splines.

Install the circlip **no. 18** in chaincase housing.

CAUTION: It is of the utmost importance to install the circlip otherwise damage to the chaincase components may occur.

Position the sprockets **no. 14** and **no. 15** with the backside of writing facing the chaincase cover. Sprocket hub faces toward chaincase.

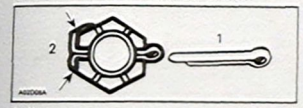
Install the washer **no. 13** and the conical spring washer **no. 12** on countershaft. Install the conical spring washer with its concave side towards sprocket.



Install the castellated nut **no. 11** and torque to 60 N•m (44 lbf•ft).

Install new cotter pin **no. 10** in the position shown.

CAUTION: When removing a cotter pin always replace with a new one. Cotter pin will rub on chaincase cover if installed otherwise.



1. New
2. Fold cotter pin over castellated nut flats only

Apply Loctite 271 (red) (P/N 293 800 005) on threads of lower sprocket screw **no. 9** and torque to 48 N•m (35 lbf•ft).

Check if chain tensioner screw is screwed correctly.

Install chaincase cover and torque its screws to 6 N•m (53 lbf•**in**).

Adjust drive chain. Refer to *DRIVE CHAIN ADJUSTMENT* at the beginning of this section.

CHAIN TENSIONER

Chain Tensioner Removal

Remove chaincase cover **no. 3**.

Remove hair pin **no. 8**.

Unscrew tensioner adjustment screw **no. 6** completely.

Pull the tensioner adjustment screw to separate it from tensioner.



TYPICAL
1. Tensioner adjustment screw
2. Tensioner

Chain Tensioner Inspection

Check chain tensioner roller **no. 22** for wear or other damages. If the roller does not turn smoothly, replace the needle bearing **no. 23**. See *CHAIN TENSIONER ROLLER BEARING*.

Check O-rings **no. 5** on tensioner adjustment screw. Replace them if necessary.

Check threads of tensioner adjustment screw for damages or wear. Replace the screw if necessary and check chaincase housing for damages.

Chain Tensioner Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Apply ThermoLube synthetic grease (P/N 293 700 417) on threads and O-rings of tensioner adjustment screw.

Check if chain tensioner screw is screwed correctly.

Adjust drive chain tension. Refer to *DRIVE CHAIN ADJUSTMENT* at the beginning of this section.

Install all removed parts.

CHAIN TENSIONER ROLLER BEARING

Roller Bearing Removal

Remove the chain tensioner, see procedure above.

Heat the roller screw **no. 24** to break the threadlocker.

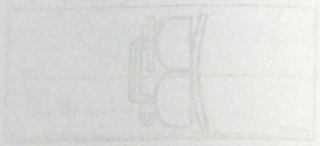
Remove the needle bearing from the roller.

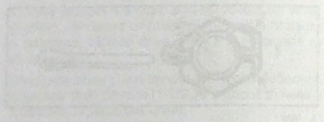
Roller Bearing Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Clean and remove grease on screw then apply Loctite 271 (red) (P/N 293 800 005) under the screw head only, **none on threads**.

Torque screw to 16 N•m (142 lbf•**in**).



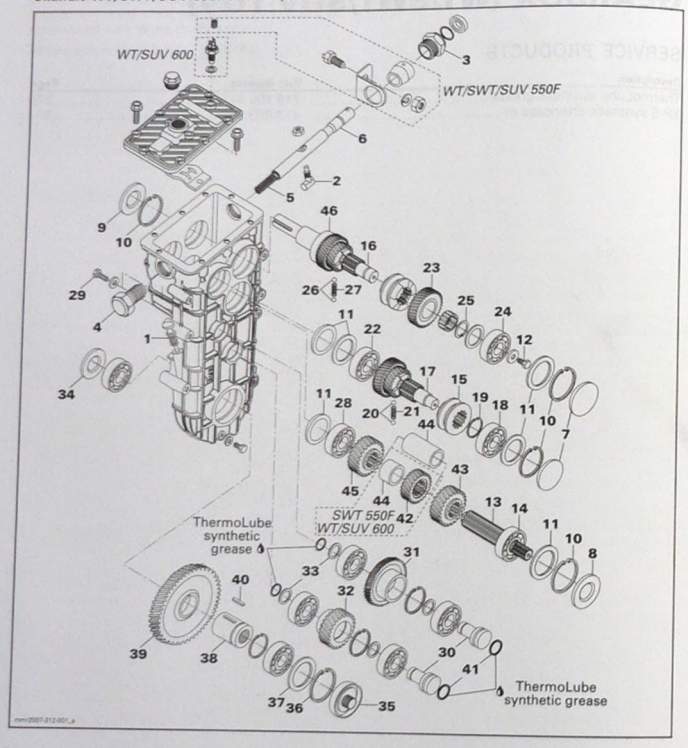


GEARBOX (WT/SWT/SUV/TUV)

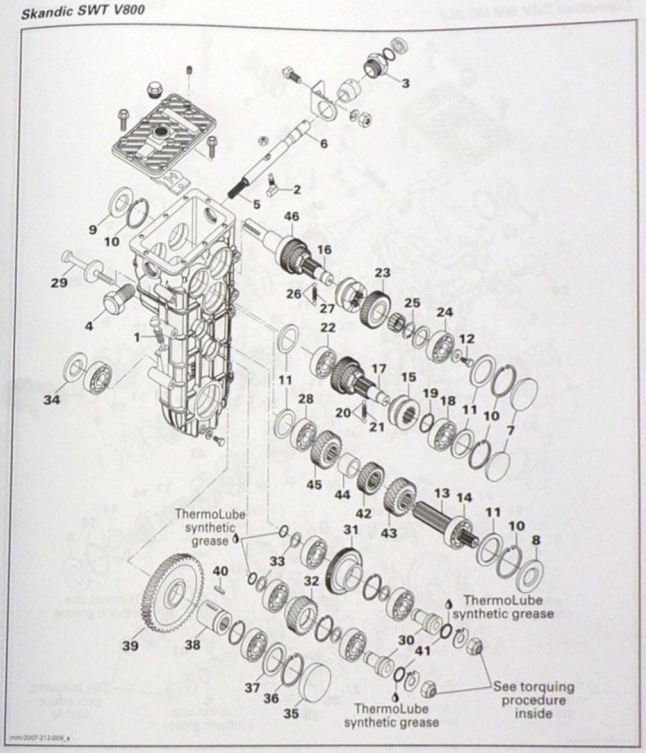
SERVICE PRODUCTS

Description	Part Number	Page
ThermoLube synthetic grease	219 700 417	623
XP-S synthetic chaincase oil	413 803 300	614

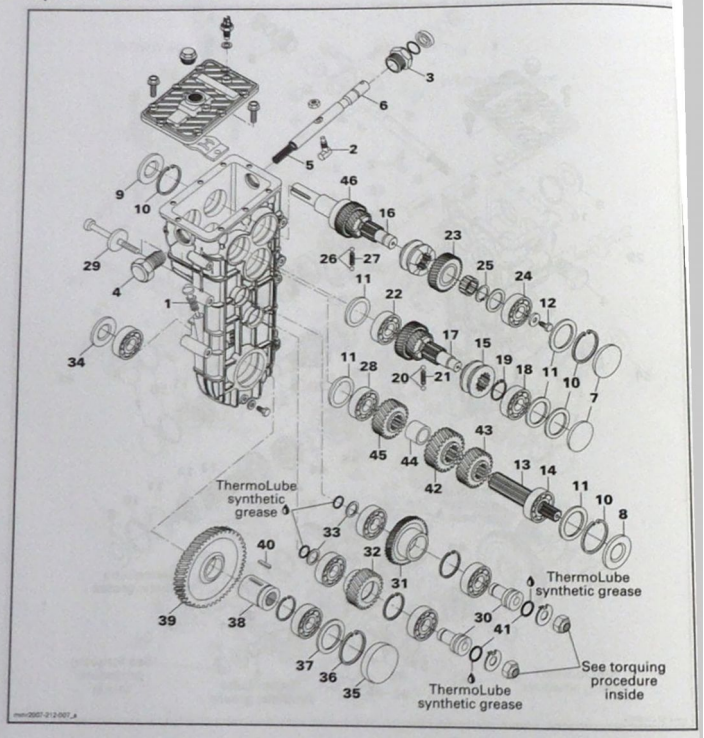
Skandic WT/SWT/SUV 550F and WT/SUV 600



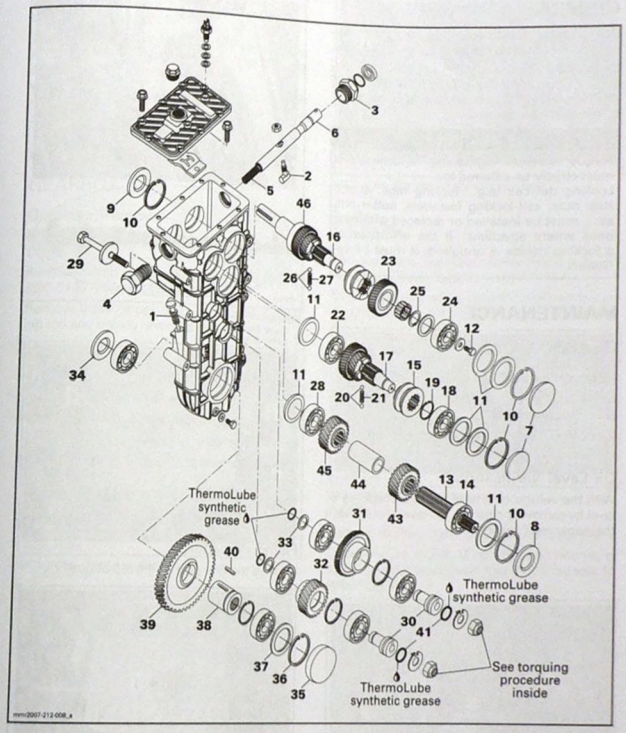
Skandic SWT V800



Expedition TUV 600 HO SDI



Expedition TUV V800



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAINTENANCE

GEARBOX OIL

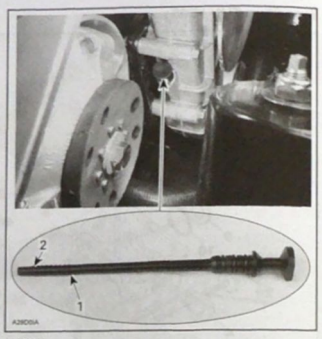
Recommended Oil

NOTE: Do not mix different oil (mineral and synthetic) for topping off.

Use XP-S synthetic chaincase oil (P/N 413 803 300).

Oil Level Verification

With the vehicle on a level surface, check the oil level by removing dipstick. Oil level should reach the upper level mark.



TYPICAL
1. Upper level mark (full)
2. Lower level mark (add)

Draining Procedure

Place the vehicle on a level surface.

Place a drain pan under gearbox drain plug area.

Remove dipstick.

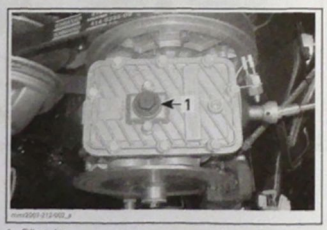
Remove the drain plug located at the bottom of gearbox.

Wait a while to allow oil to flow out of gearbox.

Install drain plug and torque it to 6 N•m (53 lbf•**in**).

Filling Procedure

Remove the filler plug on the top of gearbox.



1. Filler plug

Using a funnel, pour 400 mL (13.5 U.S. oz) of recommended oil.

CAUTION: Use only the recommended type of oil when servicing. Do not mix synthetic oil with other types of oil.

Check oil level with the dipstick and add oil if necessary. The level must reach the upper level dipstick's mark.

NOTE: After first outing, oil level will decrease as the upper oil cavity fills with oil. Recheck oil level and refill as required.

PROCEDURES

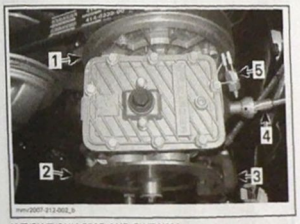
GEARBOX

Gearbox Removal

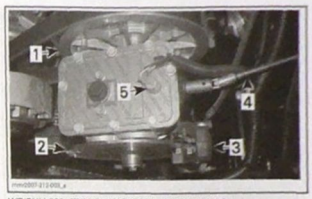
Drain gearbox oil. Refer to *DRAINING PROCEDURE*.

Remove driven pulley. Refer to *DRIVEN PULLEY (IBC 5100 AND IBC VSA 6000)*.

Remove brake caliper, brake disc. Unfasten shifting rod and unplug reverse switch.



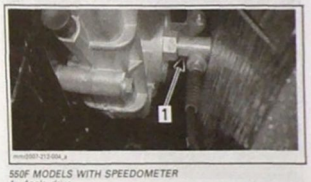
WT/SWT/SUV 550F AND SWT V800
1. Driven pulley
2. Brake disc
3. Caliper
4. Shifting rod
5. Reverse switch



WT/SUV 600, TUV 600 HO SDI AND TUV V800
1. Driven pulley
2. Brake disc
3. Caliper
4. Shifting rod
5. Reverse switch

Remove rear suspension. Refer to the appropriate *REAR SUSPENSION* section.

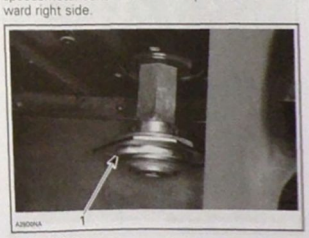
On 550F models with a speedometer, remove angle drive and square pin from bottom of gearbox.



550F MODELS WITH SPEEDOMETER
1. Angle drive

Remove muffler. Refer to *EXHAUST SYSTEM*.

Depending on model, unbolt RH end bearing or speedometer sensor cover then pull drive axle toward right side.



1. RH end bearing



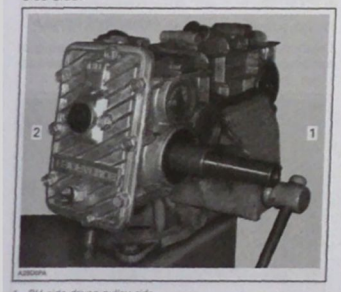
1. Speedometer sensor cover

Unbolt gearbox from chassis.



Gearbox Disassembly

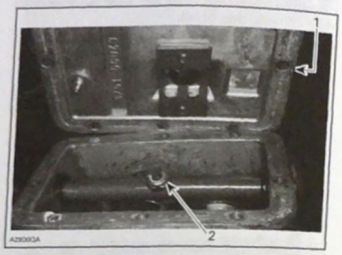
For the following procedure, right hand side refers to driven pulley side and left hand side to brake disc side.



1. RH side driven pulley side
2. LH side brake disc side

Remove dipstick **no. 1**. Unfasten cover from gearbox housing.

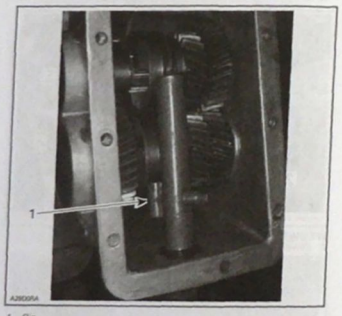
Remove nut retaining pin **no. 2**.



1. Cover
2. Nut

Unfasten sleeve nut **no. 3** and threaded plug **no. 4**.

Remove spring **no. 5** then, partially pull shifting shaft **no. 6** and remove pin.

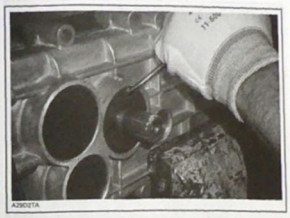


1. Pin

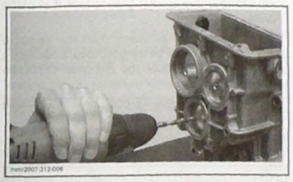
Completely remove shifting shaft.

Remove LH side rubber plugs **no. 7** and oil seal **no. 8**.

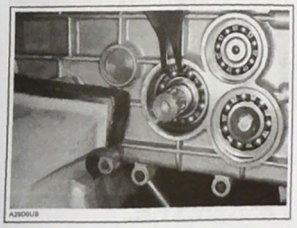
Remove RH side oil seal **no. 9**.



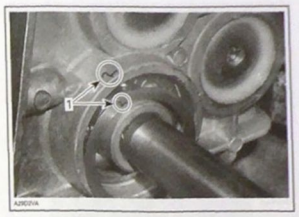
Drill a 10 mm (3/8 in) diameter hole through RH side plugs.



Remove all circlips **no. 10**.

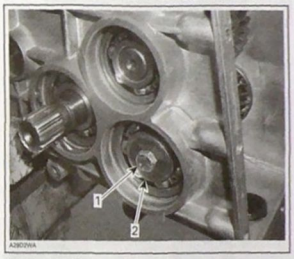


IMPORTANT: Note all shims *no. 11* quantity and location.



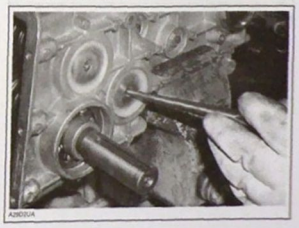
1. Note shims location

Remove driven shaft bolt **no. 12** and washer.



1. Driven shaft bolt
2. Washer

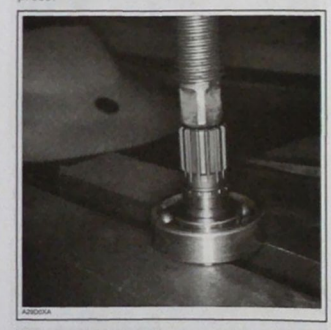
Proceeding from RH side, drive brake shaft **no. 13** out of gearbox housing.





NOTE: Brake shaft gears and sleeve remain in gearbox housing.

Remove bearing **no. 14** from brake shaft using a press.



Make sure gears mesh.



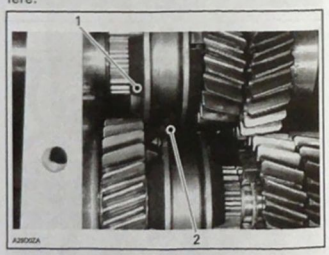
1. These gears must mesh as reverse shaft is driven out

Push sliding sleeve against gear to lock it in place (reverse gear).

This will allow the driven pulley shaft **no. 16** to be pushed out enough for bearing removal and sliding sleeve dog will not touch the RH gear of driven pulley shaft.

Drive reverse shaft **no. 17** out until its LH side bearing **no. 18** is free.

CAUTION: Make sure loose gears do not interfere.



1. Sleeve dog not touching right gear
2. Brake shaft gears are still in gearbox

Use a 3 jaws puller to extract LH reverse shaft bearing.



Remove reverse shaft from gearbox.

Remove loose gears.

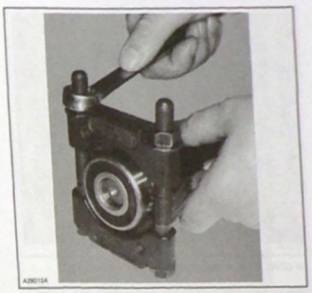
To remove sliding sleeve **no. 15** from reverse shaft, first remove circlip **no. 19**.

NOTE: Take care not to loose balls **no. 20** and spring **no. 21** when removing sliding sleeve.



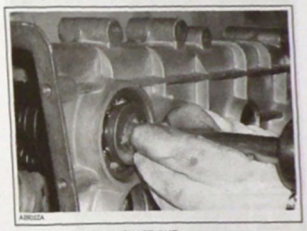
1. Circlip
2. Sliding sleeve

Use a bearing separator to extract bearing **no. 22**.

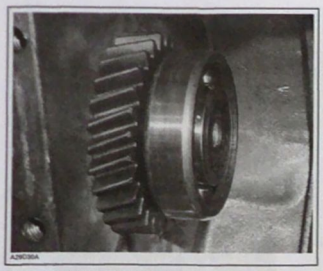


Remove brake shaft gears.

Push driven pulley shaft **no. 16** out of gearbox until its LH gear **no. 13** is against gearbox inner wall.

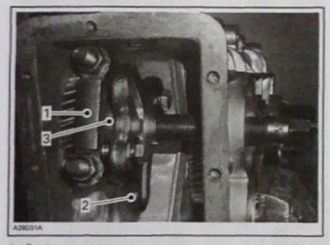


PUSH DRIVEN PULLEY SHAFT OUT



LH GEAR IS AGAINST GEARBOX INNER WALL

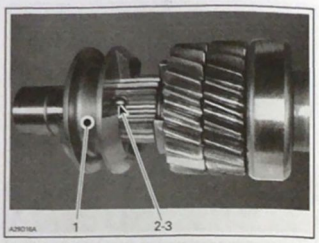
Use a bearing separator and a bolt grip puller to extract driven pulley shaft bearing **no. 24**.



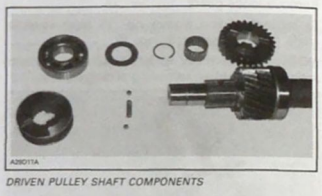
1. Bearing separator
2. Bolt grip puller
3. Bearing

Remove circlip **no. 25** then, gear **no. 23**. Now driven pulley shaft can be pulled out from gearbox.

Remove sliding sleeve taking care not to lose balls **no. 26** and spring **no. 27**.



1. Sliding sleeve
2. Spring
3. Balls



DRIVEN PULLEY SHAFT COMPONENTS

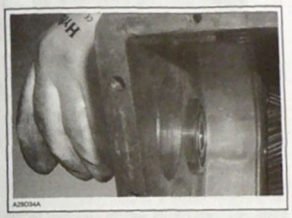
Remove sealant around caps.



Remove caps.



NOTE: Brake shaft bearing no. 28 and shims will come out with cap.



Remove screws no. 29 from intermediate shafts no. 30.

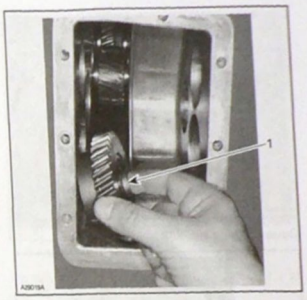
Skandic WT/SWT/SUV 550F and WT/SUV 600

Fasten a long M8 x 1.25 screw in axle end then drive it out, beginning with top one.

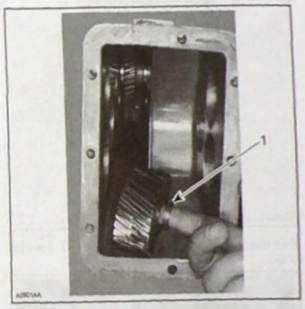


All Models

Remove intermediate gears no. 31 and no. 32 and spacers no. 33.



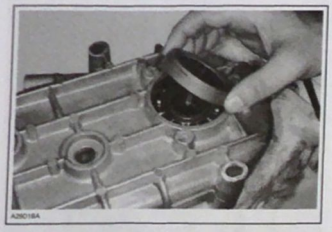
1. Spacer



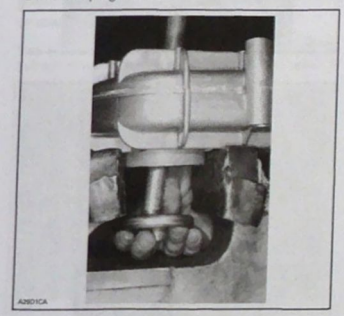
1. Spacer

Do not disassemble bearings of intermediate gears needlessly. To change these bearings, always use a press.

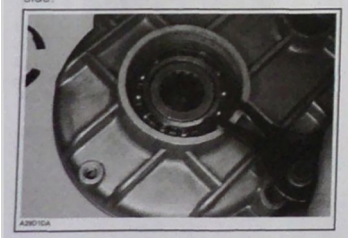
Pry out bottom seal no. 34 from gearbox housing.



Drive out plug **no. 35**.

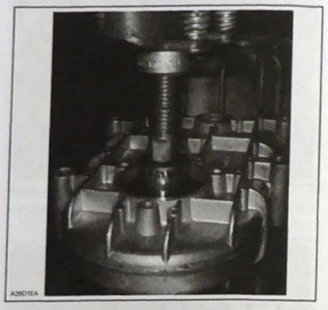


Remove circlip **no. 36** and shim **no. 37** from LH side.



Using a press, drive out lower shaft **no. 38** from RH side.

CAUTION: Do not push against inner bearing race.



Gearbox Inspection

Check bearing condition. There must be no discoloration, missing rollers or balls, broken cages, etc.

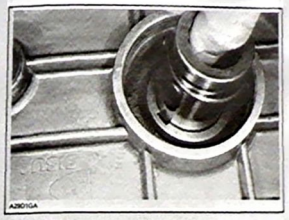
Check sprocket teeth.

Gearbox Assembly

Install lower gear **no. 39** with its shoulder facing RH side.



Install lower shaft **no. 38** with its hollow side (no splines) on RH side. Align key **no. 40** with lower gear keyway.



Apply ThermoLube synthetic grease (P/N 219 700 417) on intermediate shaft O-rings **no. 41**.

Install intermediate gears **no. 31** with their shoulder towards LH side. Position spacers **no. 33** as illustrated in removal procedure. Beveled side of spacers goes against gearbox wall.

Skandic WT/SWT/SUV 550F and WT/SUV 600

Install screws **no. 29** retaining intermediate gears.

Skandic SWT V800, Expedition TUV 600 HO SDI and TUV V800

Install bolts **no. 29** retaining intermediate gears with washer, locking washers and nuts. Tighten nut to 12 N•m (106 lbf•in) then back off the nut until the locking washer is loose. Retighten the nut until locking washer stops moving (very slight pressure on it). Turn gear, a slight drag should be felt.

Fold locking washer against a flat side of nut to lock the assembly.

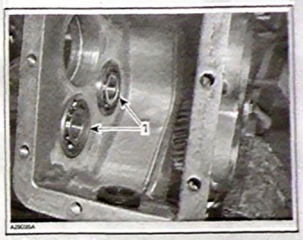
NOTE: Make sure the tab of locking washer is inserted in intermediate shaft hole.

All Models

Install new caps.

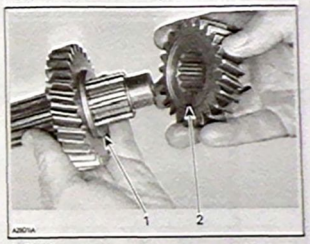
Install the appropriate premarked shims **no. 11**.

Using a pusher, install RH side bearing of brake and reverse shafts **no. 22** and **no. 28**.



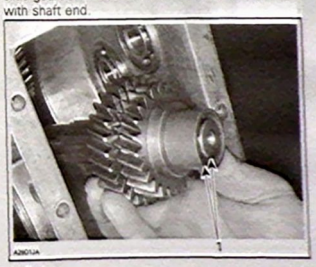
1. Bearings installed

Partially assemble brake shaft gears **no. 42** and **no. 43** with shoulder facing recess.



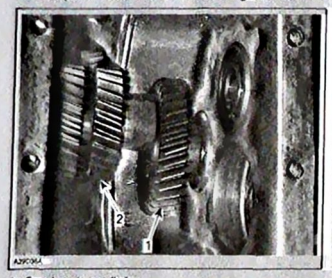
1. Shoulder
2. Recess

Install sleeve **no. 44** on brake shaft **no. 13** then, slide gears and sleeve until end of sleeve is flush with shaft end.



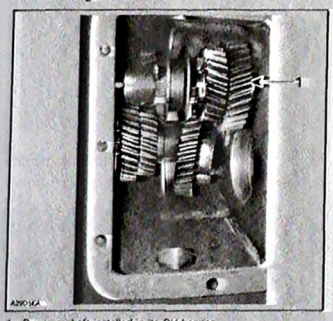
1. Flush

Install brake shaft into gearbox then, loosely install gear no. 45 with its shoulder facing bearing no. 28. Do not push brake shaft into bearing at this time.



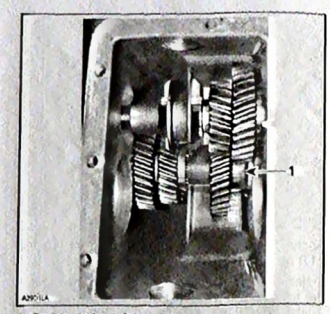
1. Gear loosely installed
2. Brake shaft assembly

Install reverse shaft assembly no. 17 into its RH side bearing no. 22.



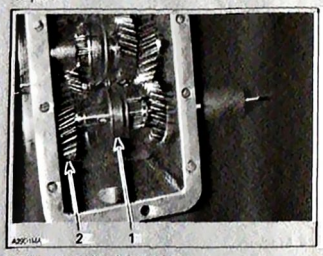
1. Reverse shaft installed in its RH bearing

Position gear no. 45 against RH side bearing no. 22 then, finalize brake shaft insertion.



1. Finalizing brake shaft insertion

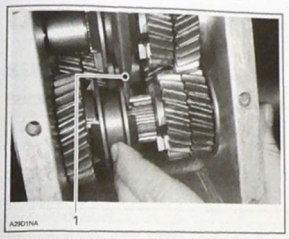
Install driven pulley shaft no. 16 with the sliding sleeve loosely inserted. Gear no. 23 must be at its place.



1. Sliding sleeve loosely inserted
2. Gear no. 23 in place

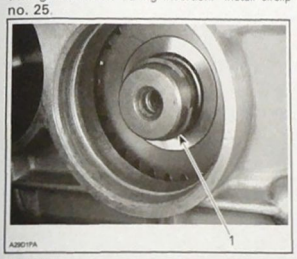
Install balls no. 26 and spring no. 27 into driven pulley shaft.

NOTE: If necessary, partly install bearing in gearbox to ease installation of balls and spring.



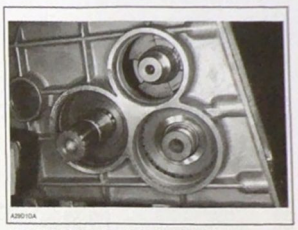
1. Push on ball with a screwdriver then move sliding sleeve to the right

Finalize driven pulley shaft insertion. Make sure that gears mesh during insertion. Install circlip **no. 25**.



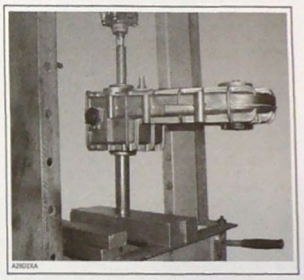
1. Circlip

Install RH side bearings **no. 46**, **no. 22** and **no. 28**, shims **no. 11**, circlip **no. 10** then, plugs **no. 7** and oil seal **no. 8**.



READY TO INSTALL BEARINGS, SHIMS, CIRCLIPS, OIL SEAL AND PLUGS

CAUTION: Make sure that gearbox is well supported before inserting driven pulley shaft bearing, see photo.



Gearbox Installation

Reverse removal procedure. However pay attention to the following.

Make sure drain plug is installed.

Fill gearbox. Refer to *FILLING PROCEDURE*.

Check pulley alignment.

DRIVE AXLE

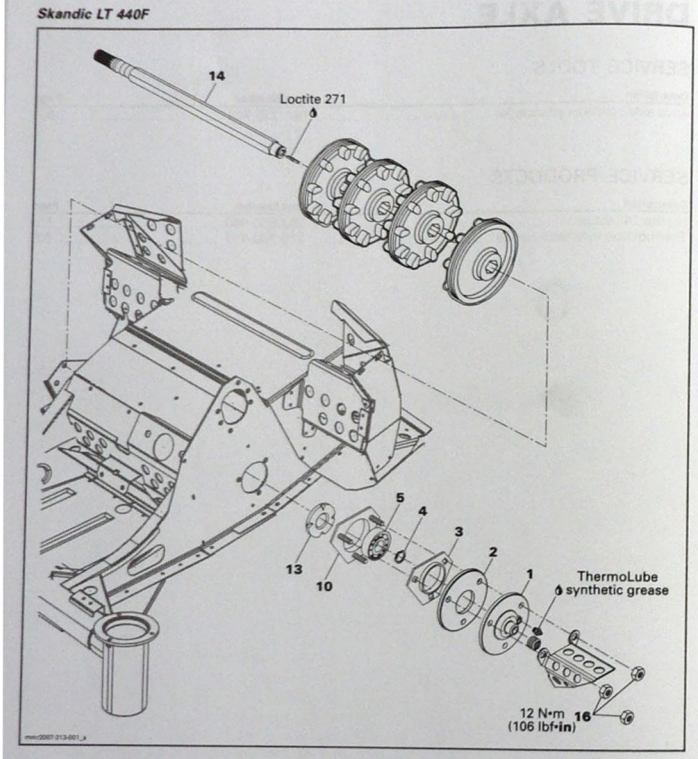
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	631

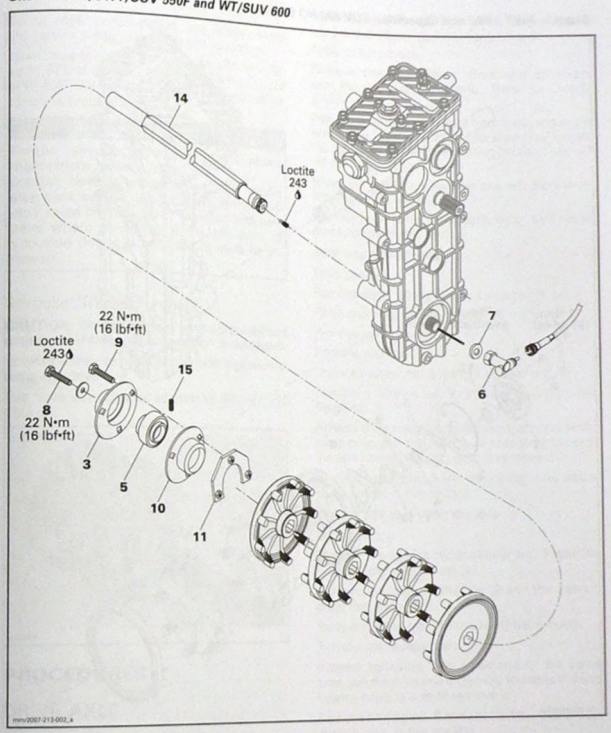
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	632
ThermoLube synthetic grease	219 700 417	632

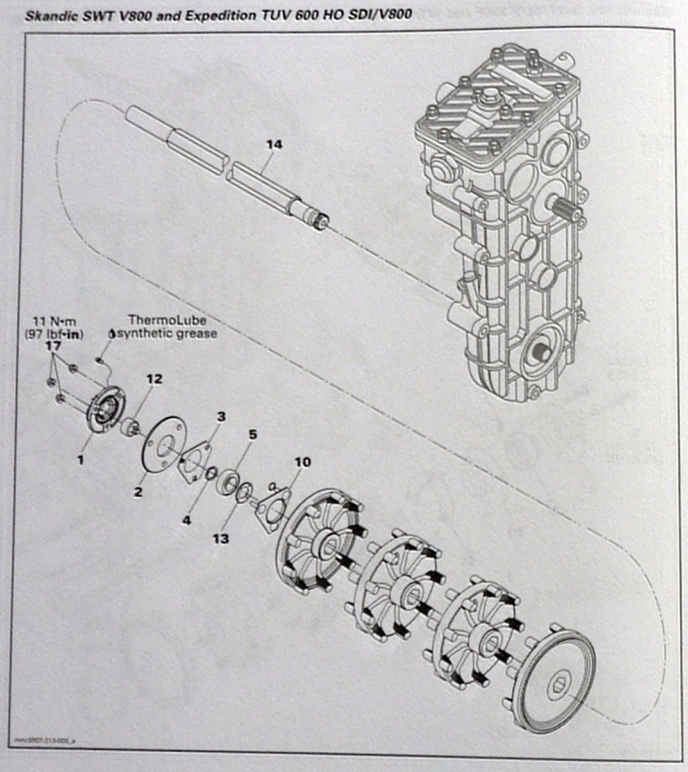
Skandic LT 440F



Skandic WT/SWT/SUV 550F and WT/SUV 600



Skandic SWT V800 and Expedition TUV 600 HO SDI/V800



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Sprocket/Track Alignment

CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets may be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



PROCEDURES

DRIVE AXLE

Drive Axle Removal

440F Models

Drain oil from chaincase.

Raise and block rear of vehicle off the ground.

Remove rear suspension.

Remove driven pulley.

Remove plastic cover **no. 1**, the large washer **no. 2** and the bearing outer flange **no. 3**.

Apply parking brake.

Remove chaincase cover, chain and sprockets then the circlip on drive axle. Refer to *CHAINCASE*.

Release drive axle sprockets from track and at the same time, push the drive axle assembly toward the right side. Drive axle bearing in chaincase will fall off.

Move the drive axle towards the left side to remove it from vehicle.

Remove bearing **no. 5** and sprockets. See procedures further in this section.

550F and 600 Models

Drain gearbox.

Remove angle drive **no. 6** and square pin **no. 7**.

Raise and block rear of vehicle off the ground.

Remove rear suspension.

Remove muffler.

Unfasten screw **no. 8** from drive axle end.

Remove 3 screws **no. 9** retaining bearing outer flange **no. 3**.

Release drive axle sprockets from track and at the same time, pull the drive axle assembly towards the end bearing housing side to remove it.

Remove bearing **no. 5** and sprockets. See procedures further in this section.

600 HO SDI and V800 Models

Drain gearbox.

Remove the speedometer sensor **no. 1** and the speedometer adaptor **no. 12**.

Remove the large washer **no. 2** and the bearing outer flange **no. 3**.

Raise and block rear of vehicle off the ground.

Remove rear suspension.

Release sprockets from track and at the same time, pull the drive axle assembly towards the end bearing housing side to remove it.

Remove bearing **no. 5** and sprockets. See procedures further in this section.

Drive Axle Inspection

Check drive axle **no. 14** for bending, wear or other damages. Replace as required.

Check if bearings turn smoothly and freely. Replace if necessary.

Drive Axle Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

440F Models

The drive axle bearing in chaincase must have its seal facing cover.

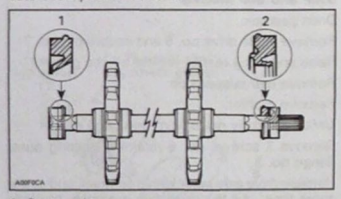
Fill chaincase or gearbox with recommended oil.

Install all other removed parts.

Torque plastic cover nuts **no. 16** to 12 N•m (106 lbf•**in**).

550F, 600, 600 HO SDI and V800 Models

When installing drive axle, always position a new seal on each end of drive axle (if applicable). Locate seal lip as illustrated.



1. Grease seal type
2. Oil seal type

On models with a speedometer, index speedometer magnetic adapter **no. 12** in drive axle and push it until it is completely inserted in its hole.

Install all other removed parts.

550F and 600 Models

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of screw **no. 8**.

Torque bearing flange bolts **no. 9** and screw **no. 8** to 22 N•m (16 lbf•ft).

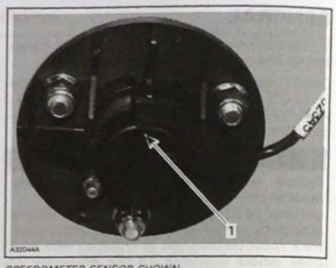
600 HO SDI and V800 Models

Torque plastic cover nuts **no. 17** to 11 N•m (97 lbf•**in**).

Drive Axle Lubrication

440F and V800 Models

Lubricate the end housing bearing with ThermoLube synthetic grease (P/N 219 700 417). Continue lubricating until grease flows out of the pilot hole on speedometer sensor or plastic cover.



SPEEDOMETER SENSOR SHOWN
1. Lubricate until grease flows out here

DRIVE AXLE BEARING

Drive Axle Bearing Inspection

Before removing the drive axle bearing **no. 5** from drive axle **no. 14**, check if it turns smoothly and freely. Replace if necessary.

Drive Axle Bearing Removal

Remove drive axle from vehicle.

550F and 600 Models

Unlock bearing by unscrewing the Allen set screw **no. 15**.

Using a suitable puller, remove the drive axle bearing **no. 5**, the bearing inner flange **no. 10** and the inner plate **no. 11**.

440F, 600 HO SDI and V800 Models

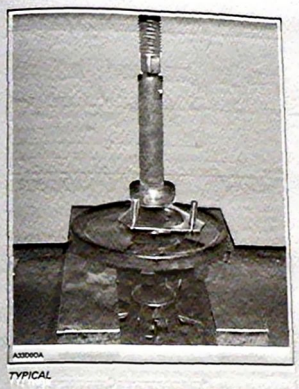
Remove circlip **no. 4**.

Using a suitable puller, remove the drive axle bearing **no. 5**, the bearing inner flange **no. 10** and the bearing protector **no. 13**.

Drive Axle Bearing Installation

Install bearing protector **no. 13** or inner plate **no. 11** and the bearing inner flange **no. 10** on drive axle. Install bearing protector so that its flat side is against bearing.

Using a press and a suitable pipe, push the bearing. Always push bearing by inner race. Push bearing until it leans on its protector.



TYPICAL

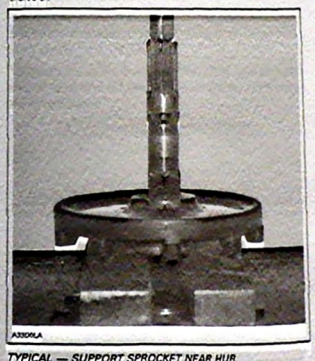
Install drive axle and all other removed parts.

SPROCKETS

Sprocket Removal

Remove drive axle from vehicle.

To remove press fit sprockets, use a press as illustrated.



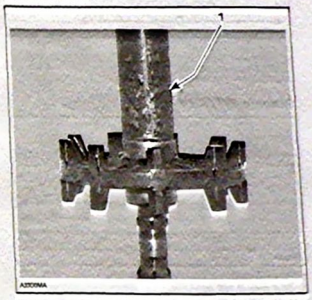
TYPICAL — SUPPORT SPROCKET NEAR HUB

Sprocket Installation

CAUTION: The same sprocket must not be pressed twice on the axle.

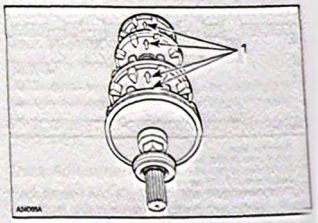
To assemble press fit sprockets, use a press and a suitable pipe as illustrated.

CAUTION: Never allow sprockets to contact the press plates and never support sprockets with blocks. Always press on center hub with appropriate pipe.



TYPICAL
1. Pipe

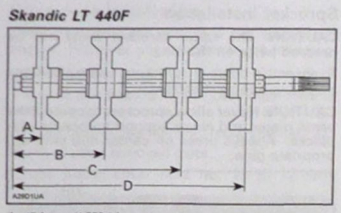
Ensure to align indexing marks of each sprocket when assembling.



TYPICAL
1. Indexing marks aligned

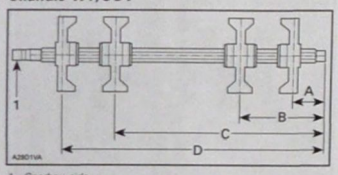
Sprockets must be assembled according to th following dimensions measured from drive ax end.

Skandic LT 440F



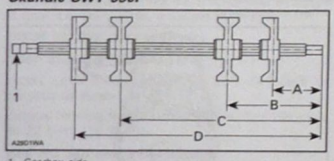
A. 47.0 mm (1.850 in)
B. 148.0 mm (5.827 in)
C. 271.0 mm (10.669 in)
D. 372.0 mm (14.646 in)

Skandic WT/SUV



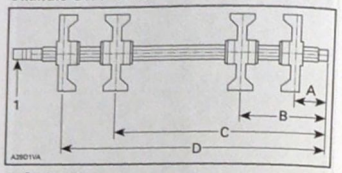
1. Gearbox side
A. 55.0 mm (2.165 in)
B. 157.0 mm (6.181 in)
C. 399.0 mm (15.709 in)
D. 501.0 mm (19.724 in)

Skandic SWT 550F



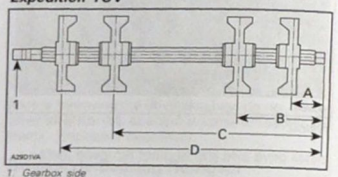
1. Gearbox side
A. 105.0 mm (4.016 in)
B. 207.0 mm (8.150 in)
C. 449.0 mm (17.677 in)
D. 551.0 mm (21.693 in)

Skandic SWT V800



1. Gearbox side
A. 96.0 mm (3.780 in)
B. 198.0 mm (7.795 in)
C. 440.0 mm (17.323 in)
D. 542.0 mm (21.339 in)

Expedition TUV



1. Gearbox side
A. 46.0 mm (1.811 in)
B. 148.0 mm (5.827 in)
C. 390.0 mm (15.354 in)
D. 492.0 mm (19.370 in)

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	636
cleat installer	529 036 044	635

TRACK

Track Inspection

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones.

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

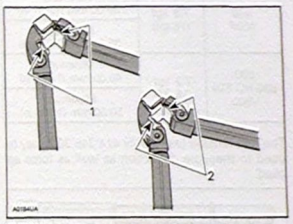
Track Cleat Replacement

Raise rear of vehicle off the ground and lift snow guard then hand rotate track to expose a cleat to be replaced.

Remove the defective cleat.

Place new cleat in position on the track and using the cleat installer (P/N 529 036 044) bend cleat then push tabs into rubber.

Re-open installer, then position cleat tabs on open end of tool and squeeze tabs until they are indented in rubber.



TYPICAL
1. Position cleat
2. Push tabs into rubber

Track Removal

Remove the following parts:
- rear suspension (refer to *SUSPENSION*)
- drive axle (refer to *DRIVE AXLE*)
- track.

Track Installation

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Check sprocket/track alignment as described in *DRIVE AXLE*.

Track Adjustment

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Track Tension

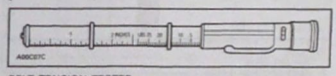
NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

Lift snowmobile by a rope, chain or lift strap hooked to rear bumper.

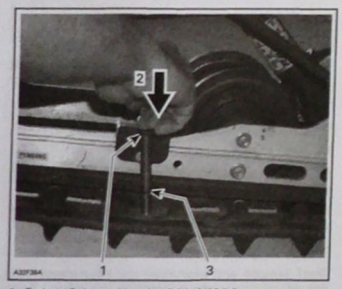
Allow the rear suspension to fully extend and check gap halfway between front and rear idler wheels. Measure between slider shoe bottom and inside of track. The gap should be as given in the following table. If the track tension is too loose, track will have a tendency to thump.

TRACK ADJUSTMENT		
MODELS	FORCE	DEFLECTION
440 550F	7.3 kgf (16 lbf)	Minimum 30.00 mm (1.181 in)
		Maximum 35.00 mm (1.378 in)
600 600 HO SDI V800	7.3 kgf (16 lbf)	Minimum 40.00 mm (1.575 in)
		Maximum 50.00 mm (1.969 in)

The belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

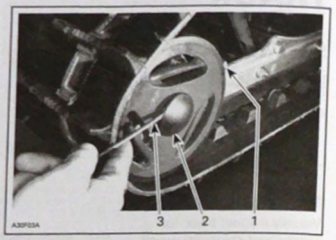


1. Tool top O-ring positioned at 7.3 kgf (16 lbf)
2. Apply pressure on tool until it contacts the upper O-ring
3. Measured track deflection

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To adjust tension, do the following:

– Remove wheel caps.
– Loosen the rear idler wheel retaining screws.
– Turn adjustment screws to adjust.



TYPICAL
1. Adjustment screw
2. Retaining screw
3. Wheel cap removal

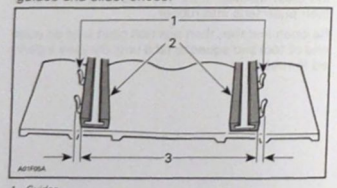
Track Alignment

⚠ WARNING

Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

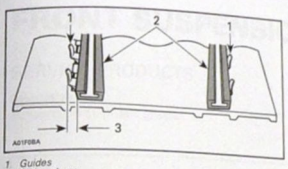
Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (1 to 2 minutes).

Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. Guides
2. Slider shoes
3. Equal distance

To correct, stop engine, loosen rear wheel screws, then tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.



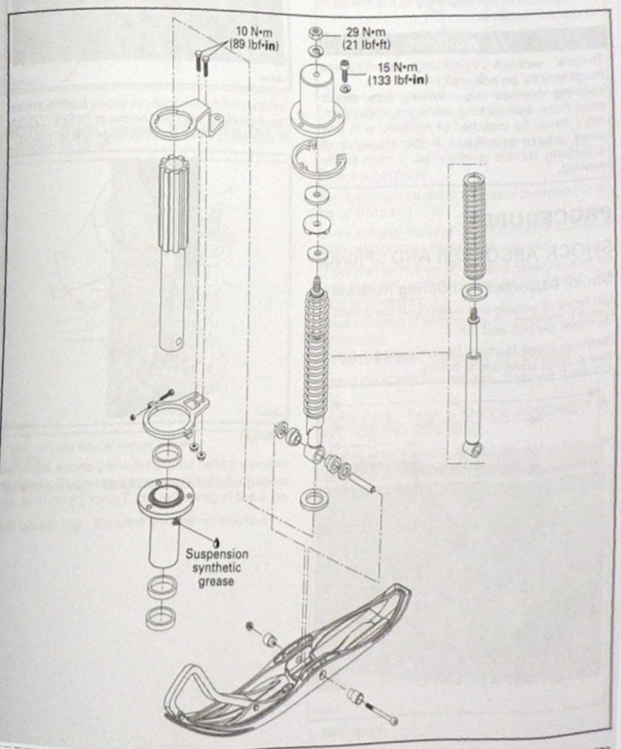
1. Guides
2. Slider shoes
3. Tighten on this side

Restart engine, rotate track slowly and recheck alignment. If the satisfactory alignment is achieved, then tighten the idler wheel retaining screws to 48 N•m (35 lbf•ft). Reinstall the wheel caps.

FRONT SUSPENSION (LT/WT/SWT)

SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	641



GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise noted.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

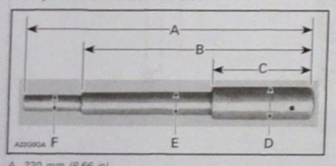
SHOCK ABSORBER AND SPRING

Shock Absorber and Spring Removal

Lift front of vehicle and support off the ground.

Remove ski bolt and nut.

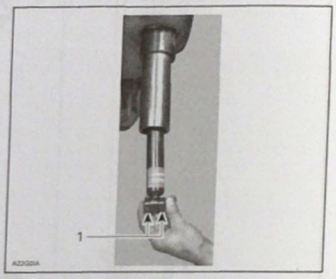
Remove steel bushing from ski using a pusher. See pusher dimensions below.



A. 220 mm (8.66 in)
B. 180 mm (7.09 in)
C. 70 mm (2.75 in)
D. 25 mm (1.0 in)
E. 15 mm (0.59 in)
F. 9 mm (0.35 in)

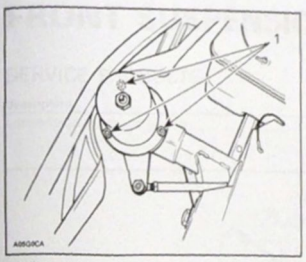


Unfasten rod nut then pull out shock from bottom. Check shock as described below in *INSPECTION*. At installation, make sure bushings are in place.



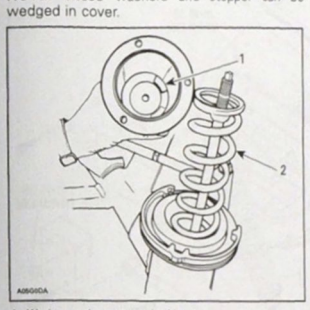
1. Bushings

Unscrew 3 Allen screws retaining shock absorber cover **no. 3**, then remove stopper **no. 5**, washers **no. 6** and large washer **no. 7**.



1. Allen screws

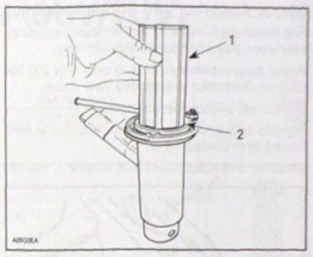
NOTE: These washers and stopper can be wedged in cover.



1. Washers and stopper wedged in cover
2. Spring

Pull out spring then check shock as described below in *INSPECTION*.

Pull up ski leg. Steering arm will not interfere.



1. Pull up ski leg
2. Steering arm in place

Remove seal. Drive out bushing if worn out.

Part Inspection

Remove cover and check for free movement of ski leg by lifting end of ski.

Check straightness of ski leg. Check for scored or scratched surface. Replace as required.

Check that splines on ski leg and steering arm interlock properly without excessive free play. Replace as necessary.

Check condition of stopper **no. 5**. Replace it when deteriorated.

Ensure that grease fittings are not clogged.

Inspect the spring for damage. Replace if necessary.

Inspect shock. Refer to *SHOCK ABSORBER INSPECTION AND SERVICING*.

Reinstall steering arm reinforcement when removed.



1. Reinforcement

Shock Absorber and Spring Installation

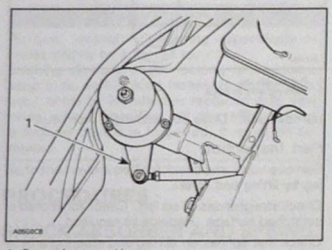
For installation, reverse the removal procedures. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) as illustrated in exploded view above.

Install seal before reinstalling ski leg.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Steering arm notch must face outside of vehicle.

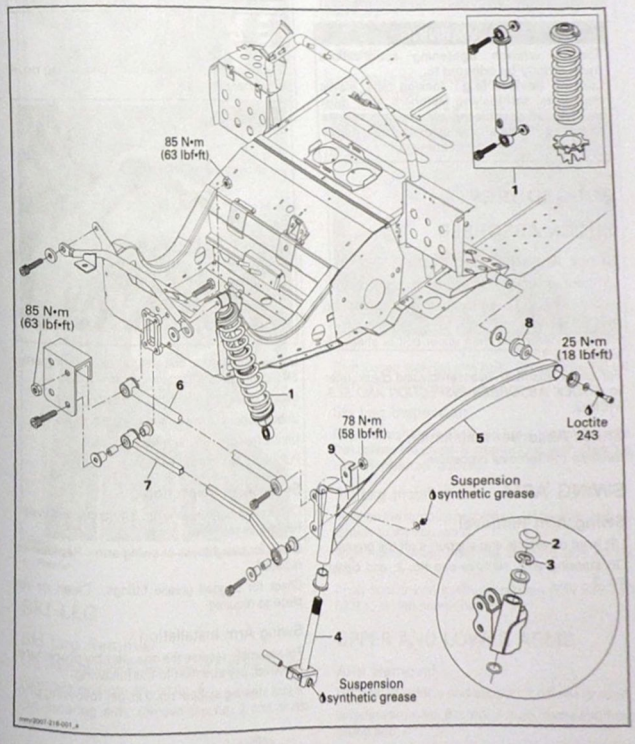


1. Recess facing outside

FRONT SUSPENSION (SUV/TUV)

SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	645



GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise noted.

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

SHOCK ABSORBER

Shock Absorber Removal

Lift front of vehicle and support it off the ground.

Reduce spring preload by turning adjusting ring accordingly.

Remove lower bolt then upper bolt of shock absorber **no. 1**.

For shock absorber disassembly and check, refer to *SHOCK ABSORBER INSPECTION AND SERVICING*.

Shock Absorber Installation

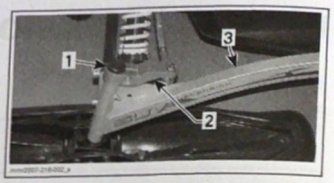
Reverse the removal procedure.

SWING ARM

Swing Arm Removal

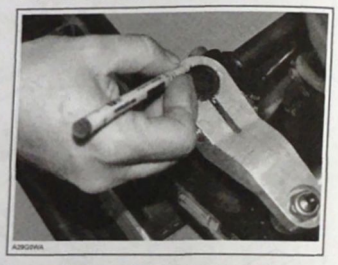
Lift front of vehicle and support it off the ground.

On steering arm, remove cap **no. 2**, and circlip **no. 3**.



1. Cap
2. Steering arm
3. Swing arm

Scribe marks on the steering arm and ski leg **no. 4** before disassembly.



Loosen steering arm bolt and pull up steering arm. Ski leg may fall off from swing arm **no. 5**.

Unbolt lower end of shock from swing arm.

Unbolt upper and lower arms **no. 6** and **no. 7**.

Unbolt rear of swing arm from frame.

Pull swing arm off the vehicle.

Swing Arm Inspection

Check all rubber cushions **no. 8** for crack and wear. Replace as required.

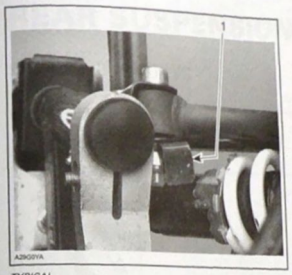
Check for straightness of swing arm. Replace as required.

Check for clogged grease fittings. Clean or replace as required.

Swing Arm Installation

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Install steering stopper **no. 9** as per following photo.

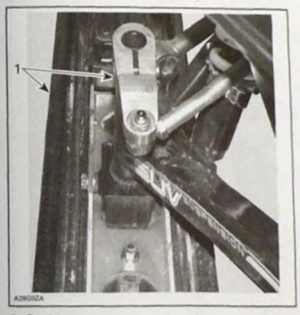


TYPICAL
1. Steering stopper

Longer bolts for shock and swing arm go on upper attachments.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Steering arm must be installed parallel to ski.



1. Parallel

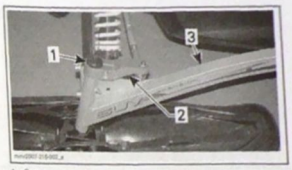
SKI LEG

Ski Leg Removal

Lift front of vehicle and support it off the ground.

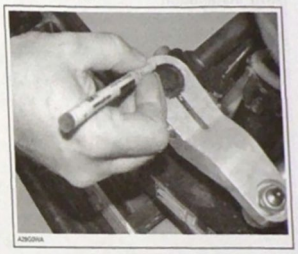
Remove ski from ski leg **no. 4**.

On steering arm, remove cap **no. 2** and circlip **no. 3**.



1. Cap
2. Steering arm
3. Swing arm

Scribe marks on the steering arm and ski leg before disassembly.



Then loosen steering arm bolt. Ski leg may fall off from swing arm **no. 5**.

Ski Leg Inspection

Check straightness of ski leg **no. 4** and make sure that splines are properly interlocking with steering arm. Replace as required.

Ski Leg Installation

Reverse the removal procedure. However, pay attention to the following.

Align marks when inserting steering arm on ski leg.

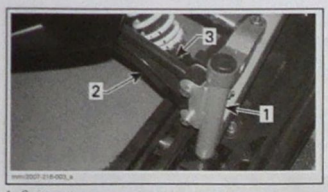
Apply suspension synthetic grease (P/N 293 550 033) to ski leg components.

UPPER AND LOWER ARMS

Arm Removal

Lift front of vehicle and support it off the ground.

Unscrew arms **no. 6** or **no. 7** from frame and from swing arm.



1. Swing arm
2. Lower arm
3. Upper arm

Arm Installation

Position arms and tie rods horizontally before tightening nuts.

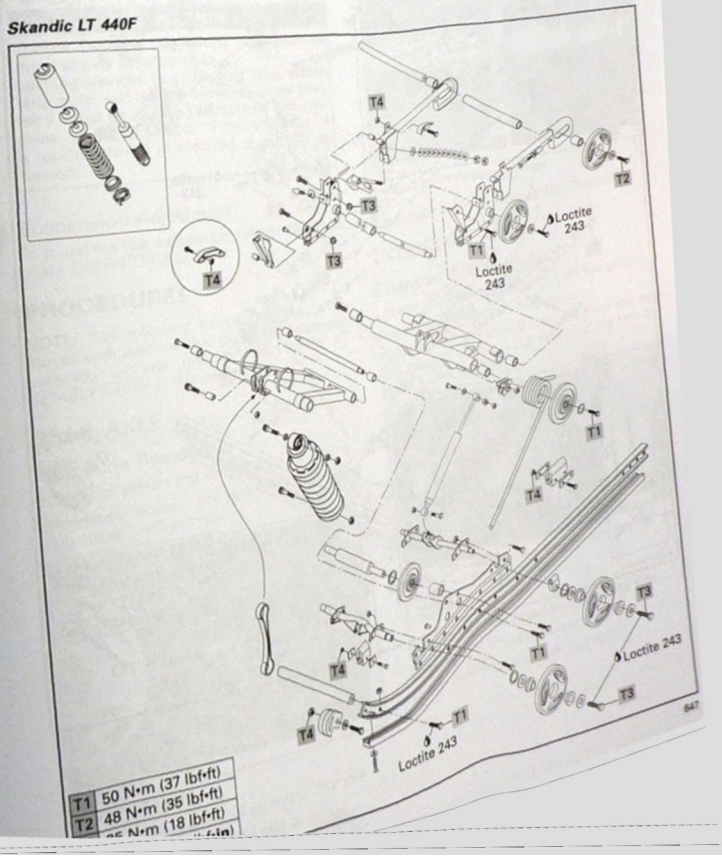
Bent portion of lower arm **no. 7** must face down.

REAR SUSPENSION (LT/WT/SWT)

SERVICE PRODUCTS

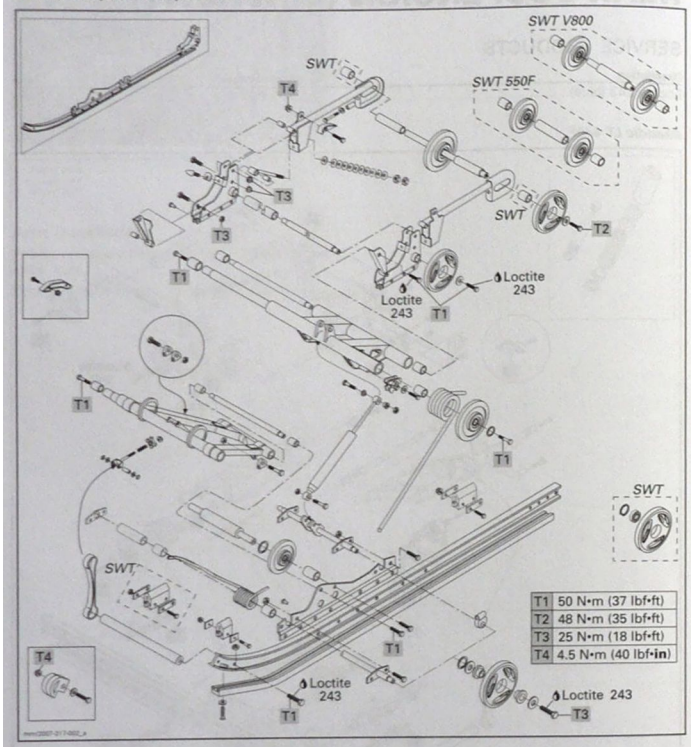
Description	Part Number	Page
Loctite 243 (blue)	293 800 060	654

Skandic LT 440F



T1	50 N•m (37 lbf•ft)
T2	48 N•m (35 lbf•ft)
	25 N•m (18 lbf•ft)

Skandic WT/SWT 550F, WT 600 and SWT V800



GENERAL

During assembly/installation, use torque values and service products as in the exploded view(s).

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Suspension Adjustment

To adjust the rear suspension, refer to the appropriate *OPERATOR'S GUIDE*.

PROCEDURES

NOTE: The following components can be removed with suspension in place. For suspension assembly removal, refer to *SUSPENSION ASSEMBLY* further in this section.

REAR AXLE

Rear Axle Removal

Lift rear of vehicle and support it off the ground.

Completely loosen track tension by unscrewing both adjustment screws.



1. Adjustment screws

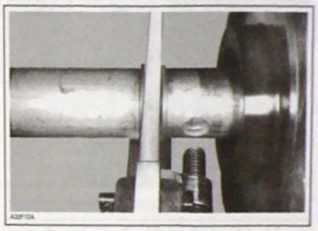
Remove rear idler wheel screws on rear axle.

Pull out rear axle from RH side of vehicle.

Rear Axle Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

Hole of outer bushing must face adjustment screw.



TYPICAL — OUTER BUSHING POSITION

Adjust track tension. Refer to *TRACK* section.

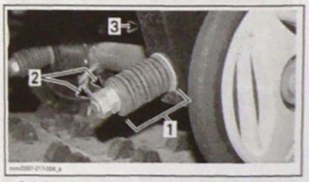
EXTENSION ARM

Extension Arm Removal

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to rear support.

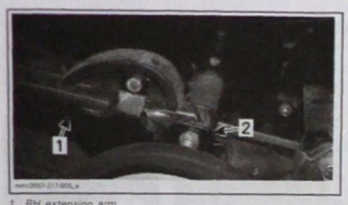


1. Conical washers
2. Nuts
3. Rear support

Remove rear idler wheel on appropriate side.

Remove idler wheel from rear support.

Unbolt extension arm from its support.

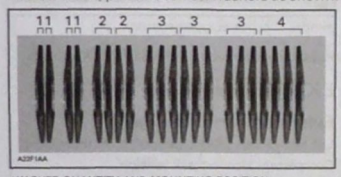


1. RH extension arm
2. Rear support

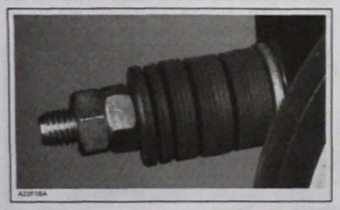
Extension Arm Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

At installation, position conical washers as shown.



WASHER QUANTITY AND MOUNTING POSITION



Tighten nut 3/4 turn after contacting washers for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

Horse-Shoe Washer

For deep snow riding, do not install washer.

For trail riding with passenger and/or weight, install 1 washer under each rubber stoppers.

For trail riding with heavy load and/or pulling a load, use 2 washers under each rubber stoppers.

REAR SHOCK ABSORBER

Rear Shock Absorber Removal

Lift rear of vehicle and support it off the ground.

Remove shock upper and lower bolt and nut.

NOTE: If necessary, to ease shock removal, release stopper strap tension to release shock pressure.

Remove rear shock absorber.

Rear Shock Absorber Inspection

Refer to *SHOCK ABSORBER INSPECTION AND SERVICING*.

Rear Shock Absorber Installation

Installation is the reverse of removal procedure.

REAR SPRING

Rear Spring Removal

Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.

Unbolt rear arm top axle from chassis.

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



TYPICAL — REMOVE SPRING SUPPORTS

Loosen set screw from locking rings.

Remove the following on both sides:
- locking ring

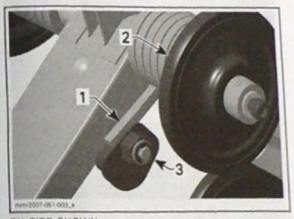
– top idler wheel
– spring.

Rear Spring Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

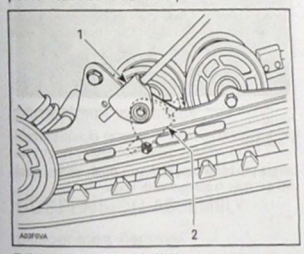
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



RH SIDE SHOWN
1. Spring end
2. Top idler wheel
3. Cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.



TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

REAR ARM

Rear Arm Removal

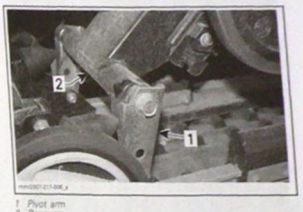
Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

Remove upper bolt securing shock absorber to rear arm.

Remove rear springs.

Remove bolts holding rear arm to pivot arms.



1. Pivot arm
2. Rear arm

Remove the rear arm.

Rear Arm Installation

Installation is reverse of removal procedure.

FRONT SHOCK ABSORBER

Skandic LT 440F

Front Shock Absorber Removal

Lift rear of vehicle and support it off the ground.

Remove upper and lower bolts securing shock absorber.

Remove shock absorber from vehicle.

Front Shock Absorber Inspection

Refer to *SHOCK ABSORBER INSPECTION AND SERVICING*.

Front Shock Absorber Installation

The installation is the reverse of the removal procedure.

FRONT SPRING

WT/SWT 550F, WT 600 and SWT V800

Front Spring Removal

Holding spring end, remove bolt of the top spring support then the bottom support bolt.

Unbolt front idler wheel axle.

Remove idler wheel on side where axle retaining plate is not welded.

Pull axle and remove springs.

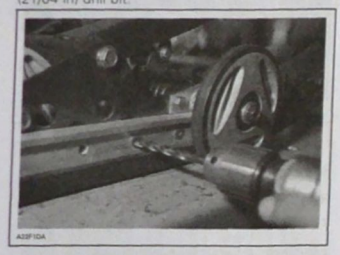
Front Spring Installation

Reverse the removal procedure.

SUPPORT PLATE

Support Plate Replacement

Drill rivets to remove support plate. Use a 8 mm (21/64 in) drill bit.



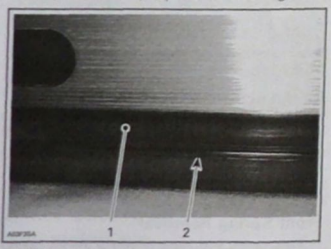
A22F1DA

Rivets can be substituted by M8 x 20 bolts and nuts.

SLIDER SHOE

Slider Shoe Inspection

Replace slider shoes when the wear reach 1 - 2 mm (.040 - .079 in) beyond the moulding line.



A03F35A

TYPICAL
1. Slider shoe
2. Wear limit

CAUTION: Slider shoes must always be replaced in pairs.

Slider Shoe Removal

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

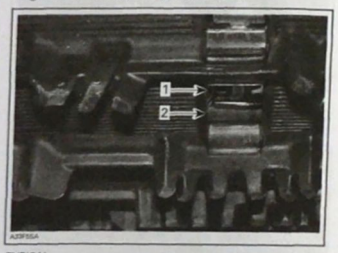
Remove front runners nut and screw.



A33F59A

TYPICAL — REMOVE NUT AND SCREW

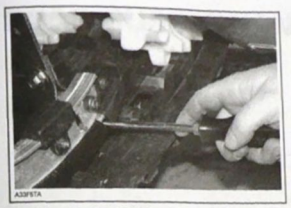
Align track window with slider shoe.



A33F55A

TYPICAL
1. Track window
2. Slider shoe

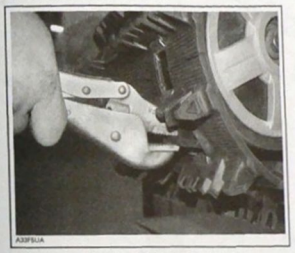
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.


A33F9TA

TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe through track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.


A33F9UA

TYPICAL — PULL ON SLIDER SHOE TO REMOVE

Slider Shoe Installation

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

SUSPENSION ASSEMBLY

Suspension Removal

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

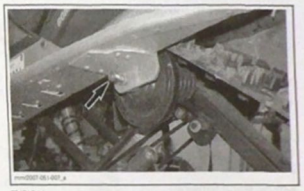
Remove both track stoppers.



1. LH track stopper
2. Front arm

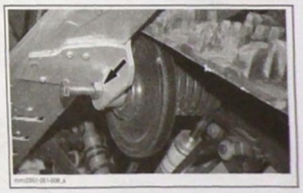
Remove rear arm top axle bolts from chassis, using the following procedure.

- Unscrew one of the socket screws securing the rear arm top axle to frame.



TYPICAL

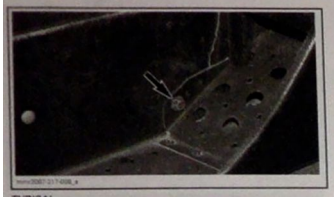
- Replace this socket screw with an hexagonal bolt (longer than socket screw) and a nut.
- Screw the hexagonal bolt completely and lock it with the nut.



TYPICAL

- Unscrew the socket screw on the other side then unlock nut and remove the hexagonal bolt.

Remove bolts retaining front arm to tunnel.



TYPICAL

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.

Suspension Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to *TRACK*.

Install suspension into track with front portion first.

Use a tie-down between front arm and spring axle to ease installation of front arm screws.

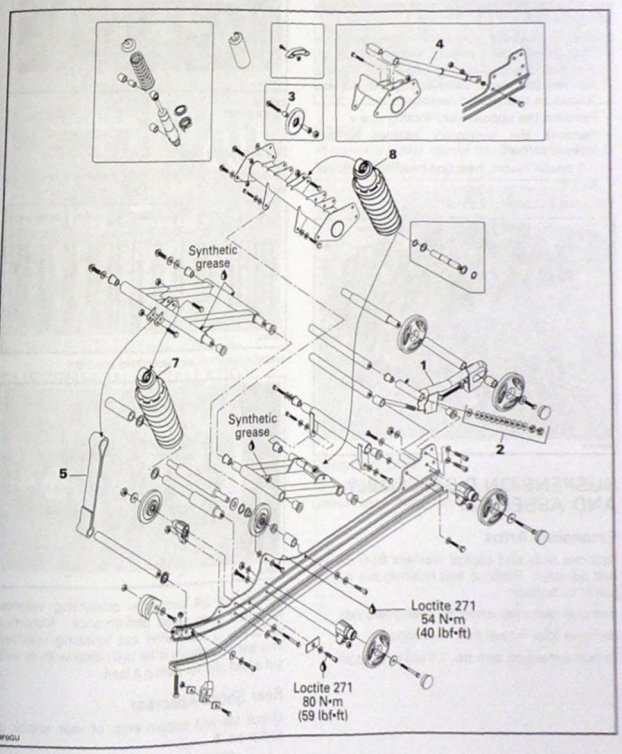
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of socket screws and torque them to 85 N•m (63 lbf•ft).

Adjust track tension.

REAR SUSPENSION (SUV/TUV)

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	658



SUSPENSION REMOVAL

Release track tension.

Lift rear of vehicle and support it off the ground.

Unbolt front arm then rear arm.

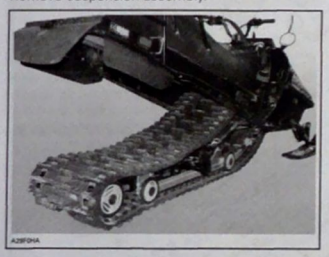
Self-Locking Screws

CAUTION: These self-locking screws must always be replaced by new ones every time they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

- Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
- Remove the opposite self-locking screw.
- Remove the temporary installed non-self-locking screw.
- If it doesn't work, heat bolt head to melt threadlocker.

Remove suspension assembly.



SUSPENSION DISASSEMBLY AND ASSEMBLY

Extension Arms

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to support.

Remove rear idler wheel on appropriate side.

Remove idler wheel from rear support.

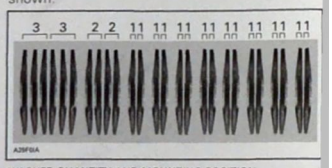
Unbolt extension arm **no. 1** from its support.



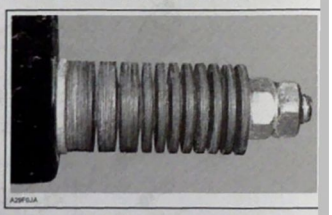
TYPICAL
1. Rear support

Conical Washer

At installation, position conical washers **no. 2** as shown.



WASHER QUANTITY AND MOUNTING POSITION



Tighten nut 3/4 turn after contacting washer for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

Rear Shock Absorber

Unbolt top and bottom ends of rear shock absorber **no. 8**.

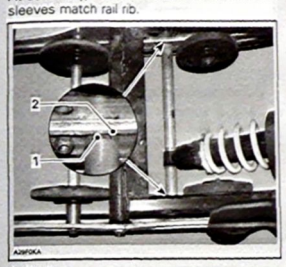
To inspect shock absorber, refer to *SHOCK ABSORBER INSPECTION AND SERVICING*

Front Shock Absorber

Unbolt top end of front shock absorber **no. 7**.

Unbolt axle retaining bottom end of shock absorber.

At assembly, make sure that notch on both axle sleeves match rail rib.



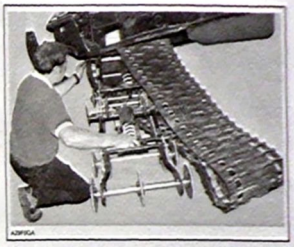
1. Notch
2. Rail rib

To disassemble shock absorber and spring and to proceed with inspection, refer to *SHOCK ABSORBER INSPECTION AND SERVICING*.

SUSPENSION INSTALLATION

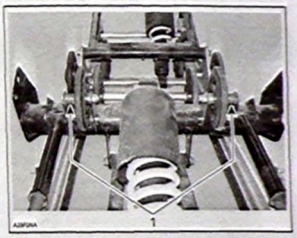
Threaded holes must be cleaned before a self-locking screw is installed. Use a metal brush or a screwtap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

Install front portion of suspension first.



Spacer

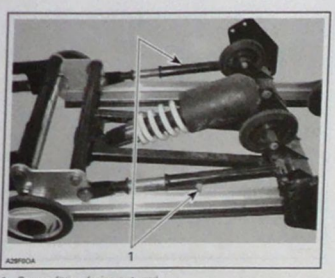
At assembly, install spacer **no. 3** on outer side of top idler wheel.



1. Spacers

Coupling Tube

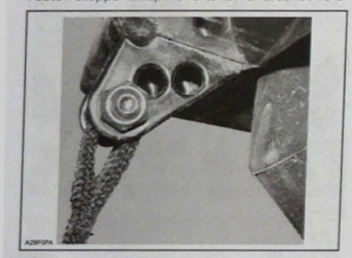
At assembly, install coupling tube **no. 4** with its grease fitting facing outward.



1. Grease fitting facing outward

Stopper Strap

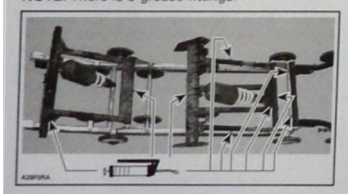
Fasten stopper strap **no. 5** to lower bracket hole.



SUSPENSION LUBRICATION

Lubricate front and rear arms at grease fittings using synthetic grease (P/N 413 711 500).

NOTE: There is 9 grease fittings.



SHOCK ABSORBER INSPECTION AND SERVICING

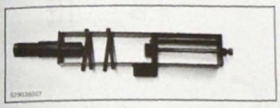
SERVICE TOOLS

Description	Part Number	Page
spring compressor tool	529 036 007	659

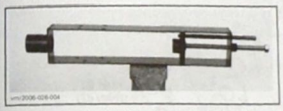
SHOCK ABSORBER

Shock Absorber/Spring Disassembly

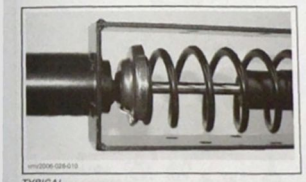
To remove spring from the shock absorber, use the spring compressor tool (P/N 529 036 007).



Place the tool in a vise.



Position the shock absorber in the tool and install the spring compressor pins.



TYPICAL

Tighten the spring tool screw until the spring is sufficiently compressed to remove spring locking devices.

Remove spring stopper then release the spring compressor tool screw.



TYPICAL

Remove spring. Inspect spring for damage.

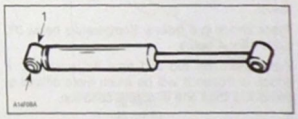
Remove shock absorber from tool.

Shock Absorber Inspection

Hydraulic Shock Absorber

Secure the shock body end in a vise with its rod upward.

CAUTION: Do not clamp directly on shock body.



1. Clamp

Examine shock for leaks. Extend and compress the piston at least 5 complete strokes with its rod upward.

After, check that shock moves smoothly and with uniform resistance over its entire stroke.

NOTE: For the first 5 complete strokes, it could be normal to note uneven resistance.

Check the following conditions that will denote a defective shock:

- a skip or a hang back when reversing stroke at mid travel
- seizing or binding condition except at extreme end of either stroke
- oil leakage
- a gurgling noise, after completing one full compression and extension strokes.

If suspecting a shock is freezing, proceed as follows:

Place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.

Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than one in normal condition.

Renew if any faults are present.

Gas Shock Absorber (HPG type)

Because of gas pressure, strong resistance is felt when compressing shock.

To inspect shock operation, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the compression stroke when the rod is fully extended.

Completely push down the shock rod then release.

The shock should extend unassisted. Rod must come out at a steady speed. If speed suddenly increases particularly at end of extension, replace shock.

If suspecting a shock is freezing, proceed as follows:

Place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.

Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than one in normal condition.

Shock Absorber/Spring Assembly

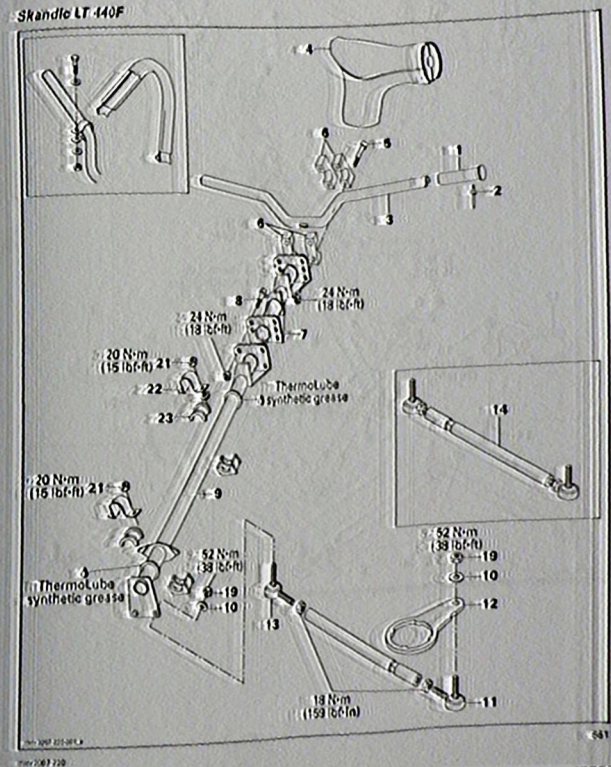
Refer to disassembly procedure.

STEERING AND HANDLEBAR

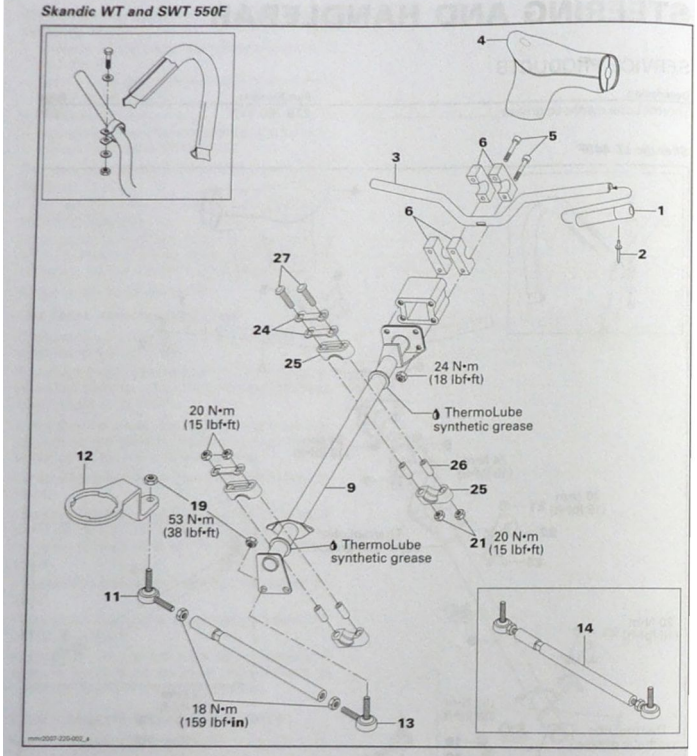
SERVICE PRODUCTS

Description	Part Number	Page
ThermoLube synthetic grease	219 700 417	6-70

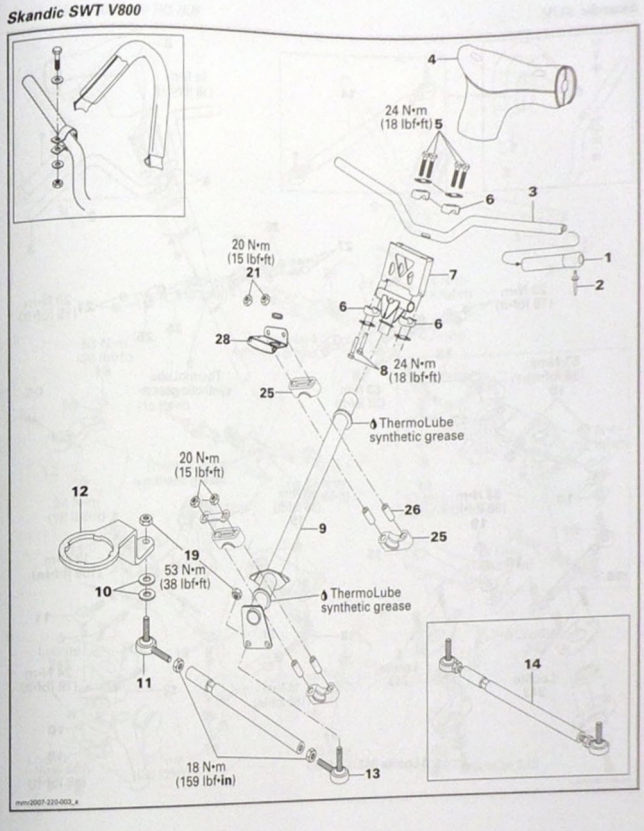
Skandic LT 440F



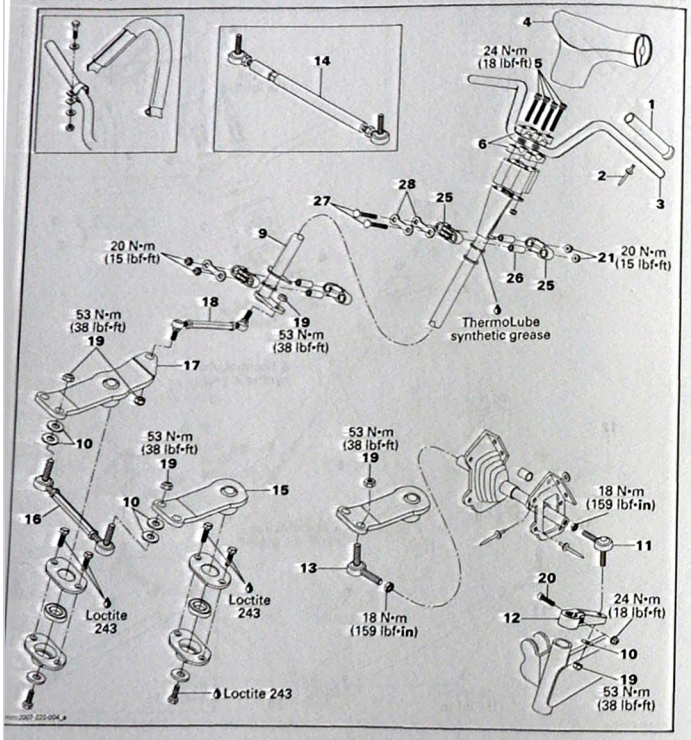
Skandic WT and SWT 550F



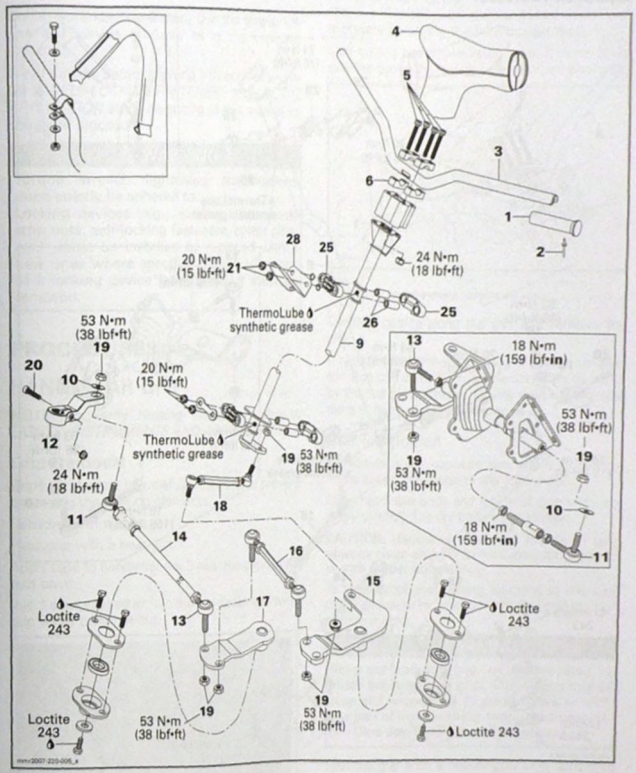
Skandic SWT V800



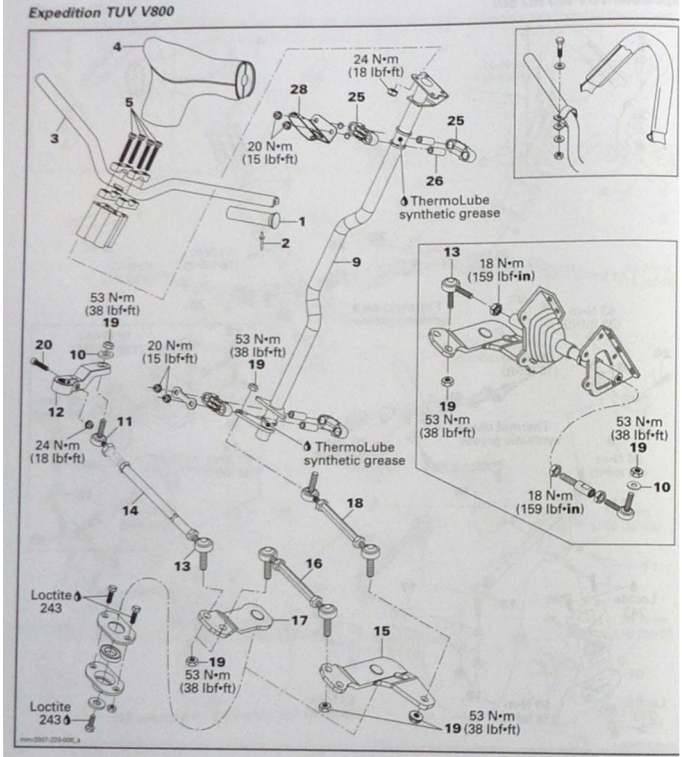
Skandic SUV


4
24 N•m (18 lbf•ft)
5
14
1
6
2
3
28
27
25
9
20 N•m (15 lbf•ft)
21
20 N•m (15 lbf•ft)
26
25
18
53 N•m (38 lbf•ft)
19
19
53 N•m (38 lbf•ft)
ThermoLube synthetic grease
17
10
53 N•m (38 lbf•ft)
19
53 N•m (38 lbf•ft)
19
18 N•m (159 lbf•in)
15
16
10
11
13
20
Loctite 243
Loctite 243
18 N•m (159 lbf•in)
24 N•m (18 lbf•ft)
12
10
19
53 N•m (38 lbf•ft)
Loctite 243

Expedition TUV 600 HO SDI



Expedition TUV V800



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with a new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

HANDLEBAR GRIP

NOTE: To verify heating elements, refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*.

Grip Removal

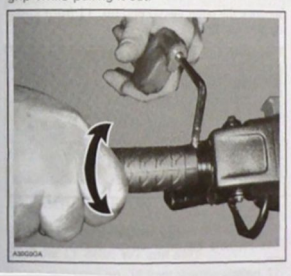
Grips **no. 1** must be carefully removed to prevent damaging the heating elements.

Remove rivet **no. 2**.

Heat grip with a heat gun.

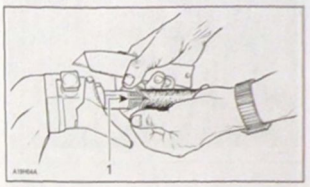
Apply tape to handlebar **no. 3** near the grip to protect paint.

Inject compressed air into the handlebar and twist grip while pulling it out.



The grips might not be removable as explained above; in this case, carefully proceed as follows to prevent damaging the heating elements.

Start cutting and immediately peel it open to locate the gap in the heating element, as shown.



TYPICAL
1. Gap in the heating element opposite the wires

Continue cutting along the gap and remove the grip.

If required, disconnect heating element connector. Remove wires from connector and pull wires by the end of handlebar. Slowly peel heating element from handlebar and remove it.

Grip Installation

Installation is the opposite procedure of the removal but pay attention to the following.

Clean handlebar ends and inside of grip with isopropyl alcohol. Let dry before installation.

CAUTION: Handlebar end and inside of grip must be clean and dry before installing grip to ensure proper adhesion.

To install, stick the heating element to the handlebar and route wires into handlebar and through handlebar hole.

⚠ WARNING

Never use lubricants (e.g. oil, grease, etc.) to install the handlebar grip. Only use a mix of soap and water. Mix 40 parts of water with one part of dish washing soap (recommended: Ultra Joy, Sunlight or Palmolive).

Heat the grip with a heater gun or a spot light to ease installation. Insert new grip with compressed air.



Install rivet **no. 2**.

HANDLEBAR

Handlebar Removal

NOTE: If the handlebar **no. 3** must be changed, remove all components (handlebar grip, throttle lever housing, etc.) before removing it from vehicle.

Remove steering padding **no. 4**.

Remove handlebar bolts **no. 5** and handlebar clamps **no. 6**. Cut locking ties retaining harness to handlebar.

Handlebar Inspection

Inspect the handlebar for damage, cracks or bending, replace if any of these problems is detected.

Check handlebar clamps **no. 6** for cracks or distortion, replace if necessary.

Handlebar Installation

The installation is the reverse of the removal procedure. However pay attention to the following.

Install all handlebar bolts **no. 5** before torquing them. Adjust the handlebar to the desired position. Torque to 24 N•m (18 lbf•ft).

HANDLEBAR EXTENSION

Skandic LT 440F and SWT V800

Handlebar Extension Removal

Remove handlebar **no. 3** from handlebar extension **no. 7**.

Unscrew bolts **no. 8** retaining the extension to steering column **no. 9**.

Remove handlebar extension from vehicle.

Handlebar Extension Inspection

Check handlebar extension for cracks, bend o other damages. Replace defective parts.

⚠ WARNING

Do not try to repair a defective handlebar extension.

Handlebar Extension Installation

The installation is the reverse of the removal procedure.

TIE-ROD

NOTE: Use same procedure for RH and LH side.

Tie-Rod Inspection

Check tie-rod ends for looseness. If play is excessive, replace tie-rod.

Check if the tie-rod is bent, cracked or otherwise damaged. Replace if necessary.

Tie-Rod Removal

NOTE: When removing a tie-rod, note its position. Check the location and the number of hardened washers **no. 10**.

LH or RH Tie-Rods

Skandic LT 440F, WT and SWT

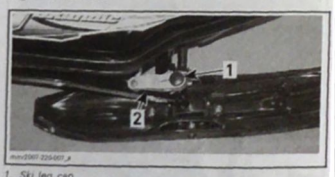
Unscrew the outer tie-rod end **no. 11** from steering arm **no. 12**.

Unscrew the inner tie-rod end **no. 13** from steering column **no. 9**.

Remove tie-rod **no. 14** from vehicle.

Skandic SUV and Expedition TUV

Separate the outer tie-rod end **no. 11** from steering arm **no. 12**.



1. Ski leg cap
2. Steering arm

Then separate the inner tie-rod end from pivot arm.

Central Tie-Rod

Skandic SUV and Expedition TUV

The central tie-rod **no. 16** links the LH pivot arm **no. 15** to the RH pivot arm **no. 17**.

To remove the central tie-rod, unscrew both tie-rod ends from pivot arms.

Short Tie-Rod

Skandic SUV

The short tie-rod **no. 18** links the steering column with the RH pivot arm **no. 17**.

Unscrew tie-rod nuts **no. 19** from steering column and pivot arm then remove it.

Expedition TUV

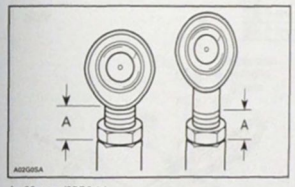
The short tie-rod **no. 18** links the steering column with the LH pivot arm **no. 15**.

Unscrew tie-rod nuts **no. 19** from steering column and pivot arm then remove it.

Tie-Rod Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

The maximum external threaded length not engaged in the tie-rod must not exceed 20 mm (25/32 in).



A. 20 mm (25/32 in)

Install tie-rod with the groove on steering arm side. Do not forget to place hardened washer (s) where required.

Install nuts **no. 19** retaining tie-rod. Torque them to 52 N•m (38 lbf•ft).

Complete the procedure by performing the steering alignment, refer to *SKI AND STEERING ALIGNMENT*.

STEERING ARM

Steering Arm Removal

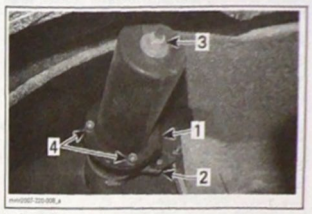
Skandic LT 440F, WT and SWT

Remove tie-rod **no. 14** from steering arm **no. 12**.

Remove bolts securing steering arm to steering arm reinforcement.

Unscrew bolts holding shock cover.

Unscrew shock absorber nut then lift the front of vehicle and remove shock absorber.



1. Steering arm
2. Steering arm reinforcement
3. Shock absorber nut
4. Shock cover bolts

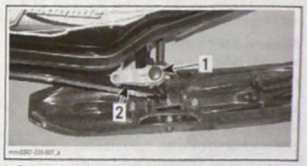
Remove shock cover.

Remove steering arm.

Skandic SUV and Expedition TUV

Separate tie-rod **no. 14** from steering arm **no. 12**.

Remove ski leg cap.



1. Ski leg cap
2. Steering arm

To maintain correct steering alignment when reassembly, scribe a mark on the steering arm and ski leg before disassembly.

Remove steering arm from ski leg.

Steering Arm Inspection

Check if steering arm is bent, crack or otherwise damage. Replace if necessary.

Check splines on steering arm and on ski leg. If a worn spline is found, replace the part with a new one.

Steering Arm Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Skandic LT 440F, WT and SWT

Install steering arm at mid-travel position when handlebar and skis are facing straight ahead.

Skandic SUV and Expedition TUV

Steering arm must be installed parallel to ski.

Torque steering arm bolt **no. 20** to 24 N•m (18 lbf•ft).

STEERING COLUMN

Steering Column Removal

Remove handlebar **no. 3** and handlebar extension **no. 7**.

Lift console to allow room and reach upper attachment.

Upper Side

Skandic LT 440F

Remove nuts **no. 21**, U-clamp **no. 22** and bushing **no. 23**.

Skandic WT/SWT/SUV 550F and Skandic WT/SUV 600

Remove bolts **no. 27**, stopper plates **no. 24**, half housings **no. 25**, bushings **no. 26** and nuts **no. 21**.

Skandic SWT V800 and Expedition TUV

Remove nuts **no. 21**, throttle cable plate **no. 28**, half housings **no. 25** and bushings **no. 26**.

Lower Side

Skandic LT 440F

Separate both tie-rods from steering column.

Remove nuts, U-clamp and bushing.

Remove steering arm from vehicle.

Skandic WT and SWT

Separate both tie-rods from steering column.

Remove nuts, stopper plates, half housings, bushings and bolts.

NOTE: On SWT V800, the removal of driven pulley is necessary to reach the bottom of steering column.

Remove steering column from vehicle.

Skandic SUV and Expedition TUV

Separate short tie-rod **no. 18** from steering column.

Remove nuts, stopper plate(s), half housings and bushings.

Remove steering column from vehicle.

Steering Column Inspection

Check steering column for crack, bend or other damage.

Steering Column Installation

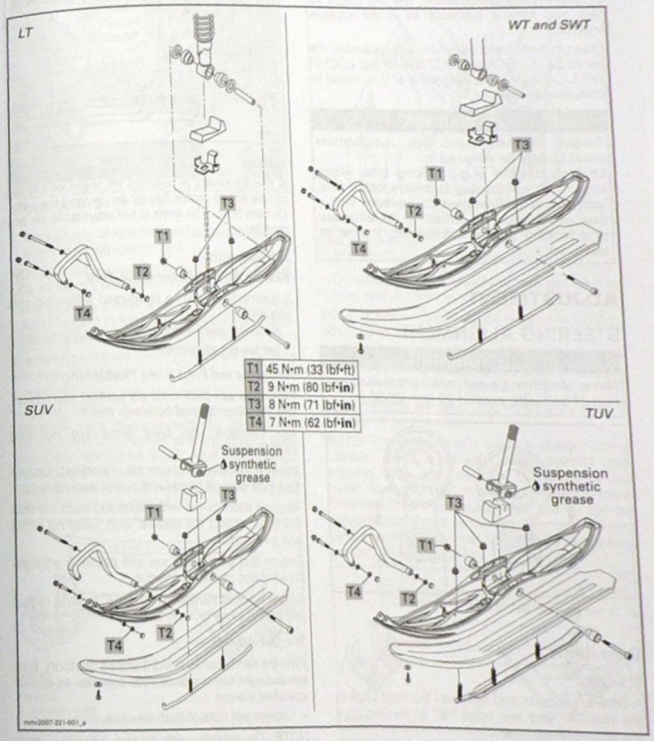
The installation is the reverse of the removal procedure. However, pay attention to the following.

Apply ThermoLube synthetic grease (P/N 219 700 417) on steering column before installing half housings **no. 25**.

Torque nuts **no. 21** to 24 N•m (18 lbf•ft).

Install tie-rod(s).

SKIS AND STEERING ALIGNMENT



T1	45 N•m (33 lbf•ft)
T2	9 N•m (80 lbf•in)
T3	8 N•m (71 lbf•in)
T4	7 N•m (62 lbf•in)

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view(s).

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

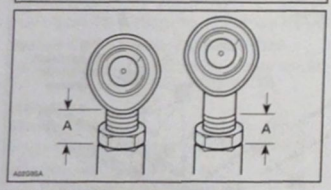
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with a new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

ADJUSTMENT

STEERING ALIGNMENT

⚠ WARNING

Never lengthen tie-rod making threaded portion of ball joint exceed 20 mm (25/32 in).

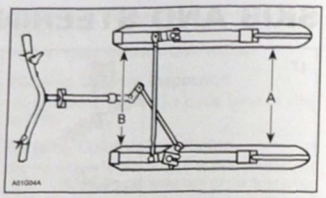


A. 20 mm (25/32 in) maximum

Definitions

Toe-Out:

A difference measured between the front edge of the skis "A" and rear edge "B" as viewed from the top. It is adjustable.



Camber:

A specific inward or outward tilt angle of ski leg compared to a vertical line when viewing the vehicle from front. This angle is not adjustable on any models.

Adjustments

Skandic SUV and Expedition TUV

Adjustments should be performed following this sequence:

- Handlebar/pivot arm positioning.
- Set toe-out adjustment.

Handlebar and Pivot Arms Positioning

First make sure pivot arms are parallel. To adjust, use the tie-rod located between them.

Turn handlebar until pivot arms are pointing straight forward.

Check if handlebar is horizontal. To adjust, loosen lock nuts of short tie-rod and turn it accordingly.

Restrain short tie-rod while torquing nuts so that ball joint sockets run parallel with steering arms and pivot arms.

Ensure that pivot arms are still pointing straight forward and check ski toe-out.

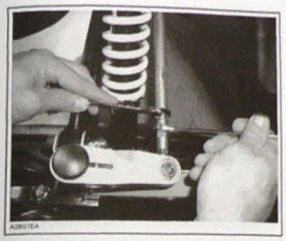
With this adjustment properly done, turning radius will be the same on both sides.

Toe-Out Adjustment

With the handlebar in straight ahead position, turn left and right tie-rods or tie-rods adjuster to obtain specified toe-out.

- Loosen jam nuts of both tie-rods.

NOTE: On models with tie-rod adjuster, only loosen adjuster jam nut.



MODELS WITH TIE-ROD ADJUSTER

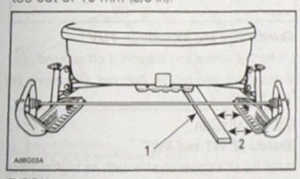
– Close front of skis manually to take all free-play from steering mechanism.

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Each ski should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 5 mm (3/16 in) more than at rear on both sides for a total toe-out of 10 mm (3/8 in).

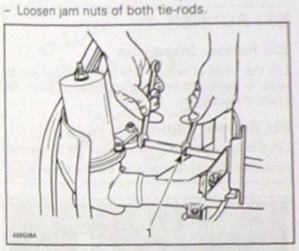


TYPICAL
1. Straight edge
2. 5.0 mm (3/16 in) toe-out on each side

Skandic LT, WT and SWT

Toe-out adjustment is performed by adjusting length of left and right tie-rods. Handlebar centering is done at same time by turning tie-rods accordingly.

– Place vehicle on level surface.
– Check that handlebar is straight.
– Loosen jam nuts of both tie-rods.



LONG TIE-ROD SHOWN
1. Restrain tie-rod to loosen or tighten lock nuts

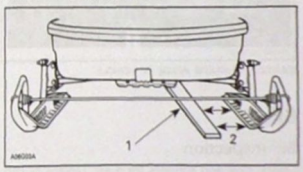
– Close front of skis manually to take all free-play from steering mechanism.

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Each ski should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 5 mm (3/16 in) more than at rear on both sides for a total toe-out of 10 mm (3/8 in).



TYPICAL
1. Straight edge
2. 5.0 mm (3/16 in) toe-out on each side

PROCEDURES

SKI RUNNER

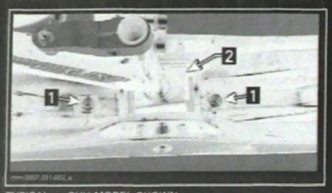
Ski Runner Inspection

Lift the front of vehicle and check ski runners for wear or damages (missing or broken carbide). Replace if necessary.

Ski Runner Removal

Lift the front of vehicle and support it off ground.

Unscrew the ski runner nuts then remove ski runners.

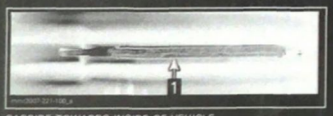


TYPICAL — SUV MODEL SHOWN
1. Ski runner nuts
2. Ski leg

Ski Runner Installation

The installation is the reverse of the removal procedure.

On models equipped with the following type of ski runner, make sure to install the carbide inside.



CARBIDE TOWARDS INSIDE OF VEHICLE

SKI

Ski Inspection

Check skis and runners for wear, replace as necessary.

Check condition of ski stopper. Replace it when deteriorated.

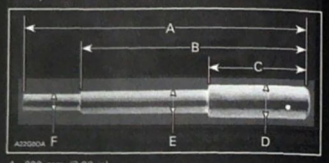
Ski Removal

Skandic LT, WT and SWT

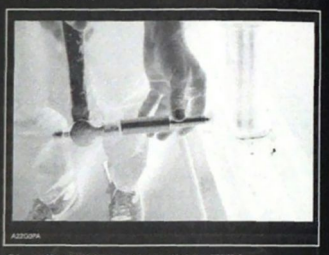
Lift front of vehicle and support off the ground.

Remove ski bolt and nut.

Remove steel bushing from ski using a pusher. See pusher dimensions below.



A. 220 mm (8.66 in)
B. 180 mm (7.09 in)
C. 70 mm (2.75 in)
D. 25 mm (1.0 in)
E. 15 mm (0.59 in)
F. 9 mm (0.35 in)



Skandic SUV and Expedition TUV

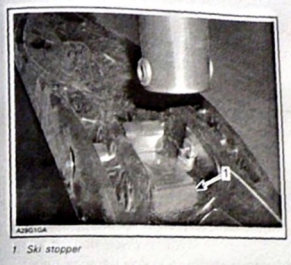
Lift front of vehicle and support it off ground.

Unscrew nut then pull ski bolt out. Remove ski from vehicle.

Ski Installation

Skandic LT, WT and SWT

Install the ski stopper on skis with its highest portion toward front then the support plate.



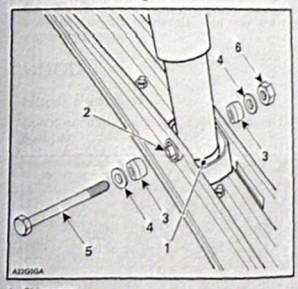
1. Ski stopper

Install the ski to shock absorber.

Secure the ski to shock absorber with the ski bolt.

NOTE: Make sure that the bolt head is toward the outside of the vehicle.

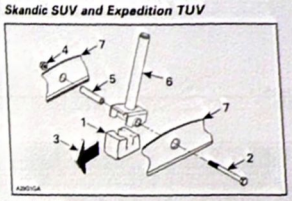
On **SWT models,** install a conical spring washers on both side of ski leg (concave surface inside).



1. Ski stopper
2. Sleeve
3. Rubber bushings
4. Conical spring washers (SWT only)
5. Ski bolt
6. Elastic stop nut

Torque ski leg nuts to 45 N•m (33 lbf•ft).

Skandic SUV and Expedition TUV



1. Ski stopper
2. Ski bolt
3. Front of vehicle
4. Elastic stop nut
5. Ski leg bushing
6. Ski leg
7. Ski

Ensure the ski leg bushing is still on the ski leg.

Insert the ski stopper into the ski. Place its higher side toward the front of vehicle.

Install the ski to ski leg.

Secure the ski to ski leg with the ski bolt.

NOTE: Make sure that the bolt head is toward the outside of the vehicle.

Torque nut to 45 N•m (33 lbf•ft).

BODY

SERVICE TOOLS

Description	Part Number	Page
fuel reservoir nut wrench	529 035 891	678

PARTS REPLACEMENT

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

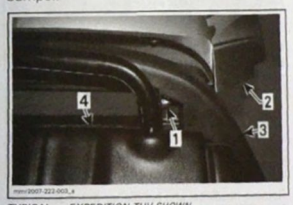
Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

HOOD

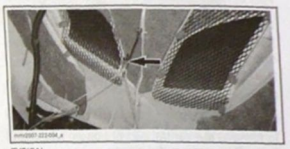
Hood Removal

Remove bolts retaining both hinges to front bumper.



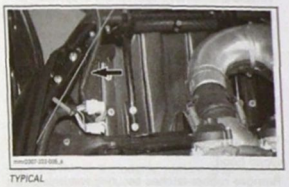
TYPICAL — EXPEDITION TUV SHOWN
1. Hinge bolt
2. Hood
3. Front bumper
4. Bottom pan

Open hood and detach retaining wire from hood.



TYPICAL

Disconnect wiring harness.



TYPICAL

Remove hood.

Hood Installation

The installation is the reverse of the removal procedure.

FRONT BUMPER

Front Bumper Removal

Remove hood.

Remove all bolts and/or rivets retaining the front bumper to bottom pan.

Remove bumper.

Front Bumper Installation

Reverse the removal procedure.

BOTTOM PAN

Bottom Pan Removal

Remove hood.

Remove front bumper.

Skandic LT, WT and SWT

Remove skis.

Drill all rivets holding bottom pan to frame.

Skandic SUV

Remove front shock absorbers and front suspension arms.

Drill all rivets holding bottom pan to frame.

Remove bottom pan.

Expedition TUV

To remove the central part of bottom pan, drill all rivets then remove the piece.

To remove the side parts of bottom pan, lift front of vehicle and remove appropriate suspension arm.

Drill rivets holding central and side parts then remove them.

Bottom Pan Installation

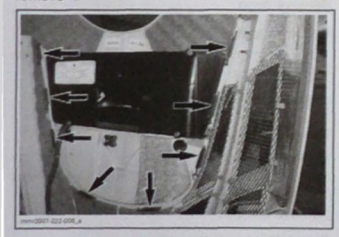
Reverse the removal procedure.

WINDSHIELD

Windshield Removal

Open hood.

Remove rubber latches securing windshield then remove it.



Windshield Installation

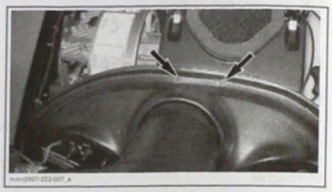
Reverse the removal procedure.

CONSOLE

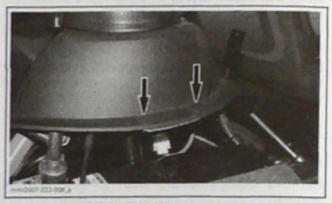
Console Removal

Open hood.

The console can be retained by rivets or darts. Drill all rivets or remove all darts.



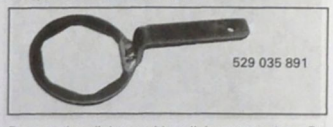
RIVETS — SKANDIC SUV



DARTS — EXPEDITION TUV 600

Remove fuel tank cap.

Using the fuel reservoir nut wrench (P/N 529 035 891), unscrew the fuel tank nut.



Remove handlebar and handlebar extension. Refer to *STEERING*.

Remove rewind handle and transmission lever (if applicable).

Lift up the console and unplug all connectors.

Install fuel tank cap.

Console Installation

The installation is the reverse of the removal procedure.

SEAT

Seat Removal

Open seat.

Remove screws holding hinges to seat or carefully drill rivets.

Detach retaining wire from seat.

Remove seat.

Seat Installation

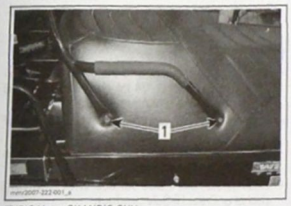
Reverse the removal procedure.

BACKREST

Backrest Removal

Fixed Backrest Model

On both sides, remove screws securing backrest to seat.

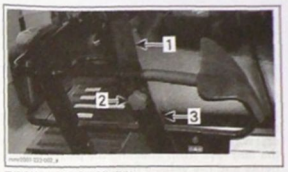


TYPICAL — SKANDIC SUV
1. Backrest support screws

Remove backrest from vehicle.

Adjustable Backrest Model

On both sides, unscrew knobs securing the backrest arms to rear rack.



TYPICAL — EXPEDITION TUV
1. Backrest arm
2. Knob
3. Rear rack

Remove backrest from vehicle.

Backrest Installation

For installation, reverse the removal procedure.

CLEANING

SEAT

It is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

PLASTIC

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

CAUTION: Do not apply isopropyl alcohol or acetone directly on decals.

CAUTION: The following products must not be used to clean or wax any of the plastic components used on the vehicles:

- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- Varsol
- naphtha
- acetone
- strong detergents

- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

Apply wax on glossy finish only. Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: If for some reason the snowmobile has to be stored outside, it is preferable to cover it with an opaque tarpaulin. This will prevent the sun rays from affecting the plastic components and the vehicle finish.

REPAIR

The very first step before repairing plastic materials is to find out exactly which type of material is involved. Refer to following chart.

PART	MATERIAL	REPAIRABLE	
		YES	NO
Bottom pan	High density polyethylene (HDPE)		✓
Hood	R.R.I.M.	✓	
Windshield	Polycarbonate		✓

CAUTION: Consult chart and repair kit instructions carefully, some repair products are not compatible with certain plastics.

⚠ WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

REPAIR PROCEDURE FOR R.R.I.M.

R.R.I.M. is light colored (tan) on the inside with a smooth surface.

⚠ WARNING

Material should be repaired and repainted in a well-ventilated area only.

CAUTION: Clean R.R.I.M. with isopropyl alcohol or Crest Hi-Solv product. Never use cleaners or products that contain chlorine.

CAUTION: R.R.I.M. should never be exposed to temperatures exceeding 93°C (200°F).

NOTE: When working on a R.R.I.M. surface, never use a grinder or a high revolution tool such as an air or electric buffer. Use of such tools could overheat material and liberate agents in it thus causing a bad adhesion.

Small Scratches

- Sand and scuff area.
- Feather out edges.
- Paint with a matching acrylic auto touch-up paint.

Deep Scratches

- Sand and scuff area.
- Make a "V" groove using a knife or a rough round file.
- Clean surface with isopropyl alcohol or Crest Hi-Solv stock no. AH-S product.
- Cover with TP-E epoxy mixed in equal quantities.
- Heat the surface with a heater lamp placed at 38 cm (15 in) for a period of 15 minutes.
- Sand the surface using a smooth dry sand paper.
- Use the same product if a final finish is required.
- Clean surface with Crest Hi-Solv product.
- Apply a flexible primer such as Crest Prima Flex stock no. AP-F.
- Wait 10 minutes.
- Repaint (air dry during 72 hours (approximately)).

Large Crack

- Sand and scuff outside and inside area by exceeding it 31.7 mm (1-1/4 in) on each side and 12.7 mm (1/2 in) at each end.
- Make a "V" groove (appr. 90°) on both sides of hood using a knife or a rough round file.
- Enlarge the crack to 2.4 mm (3/32 in) – 3.2 mm (1/8 in) using a sharp knife.
- Clean outside and inside surface with isopropyl alcohol or Crest Hi-Solv product.
- Repair inside surface first.
- Cover inside area with Crest TP-E epoxy.
- Apply a 50 mm x 30 mm (2 in x 1-1/4 in) patch. If no room for the patch, use tape.
- Cover exterior surface with same product. Damaged area should be slightly higher.
- Heat surface with a heater lamp placed at 38 mm (15 in) for a period of 15 minutes.
- Sand outside surface using a smooth dry sand paper.
- Use same product if a final finish is required.
- Apply a flexible primer.
- Wait 10 minutes.
- Repaint (air dry during 72 hours approximately).

NOTE: R.R.I.M. materials are high static plastics, painting must be done in a dust free area such as a paint booth.

Crest products used in R.R.I.M. repair procedure are available from following locations:

CREST MAIN OFFICE AND MANUFACTURING PLANT
CREST INDUSTRIES INC. 1337 King Road Trenton, Michigan, U.S.A. 48183 Phone: 734-479-4141 Toll free: 1 800 822-4100 Fax: 734-479-4040 E-mail: info@crestauto.com www.crestauto.com

FRAME

SERVICE TOOLS

Description	Part Number	Page
Supertanium drill bit	529 031 800	683

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic chaincase oil	413 803 300	683

PROCEDURES

SELF-PIERCING RIVETS

Rivet Drilling Procedure

When drilling self-piercing rivets, use the Supertanium drill bit (P/N 529 031 800), available in a 5 mm (3/16 in) size and shipped in packs of 2.

For proper drilling instructions and to prevent premature wear, follow the procedure below.

- Always use a variable speed drill.
- Maintain a slow to medium speed at all times when drilling. The proper speed is attained when a constant chip is ejected.

NOTE: To increase bit life, use XP-S synthetic chaincase oil (P/N 413 803 300) as a cutting oil.

CAUTION: High speed drilling will cause excessive heat which may destroy the cutting edge of the bit; therefore, avoid using pneumatic drills.

- Cut rivet using a chisel.
- Remove riveted part.
- Drive out remaining rivet head using a punch.

POP RIVETS

Rivet Drilling Procedure

- Always drill rivet head.
- When rivet is located on plastic part, use pliers to avoid rivet turning and heating plastic.
- Use a small punch to push the rivet end.

FRAME

Frame Cleaning

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

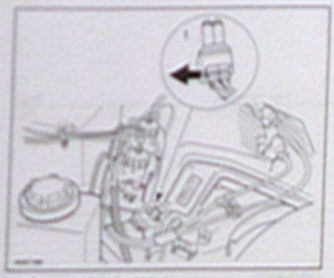
CAUTION: Never direct high-pressure water jet towards decals. They would peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

Frame Welding

- electric welding
- amperage: 70-110 A
- voltage: 20-24 V
- electrode: E-7014 (3/32 in).

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug the multiple connector at the electronic box. On models equipped with a battery, also unplug the negative cable. This will protect the electronic box and battery against damage caused by flowing current when welding.



TYPICAL — 440F/500F MODELS
1. Unplug before electrical welding



TYPICAL — 600 MODELS



TYPICAL — 600 HO SDI/V800 MODELS

CAUTION: If welding is to be done near plastic material, it is recommended to either remove the part from the area or to protect it with aluminum foil to prevent damage.

440F AND 550F MODELS

MODEL			SKANDIC
			LT
			440F
ENGINE			
Engine type			443
Number of cylinder			2
Bore		mm (in)	67.5 (2.658)
Stroke		mm (in)	61.00 (2.402)
Displacement		cm³ (cu²)	436.6 (26.64)
Compression ratio			9.6 ± 0.5
Maximum power engine speed		x 100 RPM	6900
Combustion chamber volume		cc	24.4 to 26.4
Piston ring type		1st	Semi-trapezoidal
		2nd	Rectangular
Ring end gap	New	mm (in)	0.2 (.0079)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.04 (.0016)
	Wear limit	mm (in)	0.2 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.070 (.0031)
	Wear limit	mm (in)	0.2 (.0079)
Piston skirt wear	Wear limit	mm (in)	0.15 (.006)
Cylinder head warpage	Wear limit	mm (in)	0.5 (.02)
Cylinder taper	New (max.)	mm (in)	0.05 (.0020)
	Wear limit	mm (in)	0.10 (.0039)
Cylinder out of round	New (max.)	mm (in)	0.01 (.0004)
	Wear limit	mm (in)	0.08 (.0031)
Maximum crankshaft end play	New (max.)	mm (in)	0.3 (.012)
Maximum crankshaft deflection	Wear limit	mm (in)	PTO: 0.06 (.0024) Center: 0.06 (.0031) MAG: 0.03 (.001)
Connecting rod big end axial play	New	mm (in)	0.20 to 0.527 (.0079 to .02037)
	Wear limit	mm (in)	1.2 (.0472)
Crankshaft end-play	New	mm (in)	0.10 to 0.30 (.004 to .012)
COOLING SYSTEM			
Type			Fan
Axial fan belt adjustment	Deflection	mm (in)	9.5 x 1.5 (.37 x .06)
	Force	kgf (lbf)	5.0 (11.0)

MODEL			SKANDIC LT 440F
LUBRICATION SYSTEM			
Injection oil	Type		XP-S mineral injection oil
	Quantity	L (U.S. oz)	2.5 (84.5)
FUEL SYSTEM			
Carburetor type			1 x VM32
Main jet			180
Needle jet			159
Pilot jet			50
Jet needle identification and clip position			6DGY12 — 3
Slide cut-away			3
Idle throttle slilde height			1.4 ± 0.1 (.055 ± .004)
Float adjustment		mm (in)	35.5 ± 1 (1.392 ± .040)
Air or pilot screw adjustment		± 1/16 turn	1.5
Idle speed		± 200 RPM	1650
Gas type			Unleaded
Pump octane number	Inside North America ((R+M)/2)		87 or higher
	Outside North America (RON)		92 or higher
Fuel tank capacity		L (U.S. gal)	37 (9.77)
Gas/oil ratio			Injection
ELECTRICAL SYSTEM			
Magneto generator output			240 W @ 6000 RPM
Ignition type			CDI
Spark plug	Make and type		NGK BR9ES
	Gap	mm (in)	0.40 to 0.60 (.016 to .024)
Ignition timing BTDC		mm (in)	2.79 (.110) @ 3500 RPM
Trigger coil		Ω	160 to 180
Generating coil	Low speed	Ω	5.1
	High speed	Ω	6.2
Lighting coil		Ω	0.17 to 0.21
High tension coil	Primary	Ω	—
	Secondary	kΩ	—
Headlamp		W	60/55 (H4)
Taillight and stoplight		W	8/27

MODEL			SKANDIC
			LT
DRIVE SYSTEM			440F
Chaincase oil	Type		XP-S synthetic chaincase oil
	Quantity	mL (U.S. oz)	250 (8.5)
Chain drive ratio			17/44
Chain	Pitch	in	3/8
	Type/links qty/plate qty		Silent 70/13
Drive pulley type			COMET 102
Drive pulley calibration	Clutch engagement	± 100 RPM	3200
	Spring color		Silver/Black
	Spring free length	mm (in)	79 (3.110)
	Pin		417 003 900
Driven pulley	Type		LPV 27
	Spring color		White
	Spring preload		0
	Cam angle		40°
Pulley distance	Z	mm (in)	39 ± 0.75 (1.535 ± .030)
Offset	X	mm (in)	37 ± 0.75 (1.457 ± .030)
	Y-X	mm (in)	0.75 to 1.5 (.030 to .060)
Drive belt part number		P/N	414 633 800
Drive belt	Width	mm (in)	34.60 (1.362)
	Wear limit	mm (in)	32.00 (1.260)
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)
	Force	kgf (lbf)	11.34 (25)
Track	Width	mm (in)	381 (15)
	Length	m (in)	3.97 (156)
	Profile height	mm (in)	25.4 (1)
Track adjustment	Deflection	mm (in)	30 to 35 (1.181 to 1.378)
	Force	kgf (lbf)	7.3 (16)
BRAKE SYSTEM			
Brake lining thickness	Service limit	mm (in)	1 (.039)
Brake fluid	Type		DOT 4
	Quantity	mL (U.S. oz)	60 (2.0)

MODEL		SKANDIC LT 440F
SUSPENSION		
FRONT		
Suspension type		LTS
Suspension maximum travel	mm (in)	150 (5.9)
Shock absorber type		Hydraulic
REAR		
Suspension type		LS
Suspension maximum travel	mm (in)	150 (5.9)
Shock absorber type	Center	Hydraulic
	Rear	HPG
Stroke limiter standard position		Middle position
STEERING SYSTEM		
Ski type		ADJ
Toe-out	mm (in)	5 (.197)
Camber		0°
VEHICLE INFORMATIONS		
Mass (dry)	kg (lb)	231 (509.3)
Length	m (in)	3.04 (119.7)
Width	m (in)	1.01 (39.6)
Height	m (in)	1.30 (51.2)
Ski stance (carbide to carbide)	mm (in)	820 (32)
MATERIAL		
Frame		Steel
Bottom pan		Polypropylene
Hood		RRIM

MODEL			SKANDIC		
			WT	SWT	SUV
			550F		
ENGINE					
Engine type			552		
Number of cylinder			2		
Bore		mm (in)	76 (2.992)		
Stroke		mm (in)	61.00 (2.402)		
Displacement		cm^3 (in^3)	553.40 (33.771)		
Compression ratio			9.6 ± 0.5		
Maximum power engine speed		± 100 RPM	7000		
Combustion chamber volume		cc	35.54		
Piston ring type		1st	Semi-trapezoidal		
		2nd	Rectangular		
Ring end gap	New	mm (in)	0.40 (.0157		
	Wear limit	mm (in)	1.0 (.039)		
Ring/piston groove clearance	New	mm (in)	0.037 (.0015)		
	Wear limit	mm (in)	0.2 (.0079)		
Piston/cylinder wall clearance	New	mm (in)	0.147 (.0058)		
	Wear limit	mm (in)	0.2 (.0079)		
Piston skirt wear	Wear limit	mm (in)	0.15 (.006)		
Cylinder head warpage	Wear limit	mm (in)	0.5 (.02)		
Cylinder taper	New (max.)	mm (in)	0.05 (.0020)		
	Wear limit	mm (in)	0.10 (.0039)		
Cylinder out of round	New (max.)	mm (in)	0.01 (.0004)		
	Wear limit	mm (in)	0.08 (.0031)		
Maximum crankshaft end play	New (max.)	mm (in)	0.3 (.012)		
Maximum crankshaft deflection	Wear limit	mm (in)	PTO: 0.06 (.0024) Center: 0.08 (.0031) MAG: 0.03 (.001)		
Connecting rod big end axial paly	New	mm (in)	0.20 to 0.527 (.0079 to .0207)		
	Wear limit	mm (in)	1.2 (.0472)		
Crankshaft end-play	New	mm (in)	0.10 to 0.30 (.004 to .012)		
COOLING SYSTEM					
Type			Fan		
Axial fan belt adjustment	Deflection	mm (in)	9.5 ± 1.5 (.37 ± .06)		
	Force	kgf (lbf)	5.0 (11.0)		

Section 14 TECHNICAL SPECIFICATIONS
Subsection 01 (440F AND 550F MODELS)

MODEL			SKANDIC		
			WT	SWT	SUV
			550F		
LUBRICATION SYSTEM					
Injection oil	Type		XP-S mineral injection oil		
	Quantity	L (U.S. oz)	2.5 (84.5)		
FUEL SYSTEM					
Carburetor type			2 x VM34 with choke		
Main jet			190		
Needle jet			159		
Pilot jet			40		
Jet needle identification and clip position			6DH4 - 2		
Slide cut-away			2.5		
Idle throttle slide height			1.6 ± 0.1 (.063 ± .004)		
Float adjustment		mm (in)	23.90 ± 1 (.941 ± .040)		
Air or pilot screw adjustment		± 1/16 turn	1/2		
Idle speed		± 200 RPM	1700		
Gas type			Unleaded		
Pump octane number	Inside North America ((R+M)/2)		87 or higher		
	Outside North America (RON)		92 or higher		
Fuel tank capacity		L (U.S. gal)	42 (11.1)		
Gas/oil ratio			Injection		
ELECTRICAL SYSTEM					
Magneto generator output			340 W @ 6000 RPM		
Ignition type			CDI by Denso		
Spark plug	Make and type		NGK BR9ES		
	Gap	mm (in)	0.40 to 0.60 (.016 to .024)		
Ignition timing BTDC		mm (in)	2.77 (.109) @ 3500 RPM		
Trigger coil		Ω	160 to 180		
Generating coil	Low speed	Ω	6.3		
	High speed	Ω	7.7		
Lighting coil		Ω	0.145 to 0.175		
High tension coil	Primary		—		
	Secondary		—		
Battery			12 V, 18 A•h		
Headlamp		W	60/55 (H4)		
Taillight and stoplight		W	8/27		
Fuse	Starter solenoid	A	30		

MODEL			SKANDIC		
			WT	SWT	SUV
			550F		
DRIVE SYSTEM					
Gearbox oil	Type		XP-S synthetic chaincase oil		
	Quantity	mL (US oz)	500 (17)		
Gear ratio	1st		1 : 2.93		
	2nd		1 : 2.04		
	R		1 : 3.57		
Drive pulley type			Bombardier Lite		
Drive pulley calibration	Clutch engagement	± 100 RPM	2500		
	Spring color		Yellow/Green		
	Spring free length	mm (in)	94.61 ± 1.5 (3.725 ± .060)		
	Weight 417 120 400 = 21 g 417 114 400 = 3.4 g		1 x 21 g + 4 x 3.4 g		
	Block		3 x 417 118 100		
	Cap		1 x 417 126 696		
Driven pulley	Type		IBC 5100		
	Spring color		Orange/Blue/Blue		
	Spring preload	kg (lb)	7.5 (16.5)		
	Cam angle		40°/35°		35°/30°
Pulley distance	Z	mm (in)	41.8 ± 0.75 (1.647 ± .030)		
Offset	X	mm (in)	35 ± 0.75 (1.380 ± .030)		
	Y-X	mm (in)	0.75 to 1.5 (.030 to .060)		
Drive belt part number		P/N	414 633 800		
Drive belt	Width	mm (in)	34.60 (1.362)		
	Wear limit	mm (in)	32.30 (1.272)		
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)		
	Force	kgf (lbf)	11.34 (25)		
Track	Width	mm (in)	500 (20)	600 (24)	500 (20)
	Length	m (in)	3.968 (156)		
	Profile height	mm (in)	23.5 (.925)		
Track adjustment	Deflection	mm (in)	30 to 35 (1.181 to 1.378)		
	Force	kgf (lbf)	7.3 (16)		

MODEL			SKANDIC		
			WT	SWT	SUV
			550F		
BRAKE SYSTEM					
Brake lining thickness	Service limit	mm (in)	1 (.039)		
Brake fluid	Type		DOT 4		
	Quantity	mL (U.S. oz)	60 (2.0)		
SUSPENSION					
FRONT					
Suspension type			LTS		
Suspension maximum travel		mm (in)	151 (5.95)		
Shock absorber type			Hydraulic		
Sway bar type			—		
REAR					
Suspension type			WLS		SUV
Suspension maximum travel		mm (in)	210 (8.23)		290 (11.42)
Shock absorber type		Center	—		Gas
		Rear	Gas		HPG
Stroke limiter standard position			—		
STEERING SYSTEM					
Ski type			ADJ		
Toe-out		mm (in)	5 (.197)		
Camber			0°		
VEHICLE INFORMATIONS					
Mass (dry)		kg (lb)	266 (586.4)	286 (630.5)	277 (610.7)
Length		m (in)	3.05 (120)	3.02 (119)	3.05 (120)
Width		m (in)	1.08 (42.5)		
Height		m (in)	1.3 (51)		
Ski stance (carbide to carbide)		mm (in)	900 (35.4)		
MATERIAL					
Frame			Steel		
Bottom pan			Polypropylene		
Hood			RRIM		

600 MODELS

MODEL			SKANDIC WT / SUV
			600
ENGINE			
Engine type			593
Number of cylinder			2
Bore		mm (in)	76 (2.992)
Stroke		mm (in)	65.8 (2.591)
Displacement		cm³ (in³)	597 (36.43)
Compression ratio			12.00 ± 0.5
Maximum power engine speed		± 100 RPM	7000
Combustion chamber volume		cc	25.49 to 27.96
RAVE spring	Color		Orange/Blue/Blue
	Wire diameter	mm (in)	0.90 (0.035)
	Minimum free length	mm (in)	48.50 (1.909)
Piston ring type		1st	Semi-trapezoidal
		2nd	—
Ring end gap	New	mm (in)	0.40 to 0.55 (.0157 to .0217)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.040 to 0.090 (.0016 to .0035)
	Wear limit	mm (in)	0.20 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.120 ± 0.02 (.0047 ± .0008)
	Wear limit	mm (in)	0.20 (.0079)
Piston skirt wear	Wear limit	mm (in)	0.15 (.006)
Cylinder head warpage	Wear limit	mm (in)	0.5 (.02)
Cylinder taper	New (max.)	mm (in)	0.05 (.0020)
	Wear limit	mm (in)	0.1 (.0039)
Cylinder out of round	New (max.)	mm (in)	0.010 (.0004)
	Wear limit	mm (in)	0.08 (.0031)
Maximum crankshaft end play	New (max.)	mm (in)	0.3 (.012)
Maximum crankshaft deflection	Wear limit	mm (in)	PTO: 0.06 (.0024) Center: 0.08 (.0031) MAG: 0.05 (.0020)
Connecting rod big end axial play	New	mm (in)	0.310 to 0.677 (.012 to .027)
	Wear limit	mm (in)	1.2 (.0472)
Crankshaft end-play	New	mm (in)	0.10 to 0.30 (.004 to .012)
COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/ 50%). Use premix coolant from BRP (P/N 219 700 362) or coolant specifically formulated for aluminum engines
	Quantity	L (U.S. gal.)	4.9 (1.29) / 5.17 (1.37)
Thermostat opening temperature		°C (°F)	42 (108)
Radiator cap opening pressure		kPa (PSI)	90 (13)

MODEL			SKANDIC	
			WT	SUV
			600	
LUBRICATION SYSTEM				
Injection oil	Type		XP-S mineral injection oil	
	Quantity	L (U.S. oz)	3.5 (118)	
FUEL SYSTEM				
Carburetor type			2 x VM38 with choke	
Main jet			330	
Needle jet			P-9	
Pilot jet			40	
Jet needle identification			6DFHL24	
Clip position number			3	
Slide cut-away			2.5	
Idle throttle slide height			1.5 ± 0.1 (.059 ± .004)	
Float adjustment		mm (in)	18.1 ± 1 (.710 ± .039)	
Air or pilot screw adjustment		± 1/16 turn	2	
Idle speed		± 200 RPM	1700	
Gas type			Unleaded	
Pump octane number	Inside North America ((R+M)/2)		87 or higher	
	Outside North America (RON)		92 or higher	
Fuel tank capacity		L (U.S. gal)	42 (11.1)	
Gas/oil ratio			Injection	
ELECTRICAL SYSTEM				
Magneto generator output		W	290 @ 6000 RPM	
Ignition type			C.D.I. by Denso	
Spark plug	Make and type		NGK BR9ECS	
	Gap	mm (in)	0.85 (.033)	
Ignition timing BTDC		mm (in)	3.0 (.118) @ 3500 RPM	
Trigger coil		Ω	190 to 300	
Lighting coil		Ω	0.1 to 0.4	
High tension coil	Primary	Ω	0.3 to 0.7	
	Secondary	KΩ	18 to 26 (with caps)	
Battery			12 V, 18 A•h (with electric starter)	
Headlamp		W	60/55 (H4)	
Taillight and stoplight		W	8/27	
Fuse	Starter solenoid	A	30 (if applicable)	

MODEL		SKANDIC	
		WT	SUV
		600	
SUSPENSION			
FRONT			
Suspension type		LTS	SUV
Suspension maximum travel	mm (in)	151 (6)	185 (7.3)
Shock absorber type		Hydraulic	
REAR			
Suspension type		WLS	SUV
Suspension maximum travel	mm (in)	210 (8.3)	290 (11.4)
Shock absorber type	Center	—	
	Rear	HPG	
Stroke limiter standard position		—	
STEERING SYSTEM			
Ski type		ADJ	
Toe-out	mm (in)	5 (.197)	
Camber		0°	
VEHICLE INFORMATIONS			
Mass (dry)	kg (lb)	275 (606)	291 (641.5)
Length	m (in)	3.05 (120)	
Width	m (in)	1.08 (42.5)	
Height	m (in)	1.30 (51)	
Ski stance (carbide to carbide)	mm (in)	900 (35.4)	985 (38.8)
MATERIAL			
Frame		Steel	
Bottom pan and side panels		HPPE	
Hood		RRIM	

600 HO SDI MODELS

MODEL			EXPEDITION
			TUV
			600 HO SDI
ENGINE			
Engine type			593 HO SDI
Number of cylinder			2
Bore		mm (in)	72 (2.835)
Stroke		mm (in)	73 (2.874)
Displacement		cm^3 (in^3)	594.40 (36.273)
Compression ratio			6.4
Maximum power engine speed		± 100 RPM	8000
Combustion chamber volume		cc	26.40 to 28.40
RAVE spring	Color		Black
	Wire diameter	mm (in)	0.80 (0.031)
	Minimum free length	mm (in)	42.5 (1.673)
Piston ring type		1st	Semi-trapezoidal
		2nd	—
Ring end gap	New	mm (in)	0.40 to 0.55 (.016 to .022)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.05 to 0.1 (.0020 to .0039)
	Wear limit	mm (in)	0.2 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.105 ± 0.013 (.0041 ± .0005)
	Wear limit	mm (in)	0.18 (.0071)
Piston skirt wear	Wear limit	mm (in)	0.15 (.006)
Cylinder head warpage	Wear limit	mm (in)	0.5 (.02)
Cylinder taper	New (max.)	mm (in)	0.05 (.0020)
	Wear limit	mm (in)	0.1 (.0039)
Cylinder out of round	New (max.)	mm (in)	0.012 (.0005)
	Wear limit	mm (in)	0.08 (.0031)
Maximum crankshaft end play	New (max.)	mm (in)	0.3 (.012)
Maximum crankshaft deflection	Wear limit	mm (in)	PTO: 0.06 (.0024) Center: 0.08 (.0031) MAG: 0.05 (.0020)
Connecting rod big end axial play	New	mm (in)	0.310 to 0.677 (.012 to .027)
	Wear limit	mm (in)	1.2 (.0472)
Crankshaft end-play	New	mm (in)	0.10 to 0.30 (.004 to .012)

MODEL			EXPEDITION TUV 600 HO SDI
COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/ 50%). Use premix coolant from BRP (P/N 219 700 362) or coolant specifically formulated for aluminum engines
	Quantity	L (U.S. gal.)	4.5 (1.2)
Thermostat opening temperature		°C (°F)	42 (108)
Radiator cap opening pressure		kPa (PSI)	90 (13)
LUBRICATION SYSTEM			
Injection oil	Type		XP-S 2-stroke synthetic blend
	Quantity	L (U.S. oz)	2.5 (84.5)
FUEL SYSTEM			
Throttle body type			Dell'Orto
Idle speed		± 200 RPM	1700
Gas type			Unleaded
Pump octane number	Inside North America ((R+M)/2)		87 or higher
	Outside North America (RON)		92 or higher
Fuel tank capacity		L (U.S. gal)	42 (11.1)
Gas/oil ratio			Injection
ELECTRICAL SYSTEM			
Magneto generator output		W	480 @ 6000 RPM
Ignition type			Inductive by BOSH
Spark plug	Make and type		NGK BR8ECS
	Gap	mm (in)	0.85 (.033)
Ignition timing BTDC		mm (in)	5.39 (.2122) @ 3500 RPM
Trigger coil		Ω	190 to 290
Lighting coil		Ω	0.175 to 0.180
Battery			12 V, 18 A•h
Headlamp		W	60/55 (H4)
Taillight and stoplight		W	8/27
Fuse	Starter solenoid	A	5
	Starting system	A	30

MODEL			EXPEDITION
			TUV
DRIVE SYSTEM			600 HO SDI
Gearbox oil	Type		XP-S synthetic chaincase oil
	Quantity	mL (U.S. oz)	500 (17)
Gear ratio	1st		1 : 2.82
	2nd		1 : 1.70
	R		1 : 3.44
Drive pulley type			TRA III
Drive pulley calibration	Clutch engagement	± 100 RPM	3000
	Spring color		Blue/Yellow/Green
	Spring length	mm (in)	115 (4.53)
	Pin		Solid (P/N 417 004 308)
	Ramp		410
	Screw position		5
Driven pulley type	Type		IBC VSA 8000
	Spring preload	kg (lb)	8 to 9
	Cam angle		35°/30°
Pulley distance	Z	mm (in)	67 ± 0.75 (2.638 ± .030)
Offset	X	mm (in)	37.0 ± 0.5 (1.457 ± 0.020)
	Y-X	mm (in)	0.75 to 1.5 (.030 to .060)
Drive belt part number		P/N	605 348 425
Drive belt	Width	mm (in)	37.3 (1.469)
	Wear limit	mm (in)	34.9 (1.374)
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)
	Force	kgf (lbf)	11.30 (24.91)
Track	Width	mm (in)	500 (20)
	Length	m (in)	3.968 (156)
	Profile height	mm (in)	31.8 (1.25)
Track adjustment	Deflection	mm (in)	40 to 50 (1.575 to 1.969)
	Force	kgf (lbf)	7.3 (16)
BRAKE SYSTEM			
Brake lining thickness		mm (in)	1 (.039)
Brake fluid	Type		DOT 4
	Quantity	mL (U.S. oz)	500 (17)

MODEL		EXPEDITION TUV 600 HO SDI
SUSPENSION		
FRONT		
Suspension type		SUV
Suspension maximum travel	mm (in)	200 (7.9)
Shock absorber type		H.P.G.
REAR		
Suspension type		SUV
Suspension maximum travel	mm (in)	290 (11.4)
Shock absorber type	Center	H.P.G.
	Rear	H.P.G.
Stroke limiter standard position		—
STEERING SYSTEM		
Ski type		ADJ
Toe-out	mm (in)	5 (.197)
Camber		0°
VEHICLE INFORMATIONS		
Mass (dry)	kg (lb)	320 (705.5)
Length	m (in)	3.06 (120.5)
Width	m (in)	1.17 (46)
Height	m (in)	1.31 (52)
Ski stance (carbide to carbide)	mm (in)	985 (38.8)
MATERIAL		
Frame		Steel
Bottom pan and side panels		HDPE
Hood		RRIM

V800 MODELS

MODEL				SKANDIC	EXPEDITION
				SWT	TUV
				V800	
ENGINE					
Engine type				ROTAX V810	
				4-stroke, Single Over Head Camshaft (SOHC), liquid cooled	
Number of cylinders				2	
Number of valves				8 valves (mechanical adjustment)	
Bore			mm (in)	91 (3.58)	
Stroke			mm (in)	61.5 (2.42)	
Displacement				800 cm³ (48.82 in³)	
Compression ratio				10.3:1	
Decompressor type				—	
Maximum HP RPM			RPM	7250	
Intake valve opening				15° BTDC	
Intake valve closing				45° ABDC	
Exhaust valve opening				50° BBDC	
Exhaust valve closing				10° ATDC	
Valve clearance	Intake		mm (in)	0.04 to 0.10 (.0016 to .0039)	
	Exhaust		mm (in)	0.04 to 0.15 (.0016 to .0059)	
Valve stem diameter	Intake	New	mm (in)	4.966 to 4.980 (.1955 to .1960)	
		Service limit	mm (in)	4.930 (.1941)	
	Exhaust	New	mm (in)	4.956 to 4.970 (.1951 to .1957)	
		Service limit	mm (in)	4.930 (.1941)	
Valve guide diameter		New	mm (in)	5.006 to 5.018 (.1971 to .1976)	
		Service limit	mm (in)	5.050 (.1988)	
Valve spring free length		New	mm (in)	40.81 (1.607)	
		Service limit	mm (in)	39.00 (1.535)	
Valve seat contact width	Intake	New	mm (in)	1.05 to 1.35 (.041 to (.053)	
		Service limit	mm (in)	1.8 (.070)	
	Exhaust	New	mm (in)	1.25 to 1.55 (.049 to .061)	
		Service limit	mm (in)	2 (.078)	
Rocker arm bore diameter		New	mm (in)	12.036 to 12.050 (.4739 to .4744)	
		Service limit	mm (in)	12.060 (.4748)	
Rocker arm shaft diameter		New	mm (in)	12.000 to 12.018 (.4724 to .4731)	
		Service limit	mm (in)	11.990 (.4720)	
Piston measurement		New	mm (in)	90.950 to 90.966 (3.5807 to 3.5813)	
Piston/cylinder clearance		New	mm (in)	0.027 to 0.057 (.0011 to .0023)	
		Service limit	mm (in)	0.100 (.0040)	

MODEL				SKANDIC	EXPEDITION
				SWT	TUV
				V800	
ENGINE (cont'd)					
Piston ring type		1st		Upper compression ring, rectangular	
		2nd		Lower compression ring, tapered face	
		3rd		Oil scraper ring	
Ring end gap	Rectangular	New	mm (in)	0.20 to 0.40 (.008 to .016)	
	Taper-face			0.20 to 0.40 (.008 to .016)	
	Oil scraper ring			0.20 to 0.70 (.008 to .028)	
	All	Service limit	mm (in)	1.5 (.059)	
Ring/piston groove clearance	Rectangular	New	mm (in)	0.03 to 0.070 (.0012 to .0028)	
		Service limit	mm (in)	0.15 (.0059)	
	Taper-face	New	mm (in)	0.02 to 0.060 (.0008 to .0024)	
		Service limit	mm (in)	0.15 (.0059)	
	Oil scraper ring	New	mm (in)	0.01 to 0.180 (.0004 to .0071)	
		Service limit	mm (in)	0.250 (.0098)	
Cylinder bore		New	mm (in)	90.993 to 91.007 (3.5823 to 3.5829)	
Cylinder taper		Maximum New	mm (in)	0.038 (.0015)	
		Service limit	mm (in)	0.090 (.0035)	
Cylinder out of round		Maximum New	mm (in)	0.015 (.0006)	
		Service limit	mm (in)	0.020 (.0008)	
Camshaft main bearing journal	Timing chain side	New	mm (in)	34.959 to 34.975 (1.3763 to 1.3770)	
		Service limit	mm (in)	34.950 (1.3760)	
	Spark plug side	New	mm (in)	21.959 to 21.980 (.8645 to .8654)	
		Service limit	mm (in)	21.950 (.8642)	
Camshaft main bearing journal bore	Timing chain side	New	mm (in)	35.000 to 35.025 (1.3780 to 1.3789)	
		Service limit	mm (in)	35.040 (1.3795)	
	Spark plug side	New	mm (in)	22.000 to 22.021 (.8661 to .8670)	
		Wear limit	mm (in)	22.040 (.8677)	
Camshaft lobe	Intake valve	New	mm (in)	32.11 to 32.31 (1.2642 to 1.2721)	
		Service limit	mm (in)	32.09 (1.2634)	
	Exhaust valve	New	mm (in)	31.94 to 32.14 (1.2575 to 1.2654	
		Service limit	mm (in)	31.92 (1.2567)	
Crankshaft main journal diameter MAG/PTO side		New	mm (in)	42.024 to 42.040 (1.6545 to 1.6551)	
		Service limit	mm (in)	42.000 (1.6535 in	
Crankshaft radial play MAG/PTO side		Service limit	mm (in)	0.07 (.0031)	
Crankshaft main journal diameter PTO support bearing		New	mm (in)	34.000 to 34.016 (1.3386 to 1.3392)	
		Service limit	mm (in)	33.980 (1.3378)	
Crankshaft radial play PTO support bearing		Service limit	mm (in)	0.10 (.0039)	

MODEL				SKANDIC	EXPEDITION
				SWT	TUV
				V800	
ENGINE (cont'd)					
Crankshaft pin diameter		New	mm (in)	40.009 to 40.025 (1.5752 to 1.5758)	
		Service limit	mm (in)	39.990 (1.5744)	
Crankshaft deflection	MAG/PTO	New	mm (in)	0.050 (.002)	
Crankcase plain bearing	MAG/PTO	Service limit	mm (in)	42.070 (1.6563)	
PTO cover plain bearing		Service limit	mm (in)	34.080 (1.3417)	
Connecting rod big end diameter		Service limit	mm (in)	40.100 (1.579)	
Connecting rod big end radial play		Service limit	mm (in)	0.09 (.0035)	
Connecting rod big end axial play		New	mm (in)	0.200 to 0.500 (.008 to .020)	
		Service limit	mm (in)	0.600 (.024)	
Connecting rod small end diameter		New	mm (in)	20.010 to 20.020 (.7878 to .7882)	
		Service limit	mm (in)	20.060 (.7898)	
Piston pin diameter		New	mm (in)	19.996 to 20.000 (.7872 to .7874)	
		Service limit	mm (in)	19.980 (.7866)	
Connecting rod small end radial play		Service limit	mm (in)	0.080 (.0035)	
COOLING SYSTEM					
Coolant		Type		Ethyl glycol and distilled water (50%/ 50%). Use premix coolant from BRP (P/N 219 700 362) or coolant specifically formulated for aluminum engines	
		Quantity	L (U.S. gal.)	4.00 (1.06)	4.5 (1.2)
Thermostat opening temperature			°C (°F)	45 (113)	
Radiator cap opening pressure			kPa (PSI)	110 (16)	
LUBRICATION SYSTEM					
Lubrication	Type			Wet sump. Replaceable oil filter	
	Oil filter			BRP Rotax paper type, replaceable	
	Engine oil pressure	Minimum		550 kPa (80 PSI) at 7000 RPM	
	Engine oil	Capacity (oil change with filter)		2.3 L (2.4 quarts)	
		Recommended		XP-S 0W40 synthetic oil or an equivalent	
FUEL SYSTEM					
Throttle body type				VDO	
Idle speed			± 200 RPM	1400	
Gas type				Unleaded	
Pump octane number		Inside North America ((R+M)/2)		87 or higher	
		Outside North America (RON)		92 or higher	
Fuel tank capacity			L (U.S. gal)	41 (10.8)	

mmr2007-224

Section 14 TECHNICAL SPECIFICATIONS
Subsection 04 (V800 MODELS)

MODEL			SKANDIC SWT / EXPEDITION TUV
			V800
ELECTRICAL SYSTEM			
Magneto generator output		W	460 @ 6000 RPM
Ignition type			CDI (Capacity Discharge Ignition) by DENSO
Spark plug	Make and type		NGK DCPR8E
	Gap	mm (in)	0.75 (.0303)
Ignition timing			Not adjustable
Crankshaft position sensor (CPS)		Ω	700 to 900 @ 20°C (68°F)
		Vac	2.3 @ 20°C (68°F)
Battery			12 V, 18 A•h
Headlamp		W	60/55 (H4)
Taillight and stoplight		W	8/27
Fuse	Starter solenoid	A	5
	Starting system	A	30
DRIVE SYSTEM			
Gearbox oil	Type		XP-S synthetic chaincase oil
	Quantity	mL (U.S. oz)	500 (17)
Gear ratio	1st		1 : 2.82
	2nd		1 : 2.04
	R		1 : 3.44
Drive pulley type			TRA IV
Drive pulley calibration	Clutch engagement	± 100 RPM	2500
	Spring color		Red/Red
	Spring length	mm (in)	97 (3.82)
	Pin		Hollow (P/N 417 222 594)
	Ramp		614
	Screw position		3
Driven pulley type	Type		IBC VSA 6000
	Spring preload	kg (lb)	7.5 to 9.0
	Cam angle		40°/30°
Pulley distance Offset	Z	mm (in)	67 ± 0.75 (2.638 ± .030)
	X	mm (in)	37.0 ± 0.75 (1.457 ± 0.030)
	Y-Z	mm (in)	0.75 to 2.25 (.030 to .090)
Drive belt part number		P/N	605 348 425
Drive belt	Width	mm (in)	37.3 (1.469)
	Wear limit	mm (in)	35.5 (1.398)
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)
	Force	kgf (lbf)	11.30 (24.91)

MODEL			SKANDIC	EXPEDITION
			SWT	TUV
			V800	
DRIVE SYSTEM (con'd)				
Track	Width	mm (in)	600 (24)	500 (20)
	Length	m (in)	3.968 (156)	
	Profile height	mm (in)	31.8 (1.25)	
Track adjustment	Deflection	mm (in)	40 to 50 (1.575 to 1.969)	
	Force	kgf (lbf)	7.3 (16)	
BRAKE SYSTEM				
Brake lining thickness		mm (in)	1 (.039)	
Brake fluid	Type		DOT 4	
	Quantity	mL (U.S. oz)	500 (17)	
SUSPENSION				
FRONT				
Suspension type			LTS	SUV
Suspension maximum travel		mm (in)	150 (6)	200 (8)
Shock absorber type			Motion control	
REAR				
Suspension type			WLS	SUV
Suspension maximum travel		mm (in)	210 (8.3)	293 (11.5)
Shock absorber type		Center	Motion control	
		Rear	H.P.G.	
Stroke limiter standard position			—	
STEERING SYSTEM				
Ski type			ADJ	
Toe-out		mm (in)	5 (.197)	
Camber			0°	
VEHICLE INFORMATIONS				
Mass (dry)		kg (lb)	320 (705.5)	
Length		m (in)	3.09 (121.7)	
Width		m (in)	1.08 (42.5)	1.22 (48)
Height		m (in)	1.36 (53.5)	
Ski stance (carbide to carbide)		m (in)	985 (38.8)	
MATERIAL				
Frame			Steel	
Bottom pan			HDPE	
Hood			RRIM	

ELECTRICAL CONNECTORS

SERVICE TOOLS

Description	Part Number	Page
connector crimping tool	529 035 909	716
crimp pliers	529 035 730	717
crimper die	529 035 906	716

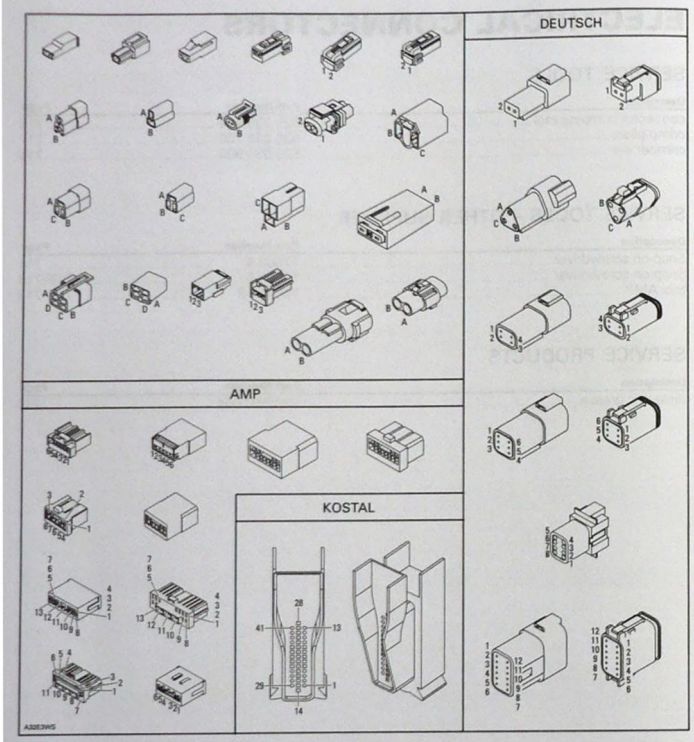
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on screwdriver	TT600-4	711
Snap-on screwdriver	TT600-5	709–710
tool AMP	755430-2	712–713

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	714

mm/2007-225


DEUTSCH
AMP
KOSTAL
A32E3WS

PROCEDURES

TAB AND RECEPTACLE CONNECTORS

Unplugging Connectors

Always unplug connectors by pulling on housing not on wire.

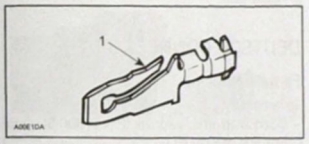


TYPICAL

Removal

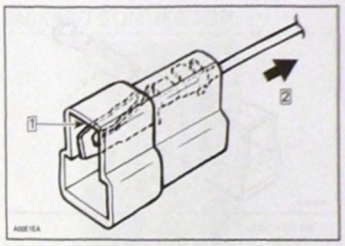
Tab Connector

It is locked in its housing by a spring tab on its side.



TAB CONNECTOR
1. Locking tab

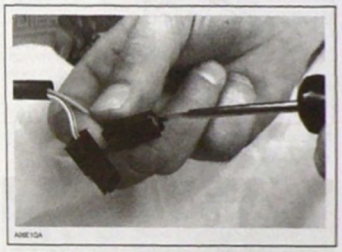
- Insert Snap-on screwdriver (P/N TT600-5) from opposite side of wire and pry locking tab.
- While holding locking tab pried, pull connector toward wire side.



Step 1: Insert screwdriver here
Step 2: Pull this side

Receptacle Connector

- Insert Snap-on screwdriver (P/N TT600-5) in access opening then pull housing toward wire side.

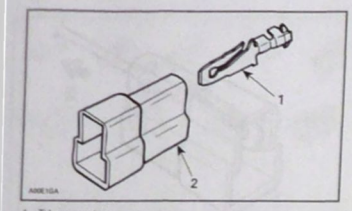


RECEPTACLE CONNECTOR

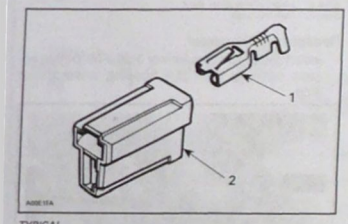
Installation

Prior to installing, make sure locking tab is sufficiently lifted to properly lock.

Insert tab and receptacle connectors in their respective housings as shown in following illustrations. Push sufficiently so that they snap. Try pulling wire to ensure they are properly locked.



1. Tab connector
2. Housing



TYPICAL
1. Receptacle
2. Housing

⚠ WARNING

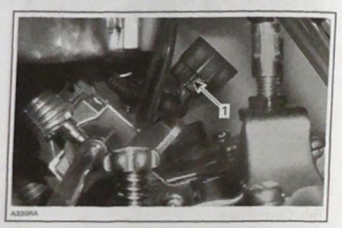
Keep wires away from any rotating, moving, heating, vibrating or sharp edge. Use proper fastening devices as required.

SUMITOMO CONNECTOR

To disconnect the Sumitomo TPS connector from carburetor or throttle body, press the release button on the other side of the connector.



TPS CONNECTOR
1. Release button



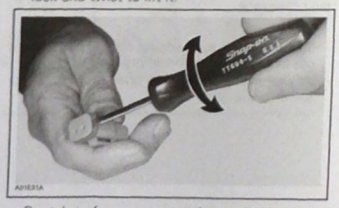
TPS CONNECTOR UNPLUGGED
1. Release button

DEUTSCH CONNECTORS

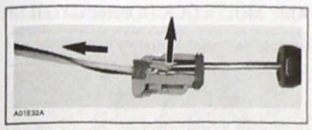
Female Housing

To remove:

- Insert Snap-on screwdriver (P/N TT600-5) under lock and twist to lift it.



- Pry tab to free connector then pull wire out of housing.

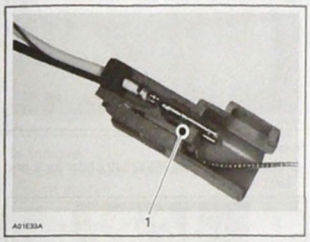


FEMALE CONNECTOR HOUSING — CUT-AWAY

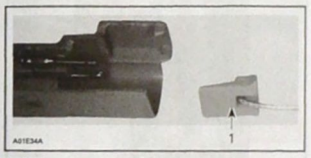
Male Housing

To remove:

– Using a small hook, pull out the lock.

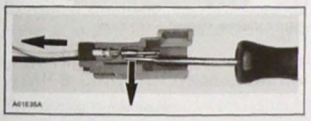


1. Lock



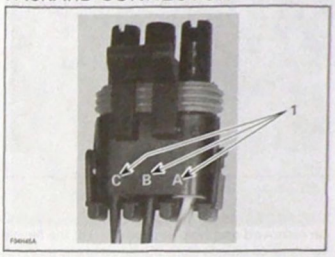
1. Lock

– Pry tab to free connector then pull wire out of housing.



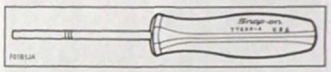
MALE CONNECTOR HOUSING — CUT-AWAY

PACKARD CONNECTOR



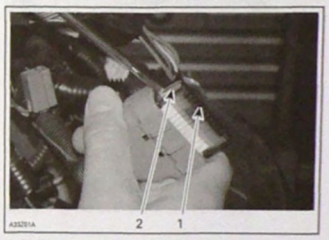
VIEW OF A 3-PIN PACKARD CONNECTOR
1. Identification letters

To remove terminal from Packard connector, use Snap-on screwdriver (P/N TT600-4) tool.



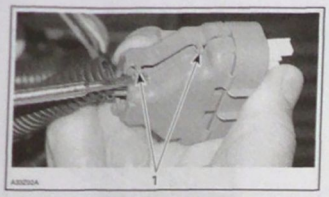
PACKARD 24-CIRCUIT AND 32-CIRCUIT CONNECTOR

Push on both tabs to remove retainer.



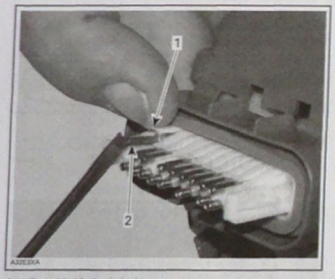
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



1. Tabs (2 on each side)

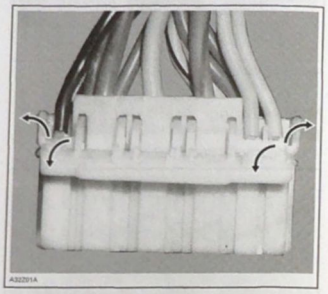
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. Lift and hold plastic lock
2. Lift to unlock and push out

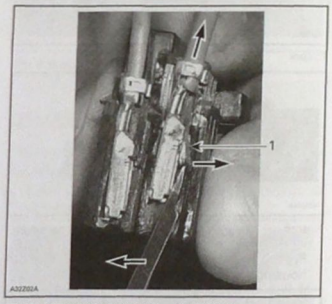
AMP MULTILOCK CONNECTOR

Female Terminal Housing



To remove:

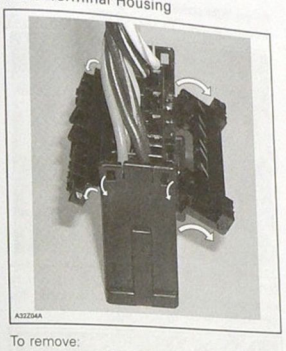
– Insert tool AMP (P/N 755430-2) under lock and twist to lift it.



FEMALE TERMINAL HOUSING — CUT-AWAY
1. Lock

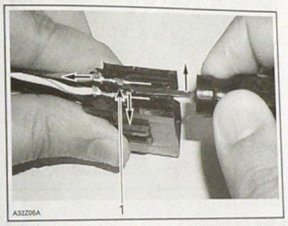
Female terminals can be removed from housing with sharp head pin.

Male Terminal Housing



To remove:

– Insert tool AMP (P/N 755430-2) under lock and twist to lift it.



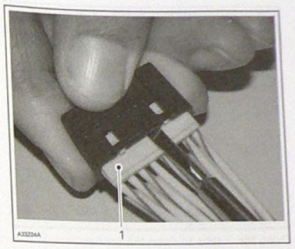
MALE TERMINAL HOUSING — CUT-AWAY
1. Lock

Terminal Crimping

Refer to *KOSTAL ECM CONNECTOR "A" AND "B"* for procedure.

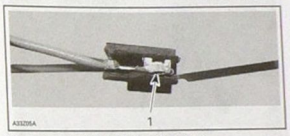
AMP 8-CIRCUIT CONNECTOR

Pry housing to release lock.



1. Lock

Insert tool AMP (P/N 755430-2) under tab and pry it to free connector. Pull on the female terminal wire to remove female terminal from housing.



AMP 8-CIRCUIT CONNECTOR — CUT-AWAY
1. Tab

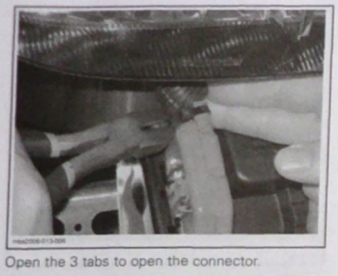
Terminal Crimping

Refer to *KOSTAL ECM CONNECTOR "A" AND "B"* for procedure.

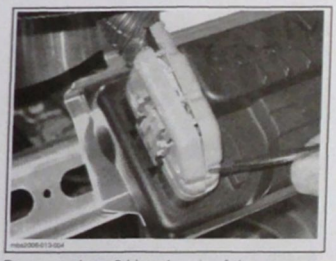
KOSTAL ECM CONNECTOR "A" AND "B"

Connector Corrosion Protection

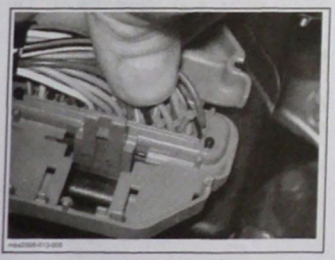
Cut the tie rap over the ECM connector.



Open the 3 tabs to open the connector.



Remove at least 2 blue plug pin of the connector (keep them).



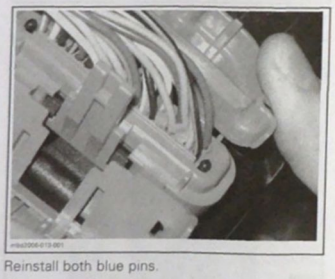
Unplug the connector from the ECM.

NOTE: Any corrosion should be carefully cleaned with a soft brass brush.

Fill the ECM socket with a generous quantity of dielectric grease (P/N 293 550 004).

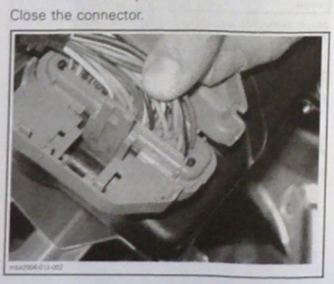


SLOWLY reinstall the connector and make sure some grease come out by both hole previously opened (blue pin).



Reinstall both blue pins.

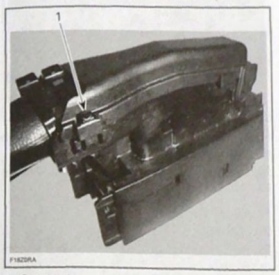
Close the connector.



Reinstall a new tie rap on ECM connector.

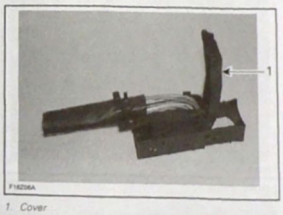
Terminal Removal

Unlock the connector housing cover by pushing in the tabs on top of the housing with a flat screwdriver to be able to flip the top cover up.



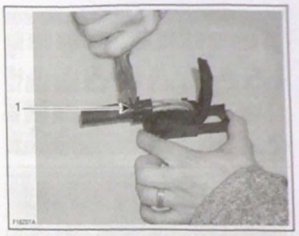
1. Push in tab

Lift the cover by pushing it forward.



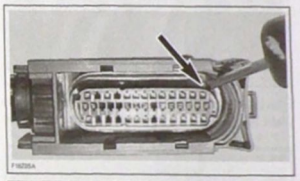
1. Cover

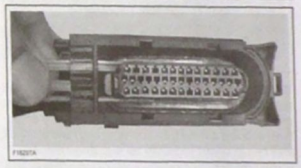
Cut both locking ties that secure the harness to the housing.



1. Locking ties

Turn the housing over and remove the lock by pushing and then pulling toward the wire harness.

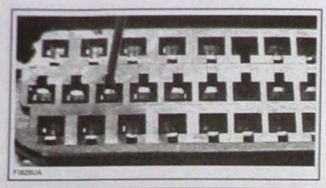


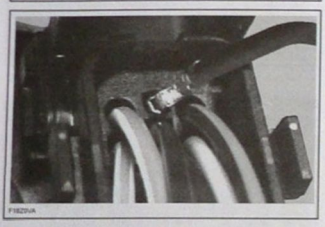


Use a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit inserted down into the housing to release the locking tab on the connector.

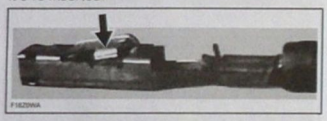
CAUTION: Using a probe larger than 0.76 mm (.030 in) may damage the terminal.

Insert the probe into the housing as shown, and locate the appropriate wire in the back of the housing. You may have to slightly cam the probe against the locking tab to release it, then remove the terminal from the housing.





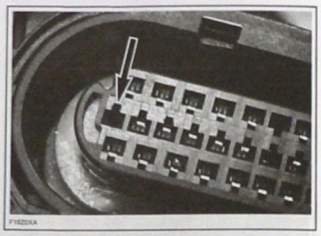
The locking tab on the connector may have to be bent out a little so it will lock in the housing when it's re-inserted.



If the wire is in good condition but the terminal is rusted or corroded, remove defective terminal and crimp a new one. If wire and terminal are defective, acquire a new genuine wire and new terminal and crimp them together as explained below.

IMPORTANT: Use genuine wires only. Otherwise wires will not fit properly.

When re-inserting the connector, the locking tab must be installed facing the smaller cutout of the connector cavity.

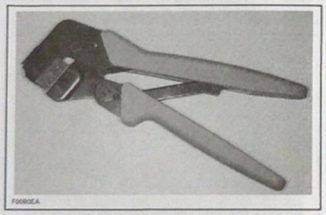


Insert the connector, ensuring the locking tab snaps into the housing.

Re-install the lock, attach the 2 tie raps, and close the housing cover.

Terminal Crimping (Kostal and AMP multilock)

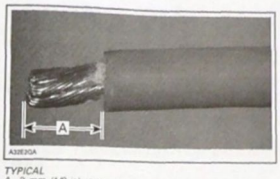
To crimp a new connector terminal, use the connector crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).



CRIMPING TOOL

To properly crimp the wires, strictly follow this procedure.

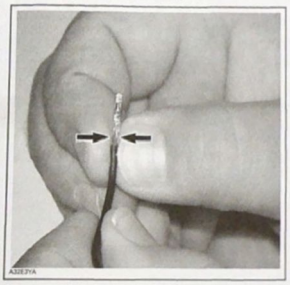
Strip the wire to a maximum of 3 mm (1/8 in).



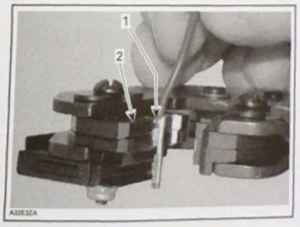
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.



Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



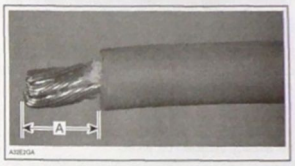
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

BATTERY CABLE TERMINAL

Terminal Installation

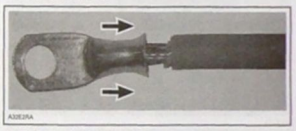
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.

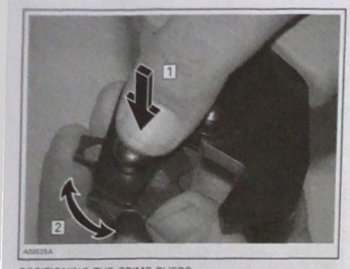


INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.



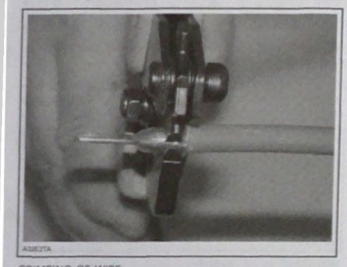
NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.



A20E25A

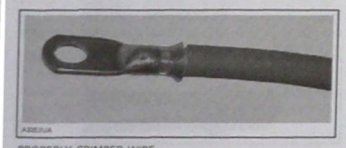
POSITIONING THE CRIMP PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimp pliers, crimp the terminal already installed on wire.



A10E27A

CRIMPING OF WIRE



A20E20A

PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

CAUTION: Never solder the wire to the terminal. Soldering can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

WIRING DIAGRAMS

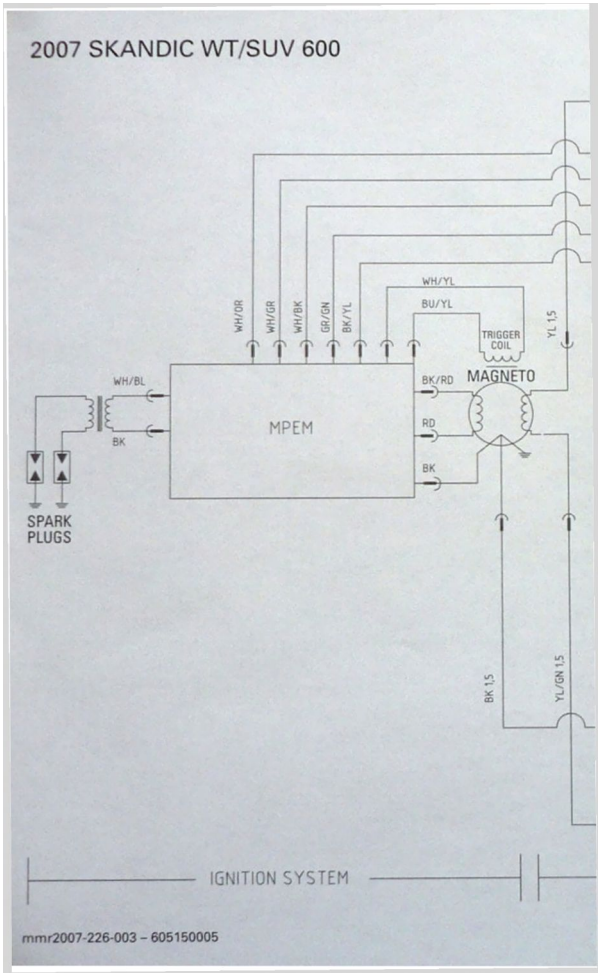
Wiring diagrams can be found at the end of the manual in the back cover sleeve.

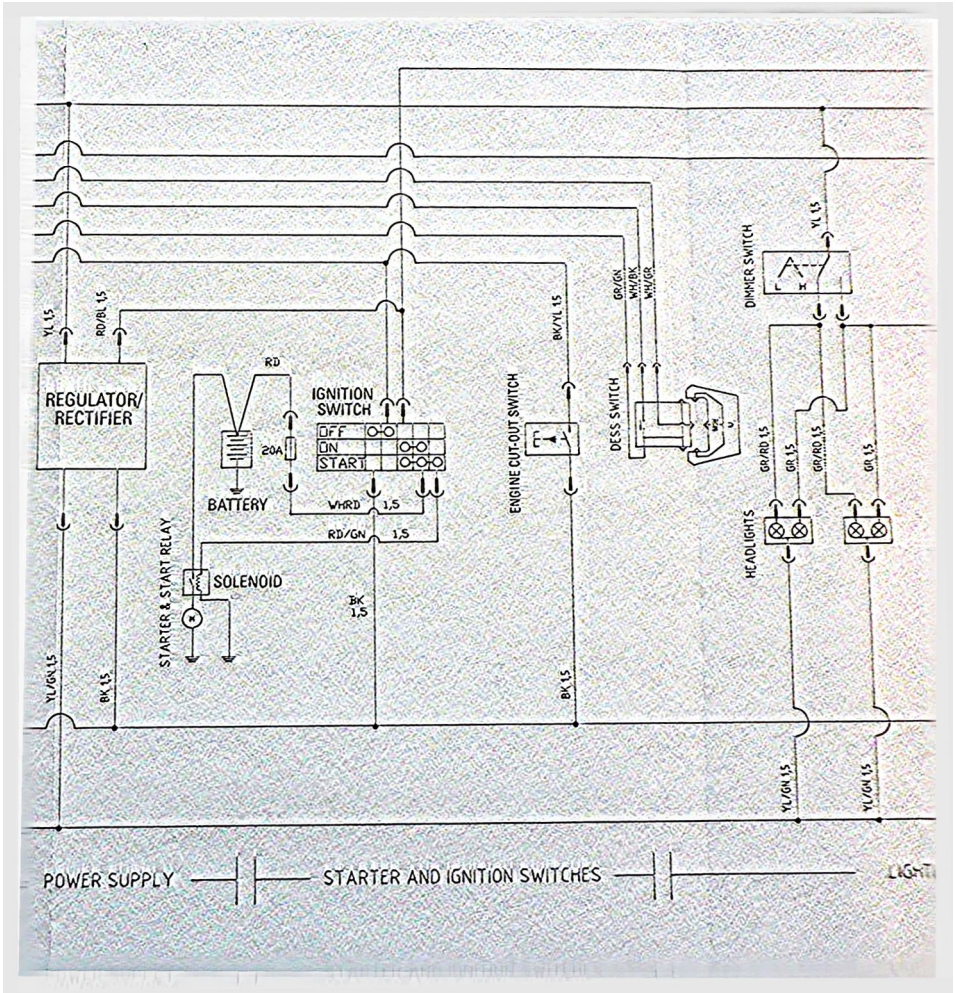
WIRE COLORS

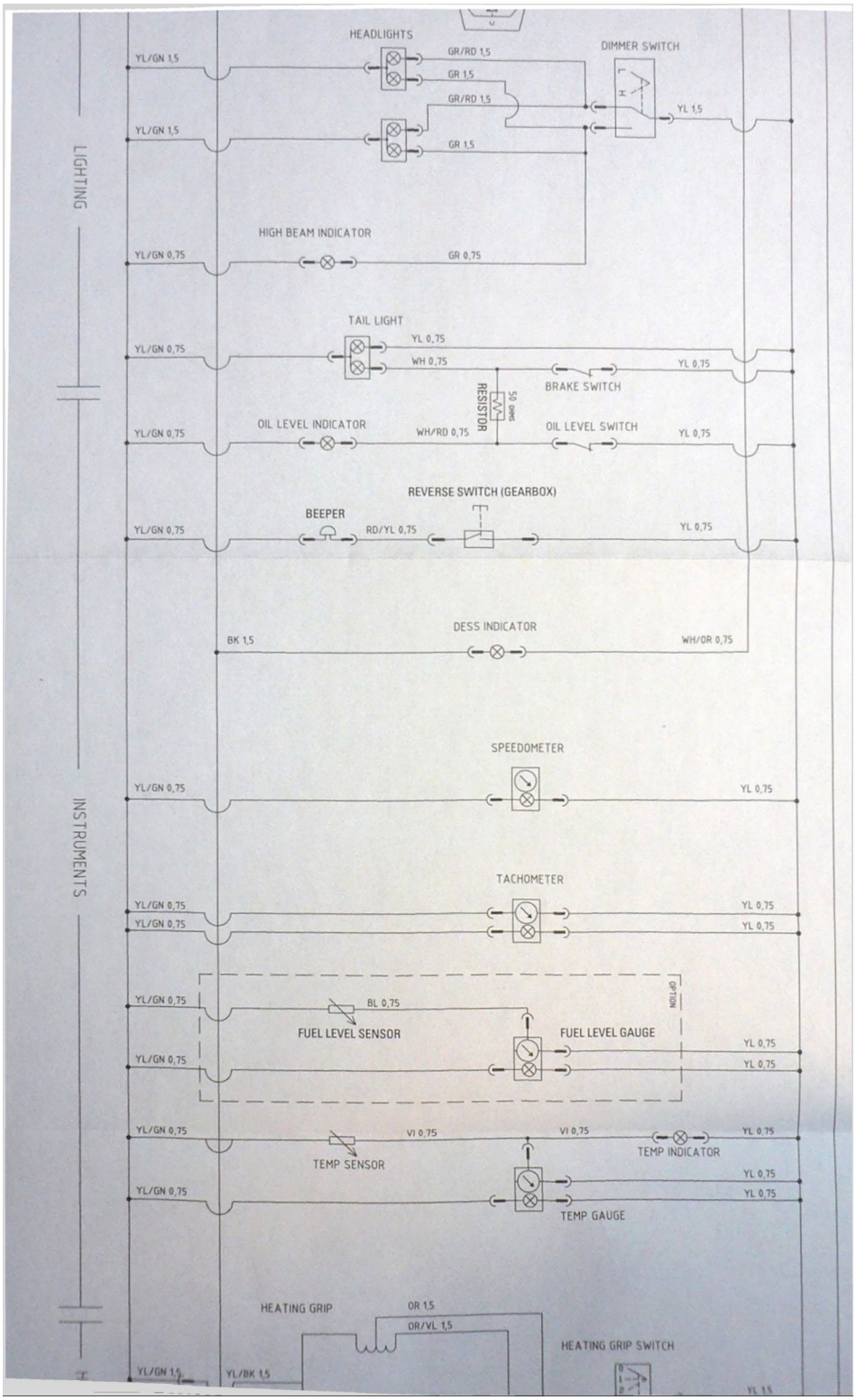
The first color of a wire is the main color, second color is the stripe.

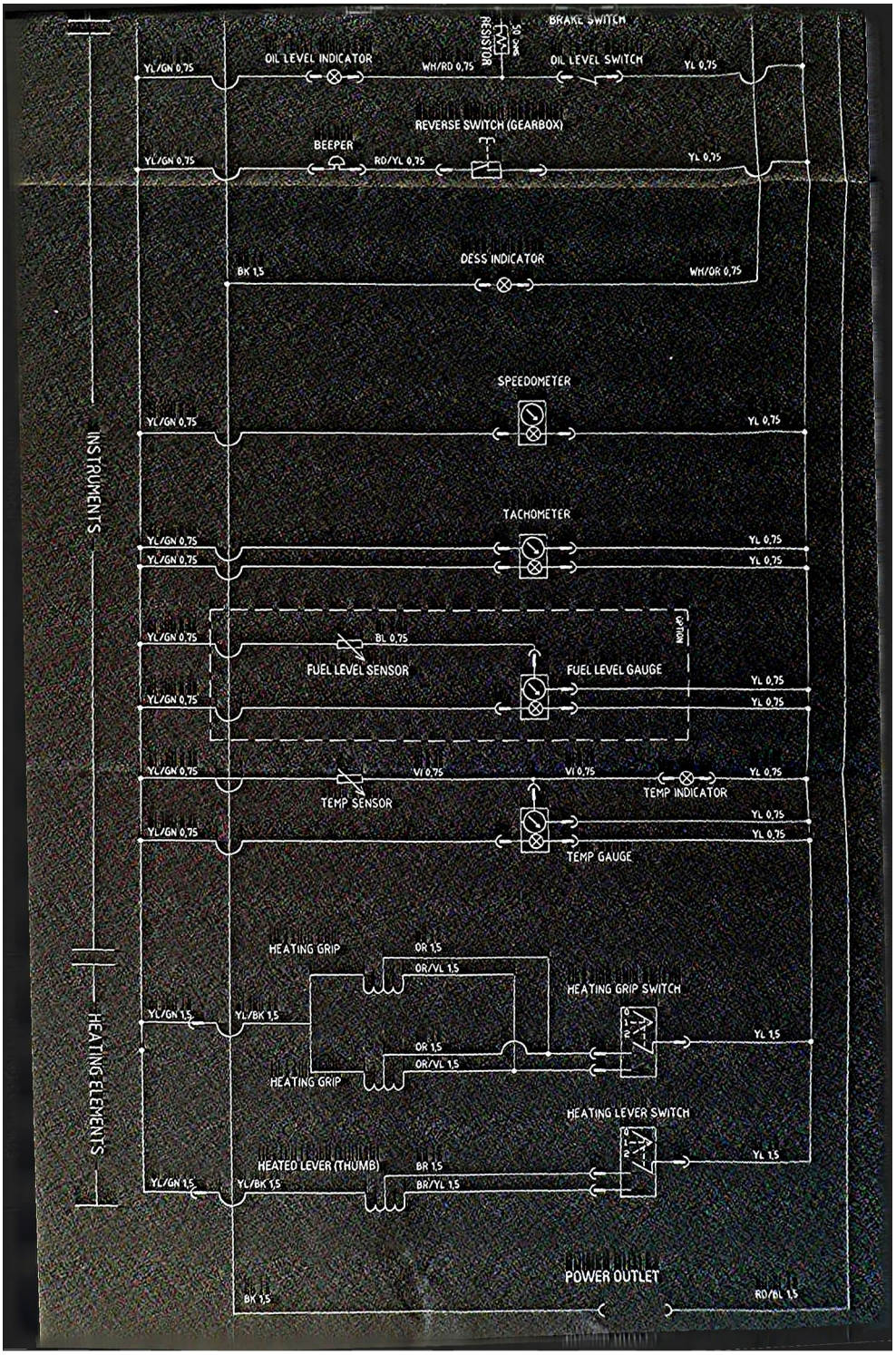
Example: YL/BK is a YELLOW wire with a BLACK stripe.

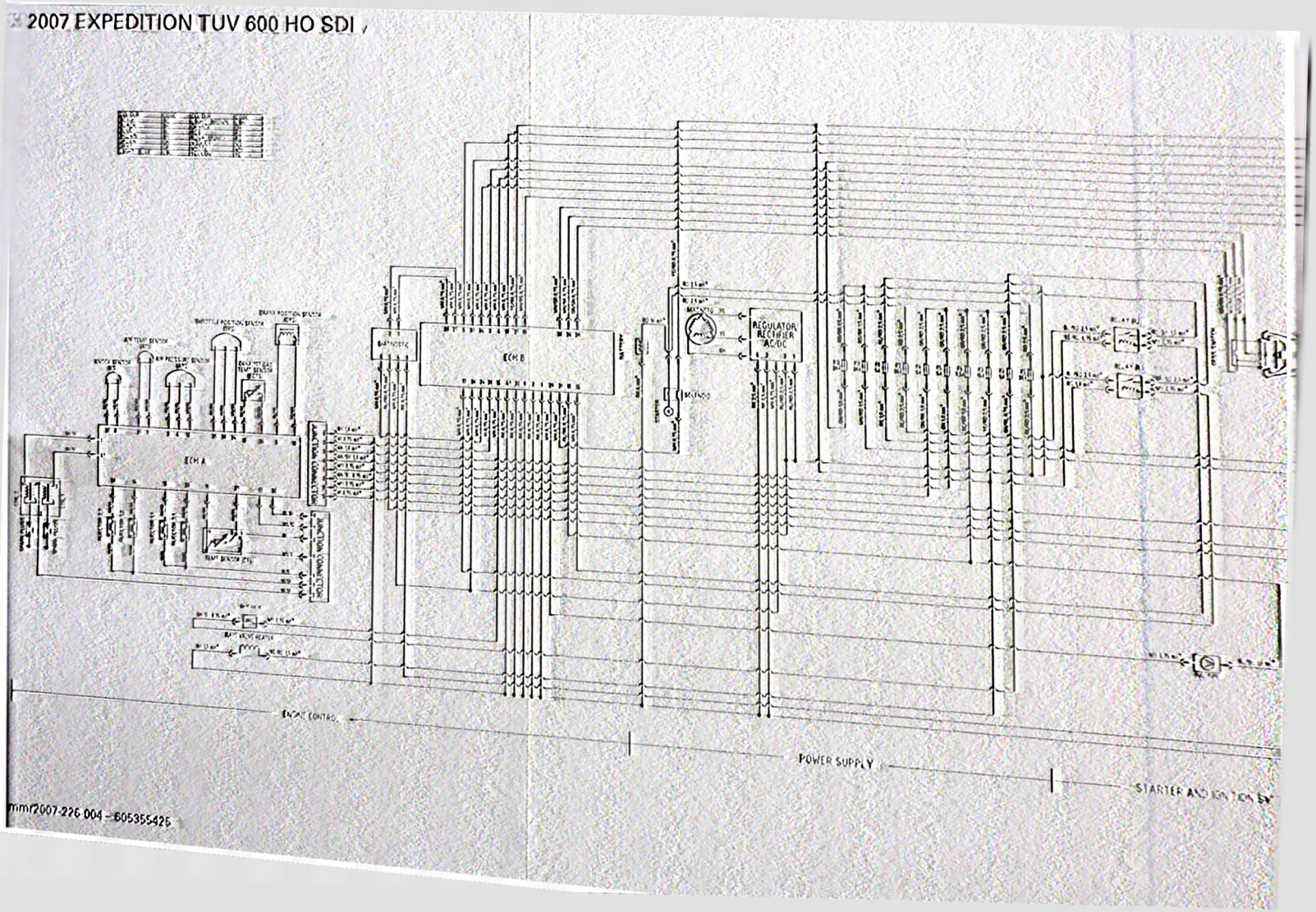
COLOR CODE	
BE – BEIGE	YL – YELLOW
WH – WHITE	BK – BLACK
BL – BLUE	OR – ORANGE
LBL – LIGHT BLUE	PI – PINK
BR – BROWN	RD – RED
LBN – LIGHT BROWN	GN – GREEN
GY – GRAY	VI – VIOLET

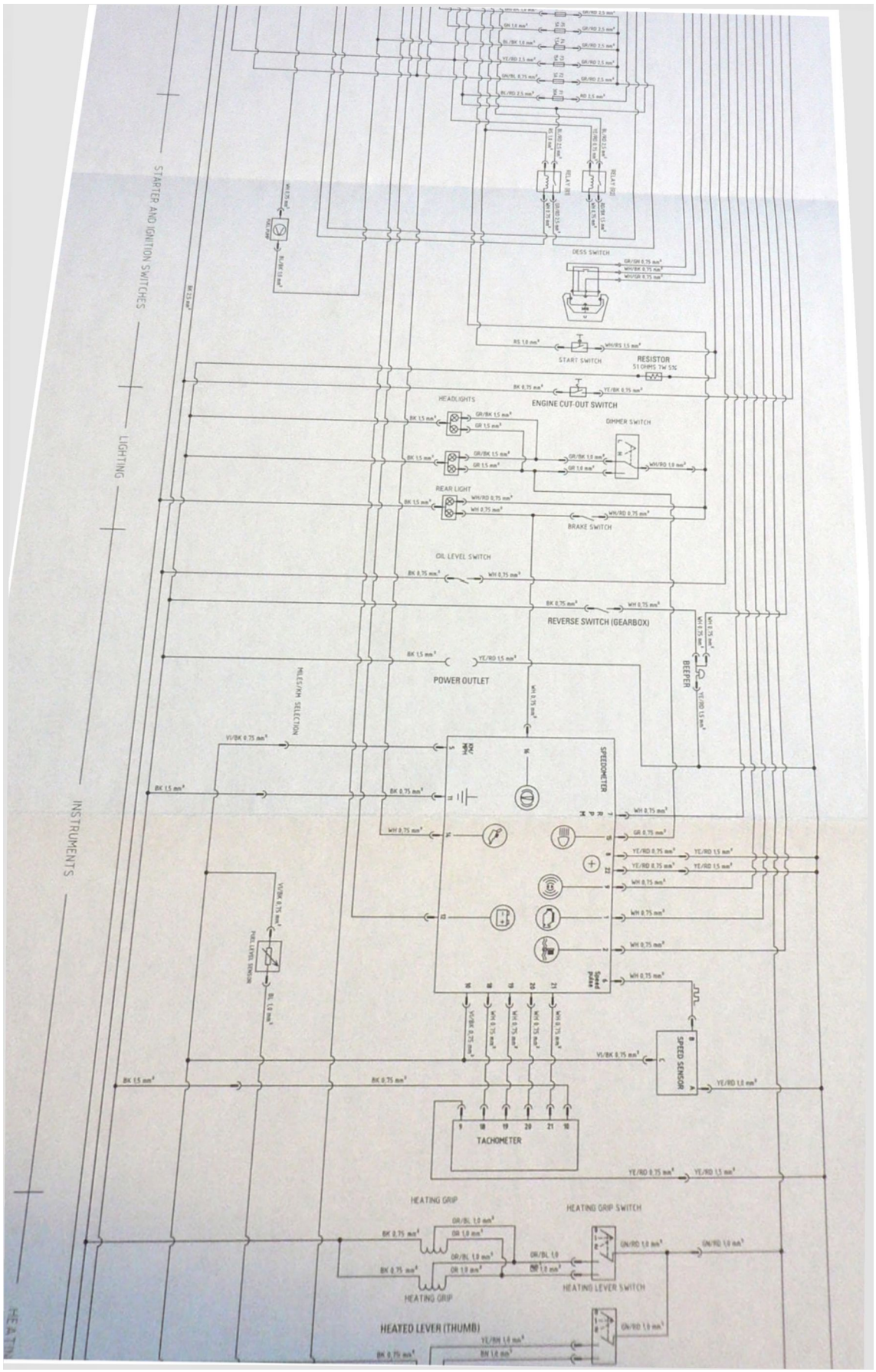

2007 SKANDIC WT/SUV 600
WH/OR
WH/GR
WH/BK
GR/GN
BK/YL
WH/YL
BU/YL
TRIGGER COIL
YL 1.5
MAGNETO
WH/BL
BK
MPEM
BK/RD
RD
BK
SPARK PLUGS
BK 1.5
YL/GN 1.5
IGNITION SYSTEM
mmr2007-226-003 – 605150005

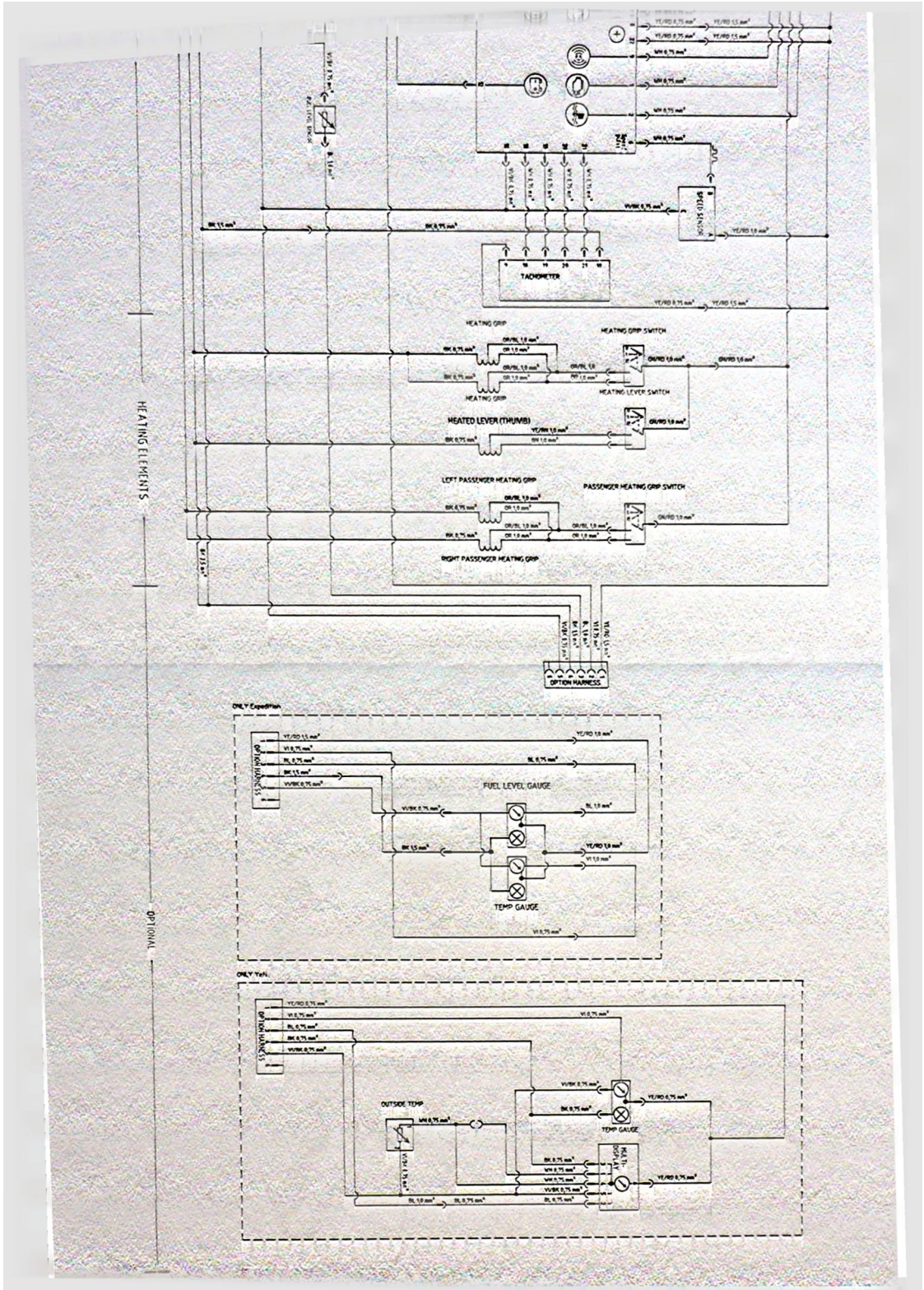

REGULATOR/
RECTIFIER
YL 1.5
RD/BL 1.5
YL/GN 1.5
BK 1.5
RD
20A
BATTERY
IGNITION
SWITCH
OFF
ON
START
WH/RD 1.5
RD/GN 1.5
BK
1.5
STARTER & START RELAY
SOLENOID
ENGINE CUT-OUT SWITCH
BK/YL 1.5
DESS SWITCH
GR/GN
WH/BK
WH/GR
DIMMER SWITCH
YL 1.5
GR/RD 1.5
GR 1.5
HEADLIGHTS
POWER SUPPLY
STARTER AND IGNITION SWITCHES
LIGHT


LIGHTING
INSTRUMENTS
HEADLIGHTS
DIMMER SWITCH
YL/GN 1,5
GR/RD 1,5
GR 1,5
YL 1,5
HIGH BEAM INDICATOR
YL/GN 0,75
GR 0,75
TAIL LIGHT
YL 0,75
WH 0,75
BRAKE SWITCH
RESISTOR
50 OHMS
OIL LEVEL INDICATOR
WH/RD 0,75
OIL LEVEL SWITCH
REVERSE SWITCH (GEARBOX)
BEEPER
RD/YL 0,75
DESS INDICATOR
BK 1,5
WH/OR 0,75
SPEEDOMETER
TACHOMETER
FUEL LEVEL SENSOR
BL 0,75
FUEL LEVEL GAUGE
OPTION
TEMP SENSOR
VI 0,75
TEMP INDICATOR
TEMP GAUGE
HEATING GRIP
OR 1,5
OR/VL 1,5
HEATING GRIP SWITCH
YL/BK 1,5

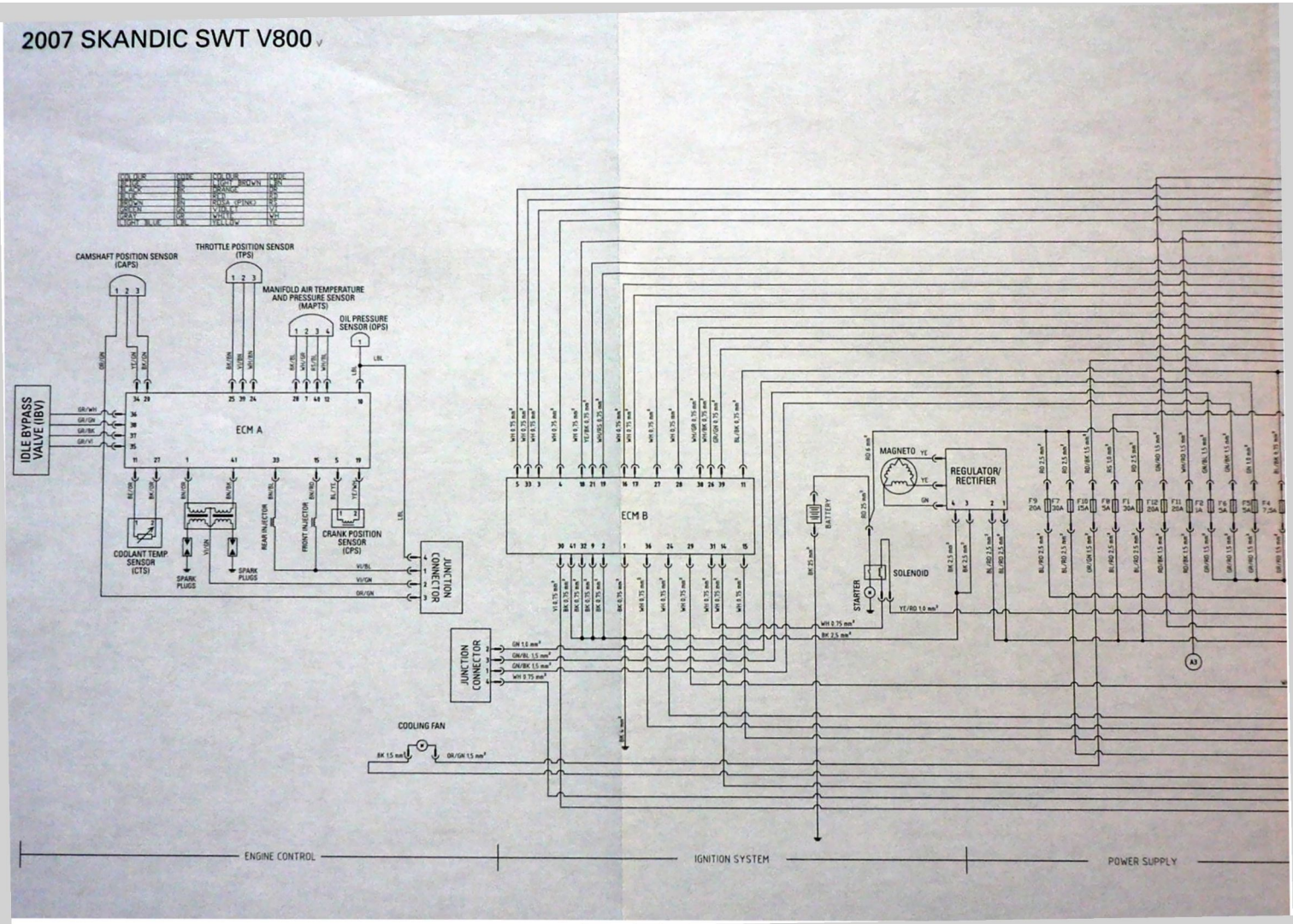

INSTRUMENTS
HEATING ELEMENTS
BRAKE SWITCH
RESISTOR
56 OHMS
OIL LEVEL INDICATOR
OIL LEVEL SWITCH
YL/GN 0,75
WH/RD 0,75
YL 0,75
REVERSE SWITCH (GEARBOX)
BEEPER
RD/YL 0,75
DESS INDICATOR
BK 1,5
WH/OR 0,75
SPEEDOMETER
TACHOMETER
FUEL LEVEL SENSOR
BL 0,75
FUEL LEVEL GAUGE
OPTION
TEMP SENSOR
VI 0,75
TEMP INDICATOR
TEMP GAUGE
HEATING GRIP
OR 1,5
OR/VL 1,5
HEATING GRIP SWITCH
YL/BK 1,5
YL 1,5
HEATING LEVER SWITCH
HEATED LEVER (THUMB)
BR 1,5
BR/YL 1,5
POWER OUTLET
RD/BL 1,5


2007 EXPEDITION TUV 600 HO SDI
ECM A
ECM B
REGULATOR RECTIFIER AC/DC
ENGINE CONTROL
POWER SUPPLY
mm/2007-226-004 – 605355425

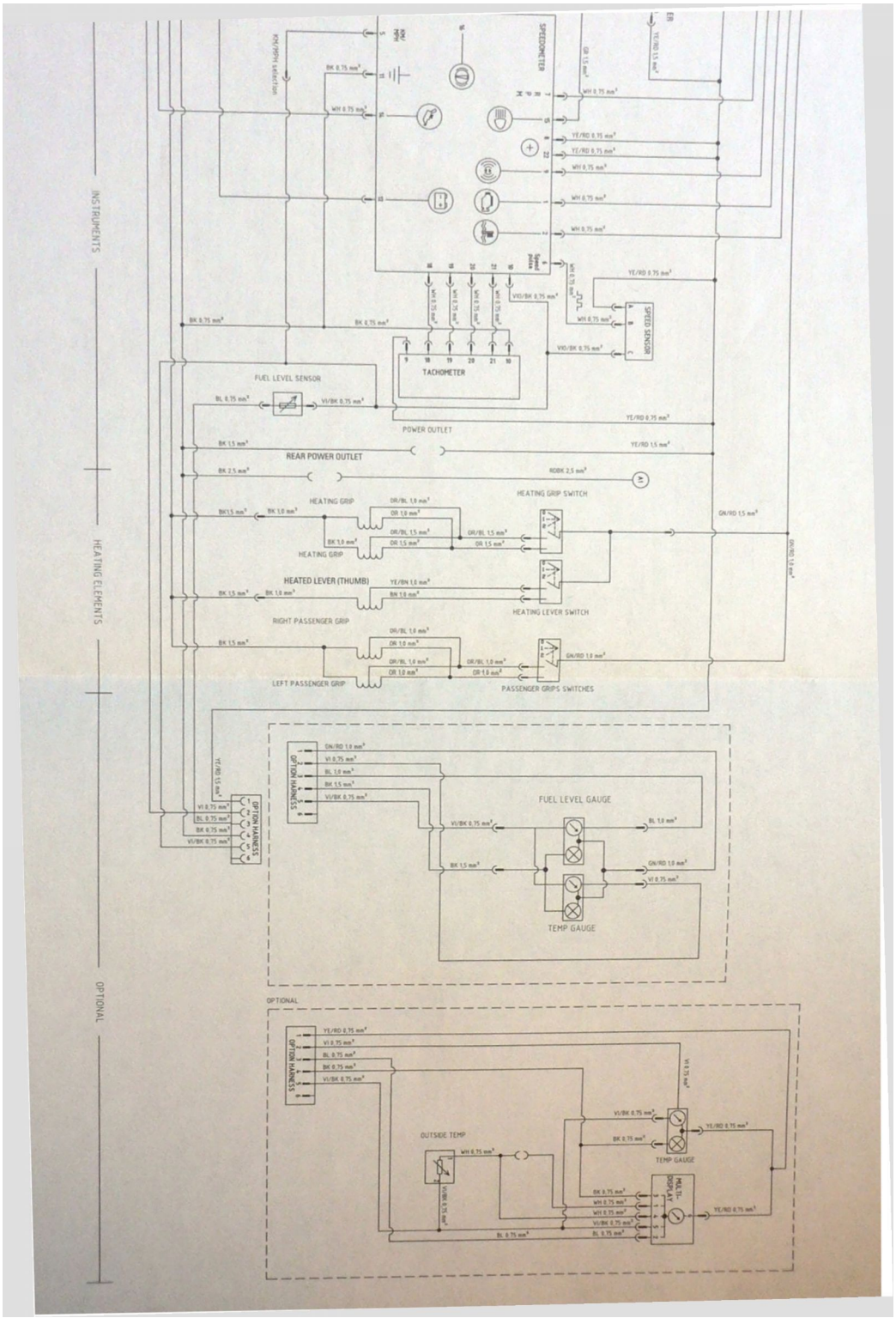

STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
HEATING
DESS SWITCH
START SWITCH
RESISTOR
51 OHMS TW 5%
ENGINE CUT-OUT SWITCH
HEADLIGHTS
DIMMER SWITCH
REAR LIGHT
BRAKE SWITCH
OIL LEVEL SWITCH
REVERSE SWITCH (GEARBOX)
POWER OUTLET
BEEPER
MILE/KM SELECTION
SPEEDOMETER
Speed pulse
SPEED SENSOR
TACHOMETER
HEATING GRIP
HEATING GRIP SWITCH
HEATING LEVER SWITCH
HEATED LEVER (THUMB)


HEATING ELEMENTS
OPTIONAL
TACHOMETER
HEATING GRIP
HEATING GRIP SWITCH
HEATING LEVER SWITCH
HEATED LEVER (THUMB)
LEFT PASSENGER HEATING GRIP
PASSENGER HEATING GRIP SWITCH
RIGHT PASSENGER HEATING GRIP
OPTION HARNESS
ONLY Expedition
FUEL LEVEL GAUGE
TEMP GAUGE
ONLY Yeti
OUTSIDE TEMP
TEMP GAUGE

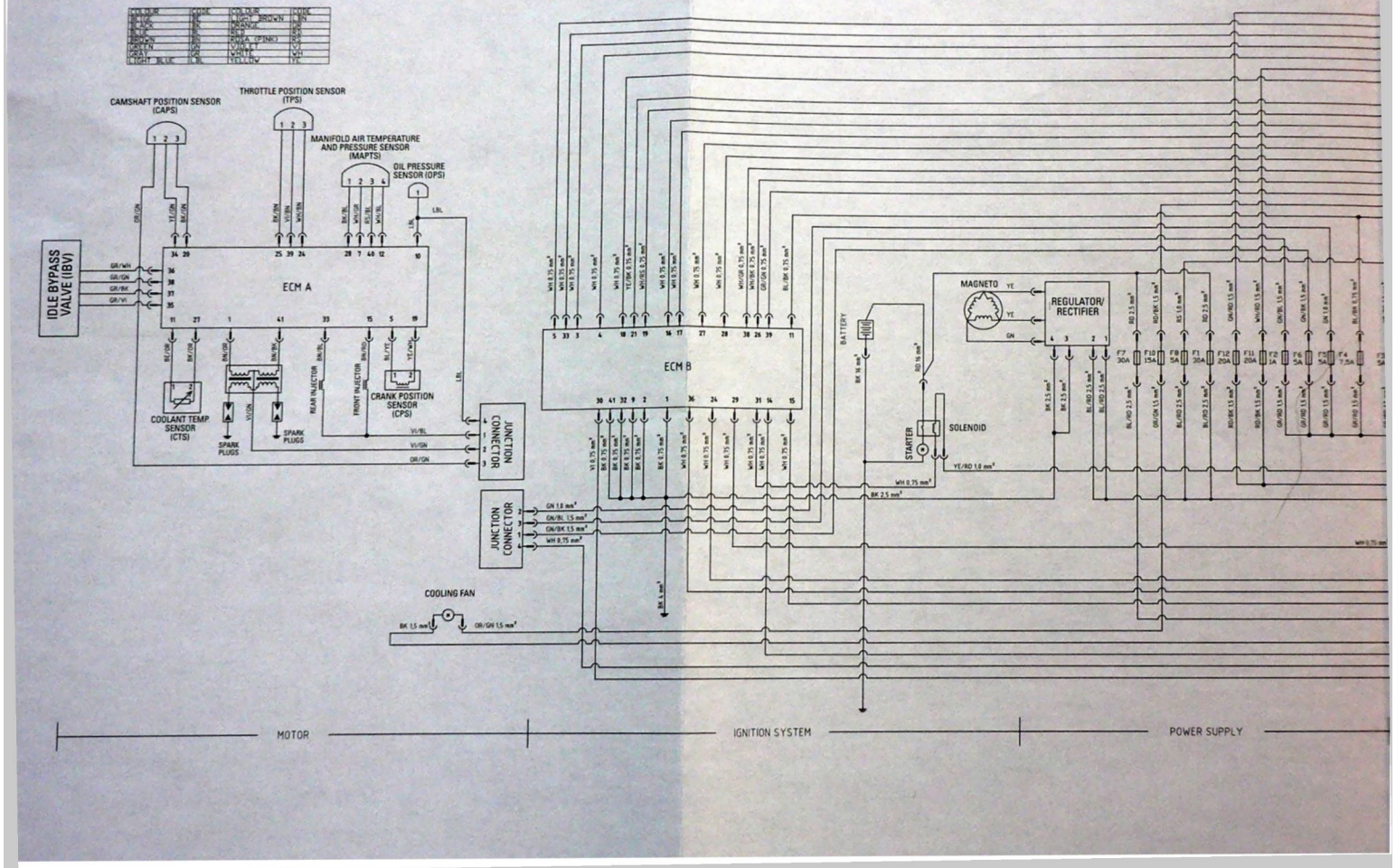
2007 SKANDIC SWT V800

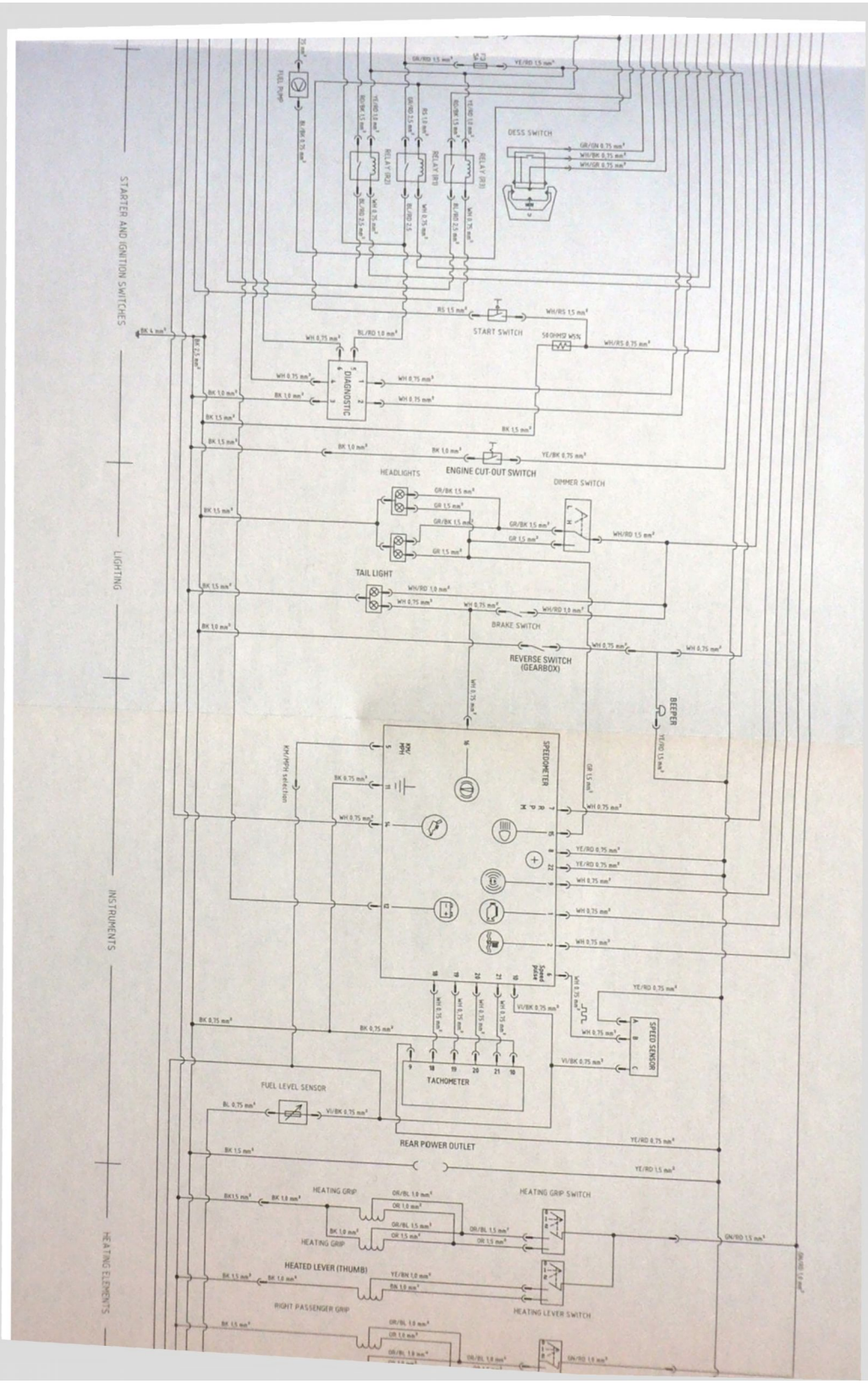


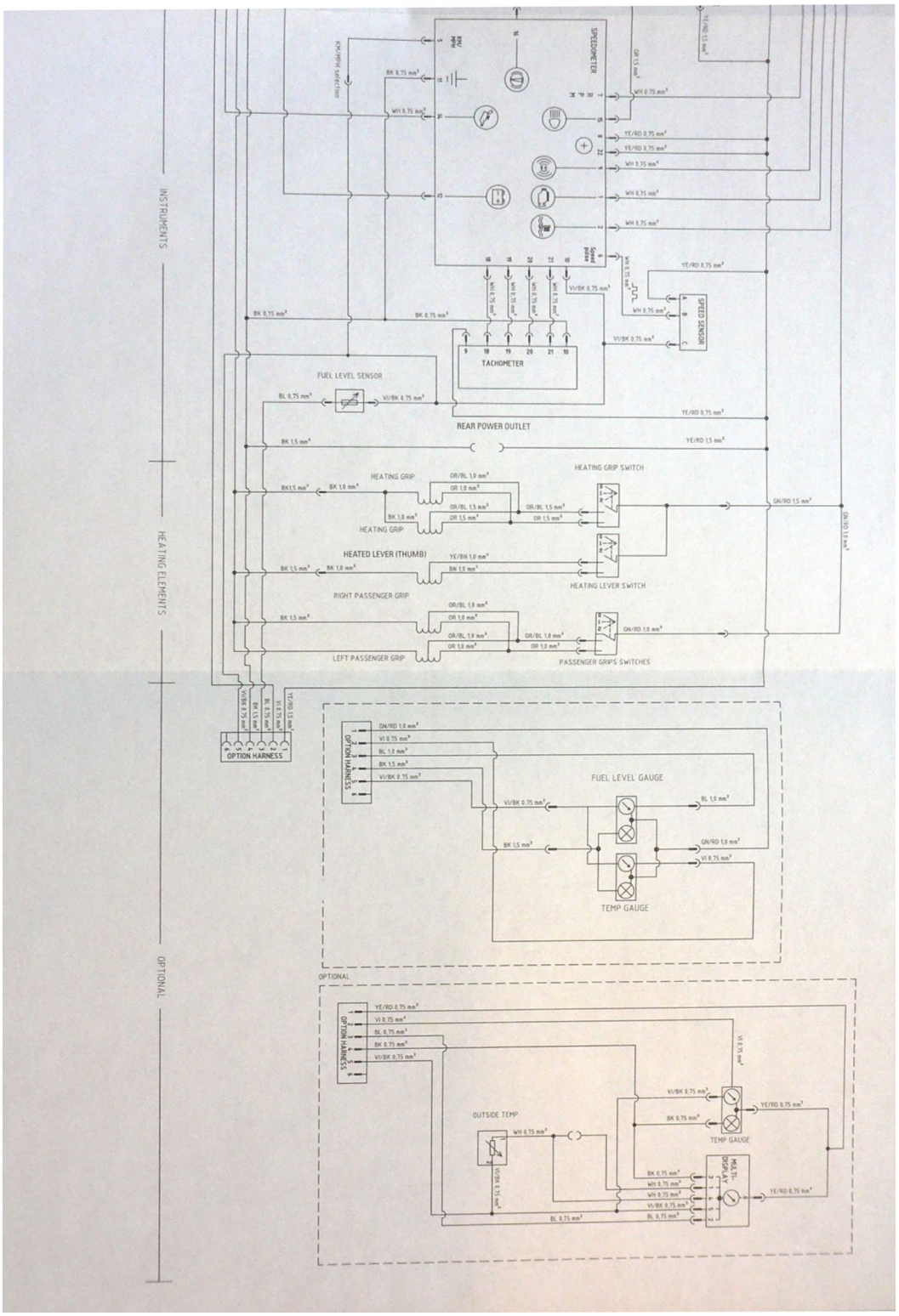
STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
HEATING ELEMENTS
FUEL PUMP
DESS SWITCH
REAR POWER OUTLET SWITH
RELAY (R2)
RELAY (R3)
RELAY (R4)
RELAY (R1)
START SWITCH
DIAGNOSTIC
ENGINE CUT-OUT SWITCH
HEADLIGHTS
DIMMER SWITCH
TAIL LIGHT
BRAKE SWITCH
REVERSE SWITCH (GEARBOX)
HORN PUSH BUTTON
BEEPER
SPEEDOMETER
SPEED SENSOR
TACHOMETER
FUEL LEVEL SENSOR
POWER OUTLET
REAR POWER OUTLET
HEATING GRIP SWITCH
HEATING GRIP
HEATED LEVER (THUMB)
HEATING LEVER SWITCH
RIGHT PASSENGER GRIP


INSTRUMENTS
HEATING ELEMENTS
OPTIONAL
SPEEDOMETER
TACHOMETER
FUEL LEVEL SENSOR
POWER OUTLET
REAR POWER OUTLET
HEATING GRIP SWITCH
HEATING GRIP
HEATED LEVER (THUMB)
HEATING LEVER SWITCH
RIGHT PASSENGER GRIP
LEFT PASSENGER GRIP
PASSENGER GRIPS SWITCHES
OPTION HARNESS
FUEL LEVEL GAUGE
TEMP GAUGE
OPTIONAL
OUTSIDE TEMP
MULTI DISPLAY

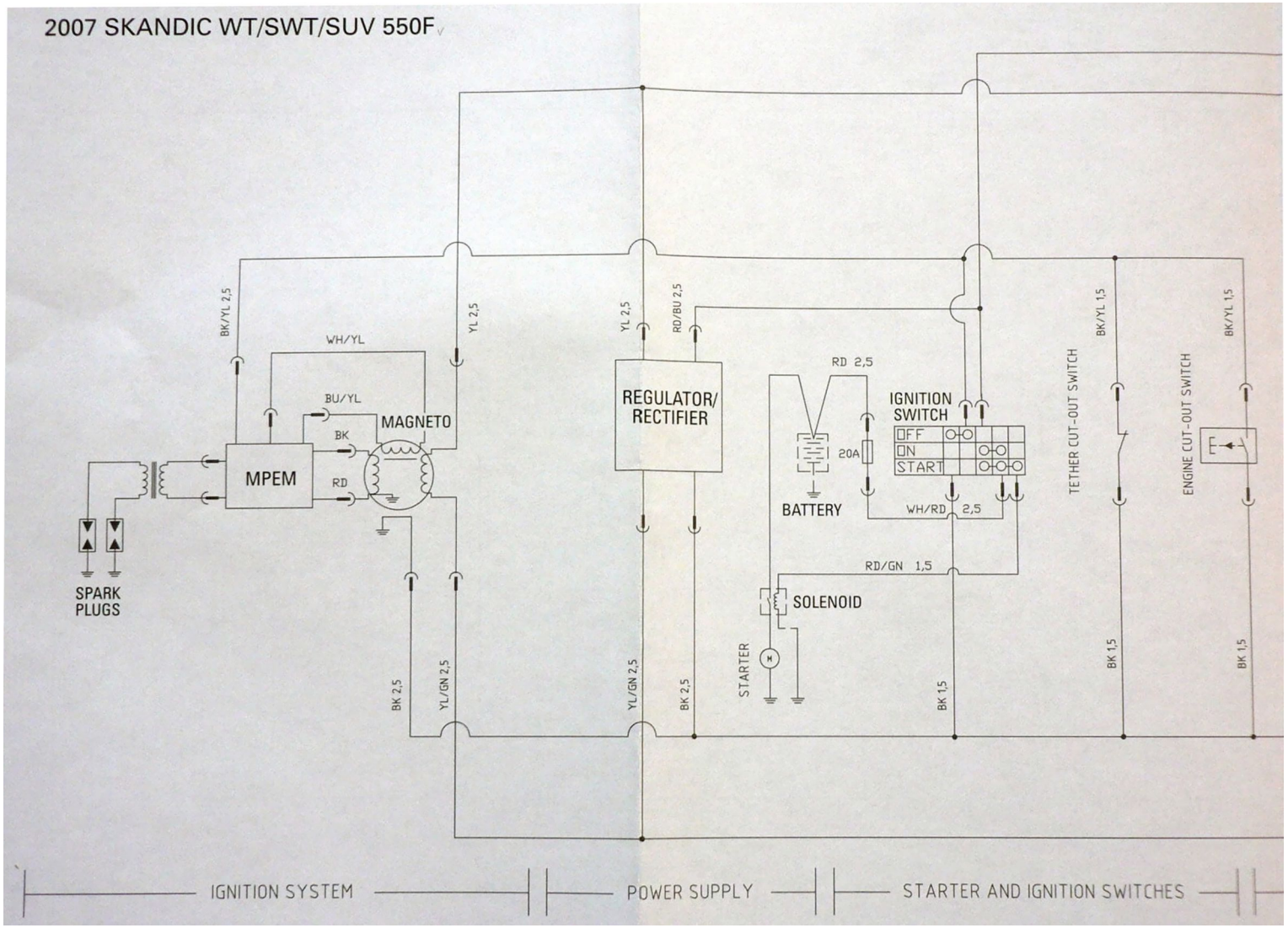
2007 EXPEDITION TUV V800

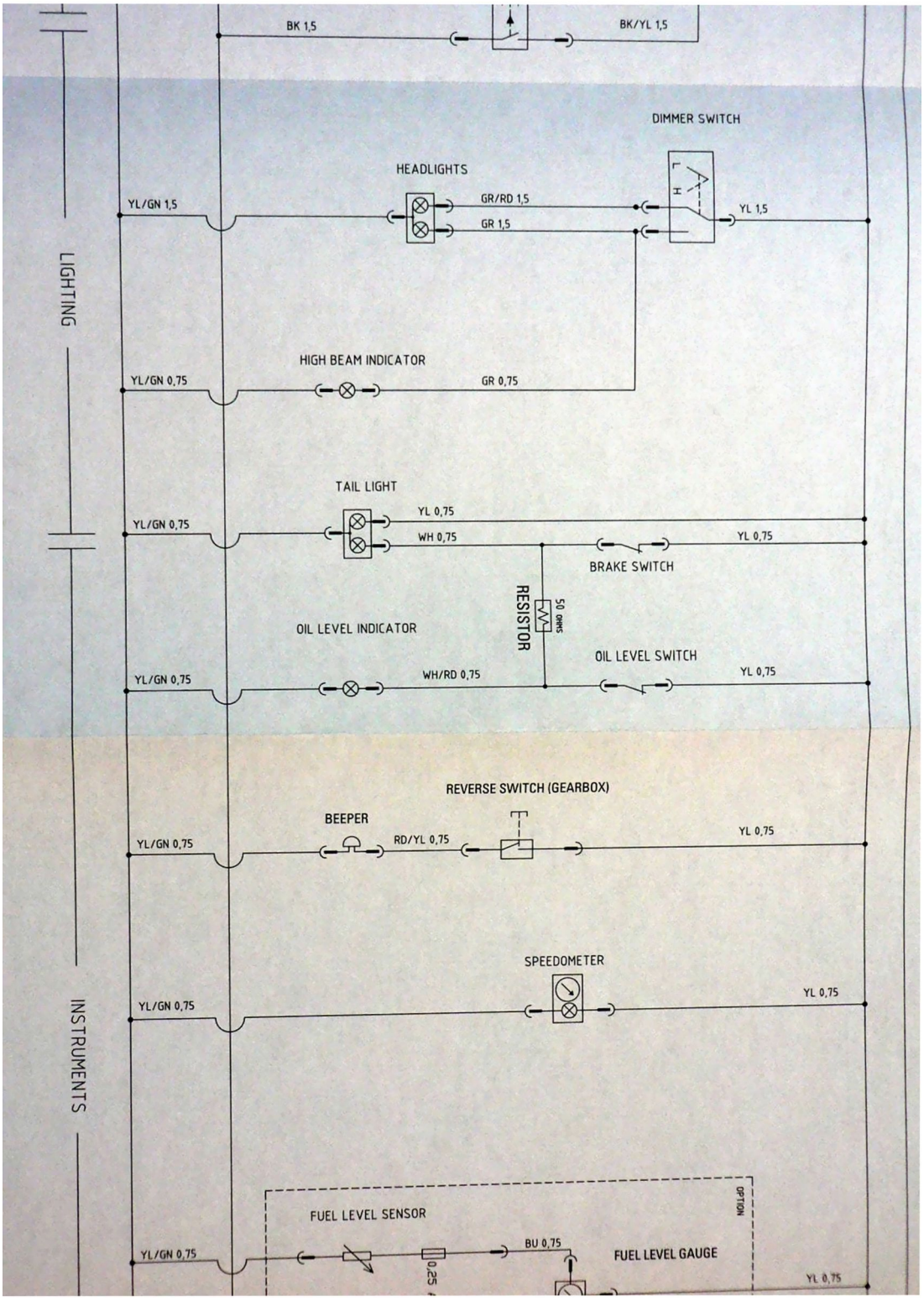


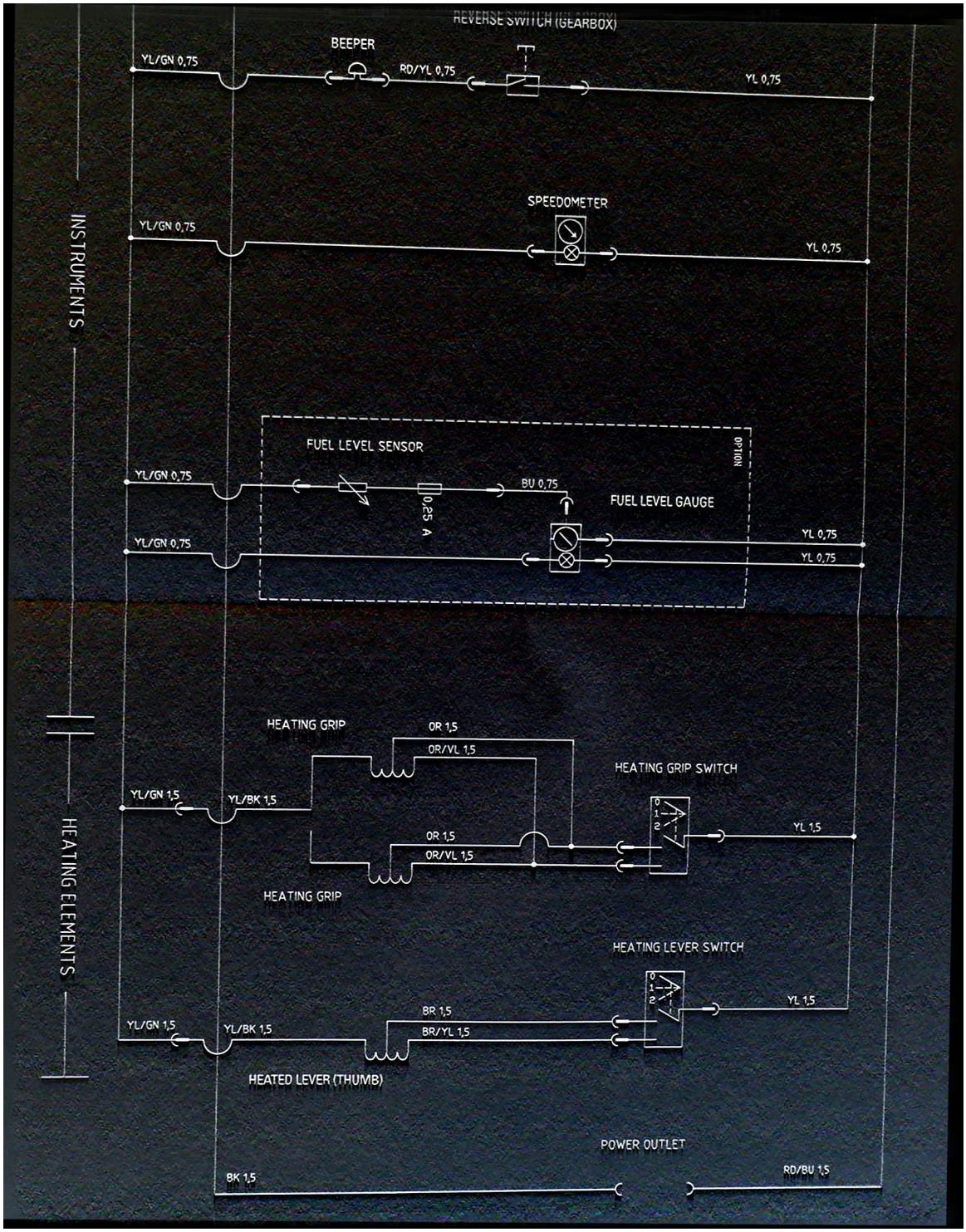

STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
HEATING ELEMENTS
FUEL PUMP
DESS SWITCH
START SWITCH
DIAGNOSTIC
ENGINE CUT-OUT SWITCH
HEADLIGHTS
DIMMER SWITCH
TAIL LIGHT
BRAKE SWITCH
REVERSE SWITCH (GEARBOX)
BEEPER
SPEEDOMETER
TACHOMETER
FUEL LEVEL SENSOR
SPEED SENSOR
REAR POWER OUTLET
HEATING GRIP
HEATING GRIP SWITCH
HEATED LEVER (THUMB)
RIGHT PASSENGER GRIP
HEATING LEVER SWITCH


INSTRUMENTS
HEATING ELEMENTS
OPTIONAL
SPEEDOMETER
SPEED SENSOR
TACHOMETER
FUEL LEVEL SENSOR
REAR POWER OUTLET
HEATING GRIP SWITCH
HEATING GRIP
HEATED LEVER (THUMB)
HEATING LEVER SWITCH
RIGHT PASSENGER GRIP
LEFT PASSENGER GRIP
PASSENGER GRIPS SWITCHES
OPTION HARNESS
FUEL LEVEL GAUGE
TEMP GAUGE
OUTSIDE TEMP
MULTI-DISPLAY

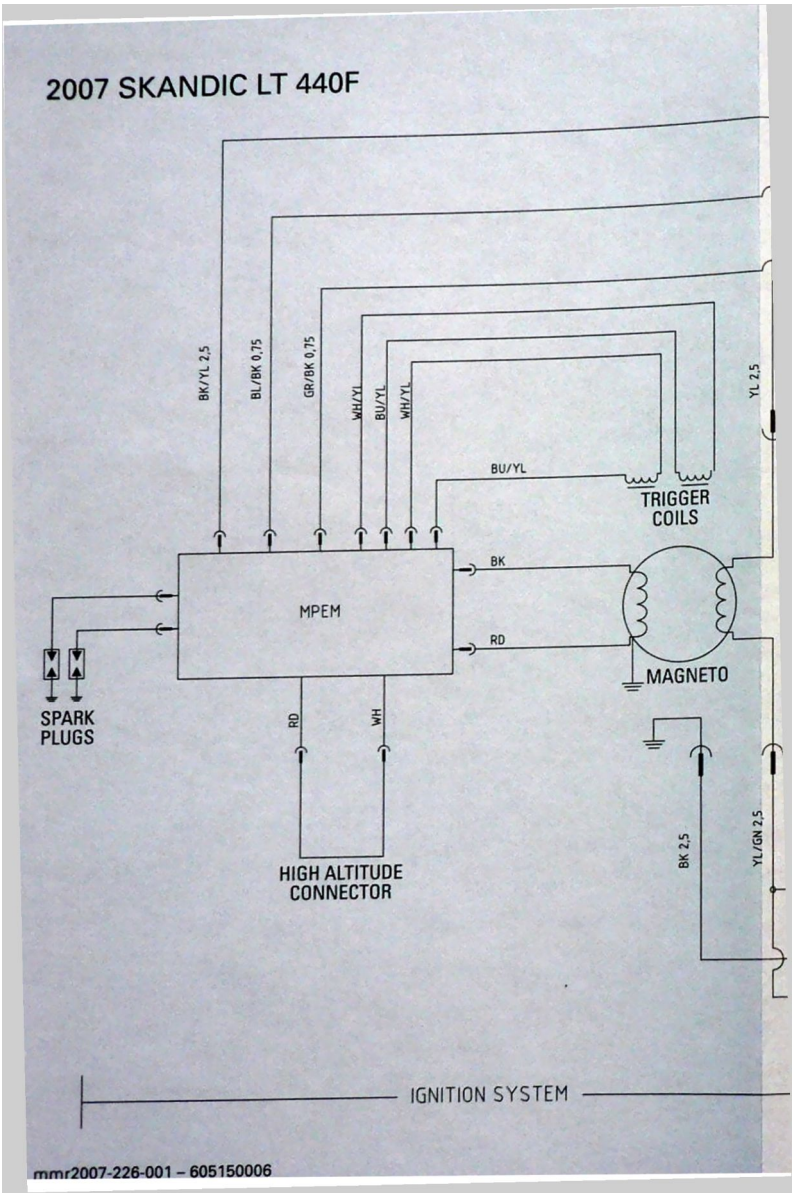
2007 SKANDIC WT/SWT/SUV 550F



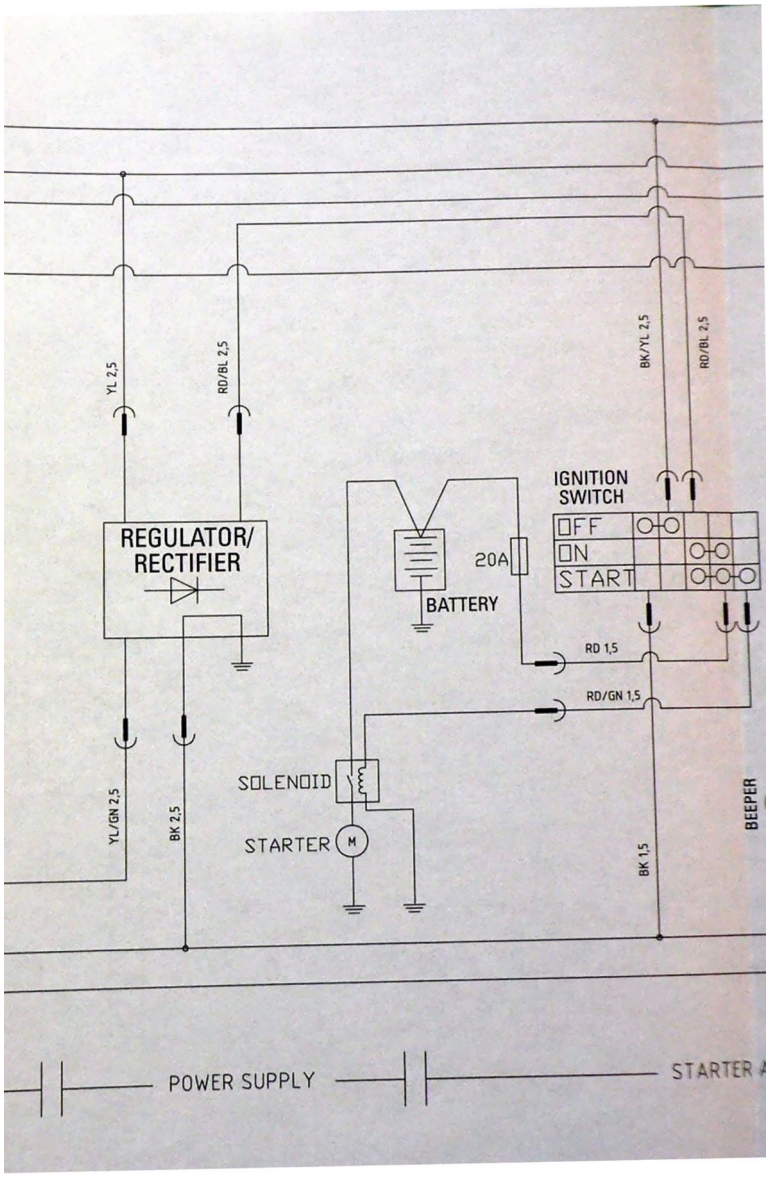

LIGHTING
INSTRUMENTS
BK 1,5
BK/YL 1,5
DIMMER SWITCH
HEADLIGHTS
L
H
YL/GN 1,5
GR/RD 1,5
GR 1,5
YL 1,5
HIGH BEAM INDICATOR
YL/GN 0,75
GR 0,75
TAIL LIGHT
YL/GN 0,75
YL 0,75
WH 0,75
YL 0,75
BRAKE SWITCH
RESISTOR
50 OHMS
OIL LEVEL INDICATOR
OIL LEVEL SWITCH
YL/GN 0,75
WH/RD 0,75
YL 0,75
REVERSE SWITCH (GEARBOX)
BEEPER
YL/GN 0,75
RD/YL 0,75
YL 0,75
SPEEDOMETER
YL/GN 0,75
YL 0,75
OPTION
FUEL LEVEL SENSOR
YL/GN 0,75
BU 0,75
FUEL LEVEL GAUGE
0,25
YL 0,75

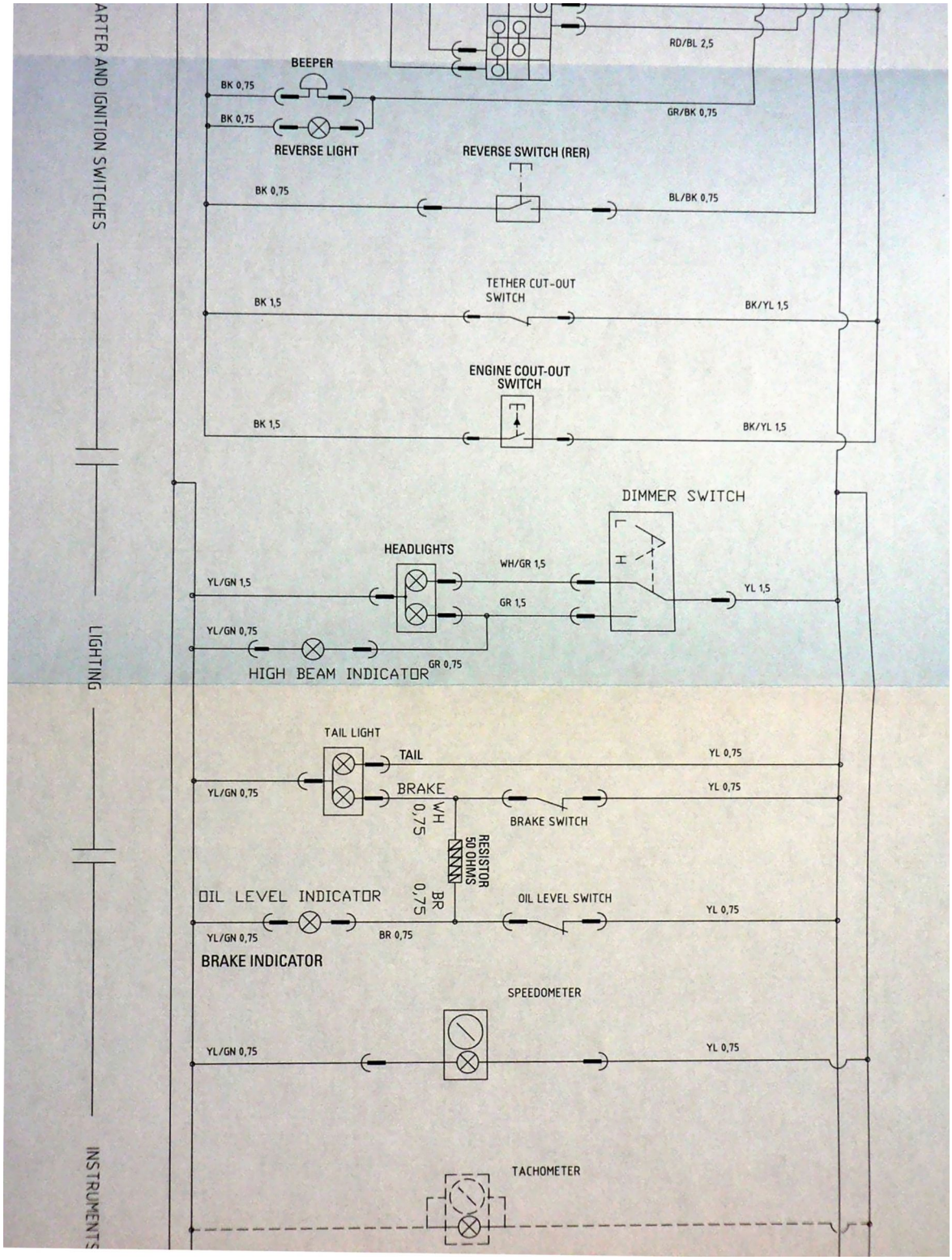

REVERSE SWITCH (GEARBOX)
BEEPER
YL/GN 0,75
RD/YL 0,75
YL 0,75
SPEEDOMETER
YL/GN 0,75
YL 0,75
INSTRUMENTS
FUEL LEVEL SENSOR
OPTION
YL/GN 0,75
BU 0,75
0,25 A
FUEL LEVEL GAUGE
YL/GN 0,75
YL 0,75
YL 0,75
HEATING GRIP
OR 1,5
OR/VL 1,5
HEATING GRIP SWITCH
YL/GN 1,5
YL/BK 1,5
YL 1,5
OR 1,5
OR/VL 1,5
HEATING GRIP
HEATING LEVER SWITCH
BR 1,5
YL 1,5
YL/GN 1,5
YL/BK 1,5
BR/YL 1,5
HEATED LEVER (THUMB)
HEATING ELEMENTS
POWER OUTLET
BK 1,5
RD/BU 1,5

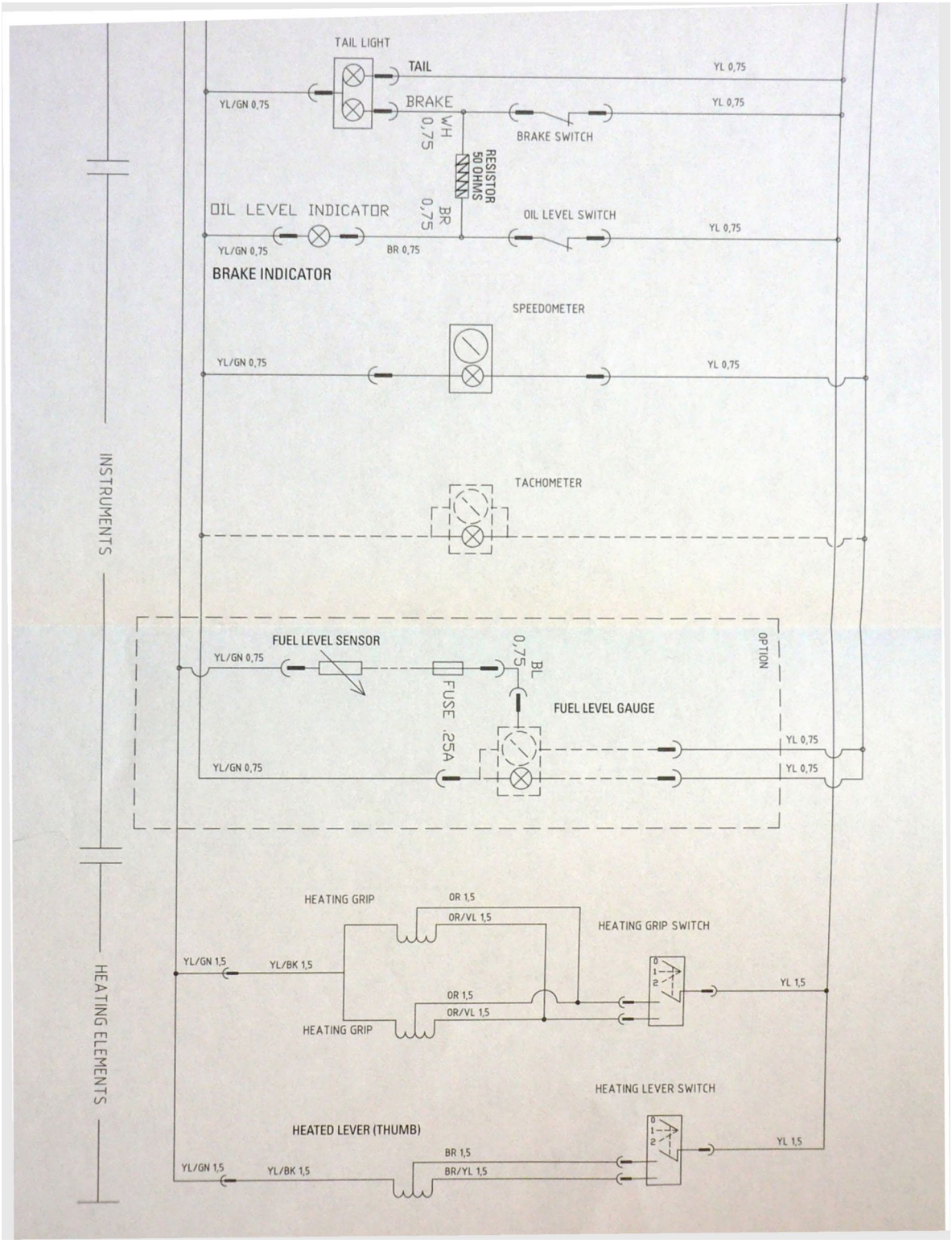
2007 SKANDIC LT 440F



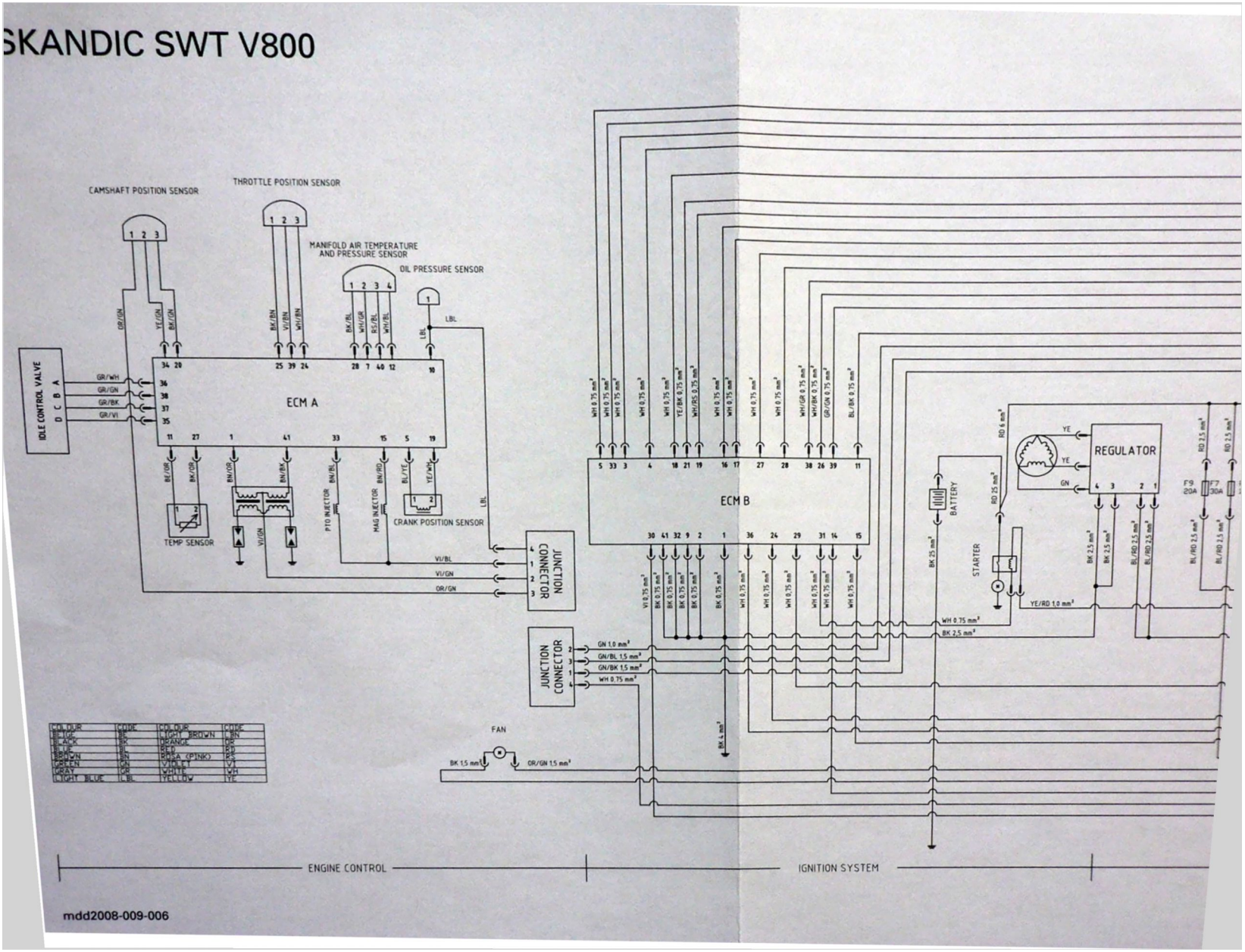
mmr2007-226-001 – 605150006


YL 2,5
RD/BL 2,5
BK/YL 2,5
RD/BL 2,5
IGNITION SWITCH
OFF
ON
START
REGULATOR/ RECTIFIER
20A
BATTERY
RD 1,5
RD/GN 1,5
SOLENOID
STARTER
M
YL/GN 2,5
BK 2,5
BK 1,5
BEEPER
POWER SUPPLY
STARTER

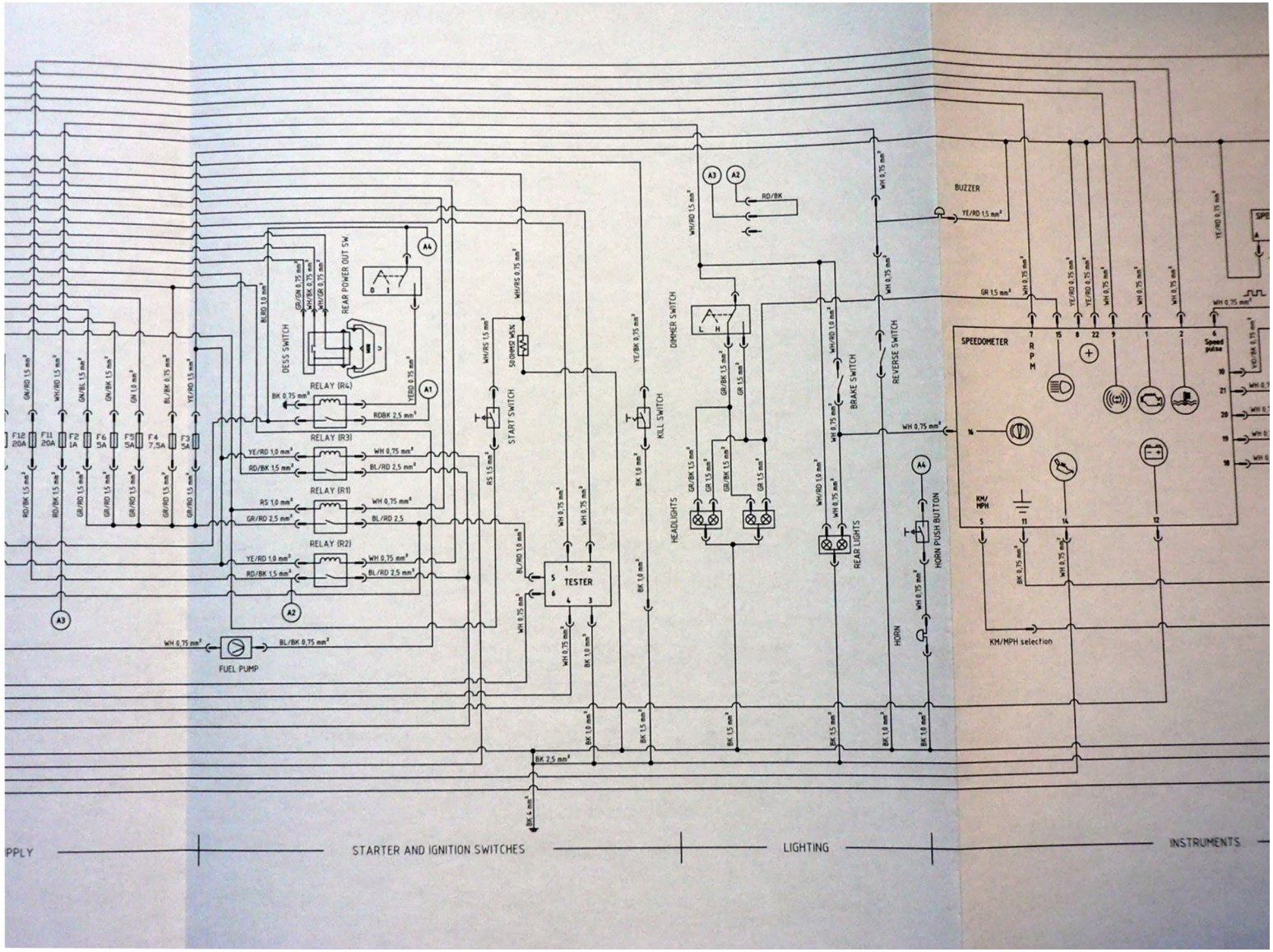

ARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
RD/BL 2,5
BEEPER
BK 0,75
BK 0,75
GR/BK 0,75
REVERSE LIGHT
REVERSE SWITCH (RER)
BK 0,75
BL/BK 0,75
TETHER CUT-OUT SWITCH
BK 1,5
BK/YL 1,5
ENGINE COUT-OUT SWITCH
BK 1,5
BK/YL 1,5
DIMMER SWITCH
H
HEADLIGHTS
WH/GR 1,5
YL/GN 1,5
GR 1,5
YL 1,5
YL/GN 0,75
HIGH BEAM INDICATOR
GR 0,75
TAIL LIGHT
TAIL
YL 0,75
YL/GN 0,75
BRAKE
YL 0,75
WH 0,75
BRAKE SWITCH
RESISTOR 50 OHMS
OIL LEVEL INDICATOR
BR 0,75
OIL LEVEL SWITCH
YL 0,75
YL/GN 0,75
BR 0,75
BRAKE INDICATOR
SPEEDOMETER
YL/GN 0,75
YL 0,75
TACHOMETER

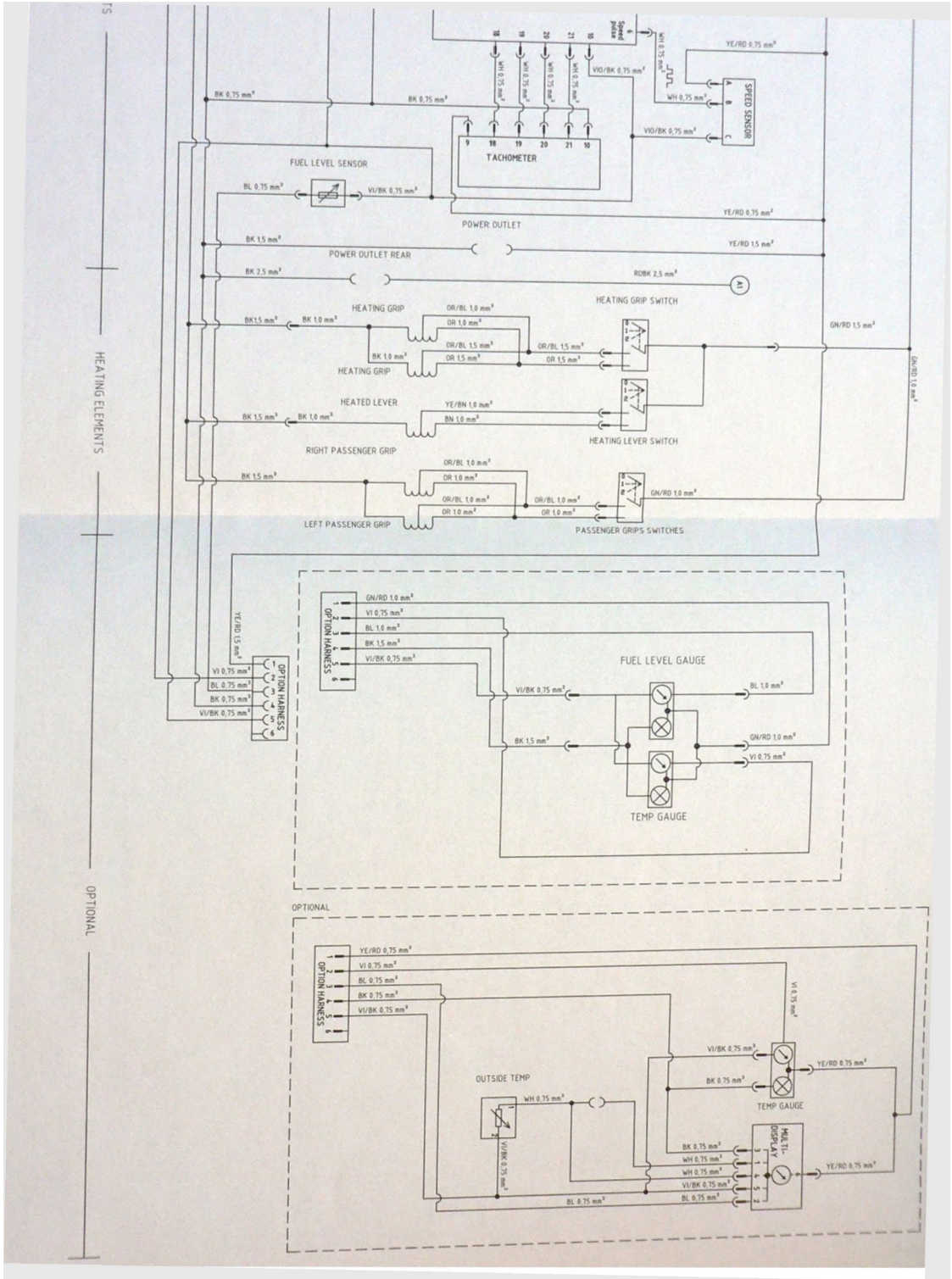

INSTRUMENTS
HEATING ELEMENTS
TAIL LIGHT
TAIL
YL 0,75
YL/GN 0,75
BRAKE
YL 0,75
WH 0,75
BRAKE SWITCH
RESISTOR 50 OHMS
OIL LEVEL INDICATOR
BR 0,75
OIL LEVEL SWITCH
YL 0,75
YL/GN 0,75
BR 0,75
BRAKE INDICATOR
SPEEDOMETER
YL/GN 0,75
YL 0,75
TACHOMETER
OPTION
FUEL LEVEL SENSOR
YL/GN 0,75
BL 0,75
FUSE .25A
FUEL LEVEL GAUGE
YL 0,75
YL/GN 0,75
YL 0,75
HEATING GRIP
OR 1,5
OR/VL 1,5
HEATING GRIP SWITCH
YL/GN 1,5
YL/BK 1,5
OR 1,5
OR/VL 1,5
YL 1,5
HEATING GRIP
HEATING LEVER SWITCH
HEATED LEVER (THUMB)
BR 1,5
BR/YL 1,5
YL 1,5
YL/GN 1,5
YL/BK 1,5

SKANDIC SWT V800

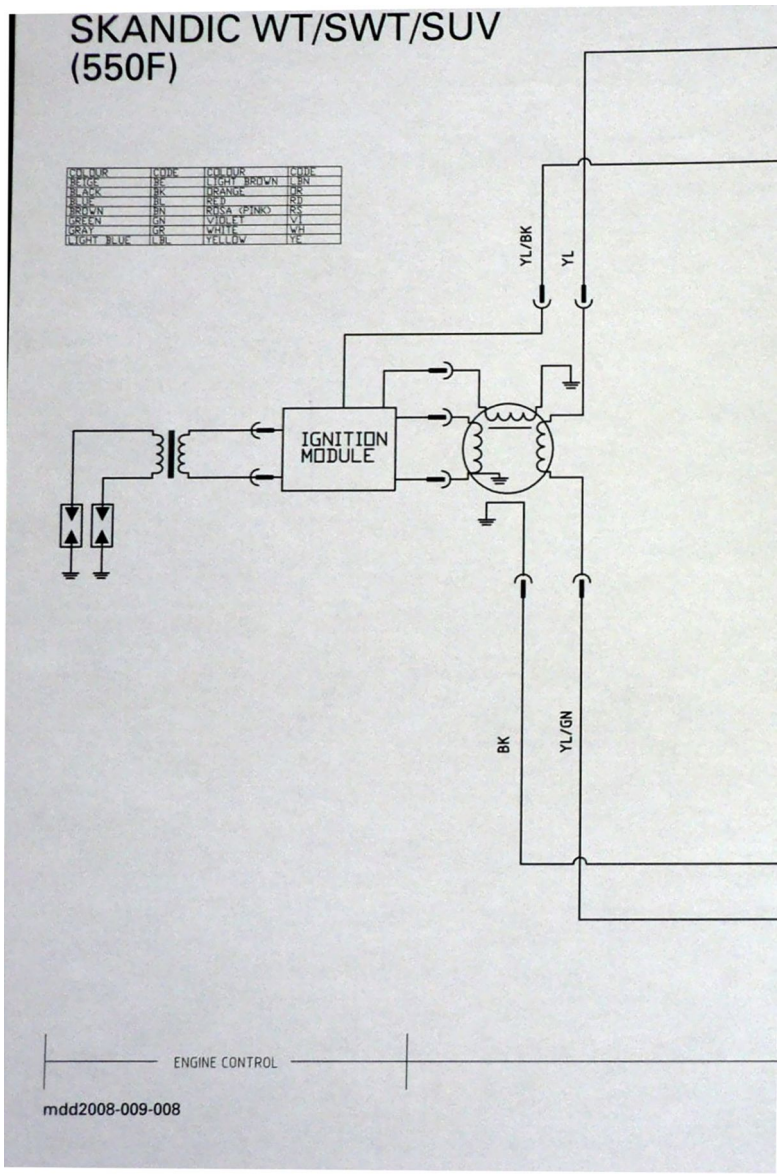


COLOUR	CODE	COLOUR	CODE
BLUE	BL	LIGHT BROWN	LBN
BLACK	BK	ORANGE	OR
BROWN	BN	PINK	PK
GREEN	GN	ROSA (PINK)	RS
GREEN	GN	VIOLET	VI
GRAY	GR	WHITE	WH
LIGHT BLUE	LBL	YELLOW	YE


F12 20A
F11 20A
F2 1A
F6 5A
F5 5A
F4 7,5A
F3 5A
REAR POWER OUT SW.
DESS SWITCH
RELAY (R4)
RELAY (R3)
RELAY (R1)
RELAY (R2)
FUEL PUMP
START SWITCH
KILL SWITCH
DIMMER SWITCH
HEADLIGHTS
TESTER
BUZZER
BRAKE SWITCH
REVERSE SWITCH
REAR LIGHTS
HORN
HORN PUSH BUTTON
SPEEDOMETER
KM/MPH selection
APPLY
STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS

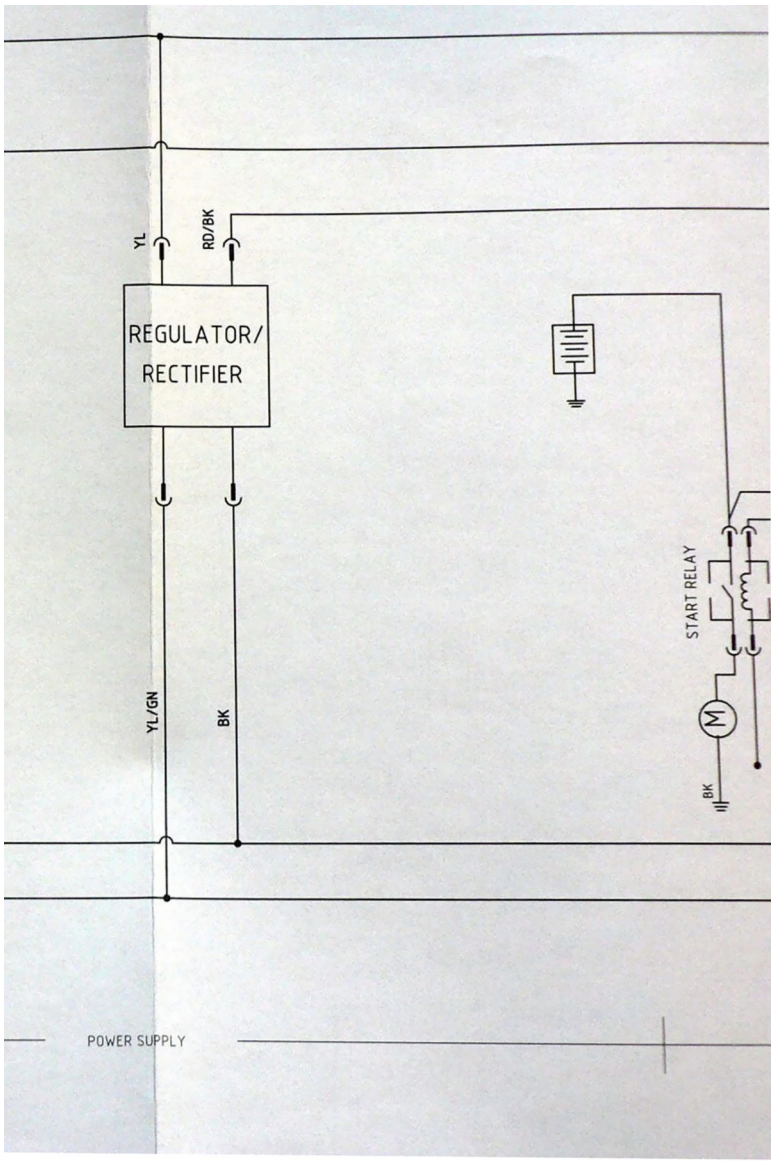

HEATING ELEMENTS
OPTIONAL
TACHOMETER
SPEED SENSOR
FUEL LEVEL SENSOR
POWER OUTLET
POWER OUTLET REAR
HEATING GRIP SWITCH
HEATING GRIP
HEATED LEVER
HEATING LEVER SWITCH
RIGHT PASSENGER GRIP
LEFT PASSENGER GRIP
PASSENGER GRIPS SWITCHES
OPTION HARNESS
FUEL LEVEL GAUGE
TEMP GAUGE
OPTIONAL
OUTSIDE TEMP
MULTI-DISPLAY

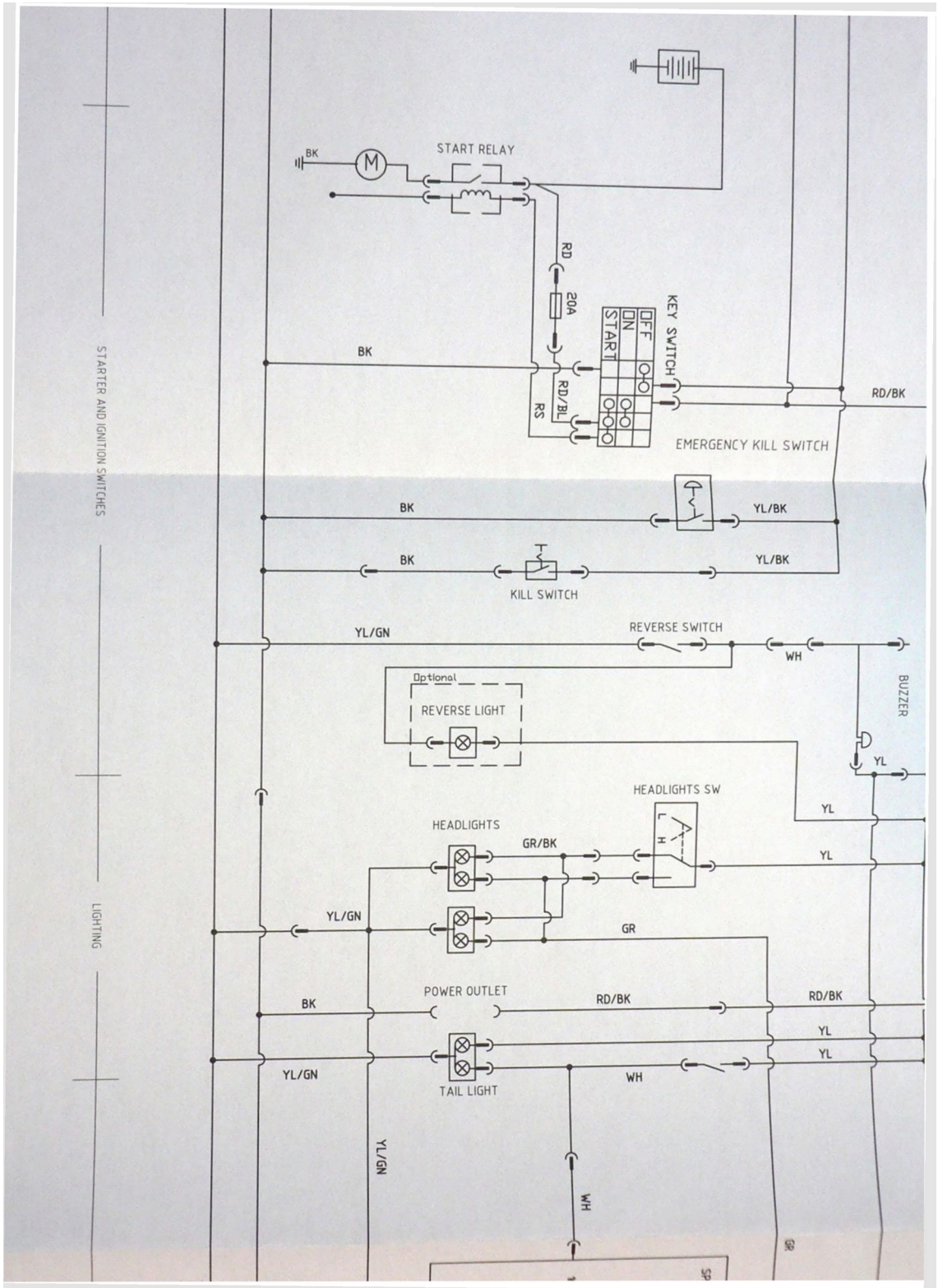
SKANDIC WT/SWT/SUV (550F)



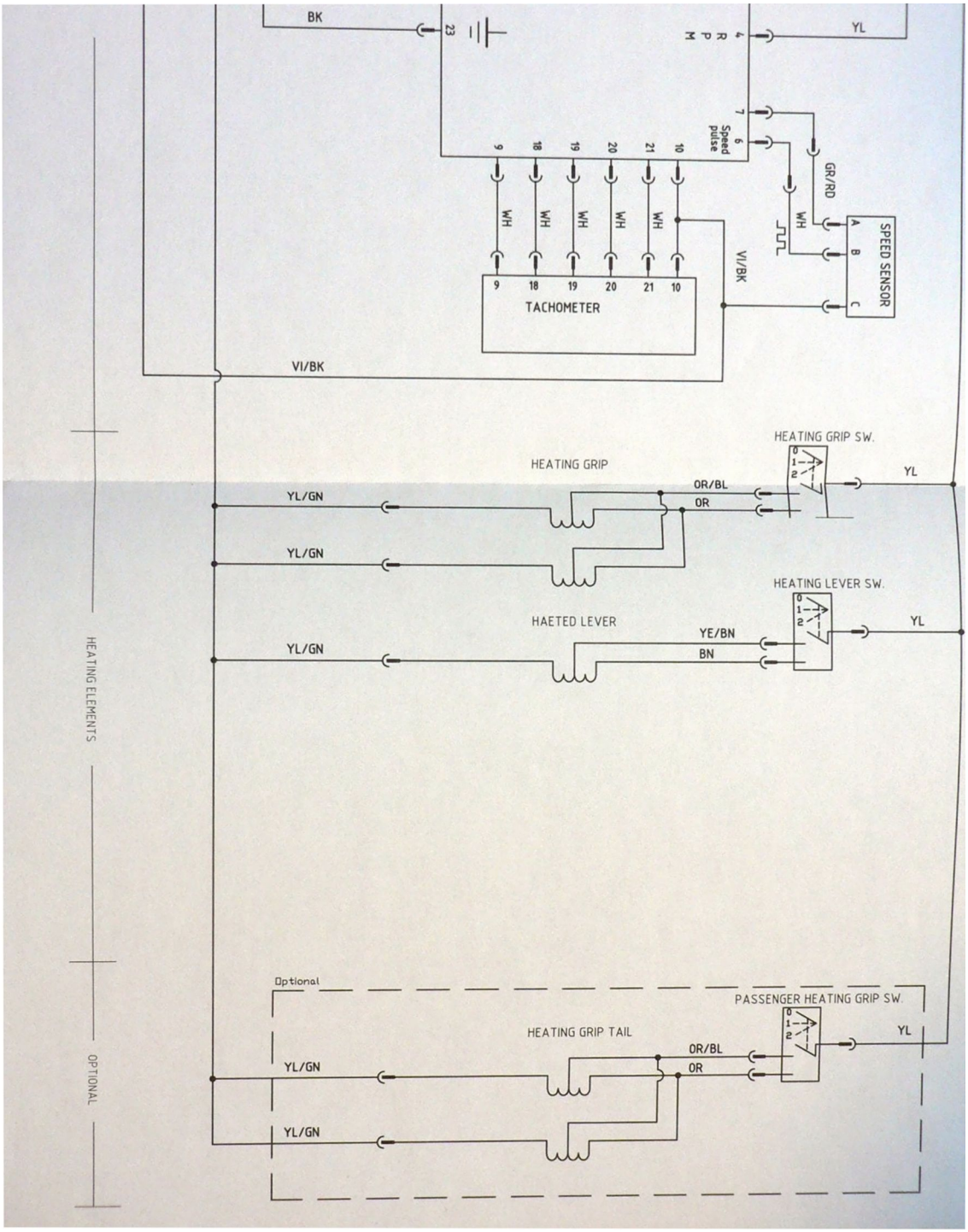
ENGINE CONTROL

mdd2008-009-008

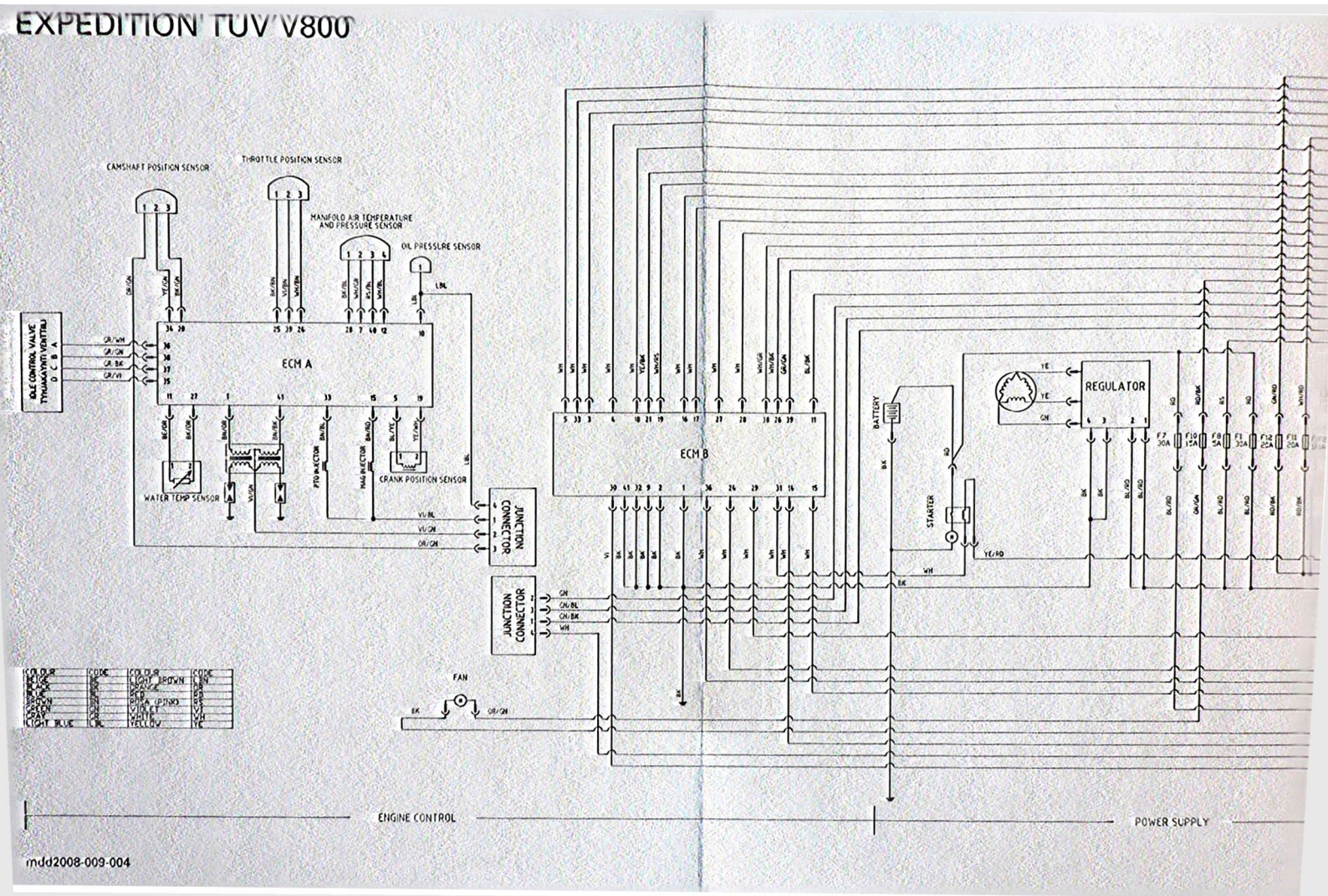

YL
RD/BK
REGULATOR/
RECTIFIER
START RELAY
M
YL/GN
BK
BK
POWER SUPPLY


STARTER AND IGNITION SWITCHES
LIGHTING
BK
START RELAY
M
RD
20A
KEY SWITCH
START
ON
OFF
BK
RD/BL
RS
RD/BK
EMERGENCY KILL SWITCH
BK
YL/BK
BK
YL/BK
KILL SWITCH
YL/GN
REVERSE SWITCH
WH
BUZZER
Optional
REVERSE LIGHT
YL
HEADLIGHTS SW
HEADLIGHTS
GR/BK
L
H
YL
YL/GN
GR
POWER OUTLET
BK
RD/BK
RD/BK
YL
YL
YL/GN
WH
TAIL LIGHT
YL/GN
WH
GR

INSTRUMENTS
HEATING ELEMENTS
SPEEDOMETER
KM/
MPH
RPM
Speed pulse
OIL LEVEL SWITCH
VI/BK
WH
BK
YL
GR
GR/RD
TACHOMETER
SPEED SENSOR
HEATING GRIP SW.
HEATING GRIP
OR/BL
OR
YL/GN
HEATING LEVER SW.
HAETED LEVER
YE/BN
BN
Optional
PASSENGER HEATING GRIP SW.

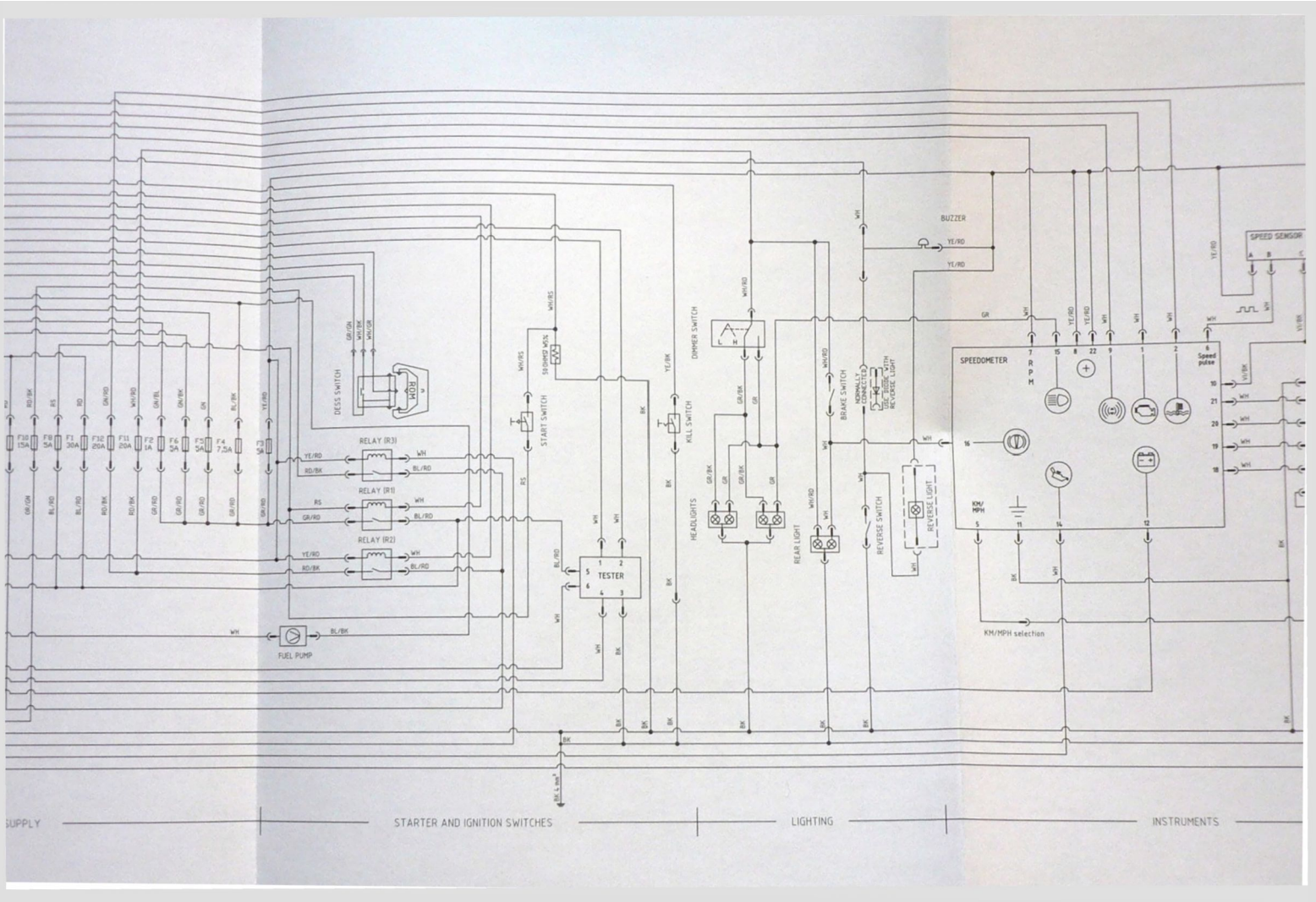

BK
23
YL
4
PPM
7
6
Speed pulse
9
18
19
20
21
10
WH
GR/RD
SPEED SENSOR
A
B
C
TACHOMETER
VI/BK
HEATING GRIP SW.
HEATING GRIP
OR/BL
OR
YL/GN
HEATING LEVER SW.
HAETED LEVER
YE/BN
BN
Optional
PASSENGER HEATING GRIP SW.
HEATING GRIP TAIL
HEATING ELEMENTS
OPTIONAL

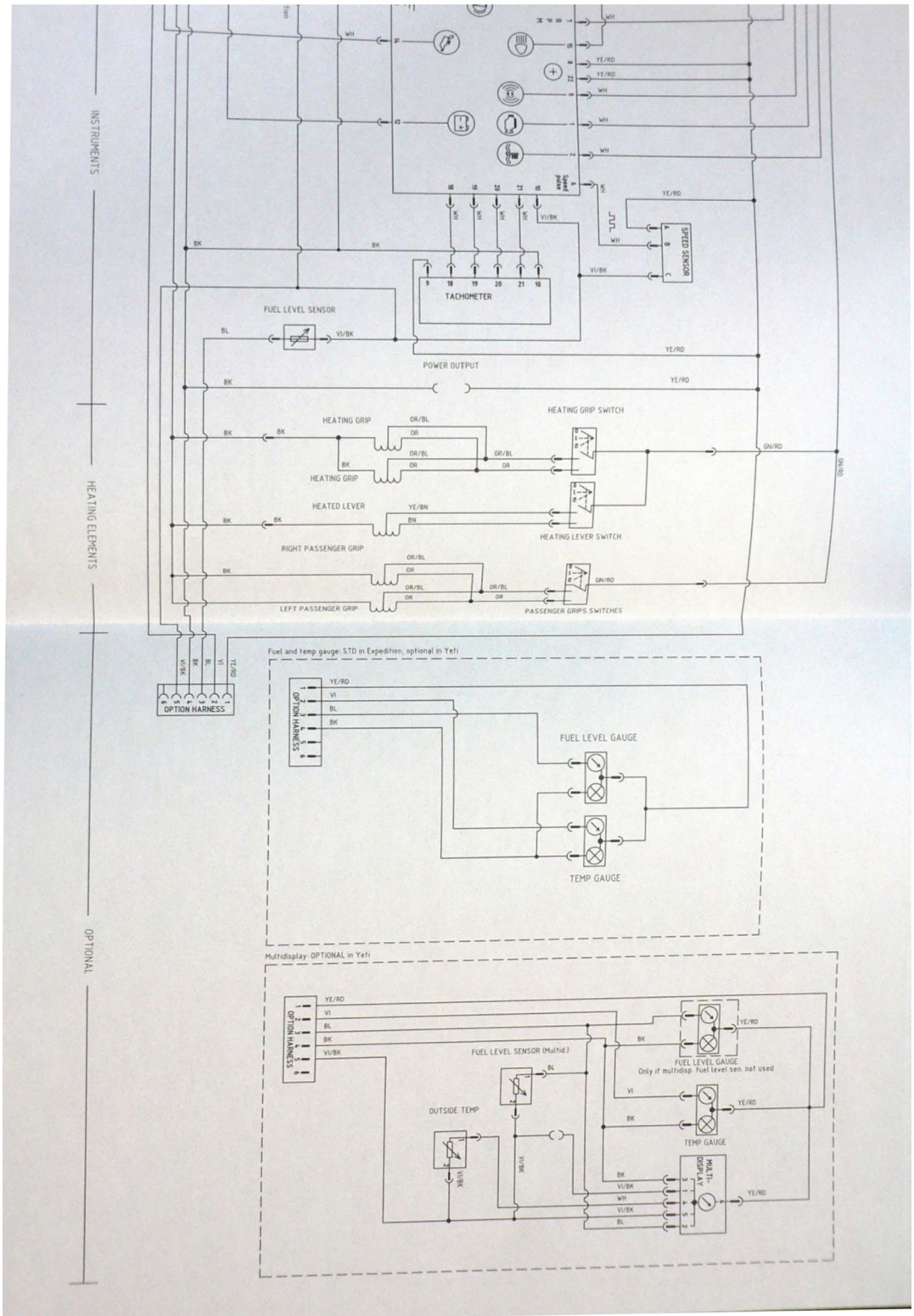
EXPEDITION TUV V800



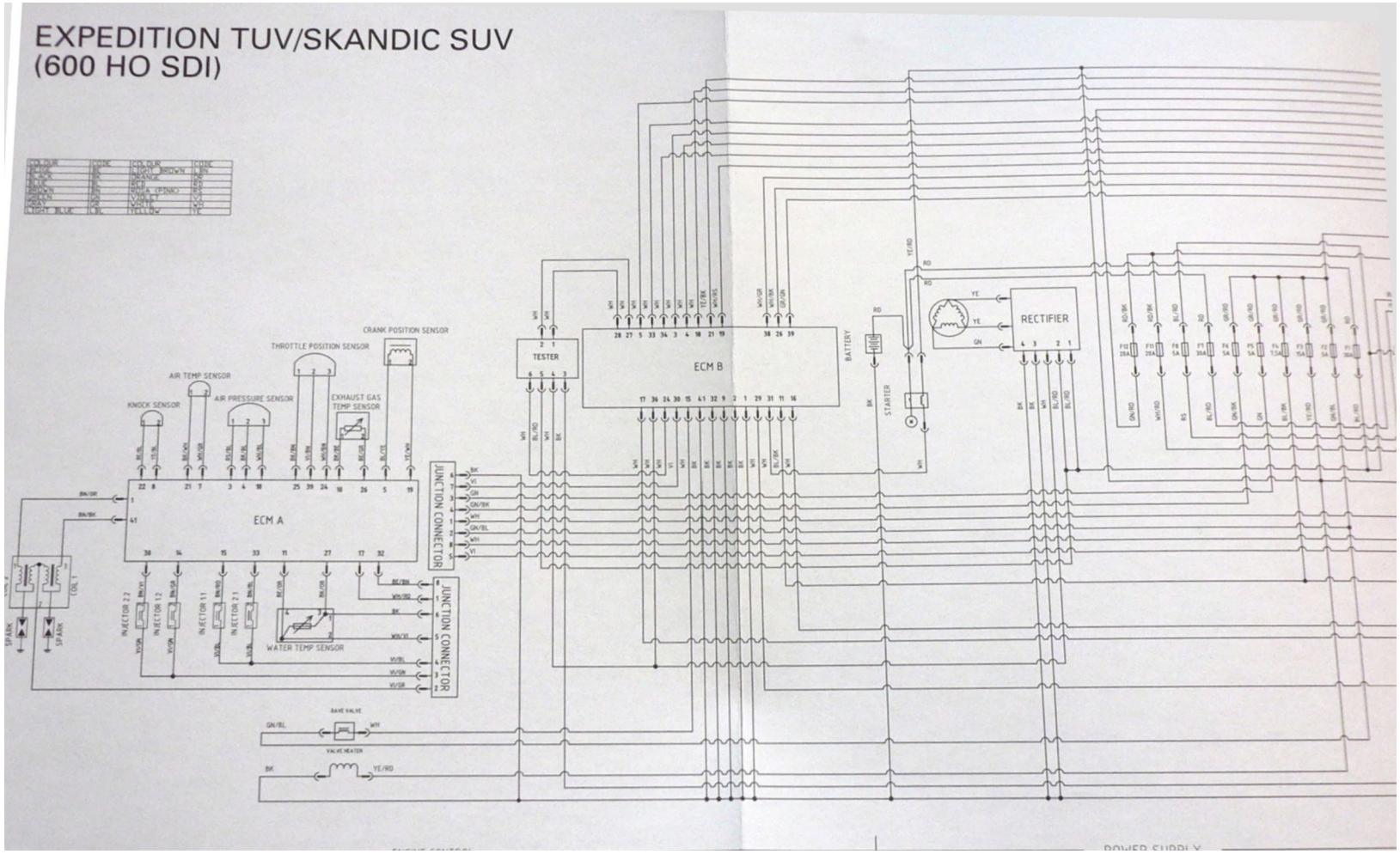
COLOR	CODE	COLOR	CODE
BLACK	BK	LIGHT BROWN	LBN
BLUE	BL	ORANGE	OR
BROWN	BN	PINK	PK
GREEN	GN	PURPLE (PINK)	PU
GRAY	GY	VIOLET	VI
LIGHT BLUE	LBL	WHITE	WH
		YELLOW	YE

mdd2008-009-004

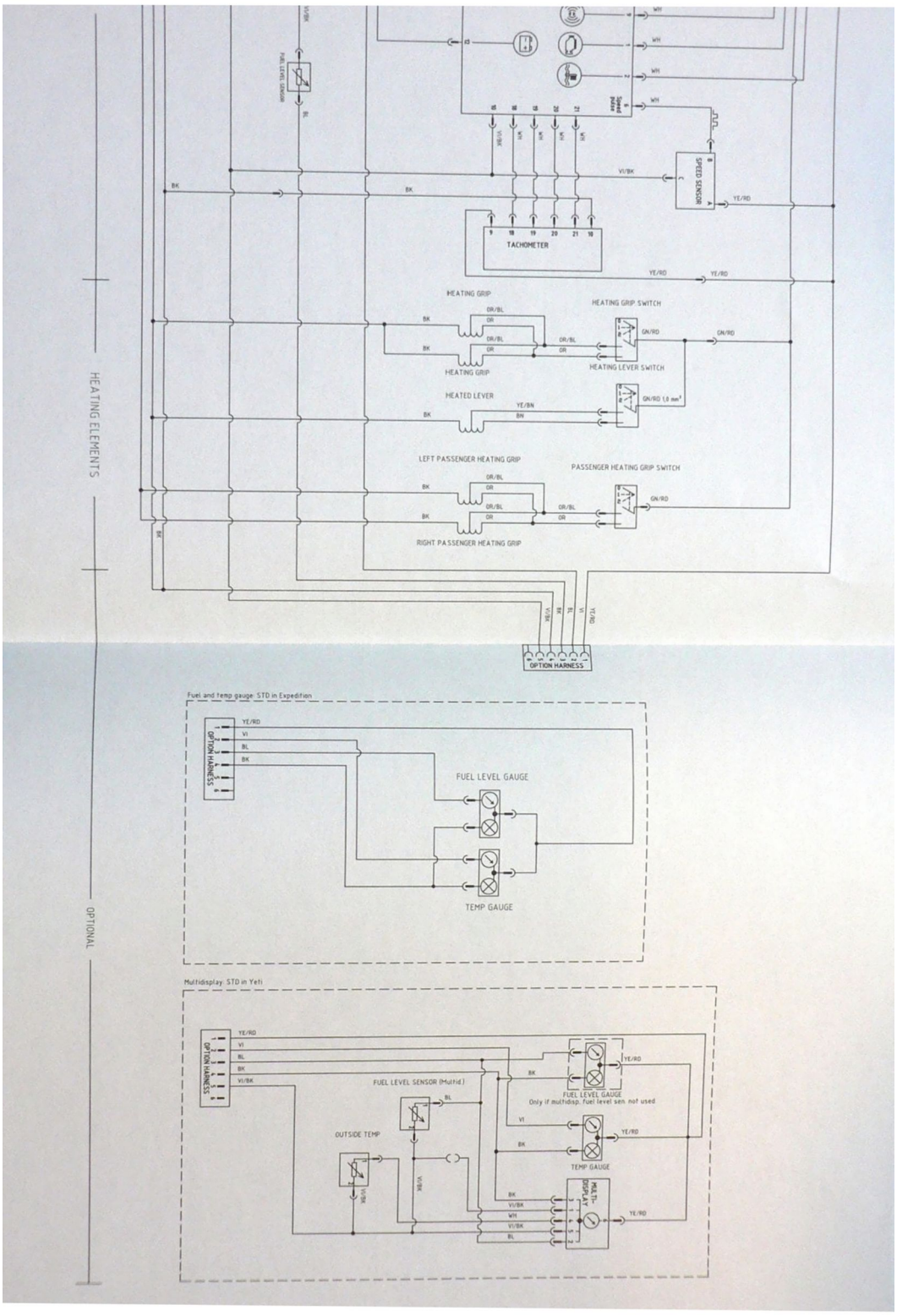

SUPPLY
STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
F10 15A
F8 5A
F1 30A
F12 20A
F11 20A
F2 1A
F6 5A
F5 5A
F4 7.5A
DESS SWITCH
RELAY (R3)
RELAY (R1)
RELAY (R2)
FUEL PUMP
START SWITCH
KILL SWITCH
DIMMER SWITCH
HEADLIGHTS
TESTER
REAR LIGHT
BRAKE SWITCH
NORMALLY CLOSED
REVERSE SWITCH
REVERSE LIGHT
BUZZER
SPEEDOMETER
KM/MPH selection
SPEED SENSOR
Speed pulse

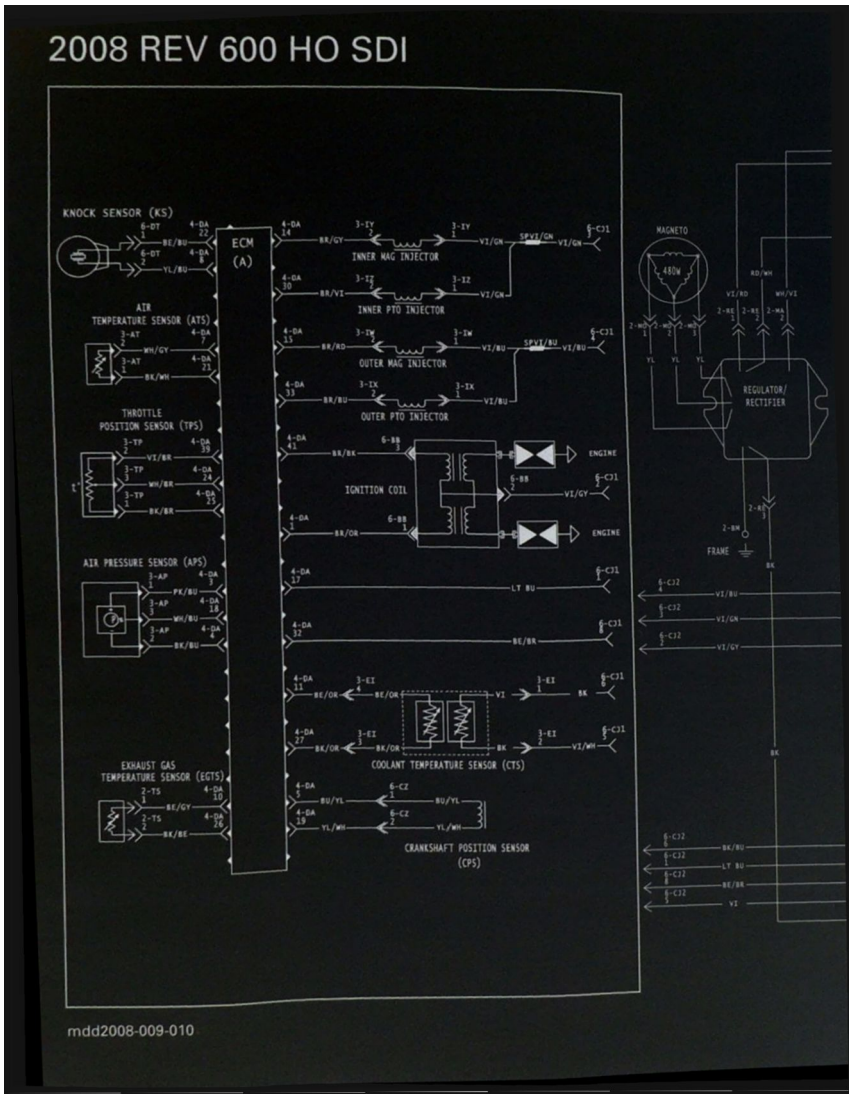

INSTRUMENTS
HEATING ELEMENTS
OPTIONAL
WH
YE/RD
VI/BK
BK
BL
SPEED SENSOR
TACHOMETER
FUEL LEVEL SENSOR
POWER OUTPUT
HEATING GRIP SWITCH
HEATING GRIP
OR/BL
OR
GN/RD
HEATED LEVER
YE/BN
BN
HEATING LEVER SWITCH
RIGHT PASSENGER GRIP
LEFT PASSENGER GRIP
PASSENGER GRIPS SWITCHES
OPTION HARNESS
Fuel and temp gauge: STD in Expedition, optional in Yeti
VI
FUEL LEVEL GAUGE
TEMP GAUGE
Multidisplay: OPTIONAL in Yeti
FUEL LEVEL SENSOR (Multid.)
OUTSIDE TEMP
Only if multidisp. fuel level sen. not used
MULTI DISPLAY

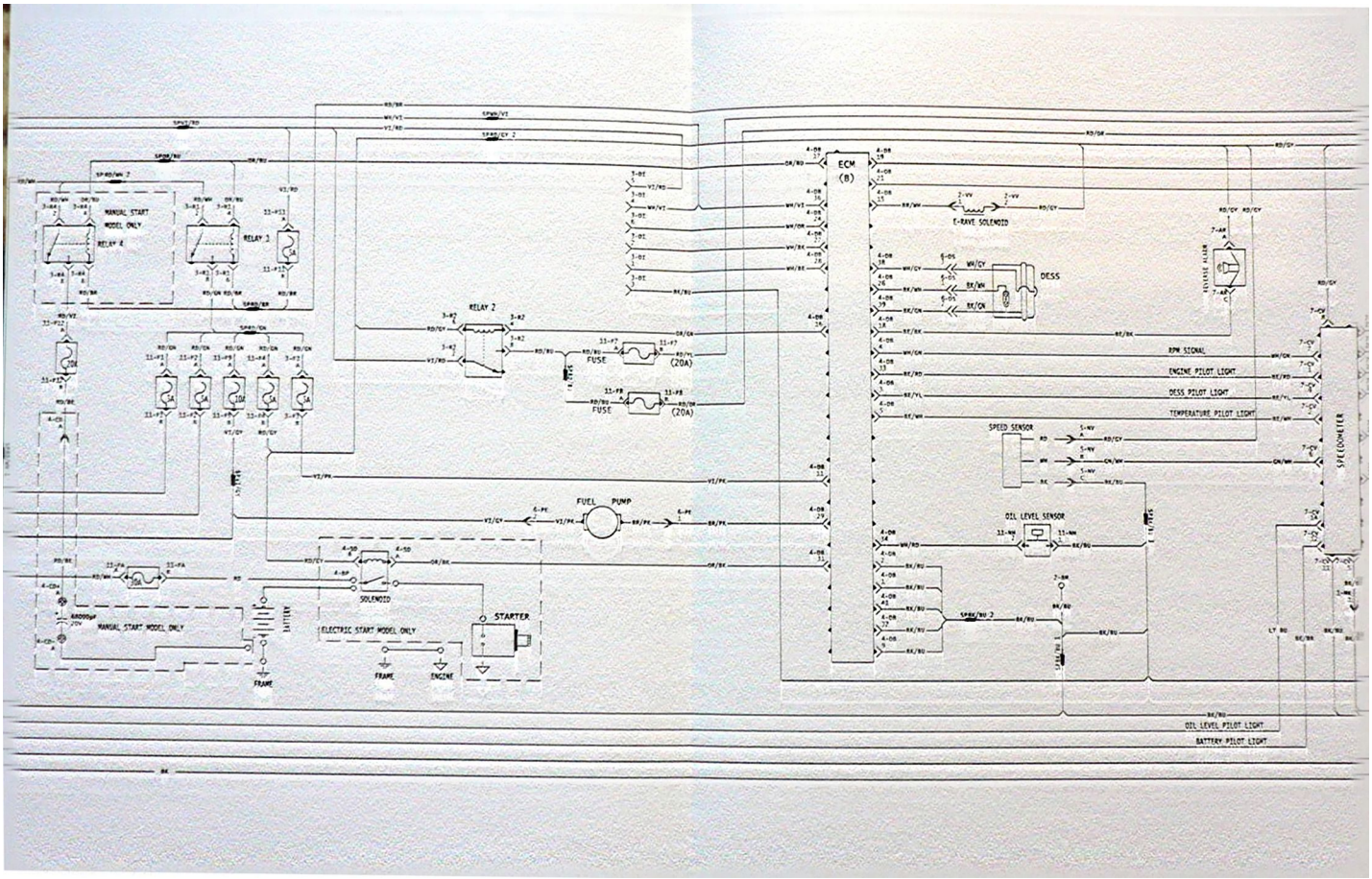
EXPEDITION TUV/SKANDIC SUV
(600 HO SDI)

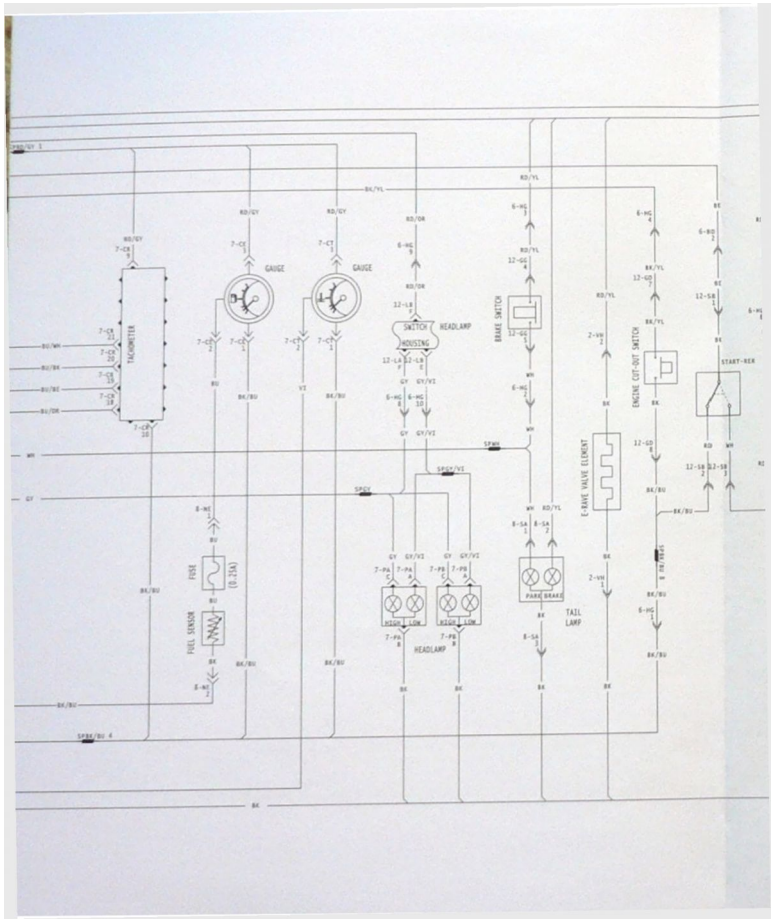


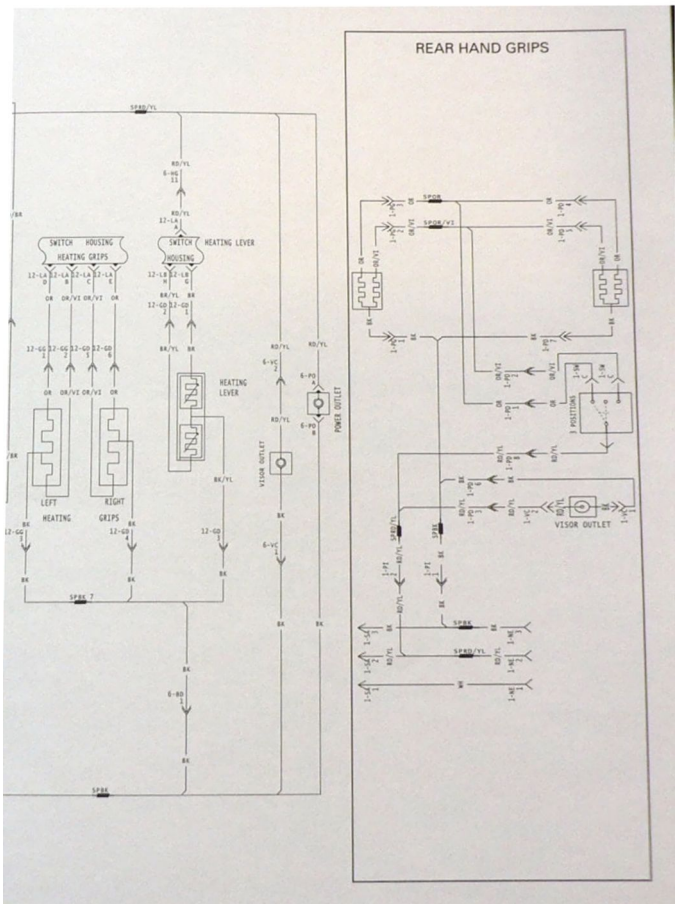
STARTER AND IGNITION SWITCHES
LIGHTING
INSTRUMENTS
DESS SWITCH
START SWITCH
KILL SWITCH
HEADLIGHTS
DIMMER SWITCH
REAR LIGHT
BRAKE SWITCH
OIL LEVEL SWITCH
REVERSE SWITCH
REVERSE LIGHT
POWER OUTPUT
MILES/KM SELECTION
SPEEDOMETER
TACHOMETER
BUZZER


HEATING ELEMENTS
OPTIONAL
FUEL LEVEL SENSOR
SPEED SENSOR
TACHOMETER
HEATING GRIP
HEATING GRIP SWITCH
HEATING LEVER SWITCH
HEATED LEVER
LEFT PASSENGER HEATING GRIP
PASSENGER HEATING GRIP SWITCH
RIGHT PASSENGER HEATING GRIP
OPTION HARNESS
Fuel and temp gauge: STD in Expedition
FUEL LEVEL GAUGE
TEMP GAUGE
Multidisplay: STD in Yeti
FUEL LEVEL SENSOR (Multid.)
OUTSIDE TEMP
FUEL LEVEL GAUGE
Only if multidisp. fuel level sen. not used
TEMP GAUGE
MULTI-DISPLAY

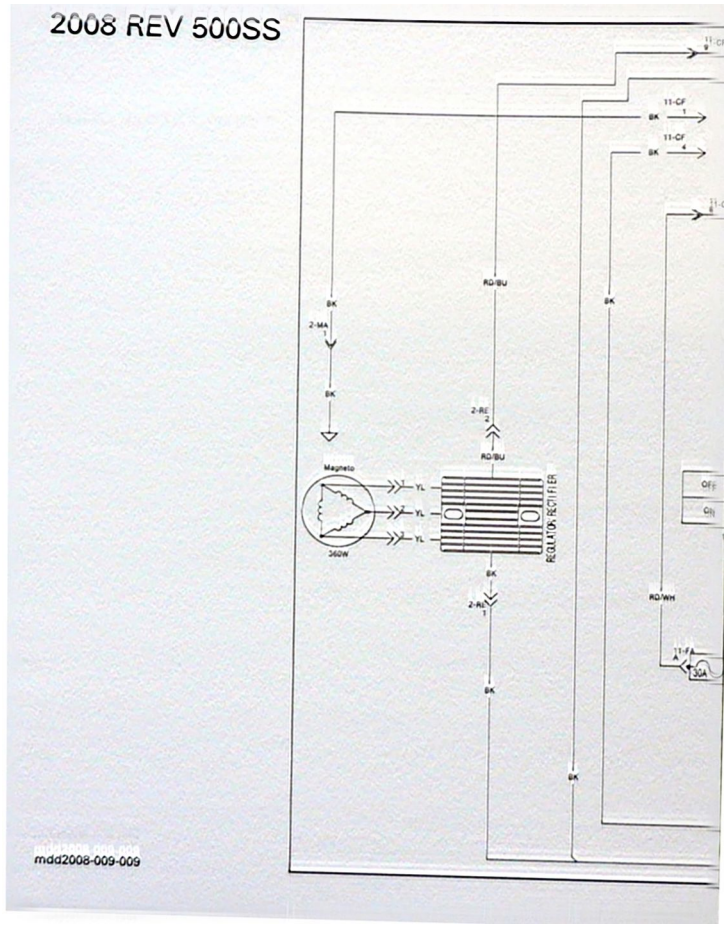

2008 REV 600 HO SDI
KNOCK SENSOR (KS)
AIR TEMPERATURE SENSOR (ATS)
THROTTLE POSITION SENSOR (TPS)
AIR PRESSURE SENSOR (APS)
EXHAUST GAS TEMPERATURE SENSOR (EGTS)
ECM (A)
INNER MAG INJECTOR
INNER PTO INJECTOR
OUTER MAG INJECTOR
OUTER PTO INJECTOR
IGNITION COIL
ENGINE
COOLANT TEMPERATURE SENSOR (CTS)
CRANKSHAFT POSITION SENSOR (CPS)
MAGNETO
480W
REGULATOR/ RECTIFIER
FRAME
mdd2008-009-010


ECM
(B)
MANUAL START
MODEL ONLY
RELAY 4
RELAY 3
RELAY 2
FUSE
(20A)
FUEL PUMP
SOLENOID
STARTER
MANUAL START MODEL ONLY
ELECTRIC START MODEL ONLY
FRAME
ENGINE
BATTERY
T-RAVE SOLENOID
DESS
SPEED SENSOR
OIL LEVEL SENSOR
SPEEDOMETER
RPM SIGNAL
ENGINE PILOT LIGHT
DESS PILOT LIGHT
TEMPERATURE PILOT LIGHT
OIL LEVEL PILOT LIGHT
BATTERY PILOT LIGHT

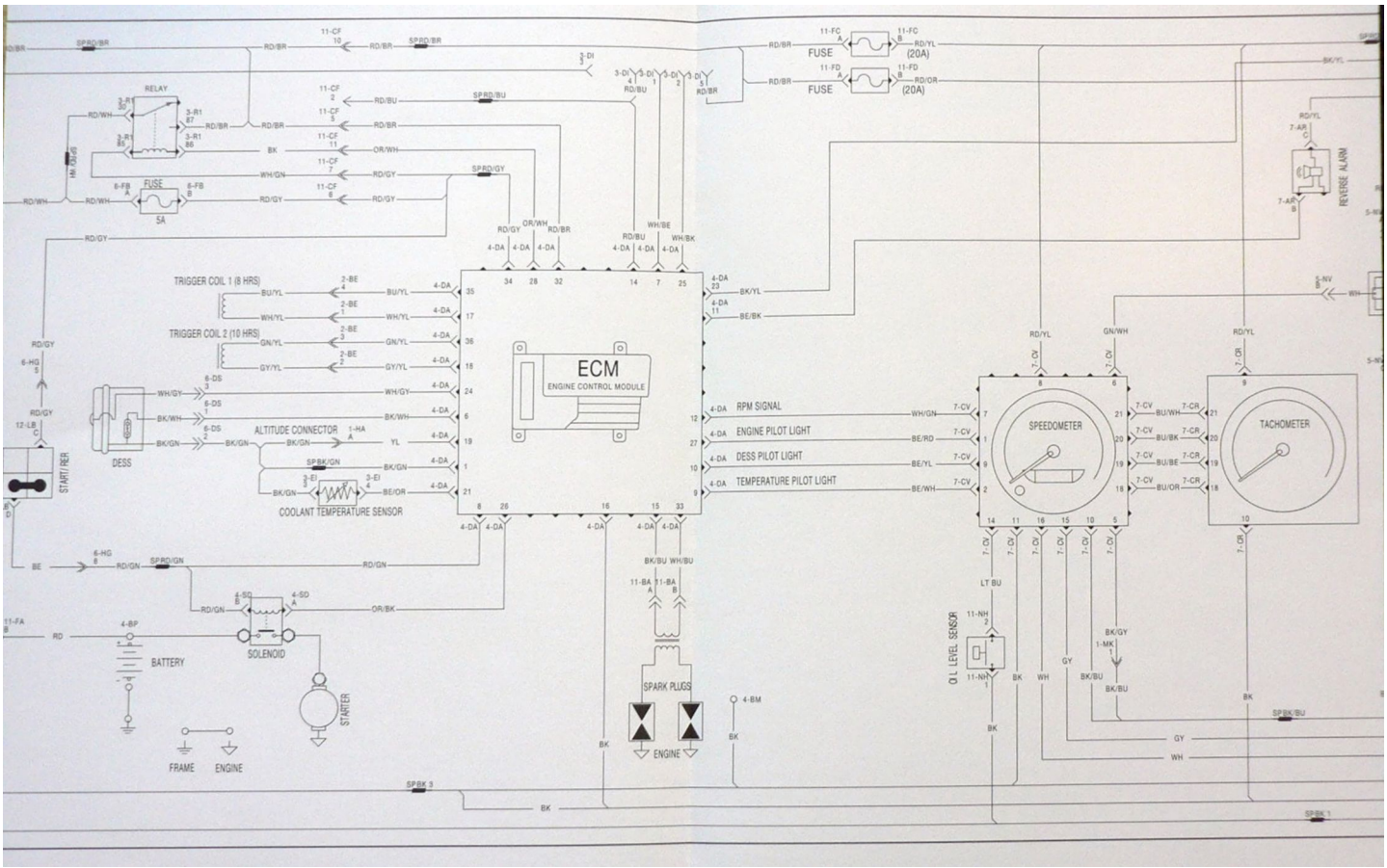

TACHOMETER
GAUGE
GAUGE
SWITCH
HOUSING
HEADLAMP
BRAKE SWITCH
E-RAVE VALVE ELEMENT
ENGINE CUT-OUT SWITCH
START-REM
FUSE
(0.25A)
FUEL SENSOR
HIGH
LOW
HIGH
LOW
HEADLAMP
PARK
BRAKE
TAIL
LAMP


REAR HAND GRIPS
SPRD/YL
RD/YL
SWITCH HOUSING
HEATING GRIPS
SWITCH HOUSING
HEATING LEVER
HEATING LEVER
POWER OUTLET
VISOR OUTLET
LEFT HEATING GRIPS
RIGHT HEATING GRIPS
SPBK 7
SPBK
3 POSITIONS
VISOR OUTLET

2008 REV 500SS

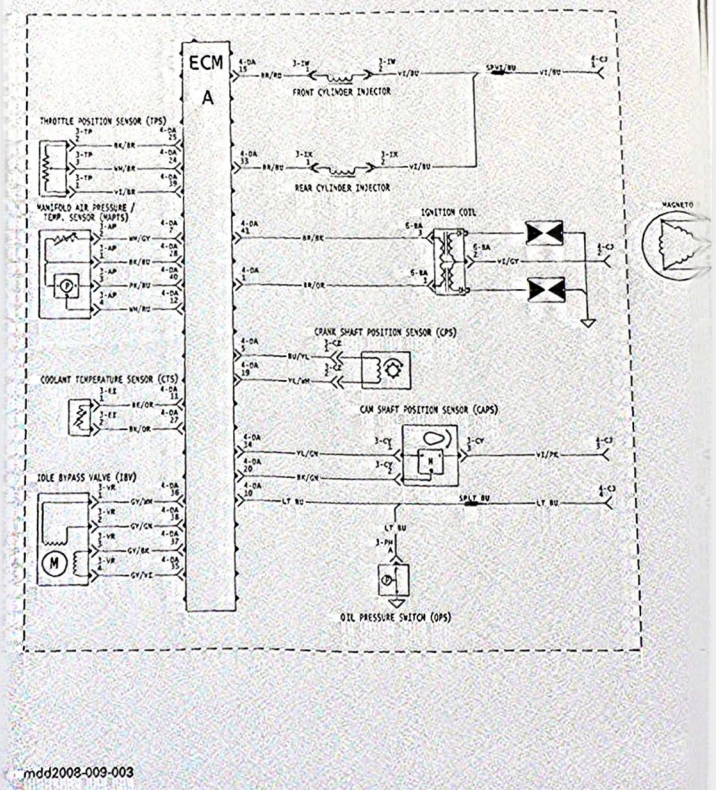


mdd2008-009-009

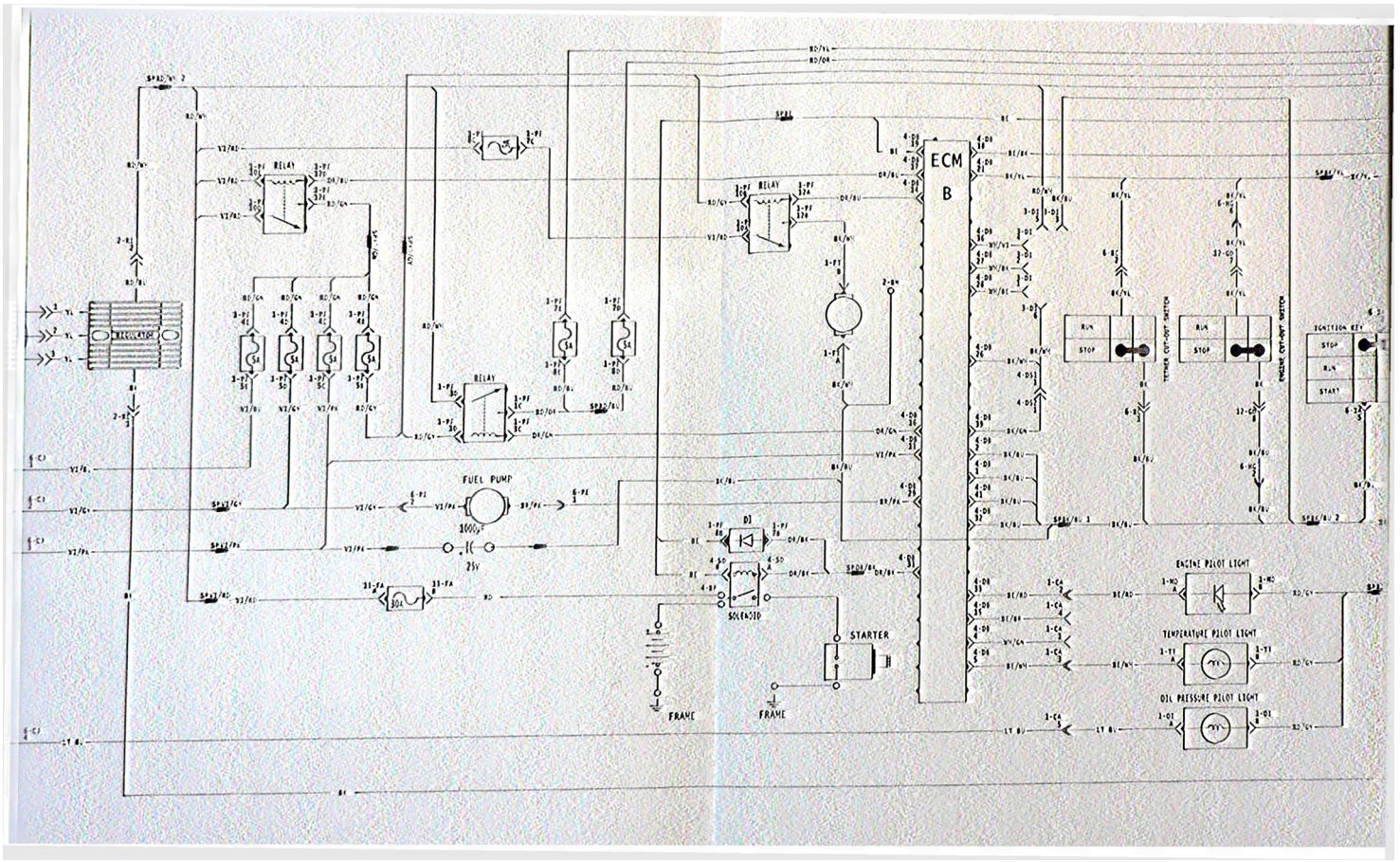

ECM
ENGINE CONTROL MODULE
RELAY
FUSE
5A
FUSE
(20A)
FUSE
(20A)
REVERSE ALARM
TRIGGER COIL 1 (8 HRS)
TRIGGER COIL 2 (10 HRS)
DESS
ALTITUDE CONNECTOR
COOLANT TEMPERATURE SENSOR
START/ REA
BATTERY
SOLENOID
STARTER
FRAME
ENGINE
SPARK PLUGS
ENGINE
4-DA RPM SIGNAL
4-DA ENGINE PILOT LIGHT
4-DA DESS PILOT LIGHT
4-DA TEMPERATURE PILOT LIGHT
SPEEDOMETER
TACHOMETER
OIL LEVEL SENSOR

SPEED SENSOR
COOLANT TEMPERATURE SENSOR
TEMPERATURE GAUGE
FUEL LEVEL SENSOR
INTEGRATED FUSE 0.25A
FUEL GAUGE
HEADLAMP
HI
LO
HEADLAMP SWITCH
BRAKE SWITCH
TAIL LAMP
HEATING GRIPS SWITCH
LEFT HEATING GRIP
RIGHT HEATING GRIP
HEATING LEVER
HEATING LEVER SWITCH
ENGINE CUT-OUT SWITCH
VISOR OUTLET
POWER OUTLET

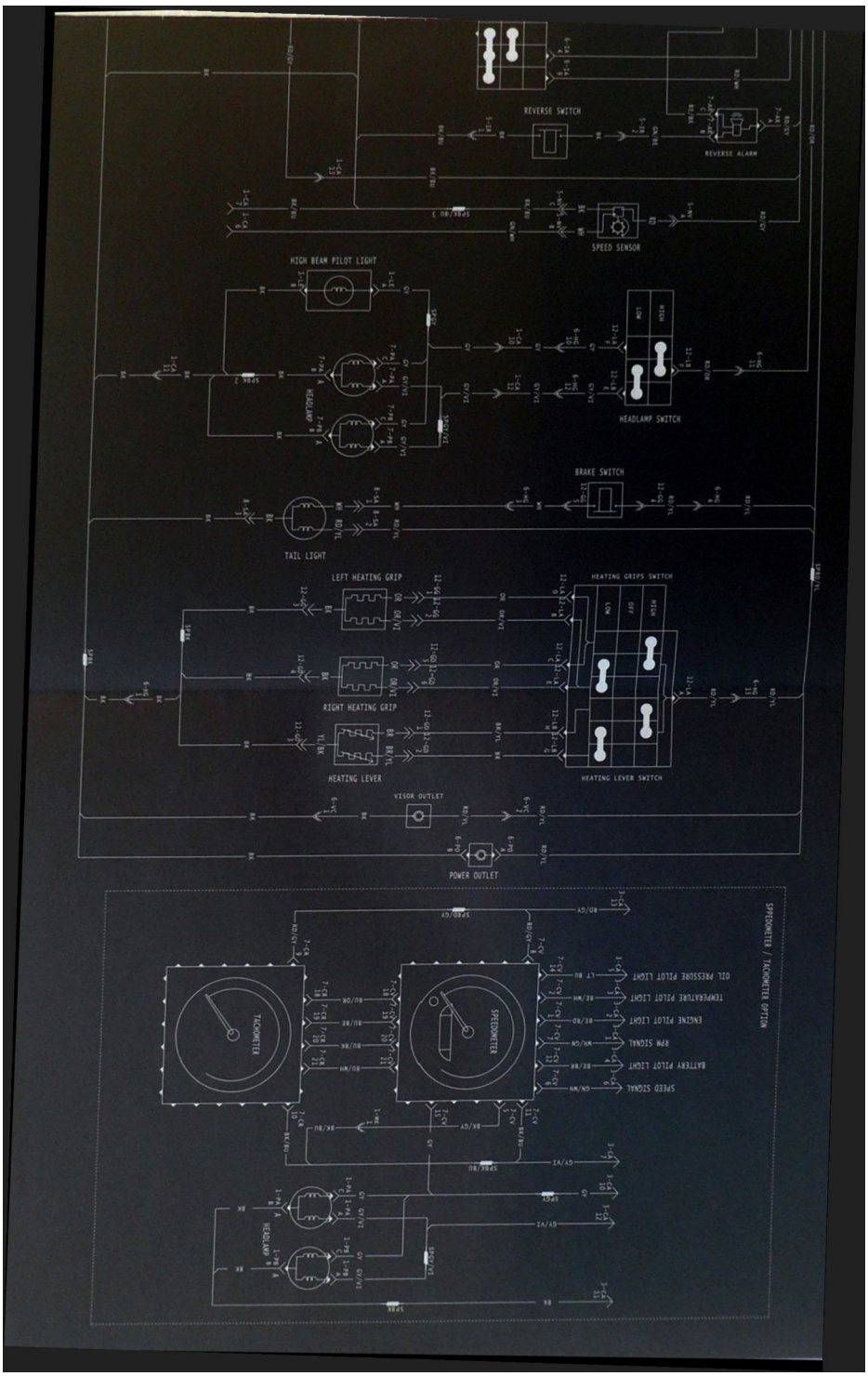
2008 RF SERIES (V800)

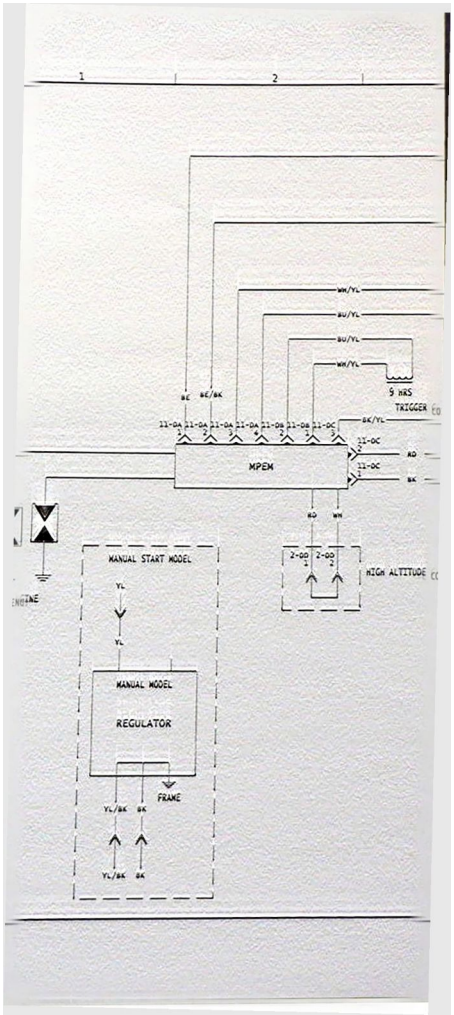


mdd2008-009-003

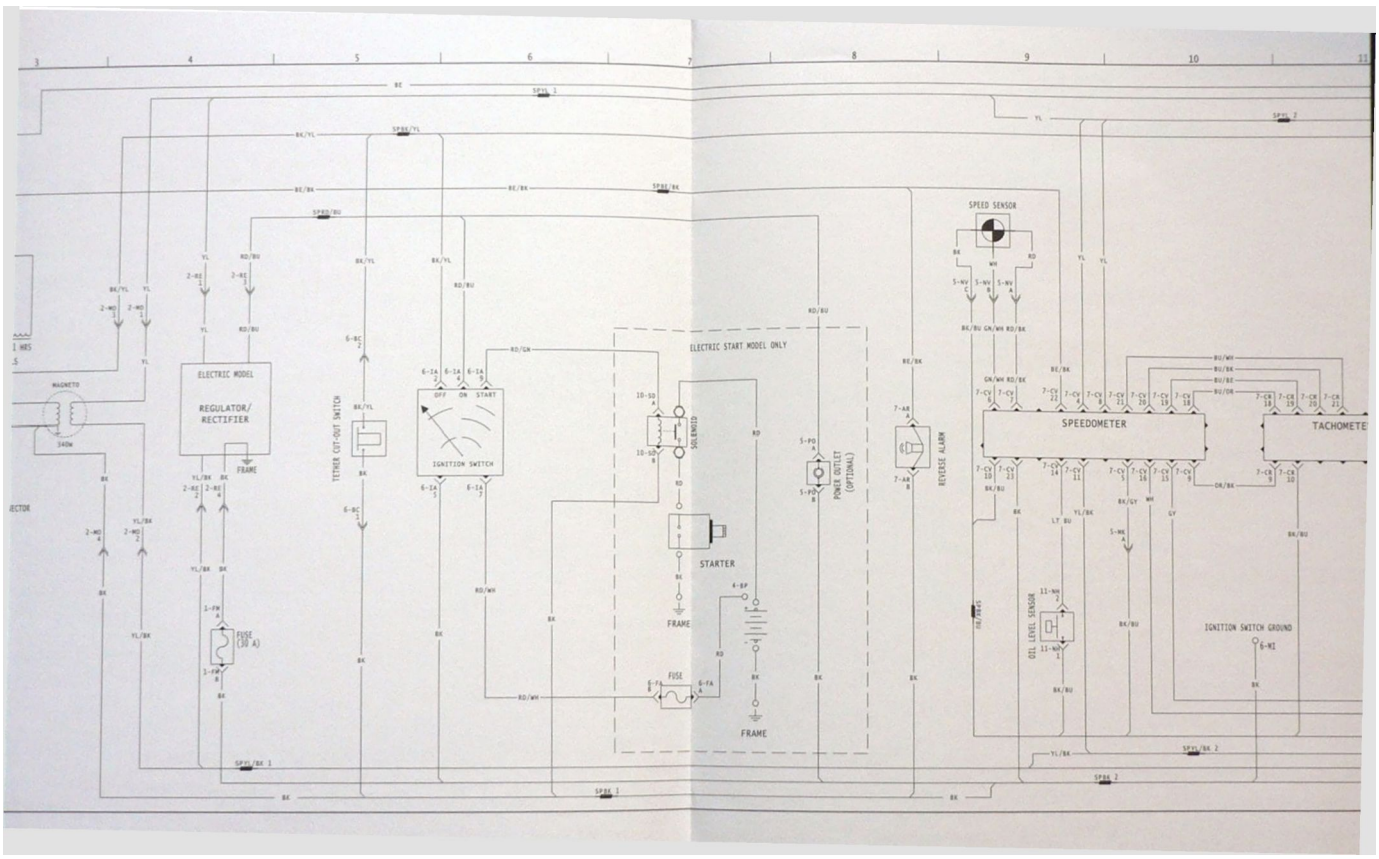


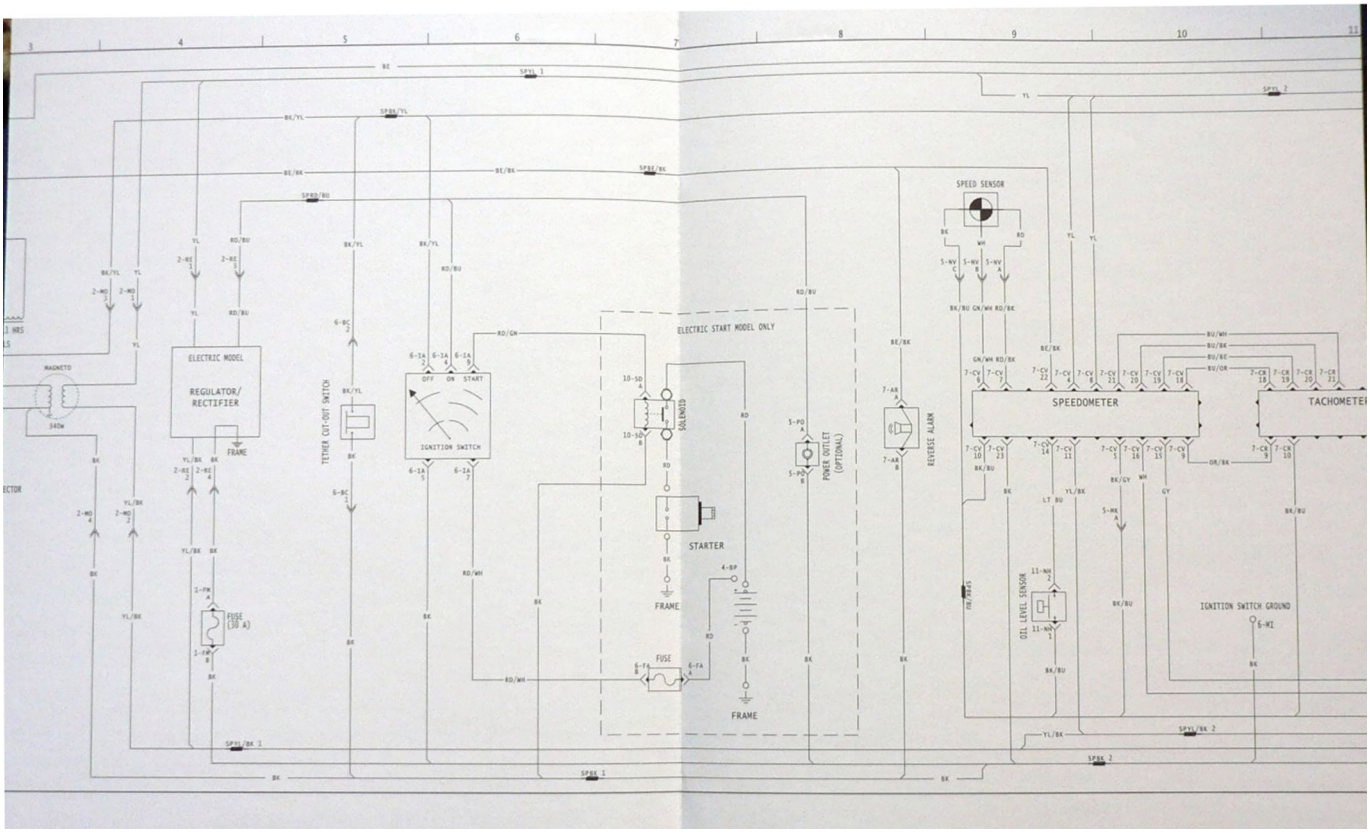
ECM
B
RELAY
RELAY
RELAY
REGULATOR
FUEL PUMP
1000μF
25V
30A
SOLENOID
STARTER
FRAME
FRAME
RUN
STOP
TETHER CUT-OUT SWITCH
RUN
STOP
ENGINE CUT-OUT SWITCH
IGNITION KEY
STOP
RUN
START
ENGINE PILOT LIGHT
TEMPERATURE PILOT LIGHT
OIL PRESSURE PILOT LIGHT


REVERSE SWITCH
REVERSE ALARM
SPEED SENSOR
HIGH BEAM PILOT LIGHT
HEADLAMP
HEADLAMP SWITCH
BRAKE SWITCH
TAIL LIGHT
LEFT HEATING GRIP
RIGHT HEATING GRIP
HEATING LEVER
HEATING GRIPS SWITCH
HEATING LEVER SWITCH
VISOR OUTLET
POWER OUTLET
SPEEDOMETER / TACHOMETER OPTION
TACHOMETER
SPEEDOMETER
OIL PRESSURE PILOT LIGHT
TEMPERATURE PILOT LIGHT
ENGINE PILOT LIGHT
RPM SIGNAL
BATTERY PILOT LIGHT
SPEED SIGNAL
HEADLAMP

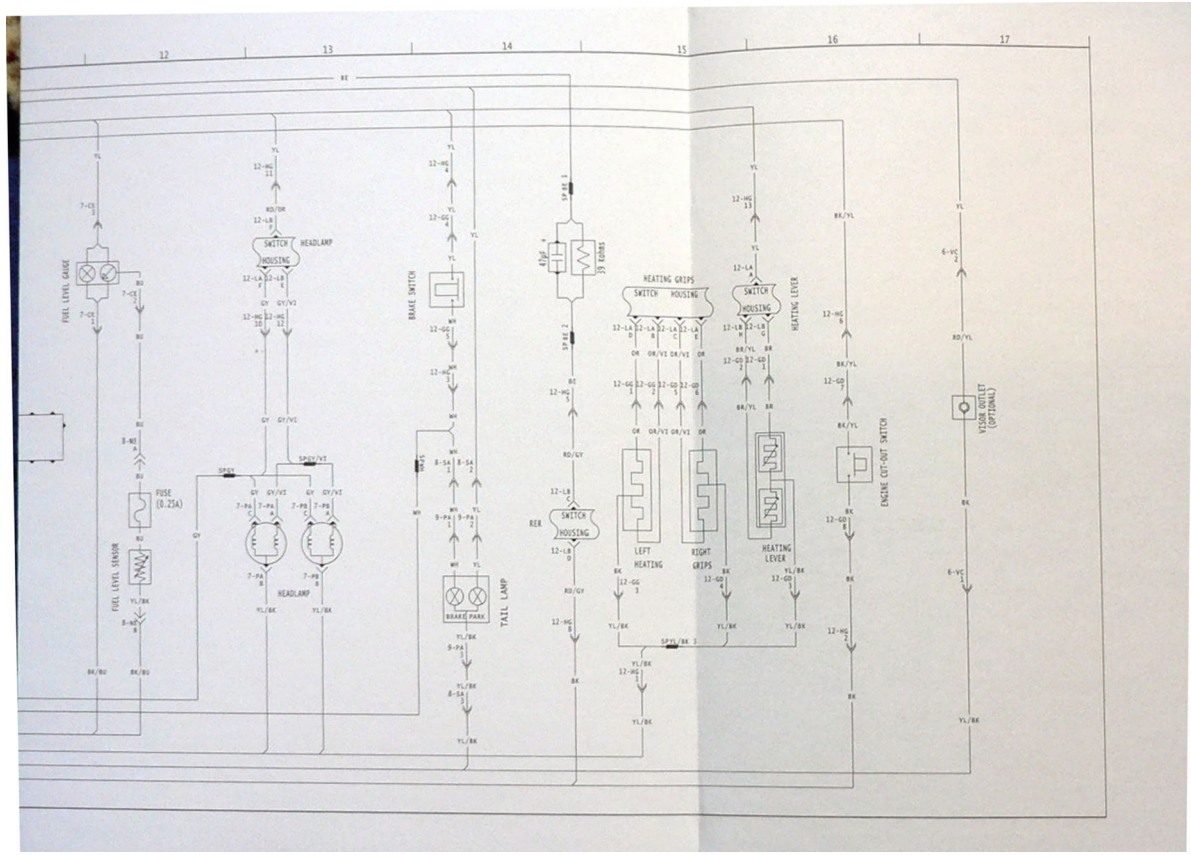


1
2
WH/YL
BU/YL
BU/YL
WH/YL
9 HRS
TRIGGER
BE
BE/BK
11-DA
11-DA
11-DA
11-DA
11-DB
11-DB
11-DC
BK/YL
11-DC
RD
11-DC
BK
MPEM
RD
WH
2-DD
2-DD
HIGH ALTITUDE
MANUAL START MODEL
YL
YL
MANUAL MODEL
REGULATOR
FRAME
YL/BK
BK
YL/BK
BK

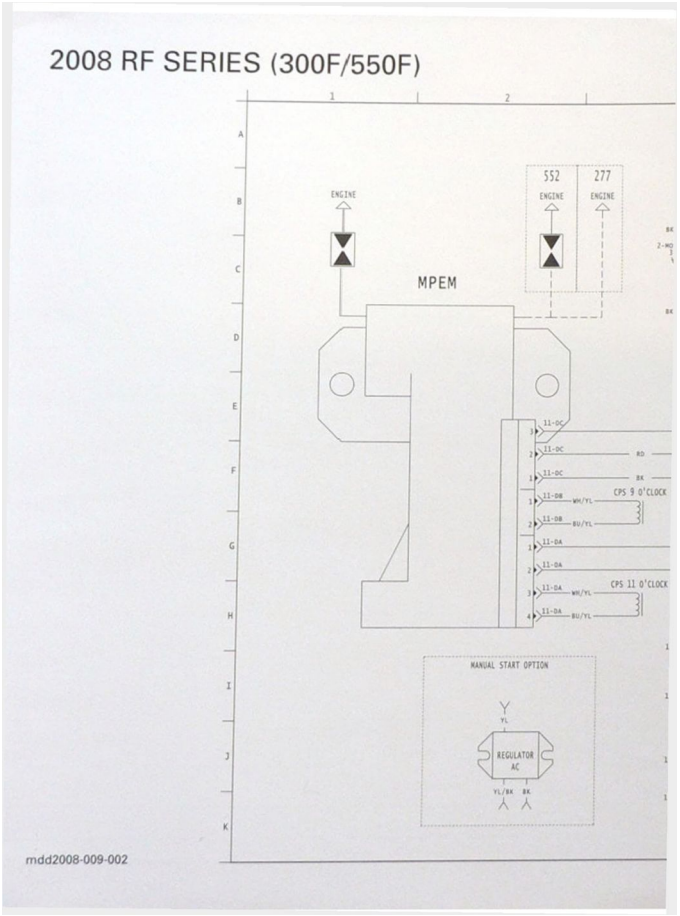

ELECTRIC MODEL
REGULATOR/
RECTIFIER
MAGNETO
340W
FRAME
TETHER CUT-OUT SWITCH
IGNITION SWITCH
OFF
ON
START
ELECTRIC START MODEL ONLY
SOLENOID
STARTER
FRAME
FUSE
(30 A)
FUSE
POWER OUTLET
(OPTIONAL)
REVERSE ALARM
SPEED SENSOR
SPEEDOMETER
TACHOMETE
OIL LEVEL SENSOR
IGNITION SWITCH GROUND
6-MI
FRAME



ELECTRIC MODEL
REGULATOR/
RECTIFIER
FRAME
MAGNETO
340W
TETHER CUT-OUT SWITCH
IGNITION SWITCH
OFF ON START
ELECTRIC START MODEL ONLY
SOLENOID
STARTER
FRAME
FUSE
FRAME
POWER OUTLET
(OPTIONAL)
REVERSE ALARM
SPEED SENSOR
SPEEDOMETER
TACHOMETER
OIL LEVEL SENSOR
IGNITION SWITCH GROUND

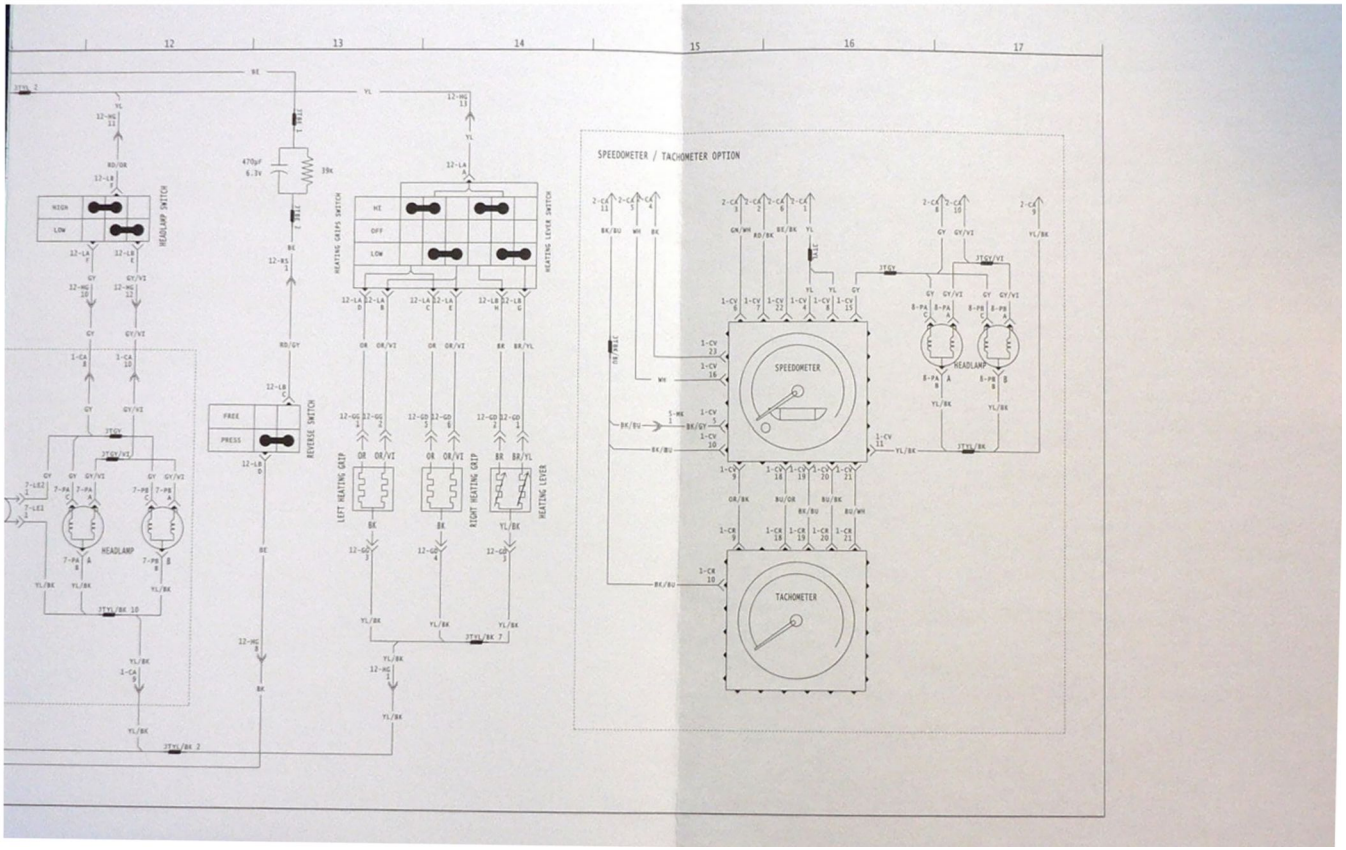

12
13
14
15
16
17
FUEL LEVEL GAUGE
FUEL LEVEL SENSOR
FUSE (0.25A)
SWITCH
HOUSING
HEADLAMP
BRAKE SWITCH
TAIL LAMP
BRAKE
PARK
39 kohms
HEATING GRIPS
LEFT HEATING
RIGHT GRIPS
HEATING LEVER
ENGINE CUT-OUT SWITCH
VISOR OUTLET (OPTIONAL)

2008 RF SERIES (300F/550F)

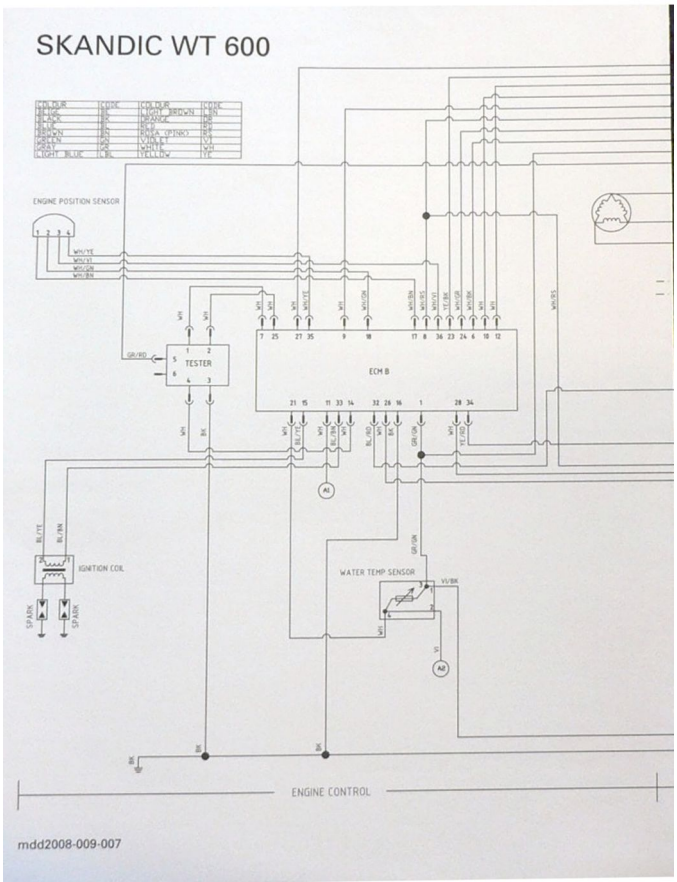


mdd2008-009-002

REGULATOR AC/DC
ELECTRIC START OPTION
IGNITION SWITCH
START
RUN
OFF
FUSE
(20 A)
STARTER
SOLENOID
POWER OUTLET
REVERSE ALARM
TETHER CUT-OUT SWITCH
ENGINE CUT-OUT SWITCH
OPTIONAL
VISOR OUTLET
TAIL LIGHT
BRAKE SWITCH
HOOD SECTION
REVERSE PILOT LIGHT
HI/LOW BEAM PILOT LIGHT
SPEED SENSOR

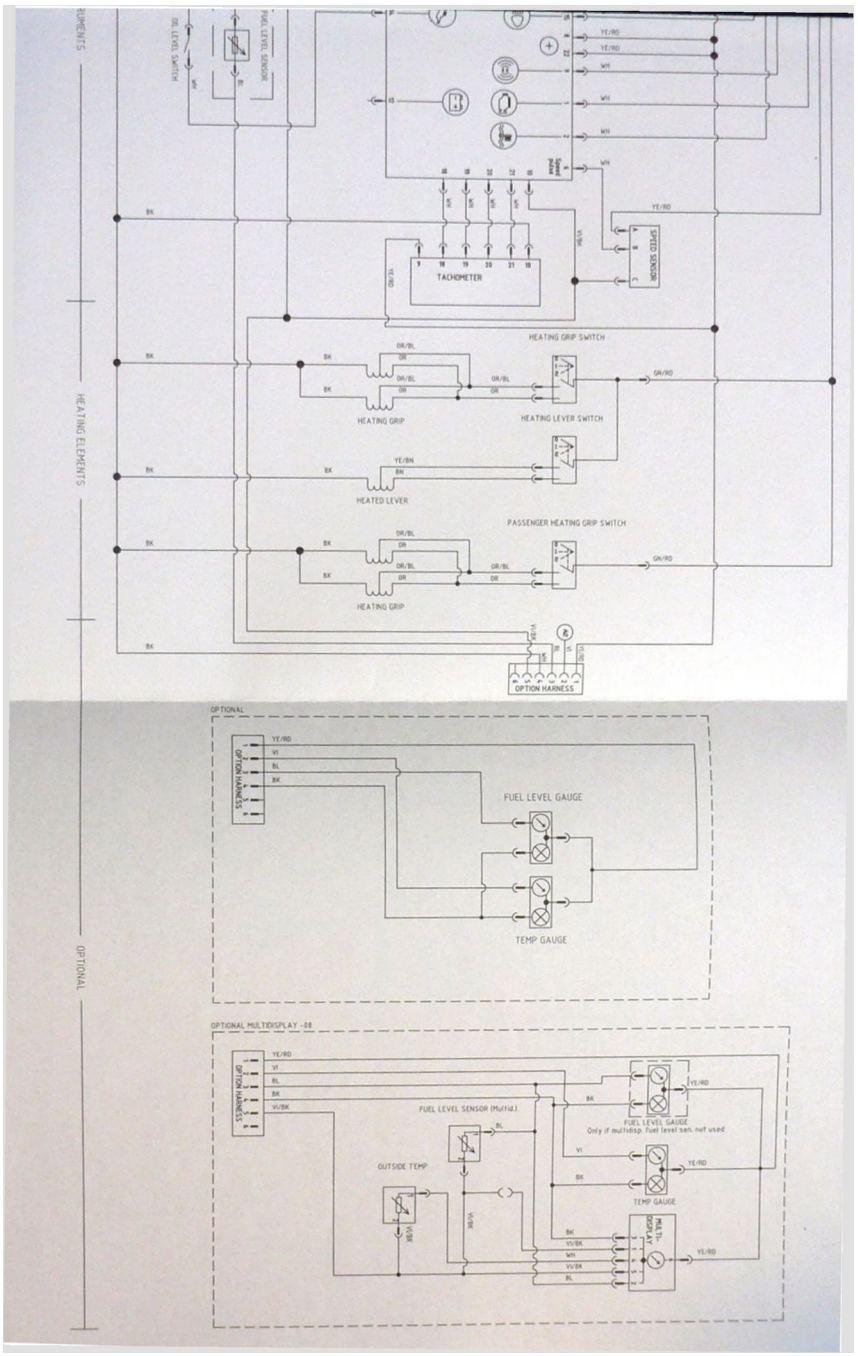

12
13
14
15
16
17
SPEEDOMETER / TACHOMETER OPTION
HEADLAMP SWITCH
HIGH
LOW
REVERSE SWITCH
FREE
PRESS
HEATING GRIPS SWITCH
HI
OFF
LOW
HEATING LEVER SWITCH
LEFT HEATING GRIP
RIGHT HEATING GRIP
HEATING LEVER
470pF
6.3V
39k
SPEEDOMETER
TACHOMETER
HEADLAMP

SKANDIC WT 600



mdd2008-009-007

REGULATOR
SET IN USE
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
R1
START SWITCH
TAIL SWITCH
BUZZER
BRAKE SWITCH
REVERSE SWITCH
REVERSE LIGHT
SPEEDOMETER
BATTERY
START RELAY
POWER SUPPLY
STARTER AND IGNITION SWITCHES
LIGHTING


INSTRUMENTS
HEATING ELEMENTS
OPTIONAL
OIL LEVEL SWITCH
FUEL LEVEL SENSOR
TACHOMETER
SPEED SENSOR
HEATING GRIP SWITCH
HEATING GRIP
HEATING LEVER SWITCH
HEATED LEVER
PASSENGER HEATING GRIP SWITCH
OPTION HARNESS
OPTIONAL
FUEL LEVEL GAUGE
TEMP GAUGE
OPTIONAL MULTIDISPLAY -08
FUEL LEVEL SENSOR (Multid.)
OUTSIDE TEMP
FUEL LEVEL GAUGE
Only if multidisp. fuel level sen. not used
TEMP GAUGE
MULTI-DISPLAY