

For use in service manual
form SB4006E

SB4007E01
May. 2000

SERVICE MANUAL CONTENTS

NOTICE

This form lists the contents of the complete Service Manual for this product. The items listed with form numbers are available and included in the manual. If form numbers listed with mark (*) are, they are not available for the initial release of the manual. When items are updated, or supplements added, they will be announced in preview and should be ordered as they become available.

TITLE	FORM NUMBER
Service Manual Contents	SB4007E01
Safety	SB2003E00
Torque Specifications	SB2004E00
ENGINE	
G420 LP/Gasoline Engine	SB4008E01
Delco Remy CS-121 Series Alternator	SB2007E01
POWER TRAIN	
Power Train	SB4009E00
VEHICLE SYSTEMS	
Vehicle Systems	SB4010E00
Vehicle Systems D & A	SB4011E00
Mast Systems	SB2143E01
Hydraulic System Schematic	SB4012E00
Electric System Schematic	SB4002E00
OPERATION & MAINTENANCE	
Operation & Maintenance Manual	SB2304E00

 **WARNING**

SAFETY

 **WARNING**

The proper and safe lubrication and maintenance for this machine, recommended by DAEWOO, are outlined in the **OPERATION & MAINTENANCE GUIDE** for this machine.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the OPERATION & MAINTENANCE GUIDE before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the machine components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all Warning plates and decals on the machine before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when pounding on any part of the machine or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Do not work on any machine that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the machine before performing any disassembly.
4. Lower the forks or other implements to the ground before performing any work on the machine. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.

 **WARNING**

Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S GUIDE. Improper machine operation is dangerous and could result in injury or death.

5. Use steps and grab handles (if applicable) when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
6. To avoid back injury, use a hoist when lifting components which weigh 23 kg (50 lb.) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
7. To avoid burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.
8. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing the last two bolts or nuts completely.
9. Be careful when removing filler caps, breathers and plugs on the machine. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.
10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.
12. If possible, make all repairs with the machine parked on a level, hard surface. Block machine so it does not roll while working on or under machine.

WARNING

13. Disconnect battery and discharge any capacitors (electric trucks) before starting to work on machine. Hang "Do Not Operate" tag in the Operator's Compartment.
14. Repairs, which require welding, should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.
15. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.
16. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.
17. Always support the mast and carriage to keep carriage or attachments raised when maintenance or repair work is performed, which requires the mast in the raised position.
18. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use cardboard or paper to locate pin hole leaks.
19. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure must be installed correctly.
20. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
21. Do not operate a machine if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.
22. On LP equipped lift trucks, be sure to close the valve on the LP tank before service work is performed. Always close the valve on the LP tank when the lift truck is being stored. Do not check for LP leaks with an open flame.
23. Caution should be used to avoid breathing dust that may be generated when handling components containing asbestos fibers. If this dust is inhaled, it can be hazardous to your health. Components in **DAEWOO** products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates and some gaskets. The asbestos used in these components is usually bound in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust which contains asbestos is not generated.

If dust which may contain asbestos is present, there are several common sense guidelines that should be followed.

 - a. Never use compressed air for cleaning.
 - b. Avoid brushing or grinding of asbestos containing materials.
 - c. For clean up, use wet methods or a vacuum equipped with a high efficiency particulate air (HEPA) filter.
 - d. Use exhaust ventilation on permanent machining jobs.
 - e. Wear an approved respirator if there is no other way to control the dust.
 - f. Comply with applicable rules and regulations for the work place (for example in the U.S.A., OSHA requirements as set forth in 29 CFR 1910. 1001).
 - g. Follow environmental rules and regulations for disposal of asbestos.
 - h. Avoid areas where asbestos particles may be in the air.

Specifications

TORQUE

SPECIFICATIONS

STANDARD TORQUE FOR METRIC FASTENERS

NOTE : Take care to avoid mixing metric and inch dimensioned fasteners. Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possible injury. Exceptions to these torques are given in the Service Manual where needed.

NOTE : Prior to installation of any hardware, be sure components are in near new condition. Bolt and nut threads must not be worn or damaged. Hardware must be free of rust and corrosion. Clean hardware with a non-corrosive cleaner and apply engine oil to threads and bearing face. If thread lock or other compounds are to be applied, do not apply engine oil.

METRIC NUTS AND BOLTS		
THREAD SIZE (mm)	STANDARD TORQUE	
	(N • m)	(lb • ft)
M6	12 ± 3	9 ± 2
M8	28 ± 7	20 ± 5
M10	55 ± 10	40 ± 7
M12	100 ± 20	75 ± 15
M14	160 ± 30	120 ± 22
M16	240 ± 40	175 ± 30
M20	460 ± 60	340 ± 44
M24	800 ± 100	600 ± 75
M30	1600 ± 200	1200 ± 150
M36	2700 ± 300	2000 ± 225

METRIC TAPERLOCK STUDS		
THREAD SIZE (mm)	STANDARD TORQUE	
	(N • m)	(lb • ft)
M6	8 ± 3	6 ± 2
M8	17 ± 5	13 ± 4
M10	35 ± 5	26 ± 4
M12	65 ± 10	48 ± 7
M16	110 ± 20	80 ± 15
M20	170 ± 30	125 ± 22
M24	400 ± 60	300 ± 45
M30	650 ± 80	480 ± 60
M36	870 ± 100	640 ± 75

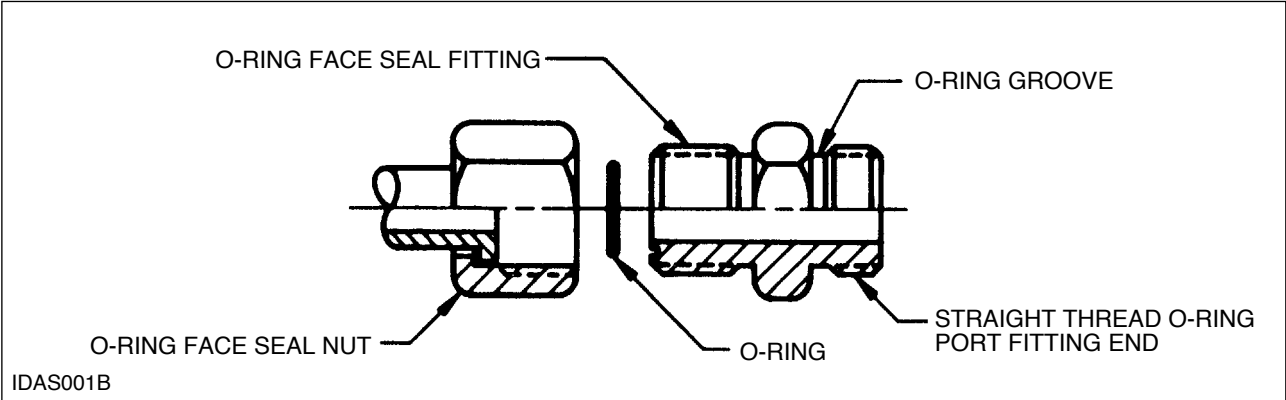
STANDARD TORQUE FOR INCH FASTENERS

Exceptions to these torques are given in the Service Manual where needed.

INCH NUTS AND BOLTS		
THREAD SIZE inch	STANDARD TORQUE	
	(N • m)	(lb • ft)
1/4	12 ± 3	9 ± 2
5/16	25 ± 6	18.0 ± 4.5
3/8	47 ± 9	35 ± 7
7/16	70 ± 15	50 ± 11
1/2	105 ± 20	75 ± 15
9/16	160 ± 30	120 ± 20
5/8	215 ± 40	160 ± 30
3/4	370 ± 50	275 ± 35
7/8	620 ± 80	460 ± 60
1	900 ± 100	660 ± 75
1-1/8	1300 ± 150	950 ± 100
1-1/4	1800 ± 200	1325 ± 150
1-3/8	2400 ± 300	1800 ± 225
1-1/2	3100 ± 350	2300 ± 250

INCH TAPERLOCK STUDS		
THREAD SIZE inch	STANDARD TORQUE	
	(N • m)	(lb • ft)
1/4	8 ± 3	6 ± 2
5/16	17 ± 5	13 ± 4
3/8	35 ± 5	26 ± 4
7/16	45 ± 10	33 ± 7
1/2	65 ± 10	48 ± 7
5/8	110 ± 20	80 ± 15
3/4	170 ± 30	125 ± 22
7/8	260 ± 40	190 ± 30
1	400 ± 60	300 ± 45
1-1/8	500 ± 70	370 ± 50
1-1/4	650 ± 80	480 ± 60
1-3/8	750 ± 90	550 ± 65
1-1/2	870 ± 100	640 ± 75

O-RING FACE SEAL FITTINGS



STRAIGHT THREAD O-RING FITTING (FOR O-RING FACE SEAL FITTING ONLY)		
THREAD SIZE inch	STANDARD TORQUE	
	(N • m)	(lb • ft)
5/16-24	5.0 ± 1.5	45±15 lb• in
3/8-24	12 ± 2	110±20 lb• in
7/16-20	20 ± 4	15 ± 3
1/2-20	30 ± 5	22 ± 4
9/16-18	40 ± 5	30 ± 4
3/4-16	100 ± 15	75 ± 10
7/8-14	135 ± 15	100 ± 10
1 1/16-12	200 ± 25	150 ± 20
1 3/16-12	250 ± 25	185 ± 20
1 5/16-12	300 ± 40	225 ± 30
1 5/8-12	300 ± 40	225 ± 30
1 7/8-12	300 ± 40	225 ± 30
2 1/2-12	300 ± 40	225 ± 30

O-RING FACE SEAL FITTING NUT		
THREAD SIZE inch	STANDARD TORQUE	
	(N • m)	(lb • ft)
9/16-18	16 ± 3	12 ± 2
11/16-16	30 ± 4	22 ± 3
13/16-16	50 ± 7	37 ± 5
1-14	90 ± 10	65 ± 7
1 3/16-12	120 ± 15	90 ± 10
1 7/16-12	160 ± 20	120 ± 15
1 11/16-12	190 ± 20	140 ± 15
2-12	215 ± 25	160 ± 20

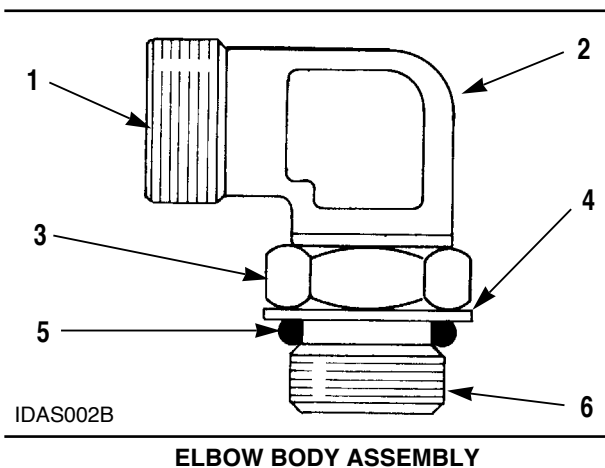
FITTING INSTALLATION

HYDRAULIC LINE INSTALLATION

1. For a metal tube to hose installation, install the tube and tighten all bolts finger tight.
2. Tighten the bolts at the rigid end.
3. Install the hose and tighten all bolts finger tight.
4. Put the hose in a position so that it does not make contact with the machine or another hose.
5. Tighten the bolts on both connections.
6. Start the engine.
7. Move the implement control levers to all positions.
8. Look at the hose during movement of the implement. Make sure hose is not in contact with the machine or other hoses.
9. Shut off the engine.
10. If necessary, put the hose in a new position where it will not make contact when the implement is moved.

ASSEMBLY OF FITTINGS WITH STRAIGHT THREADS AND O-RING SEALS

This type of fitting is used in many applications. The tube end of the fitting will be different in design so that it can be used in many different applications. However, the installation procedure of the fitting is the same. If the tube end of the fitting body is the same as in the illustration (either an elbow or a straight body) it will be necessary to assemble the sleeve on the tube before connecting the tube to the end.



- (1) End of fitting body (connects to tube). (2) Fitting body.
 (3) Lock-nut. (4) Backup washer. (5) O-ring seal. (6) End of fitting that goes into other part.

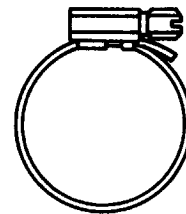
1. Put locknut (3), backup washer (4) and O-ring seal (5) as far back on fitting body (2) as possible. Hold these components in this position. Turn the fitting into the part it is used on until backup washer (4) just makes contact with the face of the part it is used on.
2. To put the fitting assembly in its correct position, turn the fitting body (2) out (counterclockwise) a maximum of 359°. Tighten locknut (3) to the torque shown in the correct chart for the fitting used.

NOTE: If the fitting is a connector (straight fitting), the hex on the body takes the place of the locknut. To install this type fitting, tighten the hex against the face of the part it goes into.

TORQUES FOR FLARED AND O-RING FITTINGS

The torques shown in the charts that follow are to be used on the nut part of 37° Flared, 45° Flared and Inverted Flared fittings (when used with steel tubing), O-ring plugs, O-ring fittings and swivel nuts when used in applications to 3000 psi (20 700 kPa).

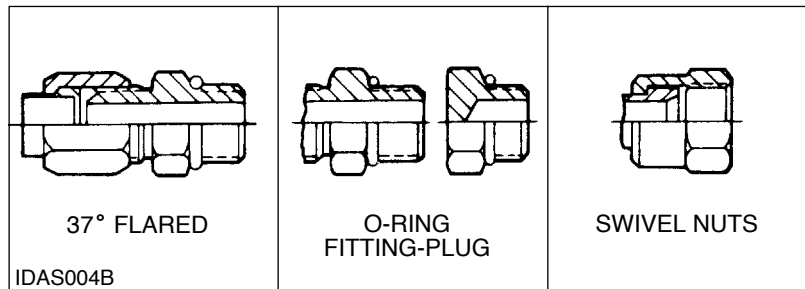
HOSE CLAMP-BAND TYPE



IDAS003B

CLAMP WIDTH	TORQUE ON NEW HOSE	RETIGHTENING TORQUE
7.9 mm (.312 in)	0.9 ± 0.2 N·m 8 ± 2 lb·in	0.7 ± 0.2 N·m 6 ± 2 lb·in
13.5 mm (.531 in)	4.5 ± 0.5 N·m 40 ± 5 lb·in	3.0 ± 0.5 N·m 25 ± 5 lb·in
15.9 mm (.625 in)	7.5 ± 0.5 N·m 65 ± 5 lb·in	4.5 ± 0.5 N·m 40 ± 5 lb·in

37° FLARED AND STRAIGHT THREAD O-RING FITTINGS

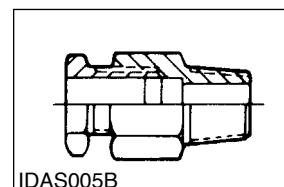


37° FLARED AND STRAIGHT THREAD O-RING FITTINGS (EXCEPT O-RING FACE SEAL FITTINGS)				
NOMINAL TUBE O.D.		THREAD SIZE inch	STANDARD TORQUE	
METRIC	INCH		(N • m)	(lb • ft)
3.18	.125	5/16	5.0 ± 1.5	4 ± 1
4.76	.188	3/8	11.0 ± 1.5	8 ± 1
6.35	.250	7/16	16 ± 2	12 ± 1
7.94	.312	1/2	20 ± 5	15 ± 4
9.52	.375	9/16	25 ± 5	18 ± 4
9.52	.375	5/8	35 ± 5	26 ± 4
12.70	.500	3/4	50 ± 7	37 ± 5
15.88	.625	7/8	65 ± 7	48 ± 5
19.05	.750	1-1/16	100 ± 10	75 ± 7
22.22	.875	1-3/16	120 ± 10	90 ± 7
25.40	1.000	1-5/16	135 ± 15	100 ± 11
31.75	1.250	1-5/8	180 ± 15	135 ± 11
38.10	1.500	1-7/8	225 ± 15	165 ± 11
50.80	2.000	2-1/2	320 ± 30	240 ± 22

TIGHTENING OTHER FITTINGS

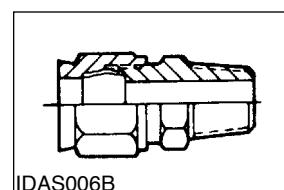
Hi Duty (Shear sleeve) Tube Fittings

After tube has been put through the nut and makes contact against the tube shoulder in the fitting body, turn the nut with a wrench until a small decrease in torque is felt. This is an indication that the sleeve has been broken off the nut. Hold the tube to prevent turning and tighten the nut 1-1/2 turns.

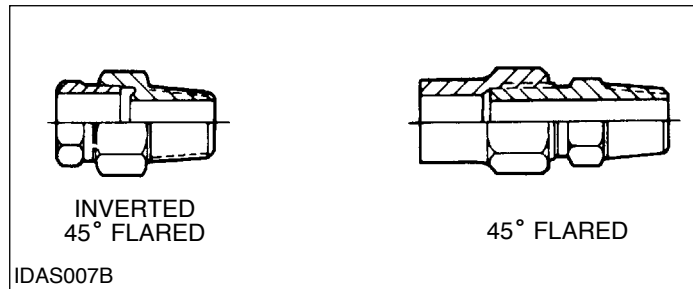


Hi Seal Fittings

Put nut and sleeve over the tubing with the short heavy end of the sleeve facing the end of tubing. Put the tube end against the counterbore in the body of the fitting and tighten until nut is over the last thread on the body. The remainder of space is used whenever the fitting is removed and installed again.



45° FLARED AND 45° INVERTED FLARE FITTINGS

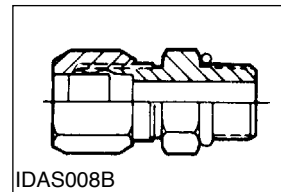


45° FLARED AND 45° INVERTED FLARE FITTINGS				
NOMINAL TUBE O.D.		THREAD SIZE inch	STANDARD TORQUE	
METRIC	INCH		(N • m)	(lb • ft)
3.18	.125	5/16	5.0 ± 1.5	4 ± 1
4.76	.188	3/8	8.0 ± 1.5	6 ± 1
6.35	.250	7/16	11 ± 2	8 ± 1
7.94	.312	1/2	17 ± 3	13 ± 2
9.52	.375	5/8	30 ± 3	22 ± 2
11.11	.438	11/16	30 ± 3	22 ± 2
12.70	.500	3/4	38 ± 4	28 ± 3
15.88	.625	7/8	50 ± 5	37 ± 4
19.05	.750	1-1/16	90 ± 8	65 ± 6
22.22	.875	1-1/4	100 ± 10	75 ± 7

TIGHTENING OTHER FITTINGS

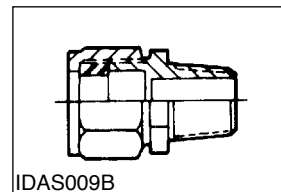
Ermeto Tube Fittings

Put nut and sleeve over the tube with head or shoulder end of sleeve next to nut. Push tube into counterbore of fitting body as far as possible. Turn nut clockwise until sleeve holds tube and prevents movement. Tighten the nut 1-1/4 turns more to seat sleeve and give a locking action. When necessary to assemble again, put sleeve over tube and tighten nut until a sudden increase in torque is felt. Then tighten 1/6 to 1/3 turn more to seat the sleeve.

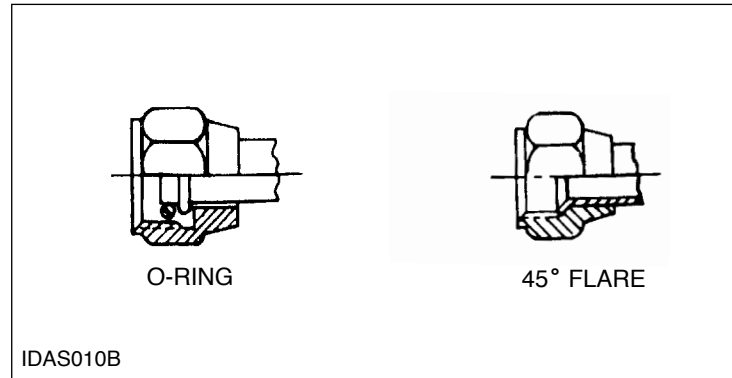


Flex Fittings

Put nut and sleeve over the tubing and push tube in to counterbore of fitting body as far as possible. Tighten the nut until it is against the hex part of the fitting body.



AIR CONDITIONING AND TAPERED PIPE THREAD FITTINGS



AIR CONDITIONING FITTINGS						
O-RING FITTING END			45° FLARE FITTING END			
THREAD SIZE inch	STANDARD TORQUE		STEEL TUBES		ALUMINUM TUBES	
			STANDARD TORQUE		STANDARD TORQUE	
	N • m	(lb • ft)	N • m	(lb • ft)	N • m	(lb • ft)
5/8-18	18 ± 4	13 ± 3	30 ± 3	22 ± 2	23 ± 3	17 ± 2
3/4-16	37 ± 4	27 ± 3	52 ± 5	38 ± 4	33 ± 4	24 ± 3
7/8-14	40 ± 4	30 ± 3	60 ± 7	44 ± 5	38 ± 4	28 ± 3
1 1/16-14	45 ± 5	33 ± 4	75 ± 8	55 ± 6	50 ± 5	37 ± 4

TAPERED PIPE THREAD FITTINGS				
PIPE THREAD SIZE inch	STANDARD TORQUE			
	THREADS WITH 1E2200E SEALANT		THREADS WITHOUT SEALANT	
	N • m	(lb • ft)	N • m	(lb • ft)
1/16-27	15	11	20	15
1/8-27	20	15	25	18
1/4-18	25	18	35	26
3/8-18	35	26	45	33
1/2-14	45	33	60	45
3/4-14	60	45	75	55
1-11 1/2	75	55	90	65
1 1/4-11 1/2	95	70	110	80
1 1/2-11 1/2	110	80	130	95
2-11 1/2	130	95	160	120

Service Manual

G420 LP/Gasoline Engine

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Read and understand all safety precautions and warnings before operating or performing lubrication, maintenance and repair on this product.

Basic safety precautions are listed in the "Safety" section of the Service or Technical Manual. Additional safety precautions are listed in the "Safety" section of the owner/operation/maintenance publication. Specific safety warnings for all these publications are provided in the description of operations where hazards exist. WARNING labels have also been put on the product to provide instructions and to identify specific hazards. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons. Warnings in this publication and on the product labels are identified by the following symbol.



Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

DAEWOO cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by DAEWOO is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this publication are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. DAEWOO dealers have the most current information available.

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General Information

How To Read This Manual

Scope of Explanation

This book describes the service procedures for the engine removed from the vehicle. For procedures concerning removal of the engine from the vehicle and on-vehicle inspection and servicing, refer to the appropriate service manuals separately prepared for the individual models.

Maintenance and Servicing Procedures

- (1) A diagram of the component parts is provided near the front each section in order to give the reader a better understanding of the installed condition of component parts.
 - (2) The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures; the symbol **N** indicates a non-reusable part; the tightening torque is provided where applicable.
- Removal steps:
The part designation number corresponds to the number in the illustration to indicate removal steps.
 - Installation steps:
Specified in case installation impossible in reverse order of removal steps. Omitted if installation is possible in reverse order of removal steps.
 - Disassembly steps:
The part designation number corresponds to the number in the illustration to indicates disassembly steps.
 - Reassembly steps.
Specified in case reassembly is impossible in reverse order of disassembly steps. Omitted if reassembly is possible in reverse order of disassembly steps.

Classification of Major Maintenance/Service points

When there are major points relative to maintenance and servicing procedures (such as essential maintenance and service points, maintenance and service standard values, information regarding the use of special tools, etc.), these are arranged together as major maintenance and service points and explained in detail.

- A : Indicates that there are essential points for removal or disassembly.
- B : Indicates that there are essential points for installation or reassembly.

Symbols for Lubrication, Sealants and Adhesives

Information concerning the locations for lubrication and for application of sealants and adhesives if provided, by using symbols, in the diagram of component parts, or on the page

following the component parts page, and explained.

- Sealant or adhesive
- Engine oil or gear oil

Inspection

Only the inspections to be performed by using special tools or measuring instruments are covered. General service procedures not covered in this manual, such as visual inspections and cleaning of parts, however, should always be performed during actual service operations.

FRONT CASE AND OIL PAN REMOVAL AND INSTALLATION

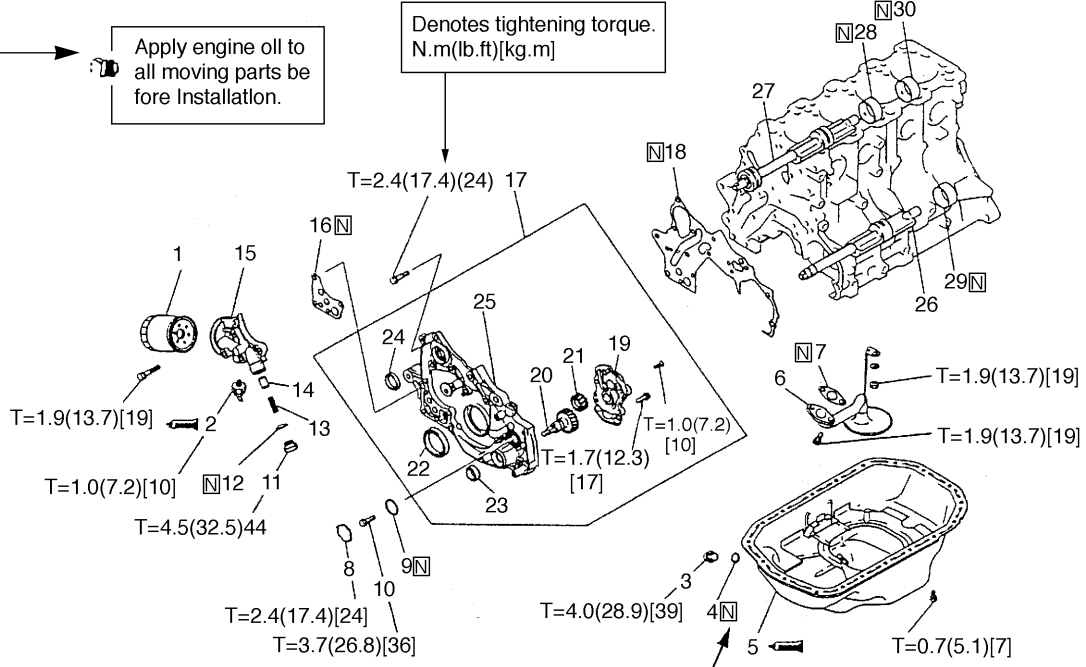
↑
Indicates
the section title.

Apply engine oil to
all moving parts be
fore Installation.

Denotes tightening torque.
N.m(lb.ft)[kg.m]

Denotes
nonreusable part.

6EN1898



Removal steps

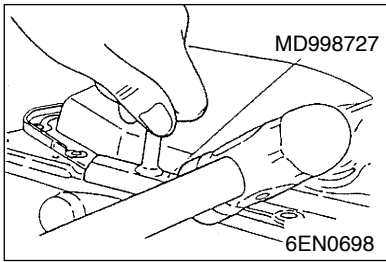
- N← 1. Oil filter
- M← 2. Oil pressure switch
- 3. Drain plug
- L← 4. Drain plug gasket
- ←A→ →K← 5. Oil pan
- 6. Oil screen
- 7. Oil screen gasket
- ←B→ →J← 8. Plug
- 9. O-ring
- ←C→ →I← 10. Flang bolt
- 11. Relief plug
- 12. Gasket
- 13. Relief spring
- 14. Relief plunger
- 15. Oil filter bracket
- 16. Oil filter bracket gasket

- H← 17. Oil pump case assembly
- 18. Front case gasket
- G← 19. Oil pump cover
- G← 20. Oil pump drive gear
- G← 21. Oil pump driven gear
- F← 22. Crankshaft front oil seal
- E← 23. Oil pump oil seal
- D← 24. Counterbalance shaft oil seal
- 25. Front case
- 26. Counterbalance shaft, left
- 27. Counterbalance shaft, right
- ←D→ →C← 28. Counterbalance shaft, front bearing
- ←E→ →B← 29. Counterbalance shaft, rear bearing, left
- ←E→ →A← 30. Counterbalance shaft, rear bearing, right

REMOVAL SERVICE POINTS

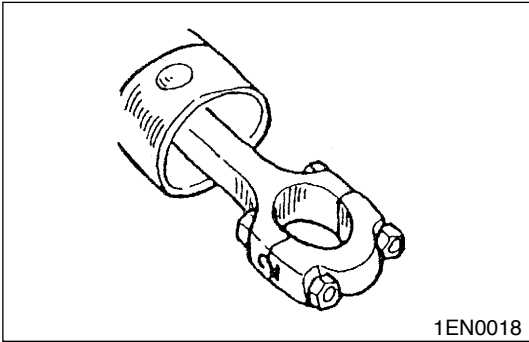
← A → Oil pan removal

- (1) Remove the all oil pan bolts.
- (2) Drive in the special tool between the cylinder block and oil pan.
- (3) Side the tool by striking the edge of the special tool to separate the oil pan from the cylinder block.



This alphabetical letter corresponds to the one assigned to a part in the removal, installation, disassembly or reassembly steps that are indicated in the drawing on the first page of each section.

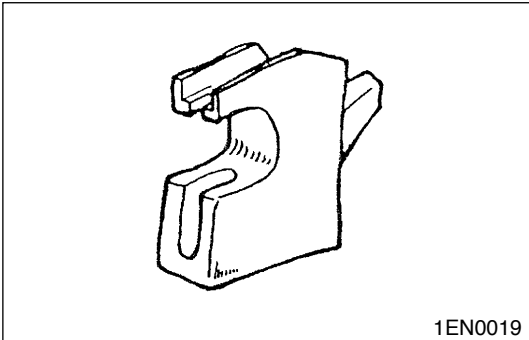
Operating procedures, cautions, etc. on removal, installation, disassembly and reassembly are described



Precautions Before Service

Removal and Disassembly

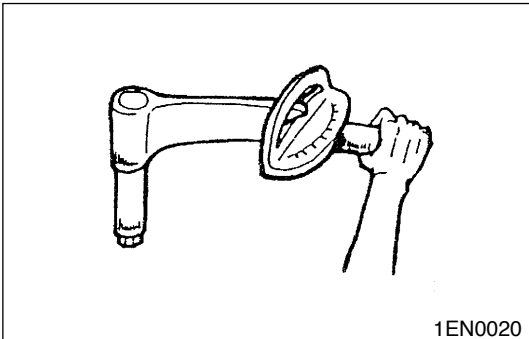
For prevention of wrong installation or reassembly and for ease of operation, put mating marks to the parts where no function is adversely affected.



Special Tool

Be sure to use Special Tools when their use is specified for the operation.

Use of substitute tools will result in malfunction of the part or damage it.



Tightening Torque

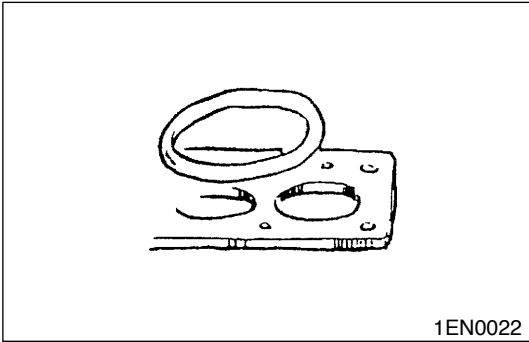
Tighten the part properly to specified torque.



Sealant

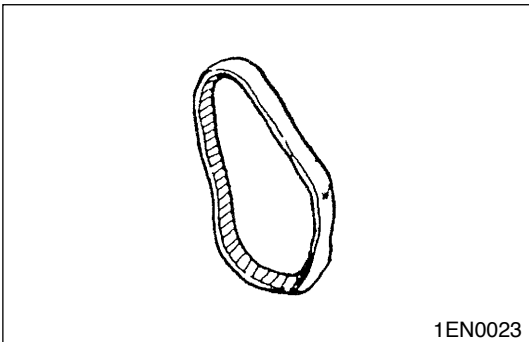
Use specified brand of sealant.

Use of sealant other than specified sealant may cause water or oil leaks.



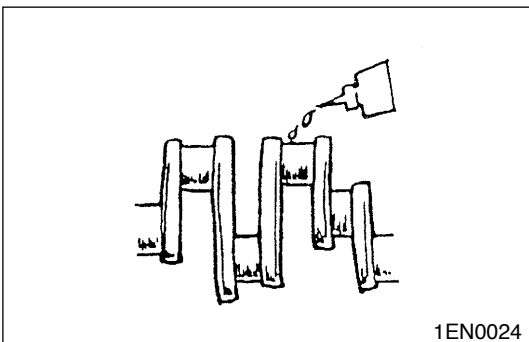
Replacement Part

When oil seal, O-ring, packing and gasket have been removed, be sure to replace them with new parts. However, rocker cover gasket may be reused if it is not damaged.



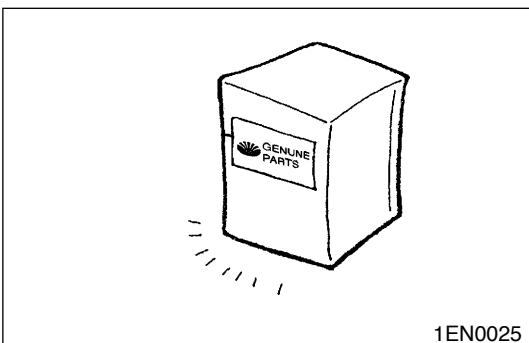
Rubber Parts

Do not stain timing belt and V-belt with oil or water. Therefore, do not clean the pulley and sprocket with detergent.



Oil and Grease

Before reassembly, apply specified oil to the rotating and sliding parts.



Genuine Part

When the part is to be replaced, be sure to use genuine part. For selection of appropriate parts, refer to the Parts Catalog.

General

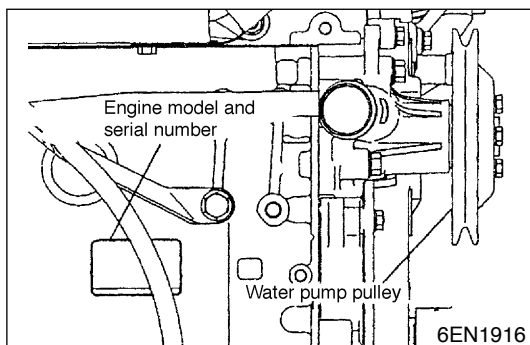
Engine models and numbers

Engine model	Fuel type
G420	L. P. G./Gasoline

Indication of engine model and number

The engine model and serial number are stamped on the right side of cylinder block surface.

Engine model	Engine number
4G63	AA0001 to YY9999



Tightening Torque

Major Bolts and Nuts

Item		Torque			Remarks	
		kg·m	lb·ft	N·m		
Ignition system	Water pump pulley bolt	0.9	6.5	9		
	Crankshaft pulley bolt	2.5	18.1	25		
	Spark plug	2.5	18.1	25		
	Distributor nut	1.2	8.7	12		
Tensioner belt	Timing belt cover bolt	1.1	8.0	11		
		0.9	6.5	9		
	Tensioner spring spacer	4.9	35.4	48		
	Tensioner bolt	4.9	35.4	48		
	Oil pump sprocket nut	5.5	39.8	54		
	Crankshaft bolt	12.0	86.8	118		
	Tensioner B bolt	1.9	13.7	19		
	Counterbalance shaft	4.6	33.3	45		
	Engine support bracket bolt	3.6	26.0	35		
	Camshaft sprocket bolt	9.0	65.1	88		
Timing belt rear bolt	1.4	10.1	14			
Fuel system carburetor	Carburetor nut	1.2	8.7	12		
	Air horn nut	1.2	8.7	12		
	Stud	1.2	8.7	12		
	Fuel pump	1.1	8.0	11		
Fuel system LPG carburetor	LPG carburetor nut	1.2	8.7	12		
	Fuel pump cover	1.1	8.0	11		
Intake manifold	Water outlet bolt	1.4	10.1	14		
	Intake manifold bolt/nut	1.8	13.0	18		
Exhaust manifold	Oil level gauge guide bolt	1.4	10.1	14		
	Heat protector bolt	0.9	6.5	9		
	Exhaust manifold nut	3.5	25.3	34		
	Water inlet pipe bolt	1.4	10.1	14		
	Water pump bolt	1.4	10.1	14		
Rocker arm and camshaft	Rocker cover bolt	0.6	4.3	6		
	Bearing cap bolt	M8 × 25	2.4	17.4	24	
		M6 × 65	2.0	14.5	20	
Cylinder head, valve	Cylinder head bolt	8.0 kgf·m(57.9 lb·ft)[78 N·m]+ 0 + 2.0 kgf·m(14.5 lb·ft)[20 N·m]+ 1/4 turn + 1/4 turn				

Item		Torque			Remarks
		kg·m	lb·ft	N·m	
Front case, oil pan	Drain plug	4.0	28.9	39	
	Oil pan bolt	0.7	5.1	7	
	Oil screen bolt/nut	1.9	13.7	19	
	Oil pressure switch	1.0	7.2	10	
	Plug	2.4	17.4	24	
	Flange bolt	3.7	26.8	36	
	Relief plug	45	32.5	44	
	Oil filter bracket	1.9	13.7	19	
	Oil pump cover bolt	1.7	12.3	17	
	Oil pump cover screw	1.0	7.2	10	
	Front case bolt	2.4	17.4	24	
Piston, connecting rod.	Connecting rod bearing nut	2.0 kg·m(14.5 lb·ft) [20 N·m]+ 1/4 turn			
Crankshaft, cylinder block	Flywheel bolt	13.5	97.6	132	
	Rear plate bolt	0.9	6.5	9	
		6.0	43.4	59	
	Rear plate cover	1.1	8.0	11	
	Oil seal case bolt	1.1	8.0	11	
	Bearing cap bolt	2.0 kg·m(14.5 lb·ft) [20 N·m]+ 1/4 turn			
Starter motor	Starter motor bolt	2.7	19.5	26	

General Bolts and Nuts Tightening Torque

Standard Bolts and Nuts

Nominal diameter	Pitch	Torque, kg·m (lb·ft) [N·m]				
		Bolt, stud, nut (with spring washer)			Flange bolt, flange nut	
		Head mark 4	Head mark 7	Head mark 10	Head mark 4	Head mark 7
M5	M5	-	0.5 (0.5) [3.6]	-	-	0.6 (4.3) [5.9]
M6	M6	-	0.9 (6.5) [8.8]	1.2 (8.7) [12]	-	1.0 (7.2) [9.8]
M7	M7	1.2 (8.7) [12]	2.2 (15.9) [22]	3.0 (21.7) [29]	1.3 (9.4) [13]	2.4 (17.4) [24]
M8	M8	2.5 (18.1) [25]	4.5 (32.5) [44]	6.0 (43.4) [59]	2.6 (18.8) [25]	5.0 (36.2) [49]
M9	M9	4.2 (30.4) [41]	8.6 (60.0) [81]	10.7 (77.4) [105]	4.7 (34.0) [46]	9.5 (68.7) [93]
M10	M10	7.3 (52.8) [72]	14.0 (101.3) [137]	14.5 (104.9) [142]	-	-

Tapered Threads

Size	Torque, kg·m (lb·ft) [N·m]	
	Material of internal threads:	Material of internal threads:
	Aluminum alloy	Cast iron or steel
NPTF 1/16	0.5 to 0.8 (3.6 to 5.8) [5 to 8]	0.8 to 1.2 (5.8 to 8.7) [8 to 11]
PT 1/8	0.8 to 1.2 (5.8 to 8.7) [8 to 11]	1.5 to 2.2 (10.8 to 15.9) [15 to 21]
PT 1/4	2.0 to 3.0 (14.5 to 21.7) [20 to 29]	3.5 to 4.5 (25.3 to 32.5) [34 to 44]
NPTF 1/4	2.0 to 3.0 (14.5 to 21.7) [20 to 29]	3.5 to 4.5 (25.3 to 32.5) [34 to 44]
PT 3/8	4.0 to 5.5 (28.9 to 39.8) [39 to 59]	5.5 to 7.5 (39.8 to 54.2) [54 to 73]
PT 1/2	7.0 to 10.0 (50.6 to 72.3) [69 to 98]	12.0 to 16.0 (86.8 to 115.7) [118 to 156]

New Tightening Method-By Use of Bolts to be Tightened in Plastic Area

A new type of bolts, to be tightened in plastic area, is currently used in some parts of the engine. The tightening method for the bolts is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts.

Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Area where the bolts are in use:

- (1) Cylinder head bolts
- (2) Main bearing cap bolts
- (3) Connecting rod cap bolts

- Tightening method

After tightening the bolts to the specified torque, tighten them another 90° or 180° (twice 90°). The tightening method varies on different areas. Observe the tightening method described in the text.

Sealant

Part to be Applied	Brand
Semi circular packing	3M™ AAD Part No.8672 or equivalent
Rocker cover	3M™ AAD Part No.8672 or equivalent
Oil pressure switch	3M™ AAD Part No.8672 or equivalent
Oil pan	Silicone RTV sealant or equivalent
Rear oil seal case	Silicone RTV sealant or equivalent
Rear plate bolt	3M™ AAD Part No.8672 or equivalent
Oil seal case bolt	3M™ AAD Part No.8672 or equivalent

From in Place Gasket(FIPG)

The engine has several areas where the from-in-place gasket(FIPG) is in use. To ensure that gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

Since the FIPG used in the engine hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas.

Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool "Oil Pan Remover" (MD998727) is available. Be sure to use the special tool to remove the oil pan.

Surface preparation

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush.

Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old FIPG remaining in the bolt holes.

From-in-place gasket Application

Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only.

The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

Specifications

General Specifications

Item		Engine model	G420
Type			Water-cooled, 4-cycle, gasoline-powered and L.P.G.-powered
No. of cylinders and arrangement			4, in-line
Combustion chamber type			Semi-spherical
Valve mechanism			OHC
Total displacement, cm ³ (cc) [cu in.]			1997 (1997) [122]
Bore x stroke, mm (in.)			85 × 88 (3.35 × 3.46)
Dry weight, kg (lb)			143 (315)
Compression ratio			8.5
Compression pressure, kPa (kgf/cm ²) [psi]			1128 (11.5) [163.5]
Valve timing	Intake valve	Open	12° BTDC
		Close	40° ABDC
	Exhaust valve	Open	54° BBDC
		Close	6° ATDC
Firing order			1 - 3 - 4 - 2
Ignition timing, BTDC/rpm			4°/740 (gasoline), 9°/740 (L.P.G.)
Fuel pump		Gasoline	Mechanical (diaphragm type)
Carburetor			Down-draft type
Governor			Air flow type
Lubrication system			Pressure feed, full-flow filtration type
Oil pump			Gear, driven by timing belt
Oil filter			Filter paper, cartridge type
Cooling system			Water-cooled, forced circulation
Water pump			Centrifugal, driven by V-belt
Thermostat			Wax type
Electrical system			12V DC, negative ground
Alternator, (12V-50A)			Alternator current, built-in fan and regulator
Starter motor, (12V-1.2kW)			Reduction drive
Distributor			Equipped with automatic timing controller, breaker less type
Spark plug (NGK)		Gasoline	BPR4ES
		L. P. G.	BPR5ES
Quantity of lubricating oil, cm ³ (liter) [U.S.gal]			4000(4.0) [1.06](including 300 cm ³ (0.3 liter)[0.08 U.S.gal]in oil filter
Quantity of coolant, cm ³ (liter) [U.S.gal]			3100 (3.1) [0.82] (in engine proper)
IDLE RPM	LOW (RPM)		750 ± 25
	HIGH (RPM)		2450 ± 50

Service Specifications

Unit : mm(in.)

Item		Standard value	Limit	Remarks	
Cylinder head	Flatness of gasket surface	0.03 (0.0012)			
	Grinding limit		0.2 (0.008)	Total resurfacing depth of both cylinder head and cylinder block	
	Overall height	89.9 to 90.1 (3.539 to 3.547)			
	Oversize rework dimensions of valve guide hole	0.05 (0.0020)	13.05 to 13.07 (0.5138 to 0.5146)		
		0.25 (0.0098)	13.25 to 13.27 (0.5217 to 0.5224)		
		0.50 (0.0197)	13.50 to 13.57 (0.5315 to 0.5343)		
	Oversize rework dimensions of valve seat ring hole	Intake	0.30 (0.0118)	44.30 to 44.33 (1.7441 to 1.7453)	
0.60 (0.0236)			44.60 to 44.63 (1.7559 to 1.7571)		
Exhaust		0.30 (0.0118)	38.30 to 38.33 (1.5079 to 1.5091)		
		0.60 (0.0236)	38.60 to 38.63 (1.5197 to 1.5209)		
Camshaft	Cam height	Intake	41.62 (1.6386)	41.12 (1.6189)	
		Exhaust	41.62 (1.6386)	41.12 (1.6189)	
	Journal diameter	33.935 to 33.950 (1.33602 to 1.33661)			
Oil clearance	0.05 to 0.09 (0.0020 to 0.0035)				
Valve	Overall length	Intake	109.8 (4.328)	109.3 (4.3031)	
		Exhaust	106.6 (4.197)	106.1 (4.126)	
	Valve stem projection	42.05 (1.6555)	42.55 (1.6752)		
	Stem diameter	Intake	7.960 to 7.975 (0.31339 to 0.31398)		
		Exhaust	7.930 to 7.950 (0.31220 to 0.31299)		
	Face angle	45° to 45.5°			
	Thickness of valve head (margin)	Intake	1.2 (0.047)		
		Exhaust	2.0 (0.079)		
Stem-to-guide clearance	Intake	0.025 to 0.058 (0.00098 to 0.00228)			
	Exhaust	0.050 to 0.088 (0.00197 to 0.00346)			
Valve spring	Free height	48.0 (1.89)	47.0 (1.85)		
	Load/installed height	176.5N (18kg) [39.7lbf]/40.4 (1.591)			
	Out-of-squareness	2° or less	4°		
Valve guide	Overall length	Intake	47 (1.85)		
		Exhaust	52 (2.05)		
Inner diameter	8.000 to 8.018 (0.31496 to 0.31567)				
Valve seat	Valve contact width	0.9 to 1.3 (0.035 to 0.051)			
	Sinkage		0.2 (0.008)		
Piston	Outside diameter	84.97 to 85.00 (3.3453 to 3.3465)			
	Piston clearance	0.02 to 0.04 (0.0008 to 0.0016)			

Unit : mm(in.)

Item		Standard value	Limit	Remarks	
Piston ring	End gap	No. 1 ring	0.25 to 0.40 (0.0098 to 0.0157)	0.8 (0.031)	
		No. 2 ring	0.45 to 0.60 (0.0177 to 0.0236)	0.8 (0.031)	
		Oil ring	0.20 to 0.60 (0.0079 to 0.0236)	1.0 (0.039)	
	Ring-to-ring groove clearance	No. 1	0.02 to 0.06 (0.0008 to 0.0024)		
		No. 2	0.02 to 0.06 (0.0008 to 0.0024)		
Piston pin	Outside diameter	22.002 to 22.005 (0.86622 to 0.86634)			
	Press-in load (at room temperature), N (kg) [lbf]	7350 to 17160 (750 to 1750) [1650 to 3860]			
Connecting rod	Big end center-to small end center length	149.9 to 150.0 (5.902 to 5.906)			
	Bend	0.05 (0.0020)			
	Twist	0.10 (0.0039)			
	Big end thrust clearance	0.10 to 0.25 (0.0039 to 0.0098)			
Crankshaft	End play	0.05 to 0.18 (0.0020 to 0.0071)			
	Journal outside diameter	56.982 to 57.000 (2.24338 to 2.24409)			
	Pin Outside diameter	44.985 to 45.000 (1.77106 to 1.77165)			
	Out-of-roundness and taper of journal and pin	0.005 (0.00020)			
	Concentricity journal and pin	0.03 (0.0012)			
	Oil clearance of journal	0.02 to 0.04 (0.0008 to 0.0016)			
	Oil clearance of pin	0.02 to 0.05 (0.0008 to 0.0020)			
Cylinder block	Cylinder inner diameter	85.00 to 85.03 (3.3465 to 3.3476)			
	Flatness of gasket surface	0.05 (0.0020)			
	Grinding limit		0.2 (0.008)	Total resurfacing depth of both cylinder head and cylinder block	
	Overall height	283.9 to 284.1 (11.177 to 11.185)			
Oil pump	Side clearance	Drive gear	0.08 to 0.14 (0.031 to 0.0055)		
		Drive gear	0.06 to 0.12 (0.0024 to 0.0047)		
Drive belt	Deflection	New belt	7.0 to 10.0 (0.28 to 0.39)		
		Used belt	10 (0.39)		
Carburetor	Throttle bore diameter	32 (1.26)			
	Outer venturi diameter	24 (0.94)			
	Inner venturi diameter	9 to 12 (0.35 to 0.47)			
	Main jet size symbol	130			
	Main air jet diameter	0.9 (0.035)			
	Pilot jet diameter	0.55 (0.0217)			
	Pilot air jet diameter	1.6 (0.063)			
	Primary throttle valve to throttle bore clearance	1.1(0.043)			

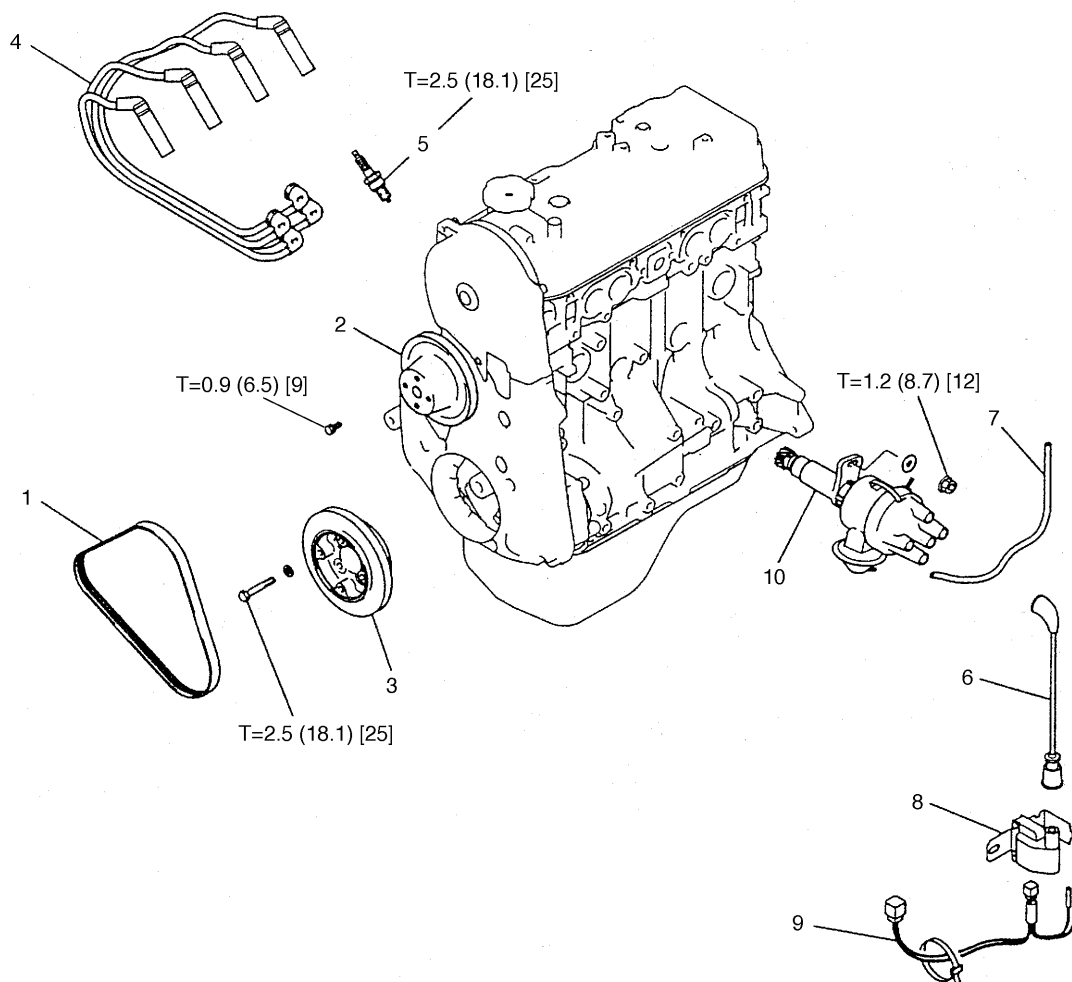
Unit : mm(in.)

Item		Standard value	Limit	Remarks	
Starter motor	Nominal output, kW	1.2			
	No-load characteristics	Voltage, V	11.0		
		Current, A	90 or less		
		Speed, rpm	3000		
	Commutator	Outer diameter	29.4 (1.16)	28.8 (1.13)	
		Runout	0.05 (0.0020)	0.1 (0.0039)	
		Undercut	0.5 (0.020)	0.2 (0.008)	
Pinion gap		0.5 to 2.0 (0.020 to 0.079)			
Brush length			Wear limit line		
Distributor	Centrifugal advance crank angle/engine speed, °/rpm	Start	0°/1000		
		End	20°/5000		
	Vacuum advance crank angle/vacuum, °/mmHg	End	0°/80		
		Start	23°/280		
Ignition coil	Primary coil resistance, Ω	1.08 to 1.32			
	Secondary coil resistance, Ω	22.1 to 29.9			
Spark plug	Plug gap	0.7 to 0.8 (0.028 to 0.031)			
Thermostat	Valve opening temperature, °C (°F)	82 (180)			
	Fully opening temperature, °C (°F)	95 (203)			
	Valve lift	8 (0.31) or more			

Removal and Installation

Ignition System

Removal and Installation



6EN1891

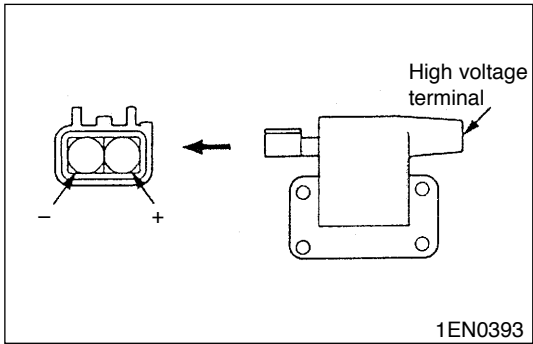
Removal steps

1. Drive belt
2. Water pump pulley
3. Crankshaft pulley
4. Spark plug cable
5. Spark plug
6. High tension cable

7. Vacuum hose

8. Ignition coil
9. Harness

→A← 10. Distributor



Inspection

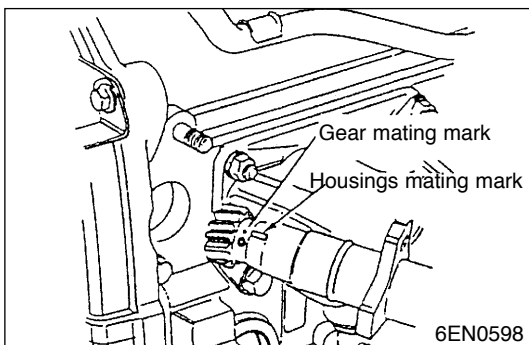
Ignition Coil

Perform the following measurements. Replace the ignition coil if the standard values are not met.

- (1) Measure the resistance values of the primary and secondary coils and of the external resistor with a tester. If the readings are within the standard limits, it follows that there is no short or open circuit in the ignition coil.
Standard value:
 Primary coil resistance value: 1.08 to 1.32 Ω
 Secondary coil resistance value: 22.1 to 29.9 Ω

Spark Plug Cable/High Tension Cable

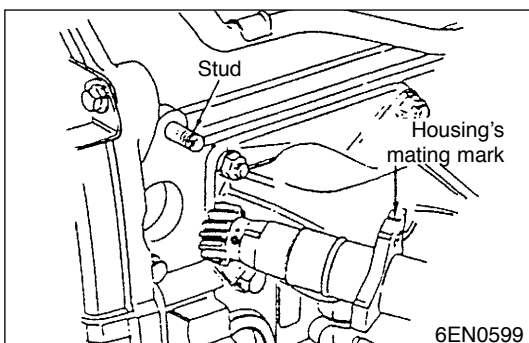
- (1) Check the caps and covering for cracks.
- (2) Measure the resistance values:
Standard value: 16 k Ω /m



Installation Service Points

→ A ← Distributor installation

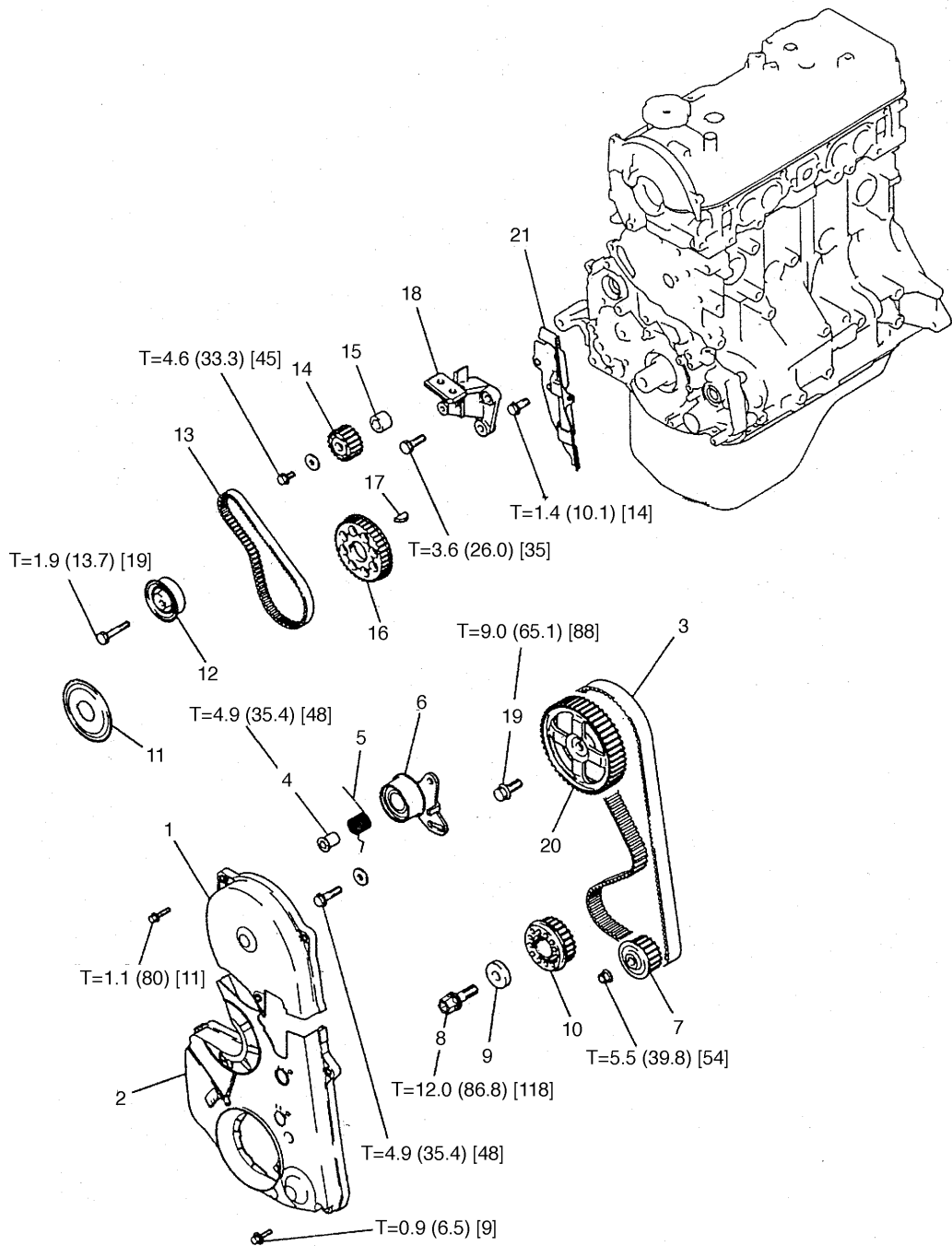
- (1) Turn the crankshaft so that the No.1 cylinder is at top dead center.
- (2) Align the distributor housing and gear mating marks.



- (3) Install the distributor to the engine while aligning the fine cut (groove or projection) of the distributor's installation flange with the center of the distributor installation stud.

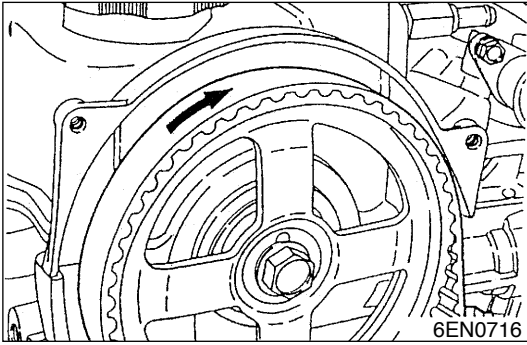
Timing Belt

Removal and Installation



Removal steps

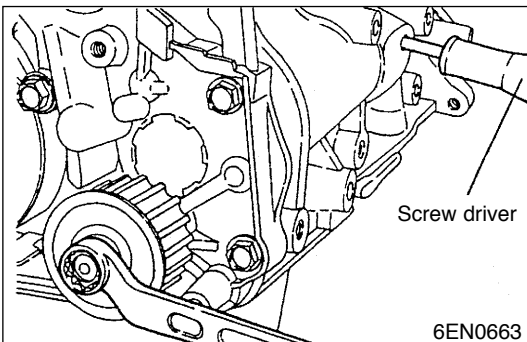
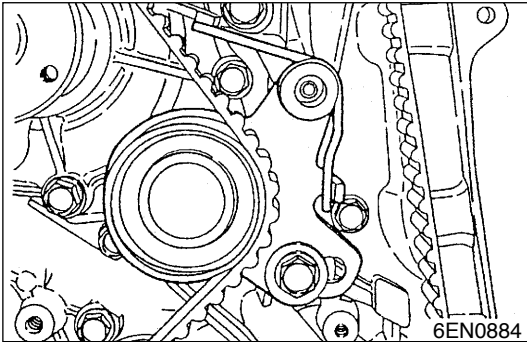
- | | | | |
|-------------|----------------------------------|-------------|-----------------------------------|
| | 1. Timing belt front cover upper | | 12. Tensioner B |
| | 2. Timing belt front cover lower | ← E → → D ← | 13. Timing belt B |
| ← A → → H ← | 3. Timing belt | ← F → → C ← | 14. Counterbalance shaft sprocket |
| | 4. Tensioner spacer | | 15. Spacer |
| | 5. Tensioner spring | ← G → | 16. Crankshaft sprocket B |
| | 6. Tensioner pulley | | 17. Crankshaft key |
| ← B → → F ← | 7. Oil pump sprocket | → B ← | 18. Engine support bracket |
| ← C → → E ← | 8. Crankshaft bolt | | 19. Camshaft sprocket bolt |
| | 9. Crankshaft washer | ← H → → A ← | 20. Camshaft sprocket |
| ← D → | 10. Crankshaft sprocket | | 21. Timing belt rear cover |
| | 11. Flang | | |



Removal Service Points

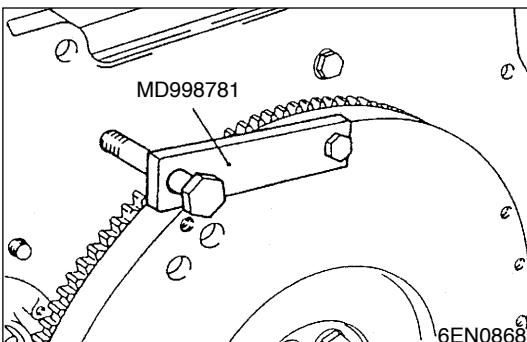
← A → Timing belt removal

- (1) When the timing belt is to be re-used, make an arrow mark on the back surface on the belt to indicate the rotating direction with a chalk or the like so that the belt can be installed in the same direction.
- (2) Move the timing belt tensioner upward and temporarily tighten the tensioner lock bolt.
- (3) Remove the timing belt.



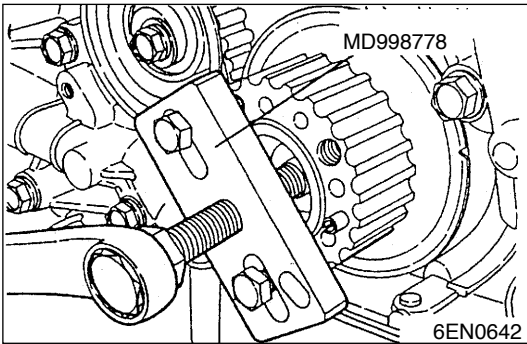
← B → Oil pump sprocket removal

- (1) Remove the plug on the left side of cylinder block.
- (2) Insert a screwdriver (shank diameter 8 mm[0.31 in.]) to block the counterbalance shaft.
- (3) Remove the nut.
- (4) Remove the oil pump sprocket.



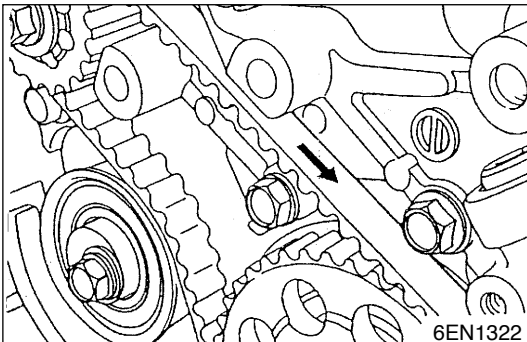
← C → Crankshaft bolt removal

- (1) Hold the flywheel with the special tool as shown.
- (2) Remove the crankshaft bolt.



← **D** → **Crankshaft sprocket removal**

- (1) If it is difficult to remove the sprocket, use the special tool.

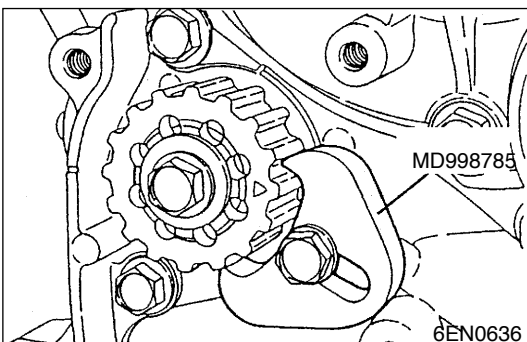


← **E** → **Timing belt "B" removal**

- (1) Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

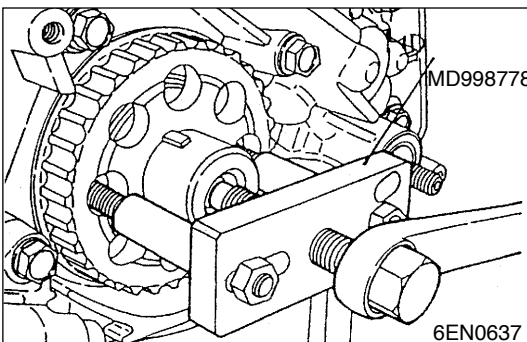
NOTE: Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace part if seriously contaminated.

- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.



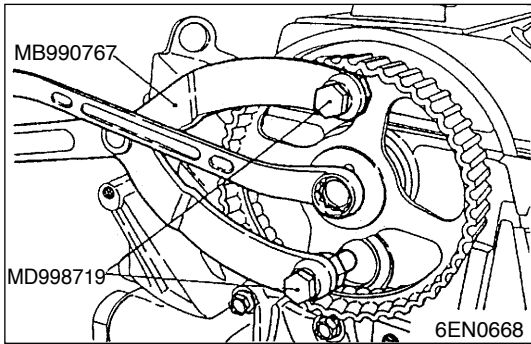
← **F** → **Counterbalance shaft sprocket removal**

- (1) Set the special tool as shown to prevent the counterbalance shaft sprocket from turning together.
- (2) Loosen the bolt and remove the sprocket.



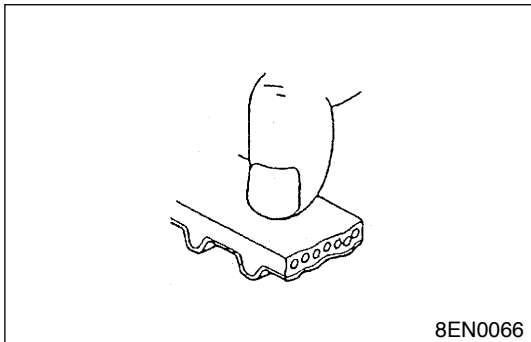
← **G** → **Crankshaft sprocket "B" removal**

- (1) If it is difficult to remove the sprocket, use the special tool.



← H → Crankshaft sprocket removal

- (1) Using the special tool show in the illustration, lock the camshaft sprocket in position.
- (2) Loosen the camshaft sprocket bolt.



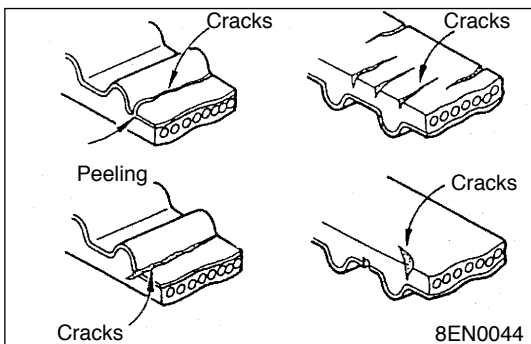
Inspection

1. Timing Belt

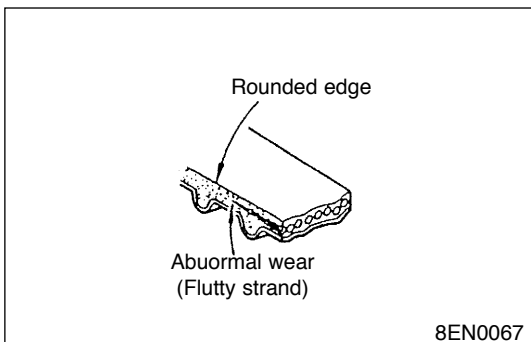
Replace belt if any of the following conditions exist.

- (1) Hardening of back rubber.

Back side is glossy without resilience and leaves no indent when pressed with fingernail.

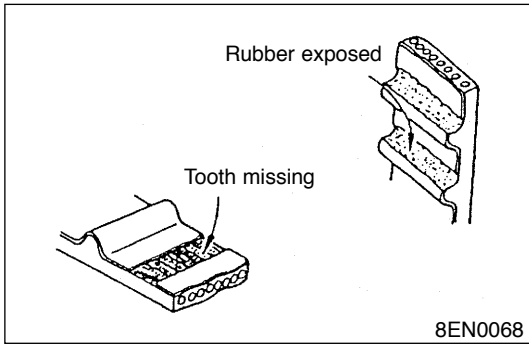


- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on tooth bottom.
- (5) Cracks on belt sides.



- (6) Abnormal wear of belt sides.

NOTE: The sides are normal if they are sharp as if cut by a knife.



(7) Abnormal wear on teeth

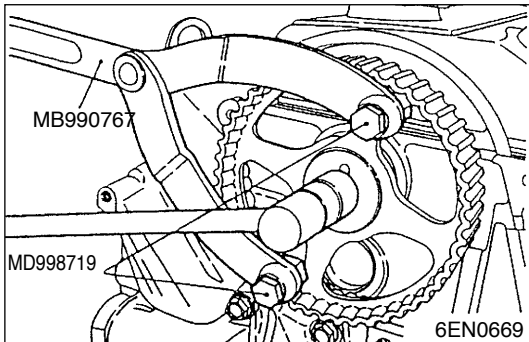
Earlier stage:

Canvas worn (canvas fibers napped, rubber lost, discolored whitish, and unclear canvas texture)

Latter stage:

Canvas lost, rubber exposed (tooth width thinner)

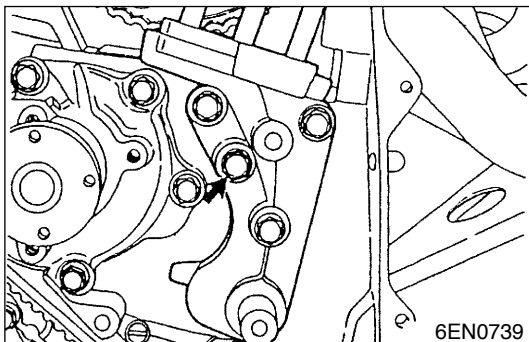
(8) Missing tooth



Installation Service Points

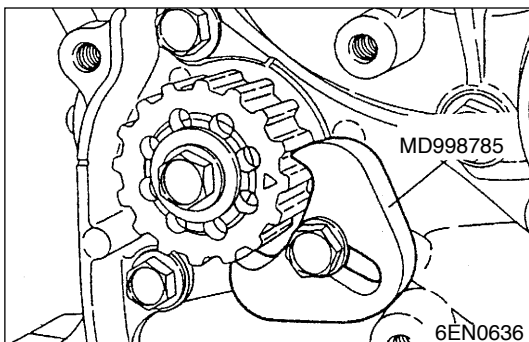
→ A ← Camshaft sprocket installation

- (1) Using the special tools show in the illustration, lock the camshaft sprocket in position.
- (2) Tighten the camshaft sprocket bolt to the specified torque.



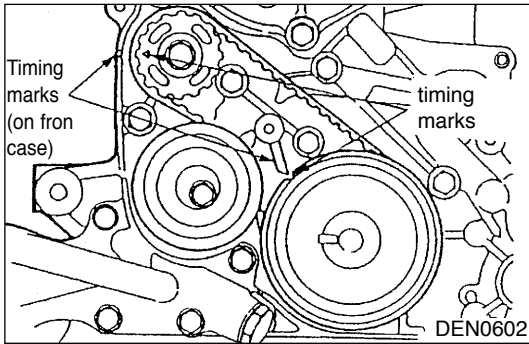
→ B ← Engine support bracket installation

- (1) Coat the bolts illustrated with sealant before tightening. Specified sealant: 3M™ AAD Part No. 8762 or equivalent



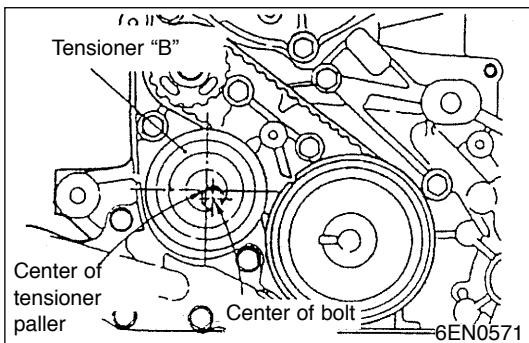
→ C ← Counterbalance shaft sprocket installation

- (1) Install the counterbalance shaft sprocket and screw the bolt.
- (2) Install special tool as shown in the illustration to lock the counterbalance shaft.
- (3) Tighten the bolt, and then remove the special tool.

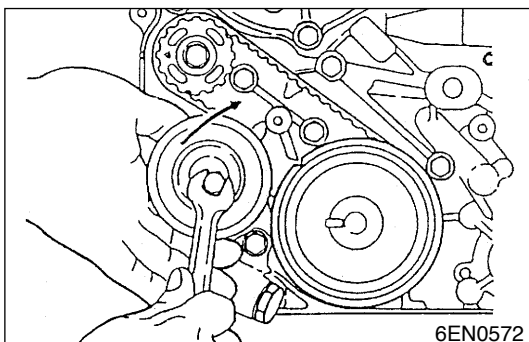


→ **D** ← **Timing belt "B" installation**

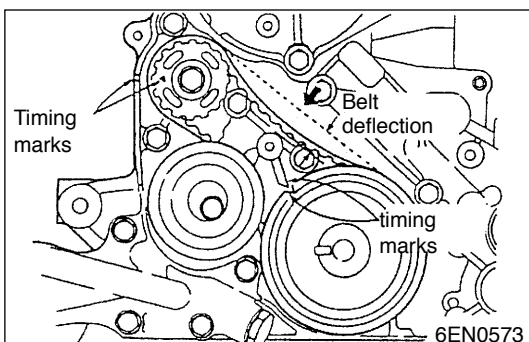
- (1) Align timing mark on the crankshaft sprocket "B" and counterbalance shaft sprocket with the marks on the front case respectively.
- (2) Install the timing belt "B" on the crankshaft sprocket "B" and counterbalance shaft sprocket. There should be no slack on the tension side.



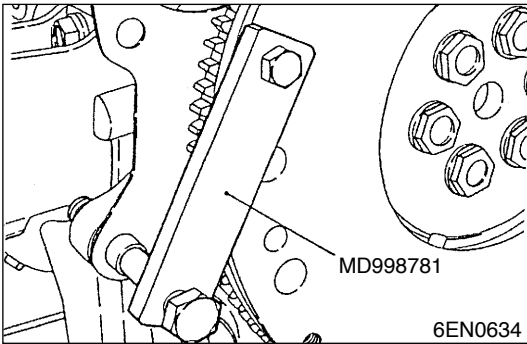
- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



- (4) Move the tensioner "B" in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten bolt to secure tensioner "B". When the bolt is tightened, use care to prevent shaft from turning together. If shaft is turned together, belt will be over tensioned.

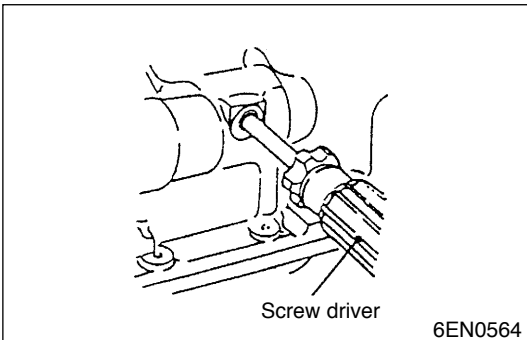


- (5) Check to ensure that timing marks on sprockets and front case are in alignment.
- (6) Press with index finger the center of span on the tension side of timing belt "B". The belt must deflect 5 to 7 mm. [0.196 to 0.276 in].



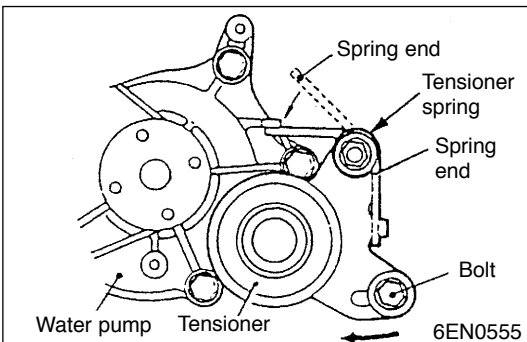
→ **E** ← **Crankshaft bolt installation**

- (1) Using the special tool, hold the flywheel.
- (2) Install the crankshaft pulley in position.



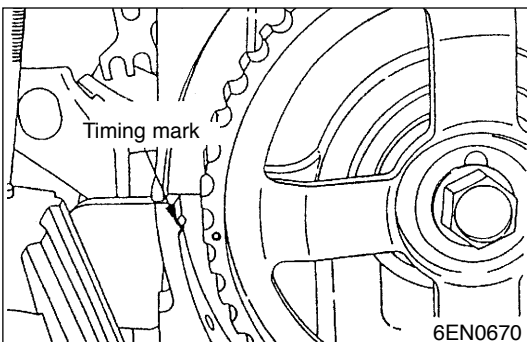
→ **F** ← **Oil pump sprocket installation**

- (1) Insert a phillips screwdriver (shank diameter 8 mm[0.31 in.] shaft) through the plug hole on the left side of the cylinder block to the left counterbalance shaft.
- (2) Install the oil pump sprocket.
- (3) Apply a proper amount of engine oil to the bearing surfaces of the nuts.
- (4) Tighten the nuts to the specified torque.



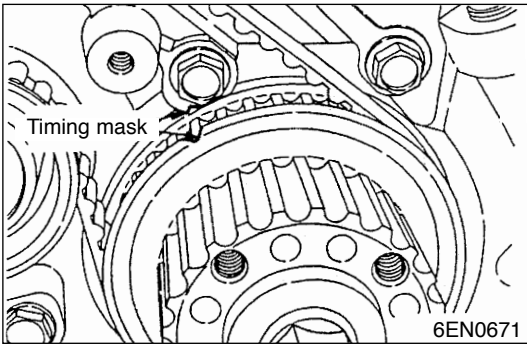
→ **G** ← **Crankshaft bolt installation**

- (1) Hook the tensioner spring end to the water pump body projection and tensioner bracket.
- (2) Move the tensioner fully toward the water pump and tighten the bolt and tensioner spacer.

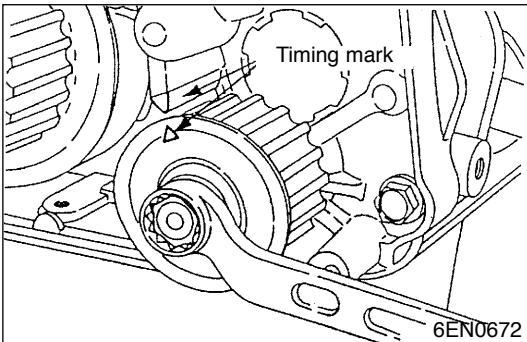


→ **H** ← **Timing belt installation**

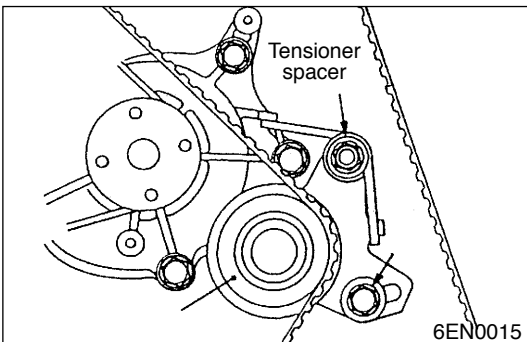
- (1) Align the timing mark on the camshaft sprocket with that on the cylinder head.



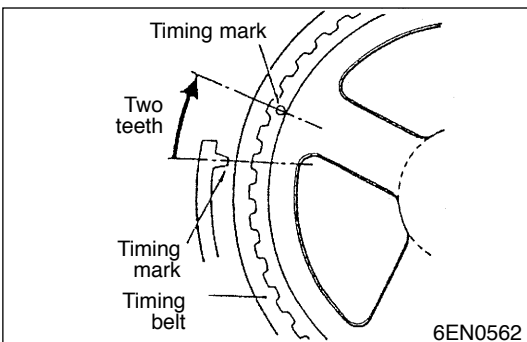
- (2) Align the timing mark on the crankshaft sprocket with that on the front case.



- (3) Align the timing mark on the oil pump sprocket with its mating mark.



- (4) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.
- (5) Apply a reverse direction (counterclockwise) force to the camshaft sprocket to make the tension side of the belt "tight". In that state, recheck that all the timing marks are in alignment.
- (6) Loosen a turn or two the tensioner bolt and nut that were temporarily tightened to hold the tensioner on the water pump side. This gives tension to the belt by the action of the tensioner spring.
- (7) Rotate the crankshaft by the amount equivalent to two camshaft sprocket teeth in the forward (clockwise) direction. Since this step is intended for giving the timing belt proper tension, do not attempt rotate the crankshaft in the reverse (counterclockwise) direction or press the belt to check the tension.



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