570T
Backhoe Loader

SERVICE MANUAL

Part number 47576089
English
June 2014

CASE CONSTRUCTION

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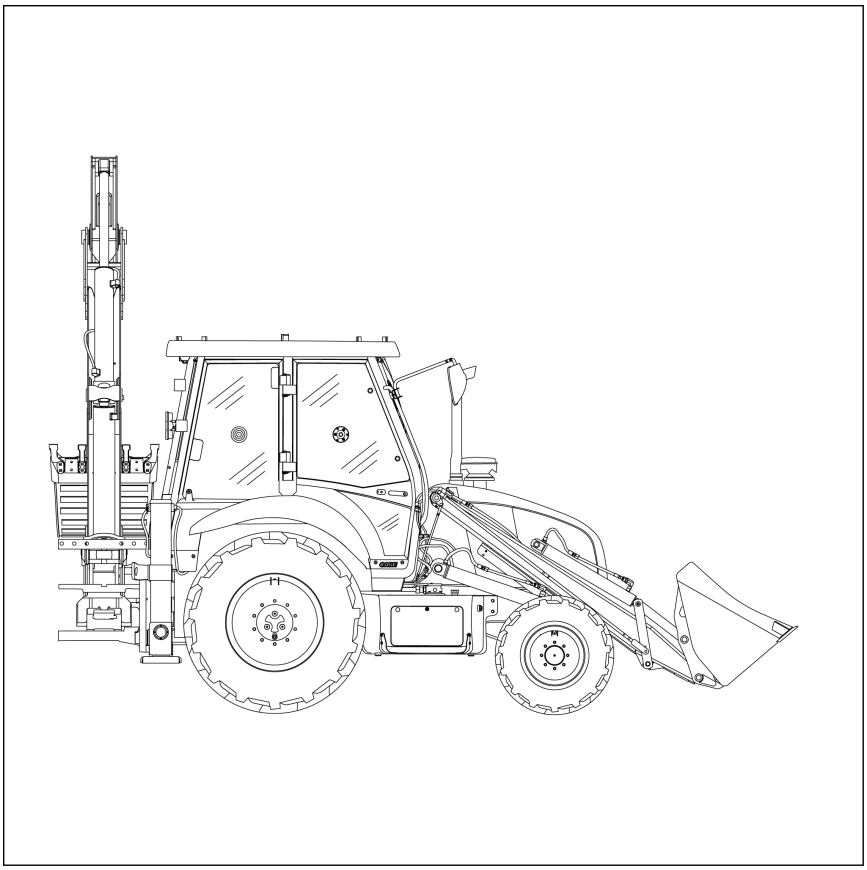
SERVICE MANUAL



570T

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INTRODUCTION

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Safety rules

Personal safety

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Electrical safety

ATTENTION: *Make sure that all loose ends of the wire harness is secured by wire tie. No wire harness should be hanging loose.*

Safety rules

⚠ DANGER

Improper operation or service of this machine can result in an accident.
Do not operate this machine or perform any lubrication, maintenance, or repair on it until you have read and understood the operation, lubrication, maintenance, and repair information.
Failure to comply will result in death or serious injury.

D0010A

⚠ WARNING

Maintenance hazard!
Always perform all service procedures punctually at the intervals stated in this manual. This ensures optimum performance levels and maximum safety during machine operation.
Failure to comply could result in death or serious injury.

W0132A

NOTICE: *Extreme working and environmental conditions require shortened service intervals.*

Use Case fluids, lubricants, and filters for the best protection and performance of your machine. All fluids, lubricants, and filters must be disposed of in compliance with environmental standards and regulations. Contact your Dealer with any questions regarding the service and maintenance of this machine.

Use this manual with the operator's manual to understand and perform the complete service procedures. Read the safety decals and information decals on the machine. Read the Operator’s Manual and safety manual. Understand the operation of the machine before you start any service.

Before you service the machine, put a “Do Not Operate” tag on the steering wheel or over the key switch. Ensure the tag is at a location where everyone who might operate or service the machine may see clearly.

Plastic and resin parts

- Avoid using gasoline, paint thinner, etc. when cleaning plastic parts, console, instrument cluster, etc.
- Use only water, mild soap, and a soft cloth when you clean these parts.
- Using gasoline, thinners, etc. can cause discoloration, cracking, or deformation of the part being cleaned.

Safety rules - Ductile iron

⚠ DANGER

Improper operation or service of this machine can result in an accident.
Any unauthorized modifications made to this machine can have serious consequences. Consult an authorized dealer on changes, additions, or modifications that may be required for this machine. Do not make any unauthorized modifications.
Failure to comply will result in death or serious injury.

D0030A

Before you weld, cut, or drill holes on any part of this machine, make sure the part is not cast ductile iron. See your dealer if you do not know if a part is cast ductile iron. The following are cast ductile iron parts:

- two wheel drive steering link
- dump links
- front axle
- stabilizers
- extendahoe
- swing
- bucket linkage
- Air Conditioning (A/C) compressor mounting bracket

Unauthorized modifications to cast ductile iron parts can cause injury or death. Welding, cutting, or drilling can cause cast ductile iron to break. Do not weld, cut, or drill to repair or to attach items to cast ductile iron parts on this machine.

Safety rules

Unless otherwise instructed, always perform these steps before you service the machine:

1. Park the machine on a flat, level surface.
2. Place the backhoe in the transport position with the swing lock pin installed for transport.
3. Place the loader bucket on the ground, with the bottom of the loader bucket parallel to the surface.
4. Place the direction control lever and the transmission in neutral.
5. If you need to open the hood to perform service, raise the loader arms and install the support strut.
6. Shut down the engine.
7. Place a 'Do Not Operate' tag on the key switch so that it is visible to other workers or remove the key.

Safety rules - Ecology and the environment

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances required by advanced technology, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

NOTE: *The following are recommendations that may be of assistance:*

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use, and dispose of these substances.

Helpful hints

- Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems that may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances that may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
- Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil, but should be collected and disposed of properly.
- Repair any leaks or defects in the engine cooling or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

Basic instructions - Important notice regarding equipment servicing

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local CASE Dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer.

In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The information in this manual is up-to-date at the date of the publication. It is the policy of the manufacturer for continuous improvement. Some information could not be updated due to modifications of a technical or commercial type, or changes to the laws and regulations of different countries.

In case of questions, refer to your Case New Holland Construction Equipments Sales and Service Networks.

Basic instructions

⚠ WARNING

Explosive gas!
Batteries emit explosive hydrogen gas and other fumes while charging. Ventilate the charging area. Keep the battery away from sparks, open flames, and other ignition sources. Never charge a frozen battery.
Failure to comply could result in death or serious injury.

W0005A

⚠ WARNING

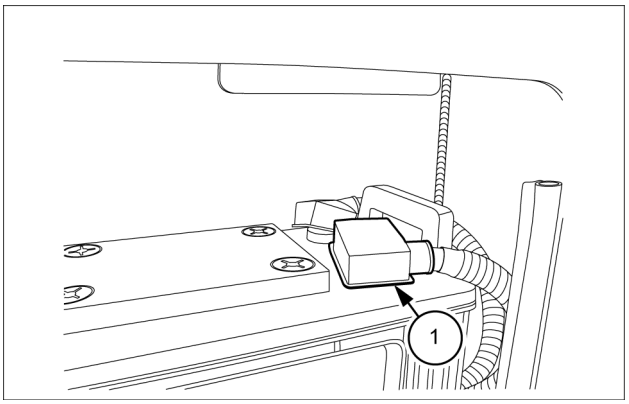
Hazardous chemicals!
Battery electrolyte contains sulfuric acid. Contact with skin and eyes could result in severe irritation and burns. Always wear splash-proof goggles and protective clothing (gloves and aprons). Wash hands after handling.
Failure to comply could result in death or serious injury.

W0006A

- Do not run the engine with the alternator wires disconnected.
- Before using an electric welder, disconnect the alternator wires, instrument cluster and batteries.
- Do not use a steam cleaner or a cleaning solvent to clean the alternator.
- Keep the battery vents clean. Ensure the battery vents are not restricted.

Disconnect battery

1. Open the battery compartment cover on the right hand side step of the vehicle, using the key.
2. Disconnect the negative battery cable **(1)** from the negative battery terminal.



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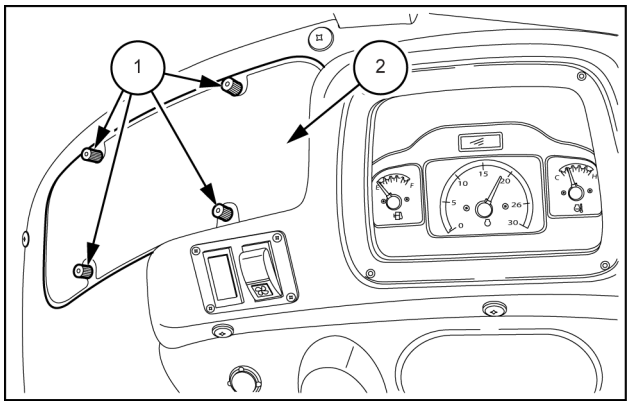
Basic instructions – Fuse and relay locations

The machine is equipped with a fuse located on the side console.

Side console box

1. Turn the thumb screws **(1)** to loosen the panel cover **(2)** for the fuse box. Remove the panel cover.
2. Remove the fuse box covers as needed.
3. Refer to the decal on top of the panel cover for fuse, relay, and/or diode functions.



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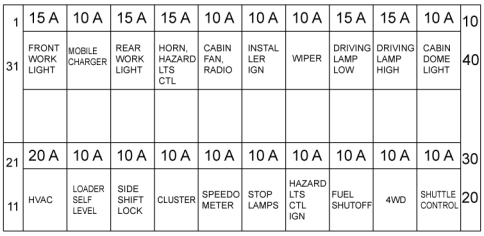
Sl No.	Fuse rating	Fuse details
1	**15 A**	Front work light
2	**10 A**	**12 V** power output
3	**15 A**	Rear work light
4	**15 A**	Horn, hazard light control
5	**10 A**	Cabin, fan, radio
6	**10 A**	Installer ignition
7	**10 A**	Wiper
8	**15 A**	Driving lamp LOW
9	**15 A**	Driving lamp HIGH
10	**10 A**	Cabin dome light
11	**20 A**	HVAC (If fitted)
12	**10 A**	Loader self level
13	**10 A**	Side shift lock
14	**10 A**	Cluster
15	**10 A**	Speedometer
16	**10 A**	Stop lamps
17	**10 A**	Hazard lights control ignition
18	**10 A**	Fuel shutoff
19	**10 A**	4WD (If fitted)
20	**10 A**	Shuttle control

The fuses are arranged as per the Fig. **2**



PTIL12TLB0441AA 2

Basic instructions

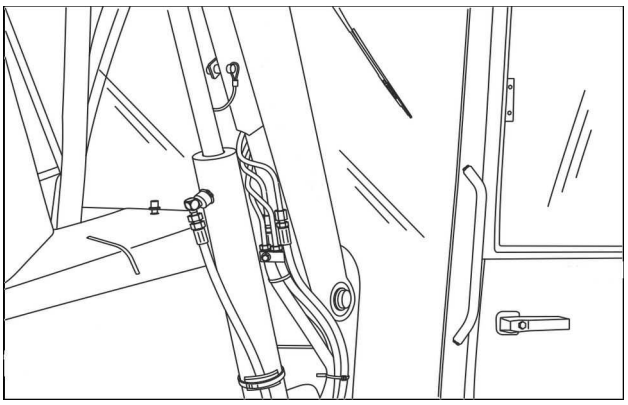
⚠ WARNING

Crushing hazard!
If you service the machine with the loader lift arms raised, always use the support strut. Remove the retaining pin and place the support strut onto the cylinder rod. Install the retaining pin into the support strut. Lower the lift arms onto the support strut.
Failure to comply could result in death or serious injury.

W0230A

Raise and support loader lift arms:

1. Empty the loader bucket.
2. Raise the loader lift arms to the maximum height.
3. Shut down the engine.



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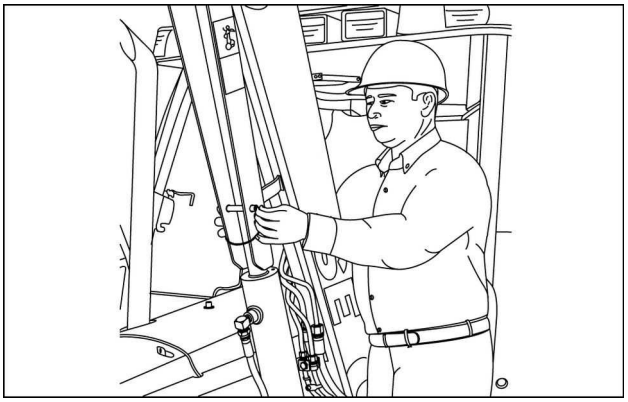
4. Remove the retaining pin.
5. Lower the support strut onto the cylinder rod.
6. Install the retaining pin.



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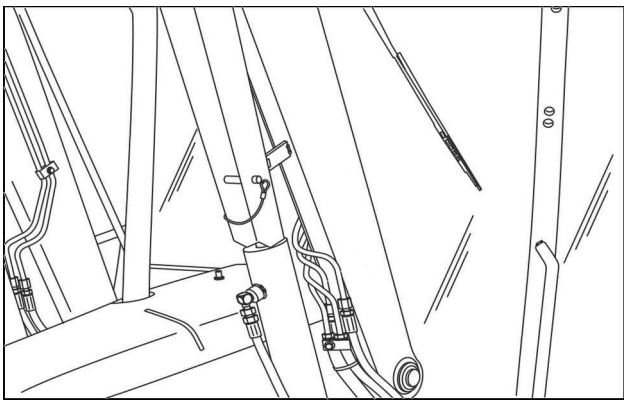
7. Start the engine.
8. Slowly lower the lift arms so that the end of the support strut rests on the cylinder.



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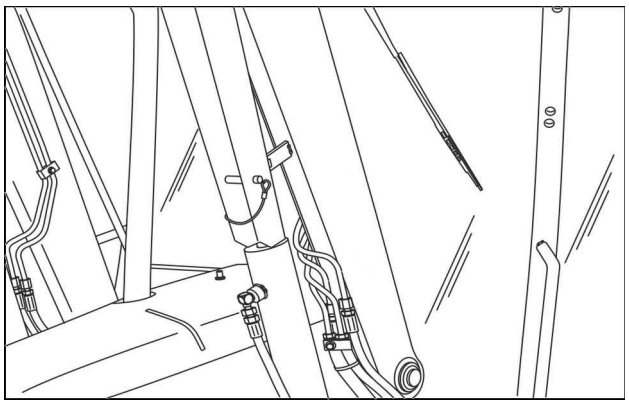
Lower supported loader lift arms:

1. Raise the lift arms so that the end of the support strut no longer rests on the cylinder.
2. Shut down the engine.



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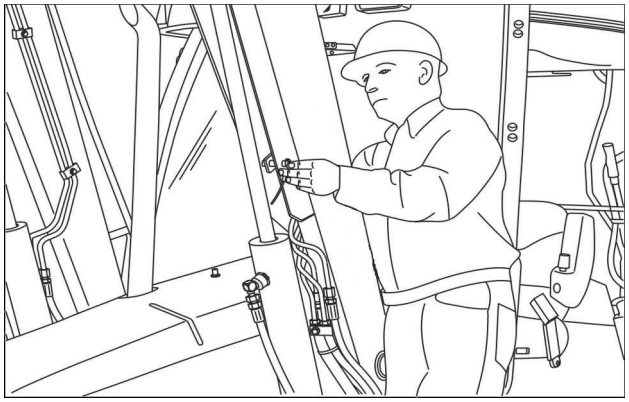
3. Remove the retaining pin from the support strut.
4. Raise the support strut up to the storage position and secure with the retaining pin, as shown.



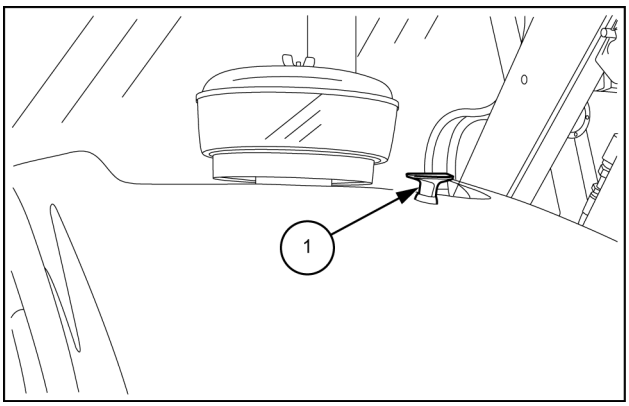
RCPH10TLB231AAF 5

5. Start the engine.
6. Lower the loader to the ground.

Basic instructions

Open the hood:

1. Shut down the engine.
2. Turn the handle **(1)** counter-clockwise to release the hood latch.



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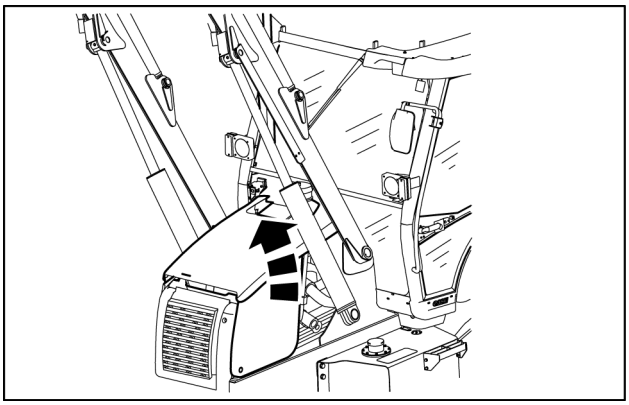
3. Lift the hood and rotate forward.

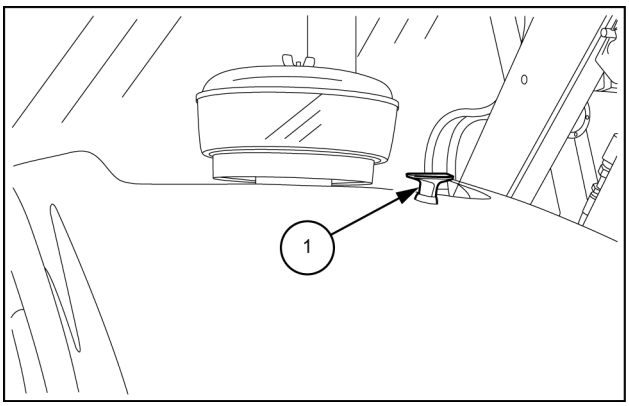


PTIL12TLB0559AB 2

NOTICE: *To avoid damage to the hood parts, always close the hood before moving the loader.*

Close the hood:

1. Lower the hood.
2. Turn the handle **(1)** clockwise to lock the hood latch.



PTIL13TLB1558AB 3

Basic instructions – Shop and assembly

Shimming

For each adjustment operation, select adjusting shims and measure the adjusting shims individually using a micrometer, then add up the recorded values. Do not rely on measuring the entire shimming set, which may be incorrect, or the rated value shown on each shim.

Rotating shaft seals

For correct rotating shaft seal installation, proceed as follows:

1. Before assembly, allow the seal to soak in the oil it will be sealing for at least thirty minutes.
2. Thoroughly clean the shaft and check that the working surface on the shaft is not damaged.
3. Position the sealing lip facing the fluid.

   NOTE: *With hydrodynamic lips, take into consideration the shaft rotation direction and position the grooves so that they will move the fluid towards the inner side of the seal.*
4. Coat the sealing lip with a thin layer of lubricant (use oil rather than grease). Fill the gap between the sealing lip and the dust lip on double lip seals with grease.
5. Insert the seal in its seat and press down using a flat punch or seal installation tool. Do not tap the seal with a hammer or mallet.
6. While you insert the seal, check that the seal is perpendicular to the seat. When the seal settles, make sure that the seal makes contact with the thrust element, if required.
7. To prevent damage to the seal lip on the shaft, position a protective guard during installation operations.

O-ring seals

Lubricate the O-ring seals before you insert them in the seats. This will prevent the O-ring seals from overturning and twisting, which would jeopardize sealing efficiency.

Sealing compounds

Apply a sealing compound on the mating surfaces when specified by the procedure. Before you apply the sealing compound, prepare the surfaces as directed by the product container.

Spare parts

Only use CNH Original Parts or CASE CONSTRUCTION Original Parts.

Only genuine spare parts guarantee the same quality, duration, and safety as original parts, as they are the same parts that are assembled during standard production. Only CNH Original Parts or CASE CONSTRUCTION Original Parts can offer this guarantee.

When ordering spare parts, always provide the following information:

- Machine model (commercial name) and Product Identification Number (PIN)
- Part number of the ordered part, which can be found in the parts catalog

Protecting the electronic and/or electrical systems during charging and welding

To avoid damage to the electronic and/or electrical systems, always observe the following practices:

1. Never make or break any of the charging circuit connections when the engine is running, including the battery connections.
2. Never short any of the charging components to ground.
3. Always disconnect the ground cable from the battery before arc welding on the machine or on any machine attachment.
   - Position the welder ground clamp as close to the welding area as possible.
   - If you weld in close proximity to a computer module, then you should remove the module from the machine.
   - Never allow welding cables to lie on, near, or across any electrical wiring or electronic component while you weld.
4. Always disconnect the negative cable from the battery when charging the battery in the machine with a battery charger.

   NOTICE: *If you must weld on the unit, you must disconnect the battery ground cable from the machine battery. The electronic monitoring system and charging system will be damaged if this is not done.*
5. Remove the battery ground cable. Reconnect the cable when you complete welding.

Special tools

⚠ WARNING

Battery acid causes burns. Batteries contain sulfuric acid.
Avoid contact with skin, eyes or clothing. Antidote (external): Flush with water. Antidote (eyes): flush with water for 15 minutes and seek medical attention immediately. Antidote (internal): Drink large quantities of water or milk. Do not induce vomiting. Seek medical attention immediately.
Failure to comply could result in death or serious injury.

W0111A

The special tools that CASE CONSTRUCTION suggests and illustrate in this manual have been specifically researched and designed for use with CASE CONSTRUCTION machines. The special tools are essential for reliable repair operations. The special tools are accurately built and rigorously tested to offer efficient and long-lasting operation.

By using these tools, repair personnel will benefit from:

- Operating in optimal technical conditions
- Obtaining the best results
- Saving time and effort
- Working in safe conditions

Torque - Minimum tightening torques for normal assembly

METRIC NON-FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 N·m (40 lb in)	5.9 N·m (52 lb in)	6.4 N·m (57 lb in)	8.5 N·m (75 lb in)	4 N·m (36 lb in)	5.8 N·m (51 lb in)
M6	7.5 N·m (66 lb in)	10 N·m (89 lb in)	11 N·m (96 lb in)	15 N·m (128 lb in)	6.8 N·m (60 lb in)	10 N·m (89 lb in)
M8	18 N·m (163 lb in)	25 N·m (217 lb in)	26 N·m (234 lb in)	35 N·m (311 lb in)	17 N·m (151 lb in)	24 N·m (212 lb in)
M10	37 N·m (27 lb ft)	49 N·m (36 lb ft)	52 N·m (38 lb ft)	70 N·m (51 lb ft)	33 N·m (25 lb ft)	48 N·m (35 lb ft)
M12	64 N·m (47 lb ft)	85 N·m (63 lb ft)	91 N·m (67 lb ft)	121 N·m (90 lb ft)	58 N·m (43 lb ft)	83 N·m (61 lb ft)
M16	158 N·m (116 lb ft)	210 N·m (155 lb ft)	225 N·m (166 lb ft)	301 N·m (222 lb ft)	143 N·m (106 lb ft)	205 N·m (151 lb ft)
M20	319 N·m (235 lb ft)	425 N·m (313 lb ft)	440 N·m (325 lb ft)	587 N·m (433 lb ft)	290 N·m (214 lb ft)	400 N·m (295 lb ft)
M24	551 N·m (410 lb ft)	735 N·m (500 lb ft)	762 N·m (560 lb ft)	1016 N·m (750 lb ft)	501 N·m (370 lb ft)	693 N·m (510 lb ft)

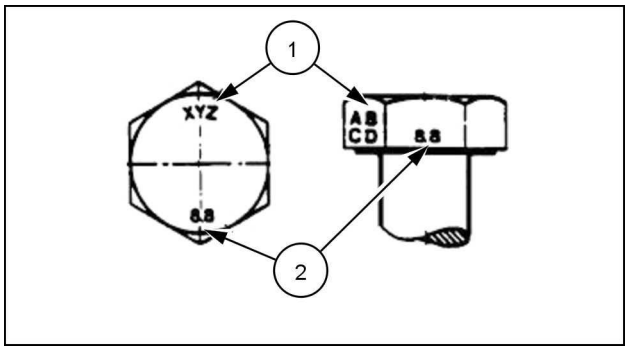
NOTE: *M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.*

METRIC FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.4 N·m (21 lb in)	3.2 N·m (28 lb in)	3.5 N·m (31 lb in)	4.6 N·m (41 lb in)	2.2 N·m (19 lb in)	3.1 N·m (27 lb in)
M5	4.9 N·m (43 lb in)	6.5 N·m (58 lb in)	7.0 N·m (62 lb in)	9.4 N·m (83 lb in)	4.4 N·m (39 lb in)	6.4 N·m (57 lb in)
M6	8.3 N·m (73 lb in)	11 N·m (96 lb in)	12 N·m (105 lb in)	16 N·m (141 lb in)	7.5 N·m (66 lb in)	11 N·m (96 lb in)
M8	20 N·m (179 lb in)	27 N·m (240 lb in)	29 N·m (257 lb in)	39 N·m (343 lb in)	18 N·m (163 lb in)	27 N·m (240 lb in)
M10	40 N·m (30 lb ft)	54 N·m (40 lb ft)	57 N·m (42 lb ft)	77 N·m (56 lb ft)	37 N·m (27 lb ft)	53 N·m (39 lb ft)
M12	70 N·m (52 lb ft)	93 N·m (69 lb ft)	100 N·m (74 lb ft)	134 N·m (98 lb ft)	63 N·m (47 lb ft)	91 N·m (67 lb ft)
M16	174 N·m (128 lb ft)	231 N·m (171 lb ft)	248 N·m (183 lb ft)	331 N·m (244 lb ft)	158 N·m (116 lb ft)	226 N·m (167 lb ft)
M20	350 N·m (259 lb ft)	467 N·m (345 lb ft)	484 N·m (357 lb ft)	645 N·m (476 lb ft)	318 N·m (235 lb ft)	440 N·m (325 lb ft)
M24	607 N·m (447 lb ft)	809 N·m (597 lb ft)	838 N·m (618 lb ft)	1118 N·m (824 lb ft)	552 N·m (407 lb ft)	

IDENTIFICATION

Metric Hex head and carriage bolts, classes 5.6 and up



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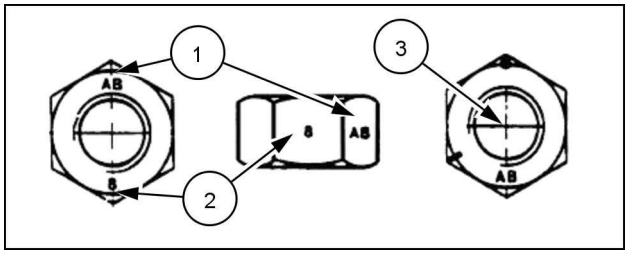
1. Manufacturer's Identification
2. Property Class

Metric Hex nuts and locknuts, classes 05 and up



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1. Manufacturer's Identification
2. Property Class
3. Clock Marking of Property Class and Manufacturer's Identification (Optional), i.e. marks **60 °** apart indicate Class 10 properties, and marks **120 °** apart indicate Class 8.

INCH NON-FLANGED HARDWARE

NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrB W/ Gr5 BOLT	LOCKNUT GrC W/ Gr8 BOLT
	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**8 N·m (71 lb in)**	**11 N·m (97 lb in)**	**12 N·m (106 lb in)**	**16 N·m (142 lb in)**	**8.5 N·m (75 lb in)**	**12.2 N·m (109 lb in)**
5/16	**17 N·m (150 lb in)**	**23 N·m (204 lb in)**	**24 N·m (212 lb in)**	**32 N·m (283 lb in)**	**17.5 N·m (155 lb in)**	**25 N·m (220 lb in)**
3/8	**30 N·m (22 lb ft)**	**40 N·m (30 lb ft)**	**43 N·m (31 lb ft)**	**57 N·m (42 lb ft)**	**31 N·m (23 lb ft)**	**44 N·m (33 lb ft)**
7/16	**48 N·m (36 lb ft)**	**65 N·m (48 lb ft)**	**68 N·m (50 lb ft)**	**91 N·m (67 lb ft)**	**50 N·m (37 lb ft)**	**71 N·m (53 lb ft)**
1/2	**74 N·m (54 lb ft)**	**98 N·m (73 lb ft)**	**104 N·m (77 lb ft)**	**139 N·m (103 lb ft)**	**76 N·m (56 lb ft)**	**108 N·m (80 lb ft)**
9/16	**107 N·m (79 lb ft)**	**142 N·m (105 lb ft)**	**150 N·m (111 lb ft)**	**201 N·m (148 lb ft)**	**111 N·m (82 lb ft)**	**156 N·m (115 lb ft)**
5/8	**147 N·m (108 lb ft)**	**196 N·m (145 lb ft)**	**208 N·m (153 lb ft)**	**277 N·m (204 lb ft)**	**153 N·m (113 lb ft)**	**215 N·m (159 lb ft)**
3/4	**261 N·m (193 lb ft)**	**348 N·m (257 lb ft)**	**369 N·m (272 lb ft)**	**491 N·m (362 lb ft)**	**271 N·m (200 lb ft)**	**383 N·m (282 lb ft)**
7/8	**420 N·m (310 lb ft)**	**561 N·m (413 lb ft)**	**594 N·m (438 lb ft)**	**791 N·m (584 lb ft)**	**437 N·m (323 lb ft)**	**617 N·m (455 lb ft)**
1	**630 N·m (465 lb ft)**	**841 N·m (620 lb ft)**	**890 N·m (656 lb ft)**	**1187 N·m (875 lb ft)**	**654 N·m (483 lb ft)**	**924 N·m (681 lb ft)**

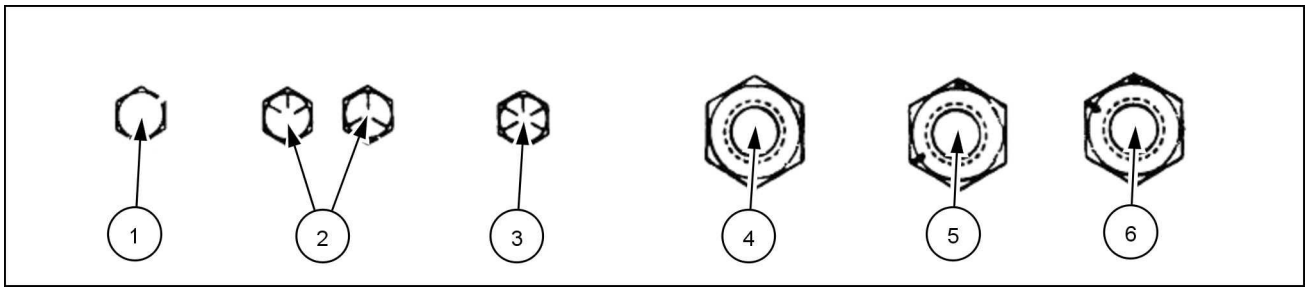
NOTE: *For Imperial Units,* ***1/4 in*** *and* ***5/16 in*** *hardware torque specifications are shown in pound-inches.* ***3/8 in*** *through* ***1 in*** *hardware torque specifications are shown in pound-feet.*

INCH FLANGED HARDWARE

NOM-INAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrF W/ Gr5 BOLT	LOCKNUT GrG W/ Gr8 BOLT
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**9 N·m (80 lb in)**	**12 N·m (106 lb in)**	**13 N·m (115 lb in)**	**17 N·m (150 lb in)**	**8 N·m (71 lb in)**	**12 N·m (106 lb in)**
5/16	**19 N·m (168 lb in)**	**25 N·m (221 lb in)**	**26 N·m (230 lb in)**	**35 N·m (310 lb in)**	**17 N·m (150 lb in)**	**24 N·m (212 lb in)**
3/8	**33 N·m (25 lb ft)**	**44 N·m (33 lb ft)**	**47 N·m (35 lb ft)**	**63 N·m (46 lb ft)**	**30 N·m (22 lb ft)**	**43 N·m (32 lb ft)**
7/16	**53 N·m (39 lb ft)**	**71 N·m (52 lb ft)**	**75 N·m (55 lb ft)**	**100 N·m (74 lb ft)**	**48 N·m (35 lb ft)**	**68 N·m (50 lb ft)**
1/2	**81 N·m (60 lb ft)**	**108 N·m (80 lb ft)**	**115 N·m (85 lb ft)**	**153 N·m (113 lb ft)**	**74 N·m (55 lb ft)**	**104 N·m (77 lb ft)**
9/16	**117 N·m (86 lb ft)**	**156 N·m (115 lb ft)**	**165 N·m (122 lb ft)**	**221 N·m (163 lb ft)**	**106 N·m (78 lb ft)**	**157 N·m (116 lb ft)**
5/8	**162 N·m (119 lb ft)**	**216 N·m (159 lb ft)**	**228 N·m (168 lb ft)**	**304 N·m (225 lb ft)**	**147 N·m (108 lb ft)**	**207 N·m (153 lb ft)**
3/4	**287 N·m (212 lb ft)**	**383 N·m (282 lb ft)**	**405 N·m (299 lb ft)**	**541 N·m (399 lb ft)**	**261 N·m (193 lb ft)**	**369 N·m (272 lb ft)**
7/8	**462 N·m (341 lb ft)**	**617 N·m (455 lb ft)**	**653 N·m (482 lb ft)**	**871 N·m (642 lb ft)**	**421 N·m (311 lb ft)**	**594 N·m (438 lb ft)**
1	**693 N·m (512 lb ft)**	**925 N·m (682 lb ft)**	**979 N·m (722 lb ft)**	**1305 N·m (963 lb ft)**	**631 N·m (465 lb ft)**	**890 N·m (656 lb ft)**

IDENTIFICATION

Inch Bolts and free-spinning nuts



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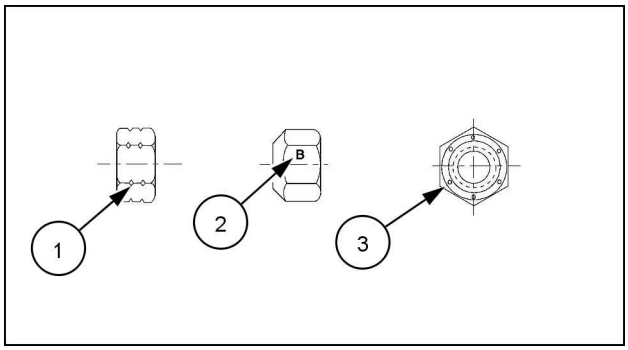
Grade Marking Examples

SAE Grade Identification			
1	Grade 2 - No Marks	4	Grade 2 Nut - No Marks
2	Grade 5 - Three Marks	5	Grade 5 Nut - Marks **120 °** Apart
3	Grade 8 - Five Marks	6	Grade 8 Nut - Marks **60 °** Apart

Inch Lock Nuts, All Metal (Three optional methods)



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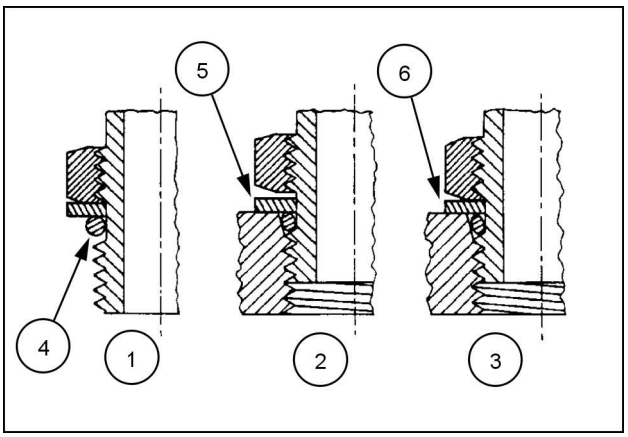
Grade Identification

Grade	Corner Marking Method (1)	Flats Marking Method (2)	Clock Marking Method (3)
Grade A	No Notches	No Mark	No Marks
Grade B	One Circumferential Notch	Letter B	Three Marks
Grade C	Two Circumferential Notches	Letter C	Six Marks

Torque - Standard torque data for hydraulics

INSTALLATION OF ADJUSTABLE FITTINGS IN STRAIGHT THREAD O RING BOSSES



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1. Lubricate the O-ring by coating it with a light oil or petroleum. Install the O-ring in the groove adjacent to the metal backup washer which is assembled at the extreme end of the groove **(4)**.
2. Install the fitting into the SAE straight thread boss until the metal backup washer contacts the face of the boss **(5)**.

   NOTE: *Do not over tighten and distort the metal backup washer.*
3. Position the fitting by turning out (counterclockwise) up to a maximum of one turn. Holding the pad of the fitting with a wrench, tighten the locknut and washer against the face of the boss **(6)**.

STANDARD TORQUE DATA FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS FOR 37° FLARED FITTINGS				O-RING BOSS PLUGS ADJUSTABLE FITTING LOCKNUTS, SWIVEL JIC- 37° SEATS
SIZE	**TUBING OD**	**THREAD SIZE**	**TORQUE**	**TORQUE**
4	**6.4 mm** (**1/4 in**)	7/16-20	**12 - 16 N·m** (**9 - 12 lb ft**)	**8 - 14 N·m** (**6 - 10 lb ft**)
5	**7.9 mm** (**5/16 in**)	1/2-20	**16 - 20 N·m** (**12 - 15 lb ft**)	**14 - 20 N·m** (**10 - 15 lb ft**)
6	**9.5 mm** (**3/8 in**)	9/16-18	**29 - 33 N·m** (**21 - 24 lb ft**)	**20 - 27 N·m** (**15 - 20 lb ft**)
8	**12.7 mm** (**1/2 in**)	3/4-16	**47 - 54 N·m** (**35 - 40 lb ft**)	**34 - 41 N·m** (**25 - 30 lb ft**)
10	**15.9 mm** (**5/8 in**)	7/8-14	**72 - 79 N·m** (**53 - 58 lb ft**)	**47 - 54 N·m** (**35 - 40 lb ft**)
12	**19.1 mm** (**3/4 in**)	1-1/16-12	**104 - 111 N·m** (**77 - 82 lb ft**)	**81 - 95 N·m** (**60 - 70 lb ft**)
14	**22.2 mm** (**7/8 in**)	1-3/16-12	**122 - 136 N·m** (**90 - 100 lb ft**)	**95 - 109 N·m** (**70 - 80 lb ft**)
16	**25.4 mm** (**1 in**)	1-5/16-12	**149 - 163 N·m** (**110 - 120 lb ft**)	**108 - 122 N·m** (**80 - 90 lb ft**)
20	**31.8 mm** (**1-1/4 in**)	1-5/8-12	**190 - 204 N·m** (**140 - 150 lb ft**)	**129 - 158 N·m** (**95 - 115 lb ft**)
24	**38.1 mm** (**1-1/2 in**)	1-7/8-12	**217 - 237 N·m** (**160 - 175 lb ft**)	**163 - 190 N·m** (**120 - 140 lb ft**)
32	**50.8 mm** (**2 in**)	2-1/2-12	**305 - 325 N·m** (**225 - 240 lb ft**)	**339 - 407 N·m** (**250 - 300 lb ft**)

These torques are not recommended for tubes of **12.7 mm** (**1/2 in**) OD and larger with wall thickness of **0.889 mm** (**0.035 in**) or less. The torque is specified for **0.889 mm** (**0.035 in**) wall tubes on each application individually.

Before installing and torquing **37 °** flared fittings, clean the face of the flare and threads with a clean solvent or Loctite cleaner and apply hydraulic sealant **LOCTITE® 569** to the **37 °** flare and the threads.

Install fitting and torque to specified torque, loosen fitting and retorque to specifications.

PIPE THREAD FITTING TORQUE

Before installing and tightening pipe fittings, clean the threads with a clean solvent or Loctite cleaner and apply sealant **LOCTITE® 567 PST PIPE SEALANT** for all fittings including stainless steel or **LOCTITE® 565 PST** for most metal fittings. For high filtration/zero contamination systems use **LOCTITE® 545**.

PIPE THREAD FITTING	
Thread Size	**Torque (Maximum)**
1/8-27	**13 N·m** (**10 lb ft**)
1/4-18	**16 N·m** (**12 lb ft**)
3/8-18	**22 N·m** (**16 lb ft**)
1/2-14	**41 N·m** (**30 lb ft**)
3/4-14	**54 N·m** (**40 lb ft**)

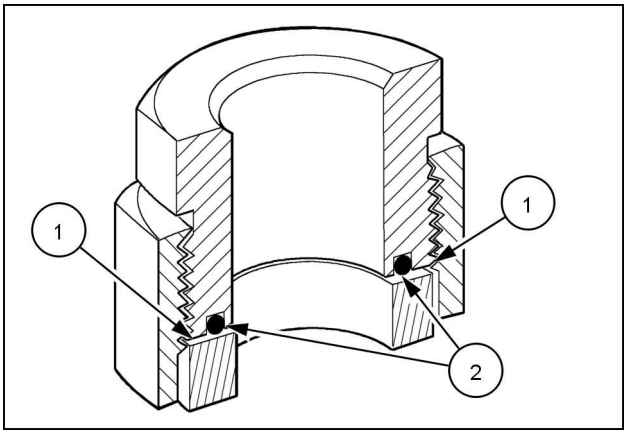
INSTALLATION OF ORFS (O-RING FLAT FACED) FITTINGS

When installing ORFS fittings thoroughly clean both flat surfaces of the fittings **(1)** and lubricate the O-ring **(2)** with light oil. Make sure both surfaces are aligned properly. Torque the fitting to specified torque listed throughout the repair manual.

NOTICE: *If the fitting surfaces are not properly cleaned, the O-ring will not seal properly. If the fitting surfaces are not properly aligned, the fittings may be damaged and will not seal properly.*

NOTICE: *Always use genuine factory replacement oils and filters to ensure proper lubrication and filtration of engine and hydraulic system oils.*

The use of proper oils, grease, and keeping the hydraulic system clean will extend machine and component life.



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Abbreviation – Measurements

Typical applications	Metric unit		Imperial unit	
	Name	Symbol	Name	Symbol
Area (Land area)				
	hectare	ha	acre	ac
	square meter	m²	square foot	ft²
			square inch	in²
	square millimeter	mm²	square inch	in²
Electricity				
	ampere	A	ampere	A
	volt	V	volt	V
	microfarad	µF	microfarad	µF
	ohm	Ω	ohm	Ω
Force				
	kilonewton	kN	pound	lb
	newton	N	pound	lb
Force per length				
	newton per meter	N/m	pound per foot	lb/ft
			pound per inch	lb/in
Frequency				
	megahertz	MHz	megahertz	MHz
	kilohertz	kHz	kilohertz	kHz
	hertz	Hz	hertz	Hz
Frequency − Rotational				
	revolution per minute	r/min	revolution per minute	r/min [a]
		rpm		rpm
Length				
	kilometer	km	mile	mi
	meter	m	foot	ft
	centimeter	cm	inch	in
	millimeter	mm	inch	in
	micrometer	µm		
Mass				
	kilogram	kg	pound	lb
	gram	g	ounce	oz
	milligram	mg		
Power				
	kilowatt	kW	horsepower	Hp
	watt	W	Btu per hour	Btu/hr
			Btu per minute	Btu/min
Pressure or stress (Force per area)				
	kilopascal	kPa	pound per square inch	psi
			inch of mercury	inHg
	pascal	Pa	inch of water	inH2O
	megapascal	MPa	pound per square inch	psi

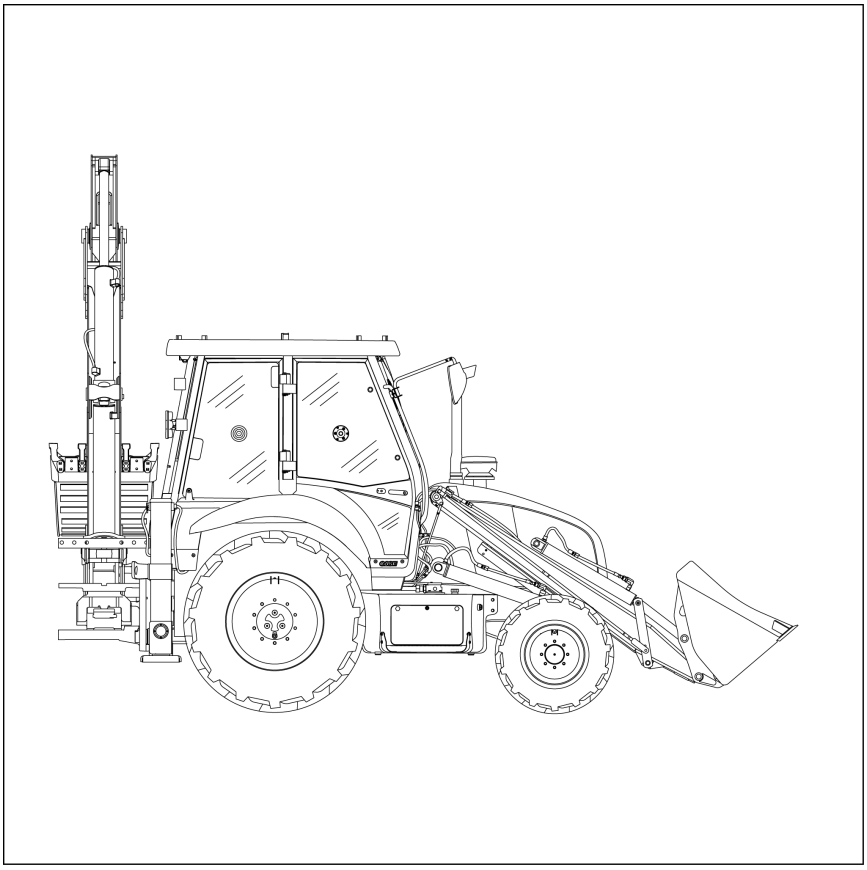
Typical applications	Metric unit		Imperial unit	
	Name	Symbol	Name	Symbol
Temperature (other than Thermodynamic)				
	degrees Celsius	°C	degrees Fahrenheit	°F
Time				
	hour	h	hour	h
	minute	min	minute	min
	second	s	second	s
Torque (includes Bending moment, Moment of force, and Moment of a couple)				
	newton meter	N m	pound foot	lb ft
			pound foot	lb in
Velocity				
	kilometer per hour	km/h	mile per hour	mph
	meter per second	m/s	foot per second	ft/s
	millimeter per second	mm/s	inch per second	in/s
	meter per minute	m/min	foot per minute	ft/min
Volume (includes Capacity)				
	cubic meter	m^3	cubic yard	yd^3
				cu yd
	liter	l	cubic inch	in^3
	liter	l	US gallon	US gal
			UK gallon	UK gal
			US quart	US qt
			UK quart	UK qt
	milliliter	ml	fluid ounce	fl oz
Volume per time (includes Discharge and Flow rate)				
	cubic meter per minute	m^3/min	cubic foot per minute	ft^3/min
	liter per minute	l/min	US gallon per minute	US gal/min
	milliliter per minute	ml/min	UK gallon per minute	UK gal/min
Sound power level and Sound pressure level				
	decibel	dB	decibel	dB

Capacities

S.N.	Usage	Specification	Brand	Capacity
1	Transmission oil 2WD	SAE 15W30	CASE TRANSPOWER	**16.00 l** (**4.23 US gal**)
2	Transmission oil 4WD	SAE 15W30	CASE TRANSPOWER	**18.50 l** (**4.89 US gal**)
3	Rear axle oil	**SAE 30**	CASE AXLPOWER	**17.10 l** (**4.52 US gal**)
4	4WD front axle oil	**SAE 30**	CASE AXLPOWER	**9.00 l** (**2.38 US gal**)
5	Engine oil - BS III	**API CI4**, **SAE 15W-40**	Servo Pride Supreme	**11.00 l** (**2.91 US gal**)
6	Brake fluid	**ISO 7308**	Servo Transtrac HVI	**0.67 l** (**0.18 US gal**)
7	Hydraulic oil	**ISO VG-68** IS:10522	CASE HYDRAPOWER	Tank: **65 l** (**17.17 US gal**) System: **65 l** (**17.17 US gal**) Total: **130 l** (**34.34 US gal**)
8	Coolant	-	COOL POWER	**20 l** (**5.28 US gal**)
9	Grease	EP GREASE GRADE 2 (IS:7623)	ServoGem EP2	**1.7 kg** (**3.75 lb**)
10	GREASE (front axle), qty. - 1OZ, #2 MOLYDISULFIDE	MAT3550 GR C	Petronas	**0.532 kg** (**1.1 lb**)
11	Refrigerant	HFC-134a	-	-
12	PAG oil (Compressor)	SP-15	-	**270.0 - 300.0 mL** (**9.1 - 10.1 US fl oz**)

SERVICE MANUAL

Engine



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Engine and crankcase - 001

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Engine - General specification

Engine - Torque

Tightening torques

Description	Thread size	Torque	Angle
Capscrew, cylinder head (C1)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	130°±5 + 140°± 5
Capscrew, main bearing caps (C2)	**M14 x 1.25**	**80 N·m** (**708 lb in**)	90°
Capscrew, timing cover and case (C3)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	-
Capscrew, connecting rod caps (C4)	**M11 x 1.25**	**40 N·m** (**354 lb in**)	60°
Capscrew, flywheel (C5)	**M12 x 1.25**	**40 N·m** (**354 lb in**)	60°
Capscrew, rocker shaft bracket (C6)	**M8 x 1.25**	**25 N·m** (**221 lb in**)	-
Nut, crankshaft pulley hub (C7)	**M30 x 1.5**	**300 N·m** (**2655 lb in**)	-
Capscrew, fan and alternator drive pulley (C8)	**M12 x 1.25**	**49 N·m** (**434 lb in**)	-
Nut, injection pump shaft gear (C9)	**M12 x 1.25**	**64 N·m** (**566 lb in**)	-
Nuts, injection pump to support (C10)	**M12 x 1.25**	**23 N·m** (**204 lb in**)	-
Retaining screws, additional weights (C11)	**M12 x 1.25**	**110 N·m** (**974 lb in**)	-
Injector clamp nut	**M8**	**18 N·m** (**159 lb in**)	-
Sheet metal oil pan	**M10 x 1.25**	**35 N·m** (**310 lb in**)	-

Engine - Sealing

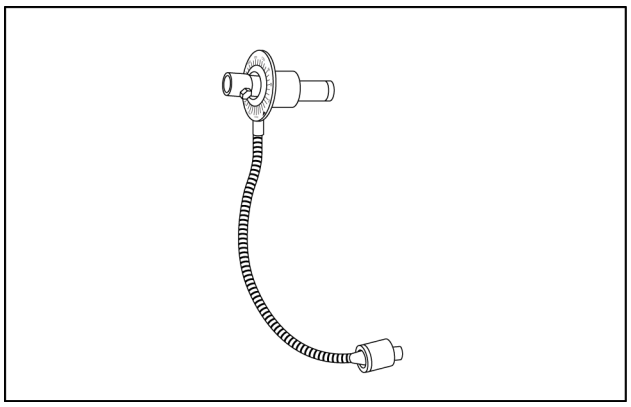
Sealants

Description	Specification
Adopter for oil filter (S1)	**LOCTITE® 270**
Adopter for tachometer cable (S2)	**LOCTITE® 243™**
Flywheel housing to engine block (S3)	**LOCTITE® 510™**
Timing gear case studs (S4)	**LOCTITE® 270**
Timing gear cover dowel pin (S5)	**LOCTITE® 270**
Starter motor to flywheel housing (S6)	**LOCTITE® 510™**
Allen plug in cylinder head thermostat housing (S7)	**LOCTITE® 243™**
Cylinder head exhaust manifold studs (s8)	**LOCTITE® 270**
Oil sump to engine block (S9)	Loctite - 5699
Silencer mounting studs on exhaust manifold (S10)	Loctite - 77164
Flywheel bolt (S11)	**LOCTITE® 243™**

Engine - Special tools

ATTENTION: *Operations described in this section of the manual must be performed using the following tools to work safely and achieve the best technical results.*

380000304 Angular torquing gauge



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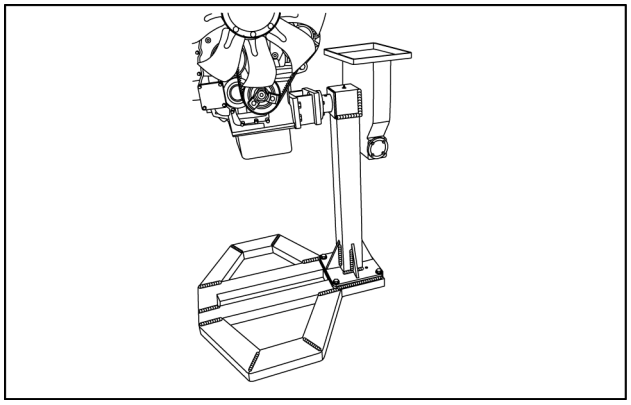
380000301 Engine stand



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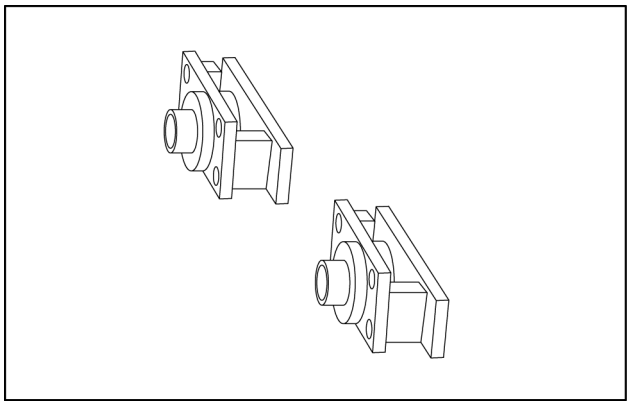
380200415 Support



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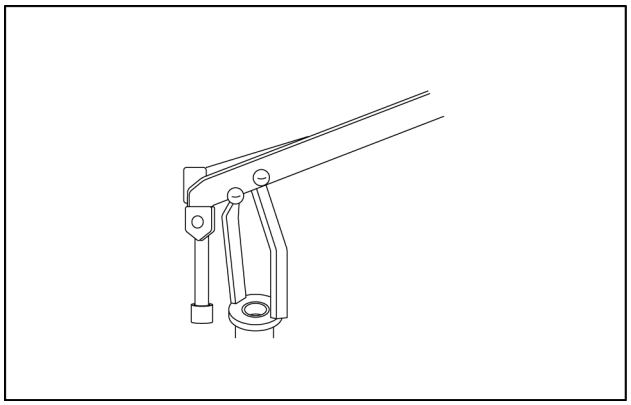
380000302 Cylinder head valve spring compressor



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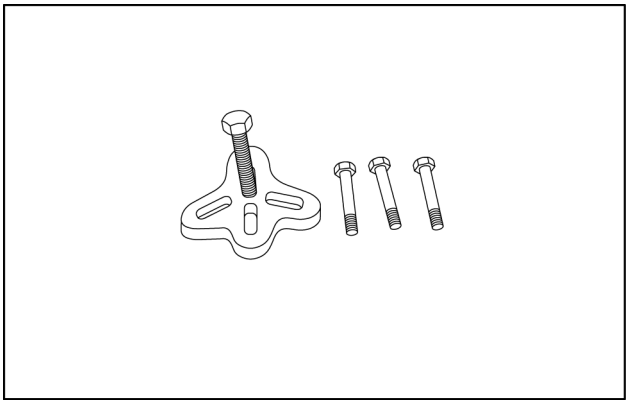
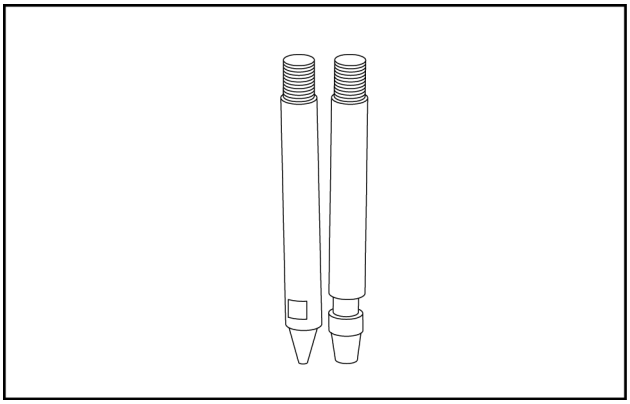
380200447 Puller (FIP gear & crank pulley hub)



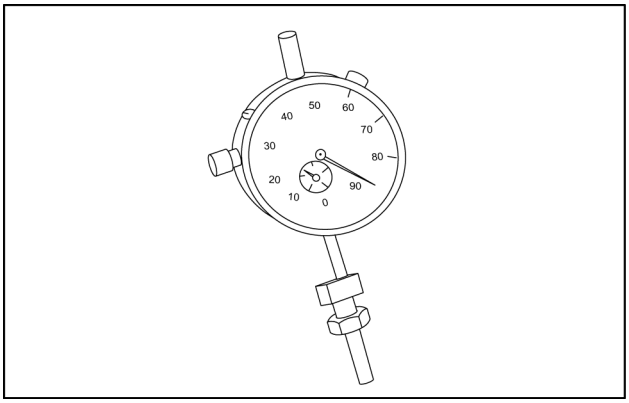
PTIL14TLB0105AA 5

380200448 Sump locating pin



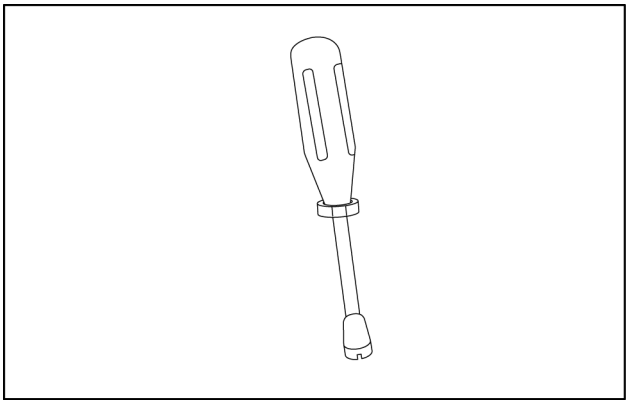
PTIL14TLB0106AA 6

380200449 Adaptor FIP timing



PTIL14TLB0107AA 7

380000232 Tappet adjusting screw driver



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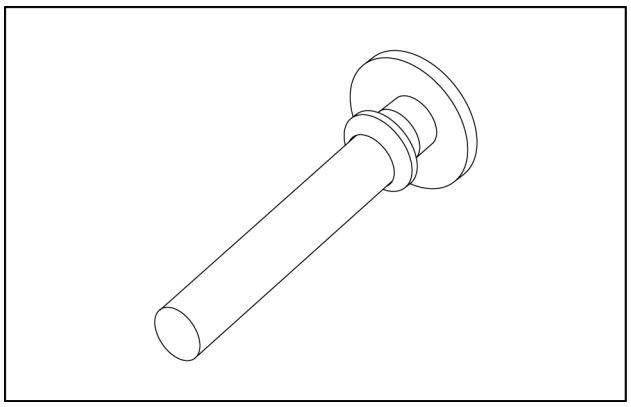
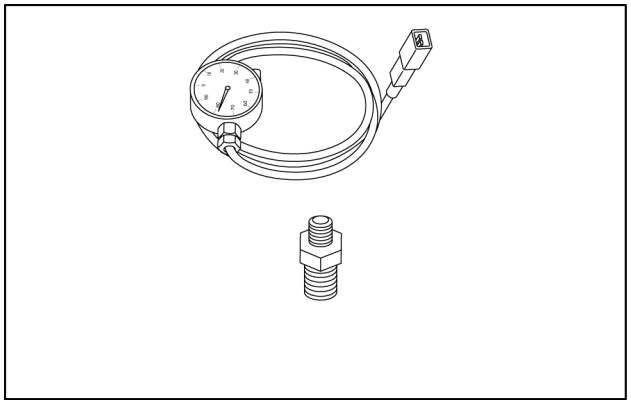
380200450 Crankshaft front seal installer



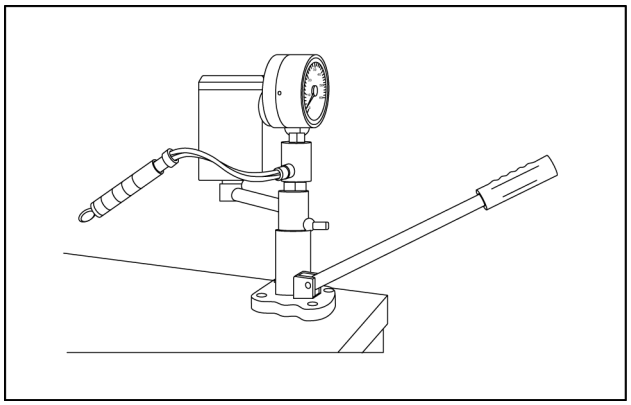
PTIL14TLB0109AA 9

380200396 Oil pressure gauge with adaptor



PTIL14TLB0110AA 10

380000215 Nozzle tester



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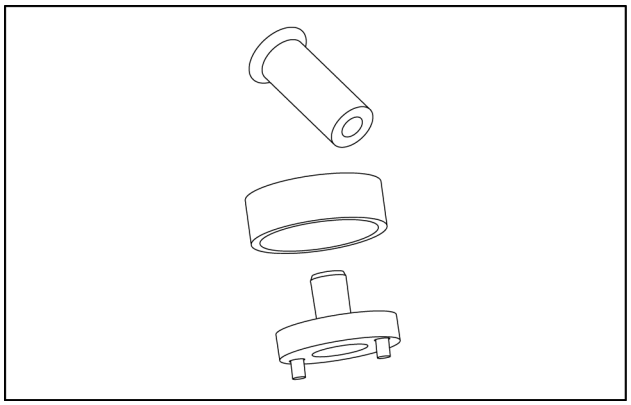
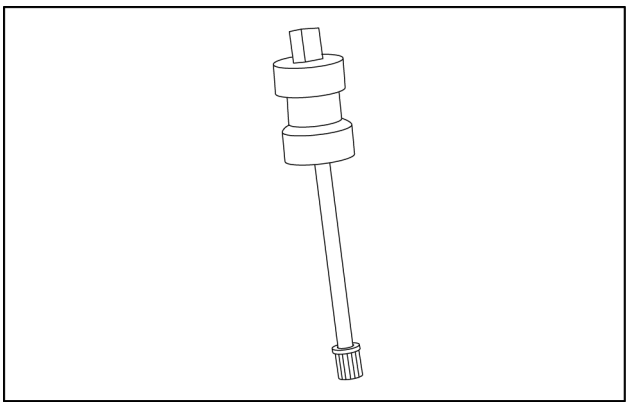
380200451 Installer main oil seal



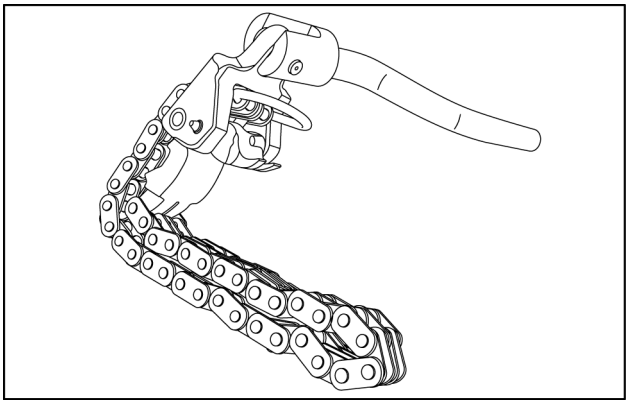
PTIL14TLB0112AA 12

380000549 Sliding hammer - Injector removal



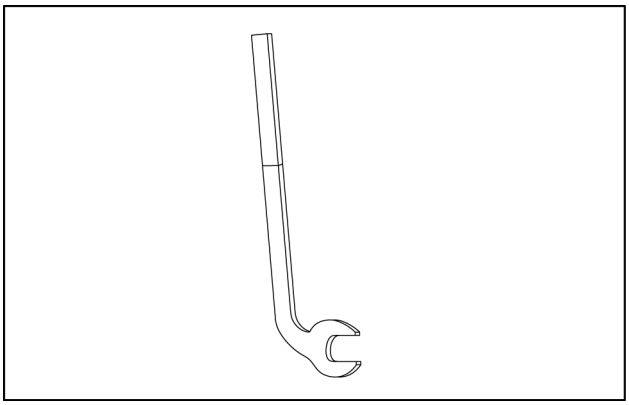
PTIL14TLB0113AA 13

380200452 Remover filters



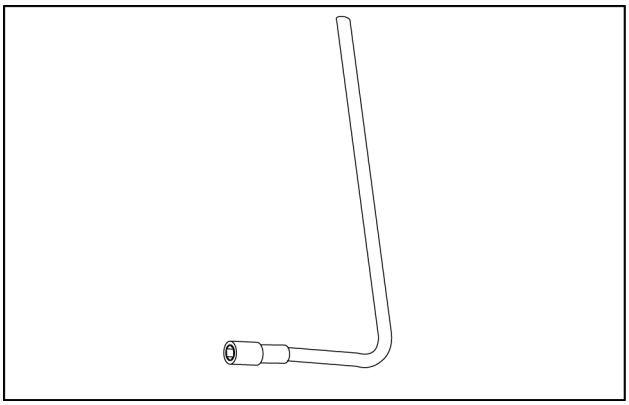
PTIL14TLB0114AA 14

380200453 Wrench to remove solenoid switch



PTIL14TLB0115AA 15

380200454 FIP nut remover



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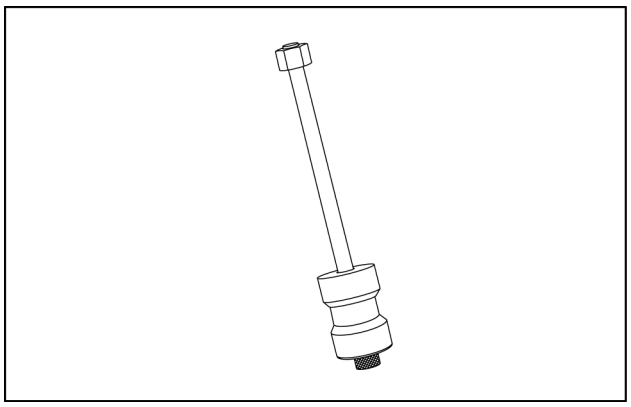
380200471 Injector sleeve puller



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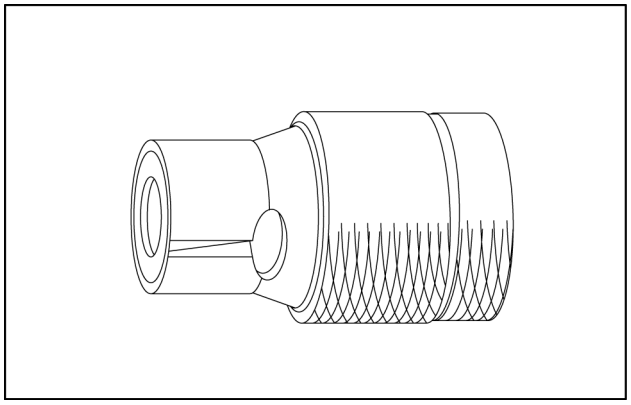
380000830 Guide socket



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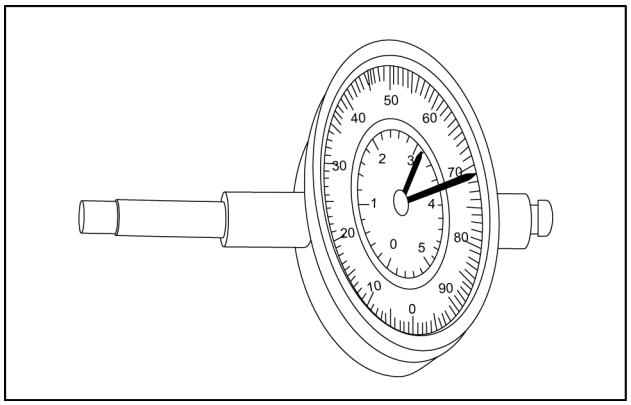
380000228 Dial gauge



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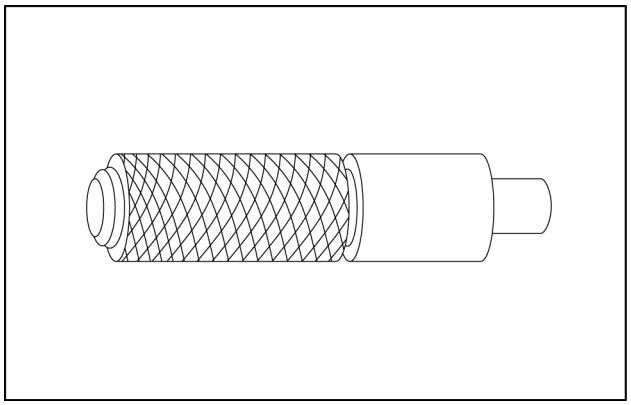
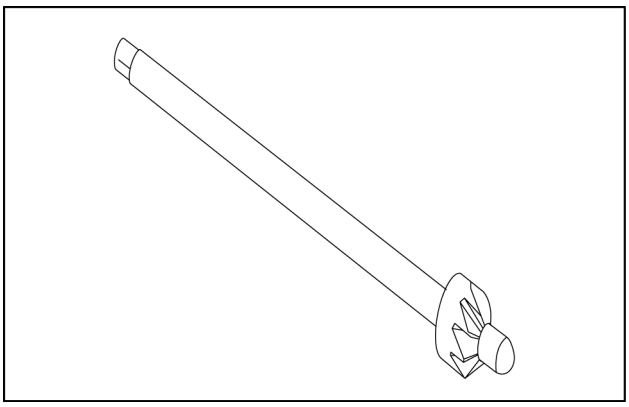
380000834 Injector sleeve installer



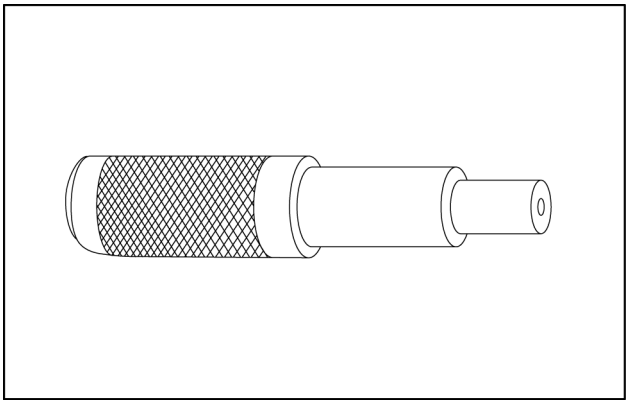
PTIL14TLB0118AA 20

380000833 Cutter - Injector holder seat



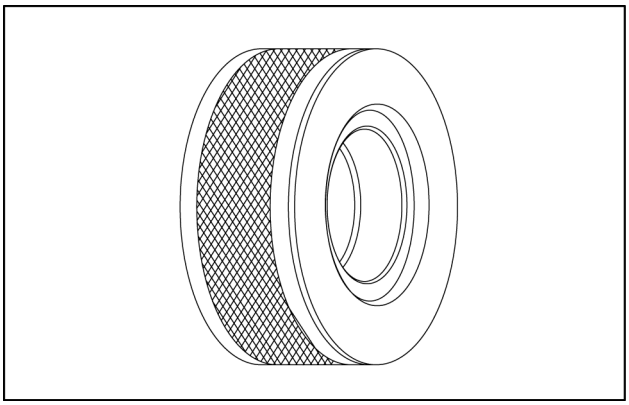
PTIL14TLB0119AA 21

380000219 Valve guide installer/remover



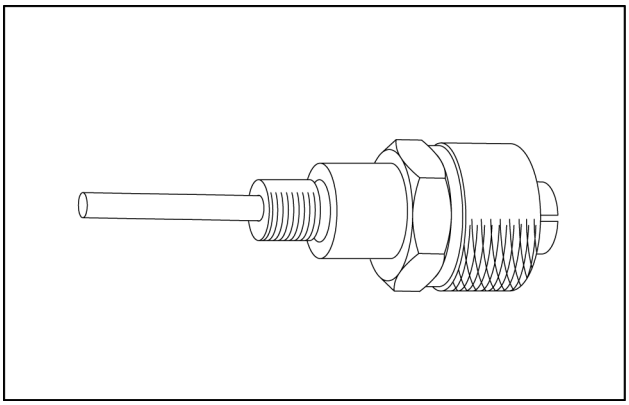
PTIL14TLB0120AA 22

380000242 Valve guide installer



PTIL14TLB0121AA 23

380000229 Dial gauge holder tool - Pump timing



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Crankcase - General specification

Crank gear

Crankshaft - Bearings

Main journal diameter	**79.791 - 79.810 mm** (**3.141 - 3.142 in**)
Main journal undersize	**0.254 mm** (**0.010 in**) **0.508 mm** (**0.020 in**) **0.762 mm** (**0.030 in**) **1.016 mm** (**0.040 in**)
Main bearing wall thickness	**2.168 - 2.178 mm** (**0.085 - 0.086 in**)
Main bearing under size	**0.254 mm** (**0.010 in**) **0.508 mm** (**0.020 in**) **0.762 mm** (**0.030 in**) **1.016 mm** (**0.040 in**)
Main journal clearance in bearings	**0.034 - 0.103 mm** (**0.001 - 0.004 in**)
• Maximum wear clearance	**0.180 mm** (**0.007 in**)
Crankpin diameter	**63.725 - 63.744 mm** (**2.509 - 2.510 in**)
Crankpin undersize	**0.254 mm** (**0.010 in**) **0.508 mm** (**0.020 in**) **0.762 mm** (**0.030 in**) **1.016 mm** (**0.040 in**)
Big end bearing wall thickness	**1.805 - 1.815 mm** (**0.071 - 0.071 in**)
Big end bearing undersize	**0.254 mm** (**0.010 in**) **0.508 mm** (**0.020 in**) **0.762 mm** (**0.030 in**) **1.016 mm** (**0.040 in**)
Crankpin clearance in big end bearing	**0.033 - 0.087 mm** (**0.001 - 0.003 in**)
• Maximum wear clearance	**0.180 mm** (**0.007 in**)
Crankshaft thrust washer thickness	**3.378 - 3.429 mm** (**0.133 - 0.135 in**)
Thrust washer oversize	**0.127 mm** (**0.005 in**) **0.254 mm** (**0.508 in**) **0.508 mm** (**0.020 in**)
Width of main bearing housing over thrust washers	**31.766 - 31.918 mm** (**1.251 - 1.257 in**)
Length of corresponding main journal	**32.000 - 32.100 mm** (**1.260 - 1.264 in**)
Crankshaft end float	**0.082 - 0.334 mm** (**0.003 - 0.013 in**)
• Maximum wear clearance	**0.400 mm** (**0.016 in**)
Maximum main journal and crankpin ovality or taper after grinding	**0.010 mm** (**0.00039 in**)
Maximum main journal and crankpin ovality or taper due to wear	**0.050 mm** (**0.0019 in**)
Maximum main journal misalignment crankshaft resting on end journals	**0.010 mm** (**0.00039 in**)
Maximum misalignment of crankpins relative to main journals (in either direction)	**0.25 mm** (**0.00098 in**)
Tolerance from outer crankpin edge to crankshaft center line	± **0.10 mm** (**0.0039 in**)
Maximum crankshaft flange run-out with gauge stylus, over **108.000 mm** (**4.252 in**) diameter (total gauge reading)	**0.0250 mm** (**0.00098 in**)
Maximum flywheel seat eccentricity relative to main journals (total gauge reading)	**0.0400 mm** (**0.00157 in**)
Side clearance of connecting rod and crankshaft	**0.06 - 0.10 mm** (**0.002 - 0.004 in**)

Connecting rods

Small end bore diameter	**41.846 - 41.884 mm** (**1.647 - 1.649 in**)
Small end bushing outer diameter	**41.979 - 42.017 mm** (**1.647 - 1.649 in**)
Bushing interference fit in small end	**0.095 - 0.171 mm** (**0.0037 - 0.0067 in**)
Small end bushing fitted ID	**38.004 - 38.014 mm** (**1.496 - 1.497 in**)
Big end bore diameter	**67.407 - 67.422 mm** (**2.654 - 2.654 in**)
Maximum connecting rod axis misalignment at **125.000 mm** (**4.921 in**)	**± 0.07 mm** (**0.0028 in**)
Maximum connecting rod weight difference over a complete set from the same engine	**25.00 g** (**0.88 oz**)

Pistons

Piston diameter: Measured at **12.000 mm** (**0.472 in**) from base of skirt and right angles to pin	**103.852 - 103.870 mm** (**4.089 - 4.089 in**)
Piston clearance in liner	**0.130 - 0.172 mm** (**0.005 - 0.007 in**)
• Maximum wear clearance	**0.300 mm** (**0.012 in**)
Piston oversize range	**0.600 mm** (**0.024 in**)
Piston stand-out with respect to head at TDC	**0.430 - 0.840 mm** (**0.017 - 0.033 in**)
Piston pin diameter	**37.983 - 37.990 mm** (**1.495 - 1.496 in**)
Piston pin seat bore in piston	**38.000 - 38.006 mm** (**1.496 - 1.496 in**)
Piston pin clearance in piston	**0.0100 - 0.0230 mm** (**0.0004 - 0.0009 in**)
Piston pin clearance in small end bushing	**0.0140 - 0.0310 mm** (**0.0006 - 0.0012 in**)
• Maximum wear clearance	**0.060 mm** (**0.002 in**)
Maximum weight difference between pistons on same engine	**20.00 g** (**0.71 oz**)
Piston ring clearance in groove:	
• Top	**0.0900 - 0.1220 mm** (**0.0035 - 0.0048 in**)
• 2nd	**0.0600 - 0.0850 mm** (**0.0024 - 0.0033 in**)
• 3rd	**0.0400 - 0.0750 mm** (**0.0016 - 0.0030 in**)
Maximum wear clearance:	
• Top	**0.50 mm** (**0.02 in**)
• 2nd and 3rd	**0.20 mm** (**0.01 in**)
Piston ring gap:	
• Top	**0.25 - 0.40 mm** (**0.01 - 0.02 in**)
• 2nd	**0.60 - 0.85 mm** (**0.02 - 0.03 in**)
• 3rd	**0.30 - 0.55 mm** (**0.01 - 0.02 in**)
Maximum wear gap	**1.20 mm** (**0.05 in**)

Valve gear

Valve timing gears

Timing gear backlash	**0.160 mm** (**0.006 in**)
Idler gear jack shaft diameter	**36.975 - 37.000 mm** (**1.456 - 1.457 in**)
Idler gear bushing fitted ID after reaming	**37.050 - 37.075 mm** (**1.459 - 1.460 in**)
Jack shaft journal clearance in bushing	**0.050 - 0.100 mm** (**0.002 - 0.004 in**)
• Max wear clearance	**0.150 mm** (**0.006 in**)
Bushing interference fit in idler gear	**0.063 - 0.140 mm** (**0.002 - 0.006 in**)
Lift and power steering pump drive gear shaft diameter	**36.975 - 37.000 mm** (**1.456 - 1.457 in**)
Bushing fitted ID after reaming	**37.050 - 37.075 mm** (**1.459 - 1.460 in**)
Shaft clearance in bushing	**0.050 - 0.100 mm** (**0.002 - 0.004 in**)
Bushing interference fit in housing	**0.063 - 0.140 mm** (**0.002 - 0.006 in**)
Pump drive gear thrust washer thickness	**1.450 - 1.500 mm** (**0.057 - 0.059 in**)

Camshaft

Camshaft bushing O D	
• Front	**54.875 - 54.930 mm** (**2.160 - 2.163 in**)
• Intermediate	**54.375 - 54.430 mm** (**2.141 - 2.143 in**)
• Rear	**53.875 - 53.930 mm** (**2.121 - 2.123 in**)
Bushing interference fit in housing	**0.070 - 0.150 mm** (**0.003 - 0.006 in**)
Camshaft bushing fitted ID after reaming	
• Front	**51.080 - 51.130 mm** (**0.003 - 0.006 in**)
• Intermediate	**50.580 - 50.630 mm** (**1.991 - 1.993 in**)
• Rear	**50.080 - 50.130 mm** (**1.972 - 1.974 in**)
Camshaft journal diameter	
• Front	**50.970 - 51.000 mm** (**2.007 - 2.008 in**)
• Intermediate	**50.470 - 50.500 mm** (**1.987 - 1.988 in**)
• Rear	**49.970 - 50.000 mm** (**1.967 - 1.969 in**)
Camshaft journal clearance in bushing	**0.080 - 0.160 mm** (**0.003 - 0.006 in**)
Maximum wear clearance	**0.200 mm** (**0.008 in**)
Camshaft end float (thrust plate to associated seat in camshaft)	**0.070 - 0.220 mm** (**0.003 - 0.009 in**)

Tappets

Tappet OD	**14.950 - 14.970 mm** (**0.589 - 0.589 in**)
Tappet clearance in housing on engine block	**0.030 - 0.068 mm** (**0.001 - 0.003 in**)
Maximum wear clearance	**0.150 mm** (**0.006 in**)
Tappet oversize	**0.1000 mm** (**0.0039 in**) **0.2000 mm** (**0.0079 in**) **0.3000 mm** (**0.0118 in**)

Rockers

Rocker bushing O D	**21.006 - 21.031 mm** (**0.827 - 0.828 in**)
Rocker bore diameter	**20.939 - 20.972 mm** (**0.824 - 0.826 in**)
Bushing interference fit in rocker	**0.034 - 0.092 mm** (**0.001 - 0.004 in**)
Rocker bracket bore diameter	**18.016 - 18.034 mm** (**0.709 - 0.710 in**)
Rocker shaft diameter	**17.982 - 18.000 mm** (**0.708 - 0.709 in**)
Rocker shaft clearance in bracket	**0.016 - 0.052 mm** (**0.001 - 0.002 in**)
Maximum wear clearance	**0.150 mm** (**0.006 in**)
Rocker spacer spring length	
• Free	**59.500 mm** (**2.343 in**)
• Under load (**4.7 - 5.3 kg** (**10.4 - 11.7 lb**))	**44.00 mm** (**1.732 in**)
Valves, guides and springs	
• Valve head diameter inlet	**45.300 - 45.500 mm** (**1.783 - 1.791 in**)
• Exhaust	**41.000 - 41.250 mm** (**1.614 - 1.624 in**)
• Valve stem diameter	**7.985 - 8.000 mm** (**0.314 - 0.315 in**)
Valve face angle	
• Inlet	60° 30’ ± 7’
• Exhaust	45° 30’ ± 7’
Timing check	**0.450 mm** (**0.018 in**)
Valve clearance:	
• Valve clearance Inlet (warm or cold)	**0.300 mm** (**0.012 in**)
• Valve clearance Exhaust (warm or cold)	**0.300 mm** (**0.012 in**)
Cam lift Inlet	**5.8885 mm** (**0.2318 in**)
Cam lift Exhaust	**6.1277 mm** (**0.2412 in**)
Valve lift Inlet	**10.4437 mm** (**0.4112 in**)
Valve lift Exhaust	**10.8679 mm** (**0.4279 in**)
Valve guide OD	**13.933 - 14.016 mm** (**0.549 - 0.552 in**)
Valve guide oversize	**0.200 mm** (**0.008 in**)
Valve guide interference fit in housing on cylinder head	**0.0050 - 0.0500 mm** (**0.0002 - 0.0020 in**)
Valve guide fitted ID after reaming	**8.023 - 8.043 mm** (**0.316 - 0.317 in**)
Valve stem clearance in guide	**0.023 - 0.058 mm** (**0.001 - 0.002 in**)
• Maximum wear clearance	**0.130 mm** (**0.005 in**)
Maximum valve stem eccentricity over one revolution with stylus on sealing face	**0.0300 mm** (**0.0012 in**)
Inlet and exhaust valve spring length	
• Free	**44.600 mm** (**1.756 in**)
• With load of **26.1 - 28.9 kg** (**57.5 - 63.7 lb**)	**34.000 mm** (**1.339 in**)
• With load of **51.2 - 56.5 kg** (**112.9 - 124.6 lb**)	**23.800 mm** (**0.937 in**)

Engine - Static description

The S8000 is a 4 cylinder turbo charged and after cool diesel engine.

It features a cross flow cylinder head, with the inlet and exhaust manifolds on opposite sides of the cylinder head.

The fuel and air combustion process, takes place in the specially designed bowel in the crown of the pistons.

Cylinder head assembly

The cylinder head incorporates valves and springs, with the valve rocker arm shaft assembly bolted to the cylinder block through the cylinder head.

Cylinder head retaining bolts are evenly spaced with a six-point pattern around each cylinder, this ensures an even clamping load across the cylinder head.

The intake and exhaust manifolds are bolted to the head, the intake manifold is mounted on the right side of the engine, with the diesel injectors mounted outside the rocker cover.

The exhaust manifold is mounted on the left side of the engine.

Water outlet connections and thermostat being attached to the front of the cylinder block directly behind the radiator valve guides are inserted into the cylinder head, and replaceable.

Special replaceable cast alloy valve seats are pressed into each valve port during manufacturing.

No oversize valve seats on guides are available. All valves are fitted with positive value rotators, valve clearance is maintained by adjustment of the self locking adjusting screw, mounted in each of the rocker arms.

Camshaft assembly

The camshaft runs in 3 replaceable bushes.

The camshaft drive gear is in mesh with and driven by the camshaft idler gear which is driven by the crankshaft timing gear.

Camshaft end thrust is controlled by a thrust plate bolted to the block, and located between the camshaft gear and the front camshaft journal.

Cylinder block assembly

The cylinder block is an alloy cast iron with deep cylinder skirts & water jackets for cooling the cylinders.

The cylinder bores are machined integral with the cylinder block, during the manufacturing process.

Cylinders are in line, vertical and numbered 1 to 4 from radiator to the engine rear.

The oil sump, which is attached to the bottom of the cylinder block, is the reservoir for the engine oil lubrication system.

A cast iron engine front cover and front plate is attached to the front of the engine and covers all of the timing gear assembly.

Crankshaft assembly

The crankshaft is supported in the cylinder block by 5 main bearings.

The crankshaft is manufactured from steel with machined finished crank webs. End thrust is controlled by a thrust bearing incorporated in the center main bearing of the crankshaft.

Connecting rods

Connecting rods “wedge” shaped at the small end has been designed to reduce the reciprocating weight at the piston end.

The connecting rods are heavy beam construction and are assembled as a matched set to each engine, attached to the crankshaft, by means of insert type bearings.

They are retained in position by the connecting rod big end cap and secured by two bolts per rod.

The small end of the connecting rod is fitted with a replaceable bronze bushing, through which the free floating piston pin is fitted.

The steel pin being held in place within the piston by two snap rings.

Pistons

Pistons are constructed of an aluminum silicon alloy with notch type combustion chamber being recessed in the piston crowns.

Each piston has two compression rings and one oil control ring, to reduce the friction and increase positive seating. All rings are located above the piston pin.

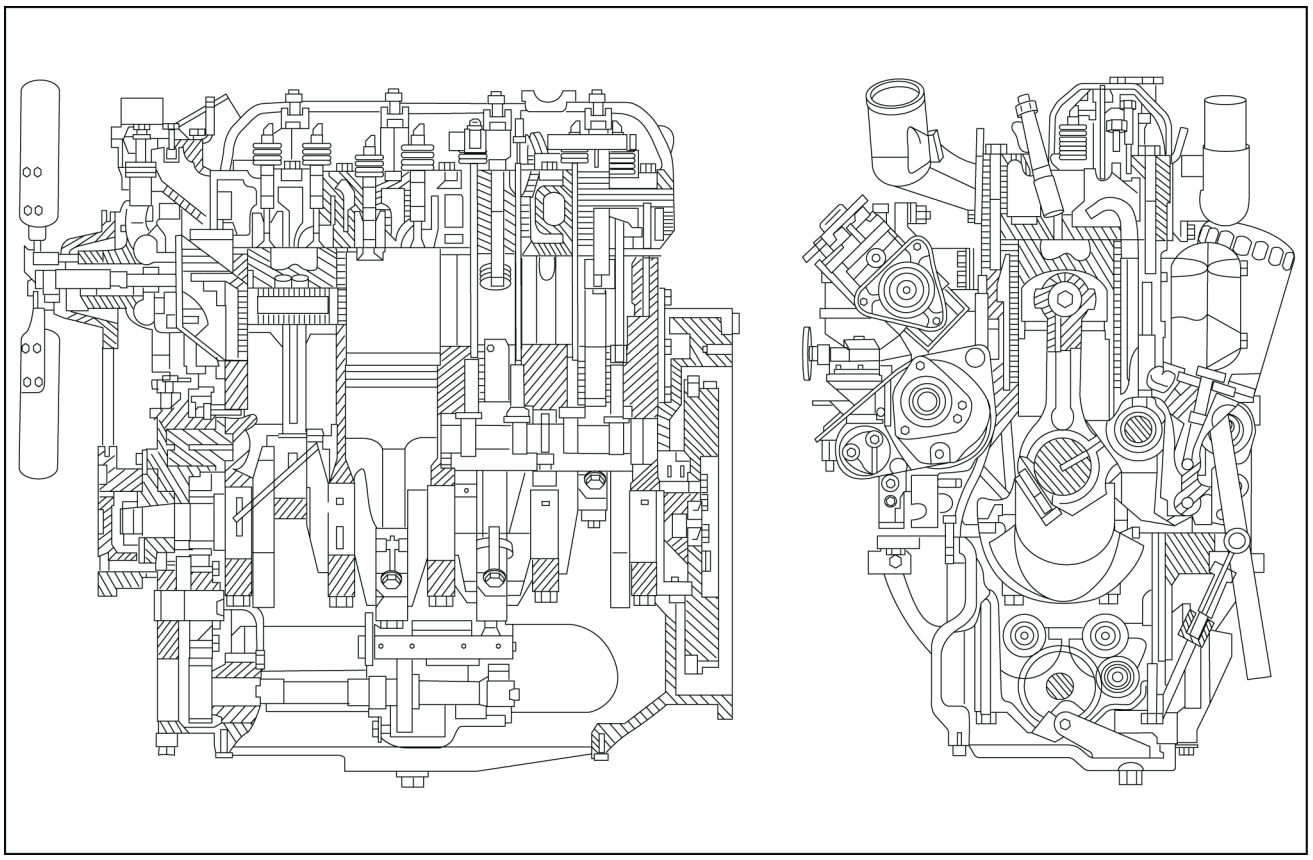
Manifolds

The cross flow design aluminum intake, and cast iron exhaust manifolds are on opposite sides of the cylinder head.

This is designed to maintain balanced heat distribution within the cylinder head.

The configuration of the manifolds also ensures minimum heat transfer to the intake manifold.

The intake manifold is connected through hose to air cleaner.



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Timing gears

The crankshaft timing gear is heated and press fitted on to the front of the crankshaft, to a high degree of accuracy during manufacturing.

This enables precise timing being maintained during the life of the engine.

The crankshaft gear drives the idler gear, which is attached to the front of cylinder block.

The idler gear then drives the camshaft and the injection pump via meshing helical gears.

The camshaft gear is bolted to the front of the shaft and is keyed to maintain position of the gear on the camshaft.

Lubrication system

Lubrication of the engine is maintained by a gear type oil pump mounted on the front end of the crank shaft.

The pump drains oil from the engine oil sump through a tube and screen assembly.

A spring loaded relief valve is integral with the oil filter and prevents over pressurization of the system.

A spin on type oil filter is mounted externally to its support housing on the left hand side of the engine.

Oil flows from the filter to the main oil gallery, which runs the length of the cylinder block, which also intersects the camshaft follower chamber.

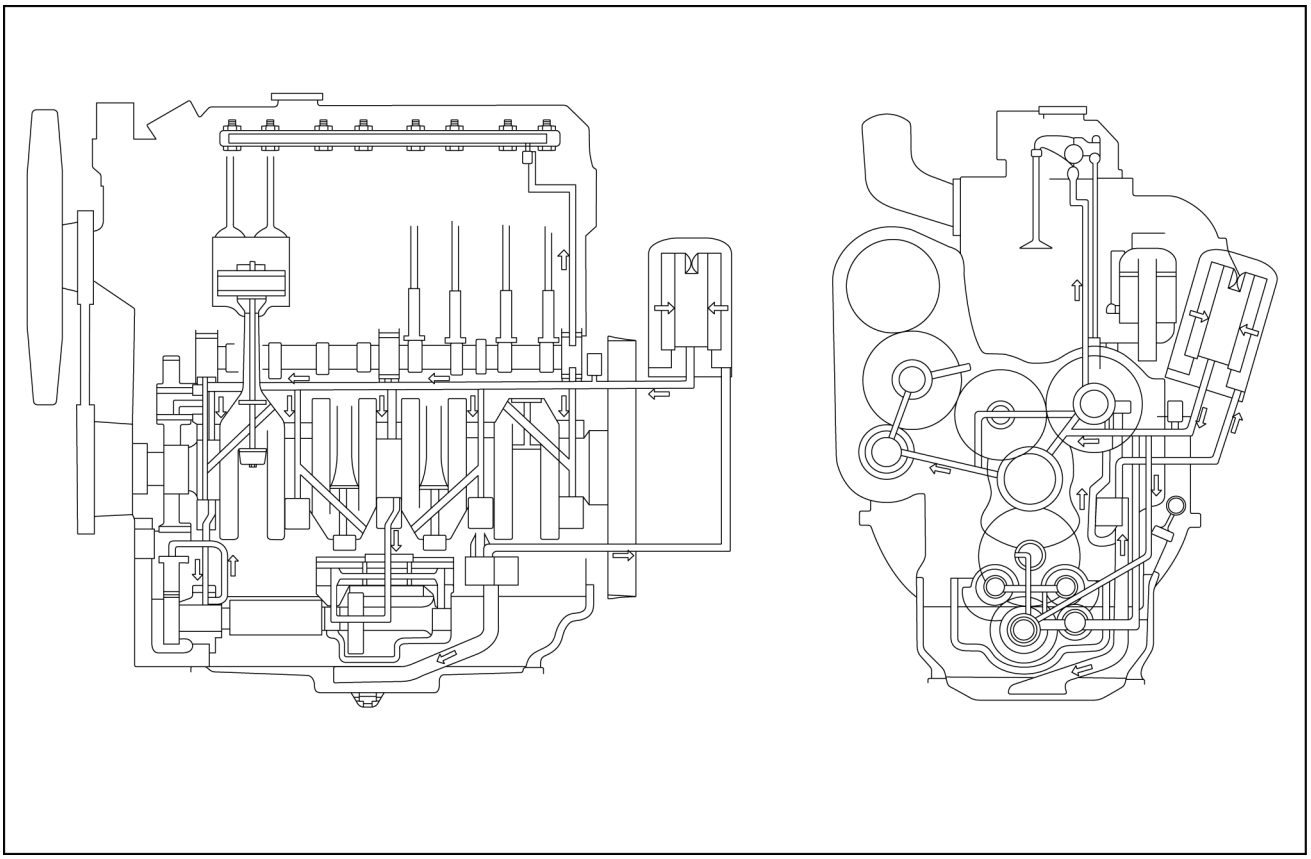
The main gallery also supplies oil to the crankshaft main bearings, connecting rods both big and small ends and timing gear bushes.

The inner side of the pistons and pins are lubricated by oil pressure jets (piston cooling nozzle).

Timing gears are lubricated by splashed oil from the cam follower chamber and the pressure lubricated camshaft drive gear bushing.

An intermittent flow of oil is directed to the value rocker arm shaft assembly via a drilled passage in the cylinder block.

This is located vertically above No. 3 camshaft bearing and aligns to a hole in the cylinder head. The rotation of the camshaft allows a controlled intermediate flow of lubrication.



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Cooling system

The function of the water pump mounted at the front of the engine, is to maintain a continuous flow of water around the cooling system inside the engine.

This is essential to ensure correct engine temperature, and performance, during vehicle operation.

The pump is driven by a ‘V’ belt from the crankshaft pulley, when the engine is running.

The cooling system for the new generation of engines, is of recirculating bypass type with full length water-jackets for the bottom tank of the radiator by the water pump, which passes the coolant to the cylinder block.

This coolant then flows through cored passages to cool the cylinder walls.

Passages in the cylinder head gasket allow coolant to flow from the cylinder block, into the cylinder head cored passages also conduct the coolant to the fuel injector nozzle locations before reentering the water pump below the thermostat.

The thermostat is located in the top of the water pump body, and controls the flow of the water as required by temperature changes.

NOTE: *A faulty thermostat may cause the engine to operate at too high (hot) or low (cold) on operating temperature. If not replaced this could result in a damaged engine or impaired engine performance.*

When the thermostat is closed a recirculating bypass is provided to allow the coolant to recirculate from block to the head for a faster warm-up.

Once the engine has reached its normal operating temperature, the thermostat will open and allow water to be drawn through the radiator by the pump action.

Cooled water then returns to the engine system.

Cooling occurs as the coolant passes down through the radiator cores, which are exposed to the air as it is drawn through the radiator by the fan.

NOTE: *Do not operate an engine without a thermostat. The cooling system incorporates a drain plug, on the left hand side of the cylinder block. The cap on the radiator is a system pressure cap and should not be removed unless refilling the system from empty or for top up of coolant.*

The engine cooling fan is mounted on a pump pulley which is belt driven from the crankshaft.