SERVICE MANUAL

LS Series
L3AL / L3BL
Tier 3
Engine

Part number 47731080
English
August 2015
Replaces part number 47528913

SERVICE MANUAL

L3AL
L3BL

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INTRODUCTION

Foreword

This publication contains data, features instructions and methods for performing repair operations on the assembly and its components and is addressed to qualified, specialized personnel.
Check to make sure you have the right publication related to the component you are about to work on before you start. Make sure that you have all the necessary safety equipment: safety glasses, helmet, gloves, footwear, etc. Check that the working lifting and transport equipment is available and in working order. Make sure that vehicle is secured. Proceed by carefully observing the instructions contained in this publication and use the indicated specific tools to ensure correct repair procedures and safety of operators.

NOTE: *This manual applies to multiple applications, therefore images may not all be accurate.*

Foreword - 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 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 CNH Industrial Sales and Service Networks.

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.

Safety rules - Ecology and the environment

Soil, air, and water quality is important for all industries and life in general. When legislation does not yet rule the treatment of some of the substances that advanced technology requires, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

Familiarize yourself with the relative legislation applicable to your country, and make sure that you understand this legislation. Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, anti-freeze, cleaning agents, etc., with regard to the effect of these substances on man and nature and how to safely store, use, and dispose of these substances.

Helpful hints

- Avoid the use of cans or other inappropriate pressurized fuel delivery systems to fill tanks. Such delivery systems may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of these products 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 you drain fluids such as used engine coolant mixtures, engine oil, hydraulic fluid, brake fluid, etc. Do not mix drained brake fluids or fuels with lubricants. Store all drained fluids safely until you can dispose of the fluids in a proper way that complies with all local legislation and available resources.
- Do not allow coolant mixtures to get into the soil. Collect and dispose of coolant mixtures properly.
- The air-conditioning system contains gases that should not be released into the atmosphere. Consult an air-conditioning specialist or use a special extractor to recharge the system properly.
- Repair any leaks or defects in the engine cooling system 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. Penetrating weld splatter may burn a hole or weaken hoses, allowing the loss of oils, coolant, etc.

Battery recycling

Batteries and electric accumulators contain several substances that can have a harmful effect on the environment if the batteries are not properly recycled after use. Improper disposal of batteries can contaminate the soil, groundwater, and waterways. CNH Industrial strongly recommends that you return all used batteries to a CNH Industrial dealer, who will dispose of the used batteries or recycle the used batteries properly. In some countries, this is a legal requirement.

Mandatory battery recycling

NOTE: *The following requirements are mandatory in Brazil.*

Batteries are made of lead plates and a sulfuric acid solution. Because batteries contain heavy metals such as lead, CONAMA Resolution 401/2008 requires you to return all used batteries to the battery dealer when you replace any batteries. Do not dispose of batteries in your household garbage.

Points of sale are obliged to:

- Accept the return of your used batteries
- Store the returned batteries in a suitable location
- Send the returned batteries to the battery manufacturer for recycling

SERVICE MANUAL

Engine

L3AL
L3BL

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Engine and crankcase - 001

L3AL
L3BL

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Engine - 10

Engine and crankcase - 001

(*) See content for specific models

Engine - General specification

L3AL	

Engine model	L3AL
Number of cylinders	3
Bore x stroke	**90 mm** x **105 mm** (**3.54 in** x **4.13 in**)
Displacement	**2003 cm³** (**122 in³**)
Compression ratio	
Engine speed (Low idle no load)	**810 - 850 RPM**
Engine speed (High idle no load)	**2790 - 2830 RPM**
PTO engine horsepower	**28 kW** (**38 Hp**)
Firing order	1-3-2
Cylinder arrangement	In-Line vertical
Valve arrangement	Overhead
Compression pressure at **150 RPM** (cylinder speed) to **200 RPM**	**2940 kPa** (**426 psi**)
Minimum compression pressure at **150 RPM** (cylinder speed) to **200 RPM**	**2550 kPa** (**370 psi**)
Variation between cylinders	**345 kPa** (**50 psi**)

Engine - General specification

L3BL	

Engine specifications

Engine model	L3BL
Number of cylinders	3
Bore x stroke	**88 mm** x **105 mm** (**3.5 in** x **4.13 in**)
Displacement	**1915 cm³** (**117 in³**)
Compression ratio	
Engine speed (Low idle no load)	**810 - 850 RPM**
Engine speed (High idle no load)	**2790 - 2830 RPM**
PTO engine horsepower	**24 kW** (**33 Hp**)
Firing order	1-3-2
Cylinder arrangement	In-Line vertical
Valve arrangement	Overhead
Compression pressure at **150 RPM** (cylinder speed) to **200 RPM**	**2940 kPa** (**426 psi**)
Minimum compression pressure at **150 RPM** (cylinder speed) to **200 RPM**	**2550 kPa** (**370 psi**)
Variation between cylinders	**345 kPa** (**50 psi**)

Engine - Torque

Component	Bolt size and thread	Torque
Cylinder head bolts	M12 x 1.75	**113 - 123 N·m** (**83 - 91 lb ft**)
Rocker cover bolts	M8 x 1.25	**11 - 14 N·m** (**8 - 10 lb ft**)
Rocker arm assembly (Long bolts)	M8 x 1.25 x 62	**13 - 0.0 N·m** (**10 - 12.4 lb ft**)
Rocker arm assembly (Short bolts)	M8 x 1.25 x 25	**11 - 13 N·m** (**8 - 9 lb ft**)
Main bearing retaining bolts	M12 x 1.75	**77 - 88 N·m** (**57 - 65 lb ft**)
Connecting rod cap bolts	M10 x 1	**49 - 60 N·m** (**36 - 44 lb ft**)
Flywheel retaining bolts	M12 x 1.25	**77 - 88 N·m** (**57 - 65 lb ft**)
Camshaft thrust plate	M8 x 1.25	**11 - 14 N·m** (**8 - 10 lb ft**)
Crankshaft main bearing bolts	M12 x 1.75	**77 - 88 N·m** (**57 - 65 lb ft**)
Front end plate	M8 x 1.25	**11 - 14 N·m** (**8 - 10 lb ft**)

Component	Bolt size and thread	Torque
Engine rear mounting plate	M10 x 1.25	**31 - 37 N·m (23 - 27 lb ft)**
Engine timing gear case and cover	M8 x 1.25 x 50 M8 x 1.25 x 55	**11 - 14 N·m (8 - 10 lb ft)**
Crankshaft pulley nut	M24 x 1.25	**382 - 401 N·m (282 - 296 lb ft)**
Rear housing	M10 x 1.25	**54 - 66 N·m (40 - 48 lb ft)**
Oil pan	M8 x 1.25	**15 - 0.0 N·m (11 - 13 lb ft)**
Oil pan drain plug	M14 x 1.5	**35 - 43 N·m (26 - 32 lb ft)**
Oil filter shaft	M20 x 1.5	**43 - 54 N·m (32 - 40 lb ft)**
Cooling fan bolts	M8 x 1.25 x 104	**9 - 13 N·m (7 - 9 lb ft)**
Fuel injection nozzle	M20 x 1.5	**53 - 64 N·m (39 - 47 lb ft)**
Fuel leak - off pipe	M12 x 1.5	**22 - 24 N·m (16 - 18 lb ft)**
Fuel injection gear pump (distributor type)	M14 x 1.5	**76 - 87 N·m (56 - 64 lb ft)**
“B” terminal of the starter	M8 x 1.25	**11 - 12 N·m (8 - 9 lb ft)**
Glow plug (body terminal)	M10 x 1.25 M4 x 0.7	**16 - 19 N·m (12 - 14 lb ft)** **4 - 5 N (1 - 1 lb)**
Pressure relief valve		**43 - 54 N·m (32 - 40 lb ft)**
Coolant drain plug	M22 x 1.5	**35 - 43 N·m (26 - 32 lb ft)**
Fuel injection pipe	M12 x 1.5	**27 - 33 N·m (20 - 24 lb ft)**
Fuel return pipe	M10 x 1.25	**18 - 20 N·m (13 - 15 lb ft)**
Oil pump set bolt	M12 x 1.75	**30 - 0.0 N·m (22 - 28 lb ft)**
Overheat warning unit (thermo switch)	M16 x 1.5	**2 - 2 N·m (16 - 18 lb in)**
Drain plug	M16 x 1.5	**39 - 50 N·m (29 - 37 lb ft)**

Engine - 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)**

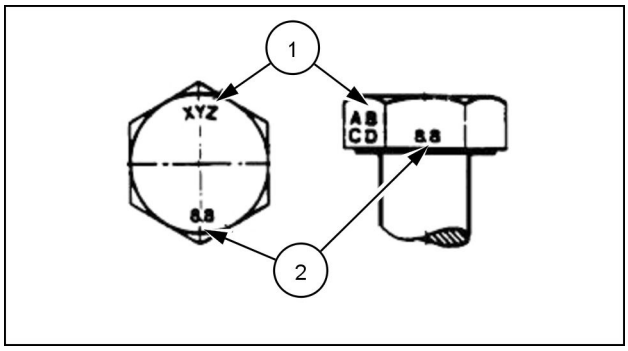
NOTE: *M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.*

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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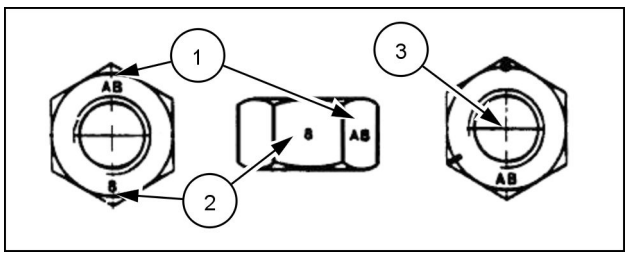
(1) Manufacturer's Identification

(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

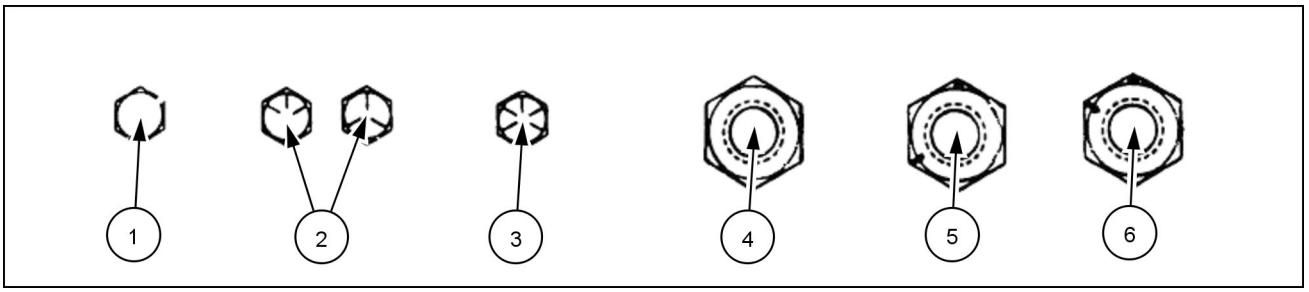
NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrB W/ Gr5 BOLT	LOCKNUT GrC W/ Gr8 BOLT
	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**8 N·m (71 lb in)**	**11 N·m (97 lb in)**	**12 N·m (106 lb in)**	**16 N·m (142 lb in)**	**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)**

Inch Bolts and free-spinning nuts



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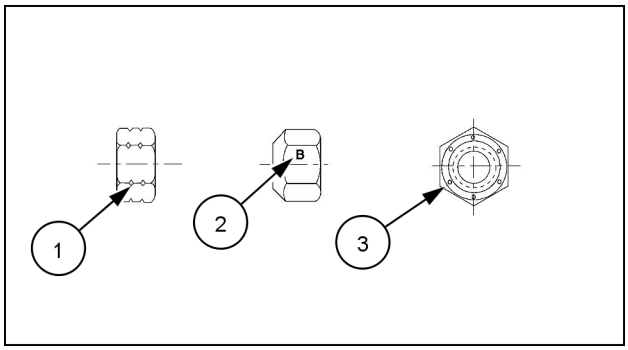
Grade Marking Examples

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

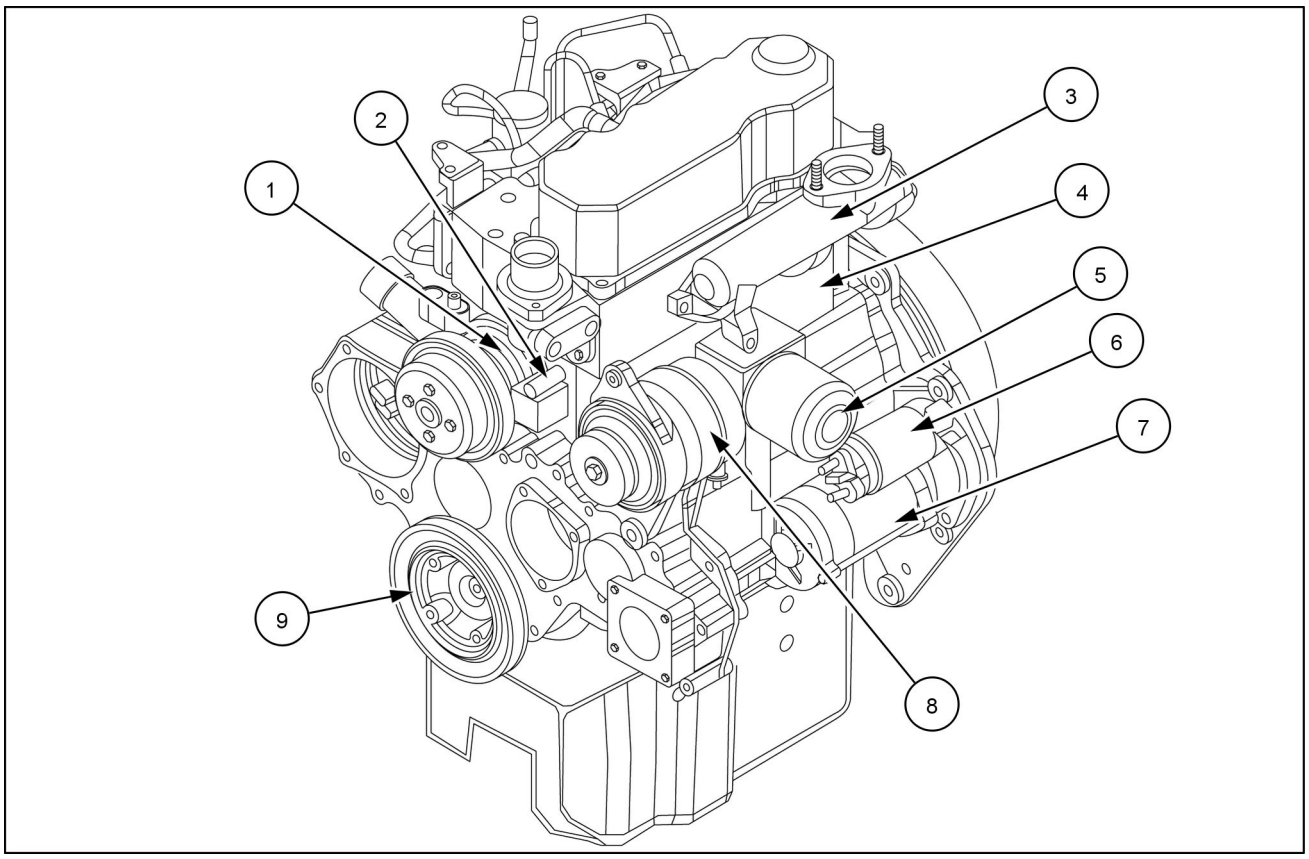
Engine - Special tools

Tool number	Description
OEM1064	Injector tester
FNH00120	Adapter - Compression tester
FNH01728	Injector adapter set
OEM1074	Compression test gauge assembly
FNH01720	Injector cleaning kit
FNH00011	Oil pressure test fitting
294165	Seal installer set
Micrometer, outside	**0 - 25 mm** (**0 - 1 in**)
Micrometer, outside	**25 - 51 mm** (**1 - 2 in**)
Micrometer, outside	**76.2 - 101.6 mm** (**3 - 4 in**)
Small hole gauge	**19 - 25 mm** (**0.75 - 1 in**)
Cylinder bore gauge	**76.2 - 101.6 mm** (**3 - 4 in**)
Cylinder bore gauge	**25 - 51 mm** (**1 - 2 in**)

Crankcase - Dimension

Bore	
Standard	**84 - 84.019 mm** (**3.3071 - 3.3078 in**)
Head surface warp	
Standard	**0.05 mm** (**0.002 in**)
Maximum	**0.20 mm** (**0.0079 in**)

Engine and crankcase - Component localization



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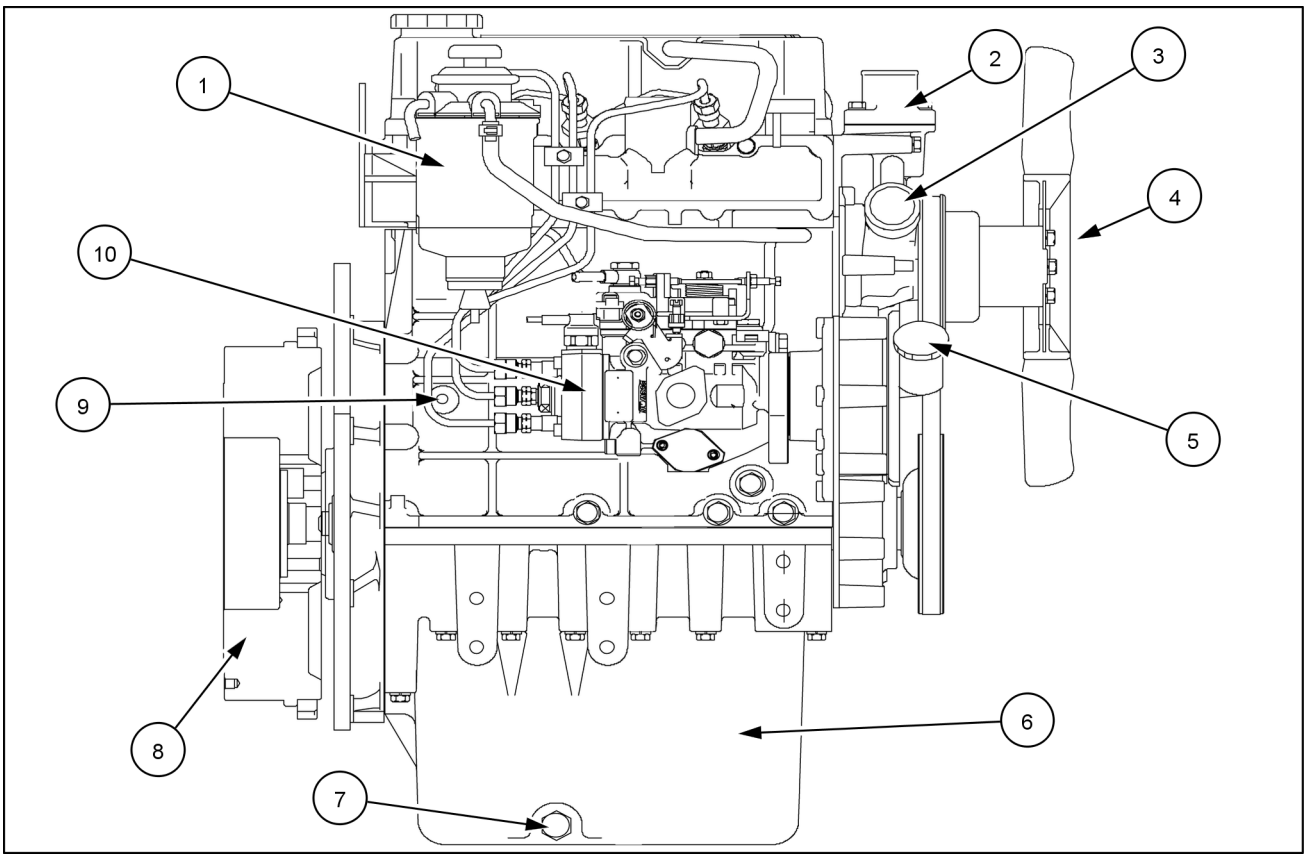
Left side components

(1) Water pump
(2) Water temperature sensor
(3) Exhaust manifold
(4) Engine number
(5) Oil filter
(6) Starter solenoid
(7) Starter motor
(8) Alternator
(9) Crankshaft pulley



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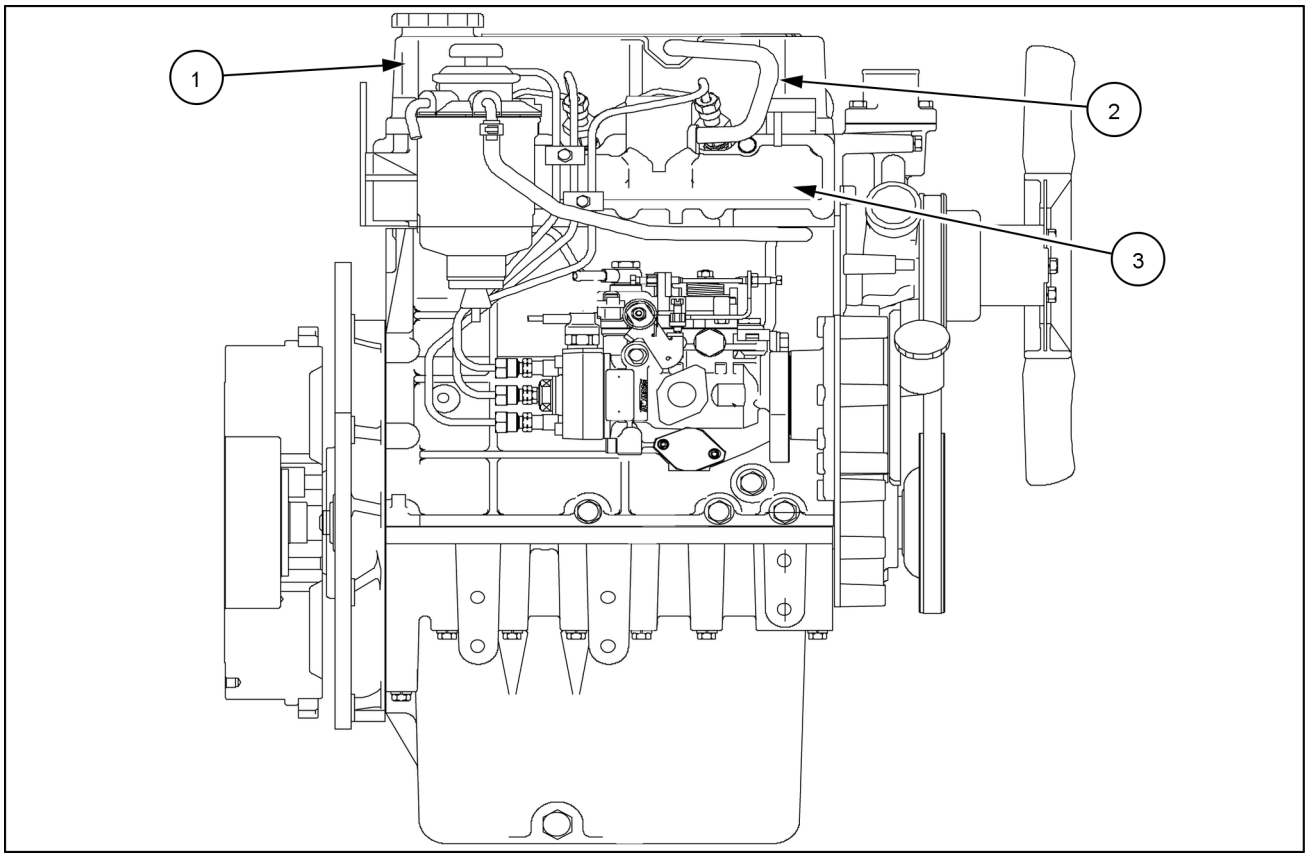
Right side components

(1) Fuel filter
(2) Thermostat
(3) Water outlet
(4) Cooling fan
(5) Oil filler
(6) Oil pan
(7) Oil drain plug
(8) Flywheel
(9) Oil pressure sensor
(10) Injection pump

Engine and crankcase - Dynamic description ventillation



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When the gas (created by combustion) passes through the piston ring, the gas is called "blow-by-gas".
The blow-by-gas flows into the valve cover **(1)**.
Natural aspiration allows blow-by-gas to pass into the intake manifold **(3)** through the breather hose **(2)** and be burned with the aspirated air.

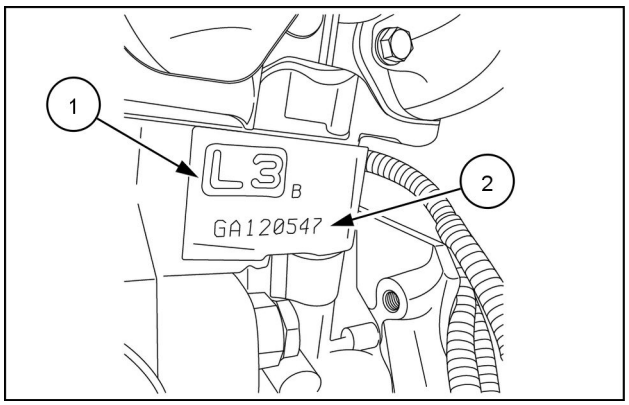
Engine - Identification

NOTE: *Engine - Identification is located by the oil filter and oil pressure relief valve on the left side of the engine.*

The L3B **(1)** in the engine cast indicates : LS engine, 3 cylinder, (B) 33 horse power.

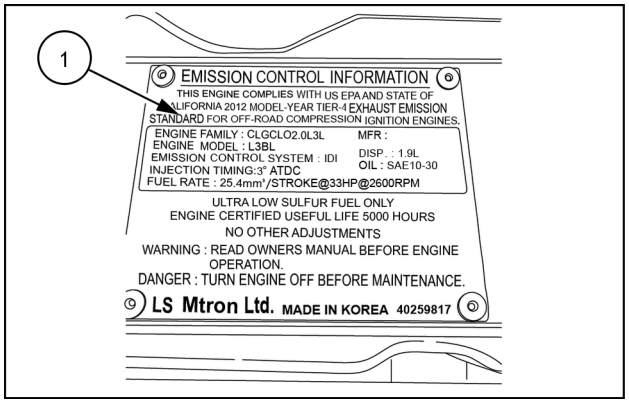
The L3A in the engine cast indicates : LS engine, 3 cylinder, (A) 38 horse power. (Not shown)

Numeric value **(2)** under the engine code **(1)** indicates the engine serial number.



NHIL14ENG0340AA 1

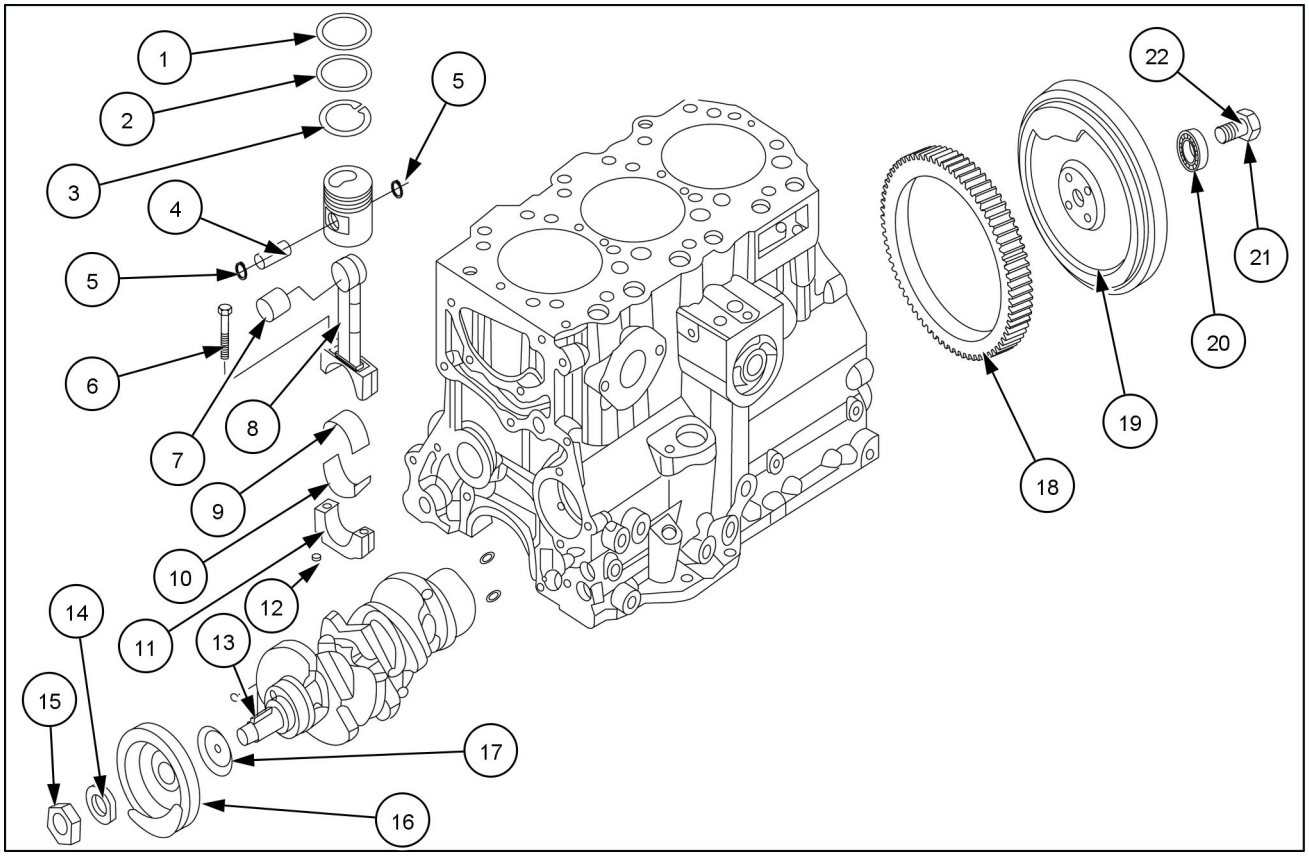
NOTE: *The emission plate **(1)** is located on the valve cover.*



NHIL14ENG0339AA 2

Engine - Exploded view

L3AL	



NHIL14ENG0270FA 1

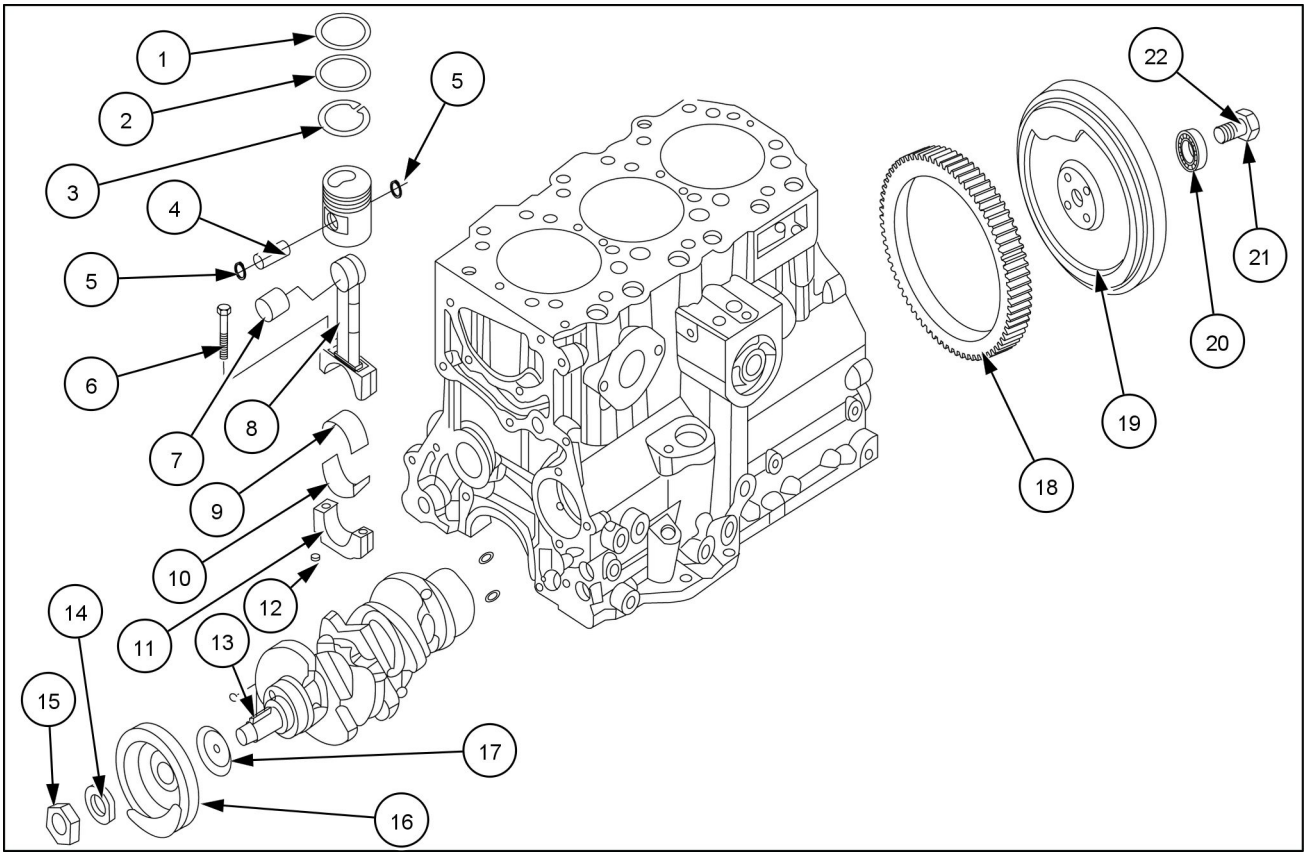
Three cylinder engine (Single cylinder shown)

(1) First ring (OD **90 mm** (**3.54 in**)
(2) Second ring (OD **90 mm** (**3.54 in**)
(3) Oil ring assembly
(4) Piston pin
(5) Snap ring
(6) Connecting rod bolt
(7) Connecting rod bushing
(8) Connecting rod
(9) Connecting rod bearing
(10) Connecting rod bearing
(11) Connecting rod cap
(12) Connecting rod nut
(13) Key
(14) Crankshaft washer
(15) Nut
(16) Crankshaft pulley
(17) Baffle plate
(18) Ring gear
(19) Flywheel assembly
(20) Ball bearing
(21) Hex bolt, M12 x 36mm
(22) Lock washer, M12

The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The crankshaft is supported on five main bearings. The front bearing is positioned in a bore in front of the block. The other bearings are split liners located in holders bolted to the block. The camshaft is supported on four cam bearings located in the block.

Engine - Exploded view

L3BL	



NHIL14ENG0270FA 1

Three cylinder engine (Single cylinder shown)

(1) First ring (OD **88 mm** (**3.46 in**)
(2) Second ring (OD **88 mm** (**3.46 in**)
(3) Oil ring assembly
(4) Piston pin
(5) Snap ring
(6) Connecting rod bolt
(7) Connecting rod bushing
(8) Connecting rod
(9) Connecting rod bearing
(10) Connecting rod bearing
(11) Connecting rod cap
(12) Connecting rod nut
(13) Key
(14) Crankshaft washer
(15) Nut
(16) Crankshaft pulley
(17) Baffle plate
(18) Ring gear
(19) Flywheel assembly
(20) Ball bearing
(21) Hex bolt, M12 x 36mm
(22) Lock washer, M12

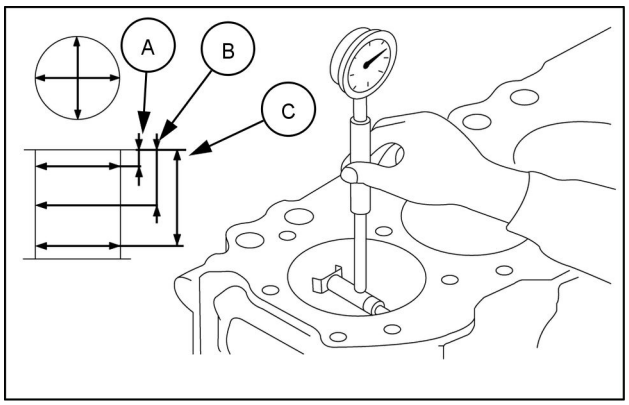
The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The crankshaft is supported on five main bearings. The front bearing is positioned in a bore in front of the block. The other bearings are split liners located in holders bolted to the block. The camshaft is supported on four cam bearings located in the block.

Engine and crankcase - Check cylinder bores

L3AL	

1. Measure the engine bore with a cylinder bore gauge having a dial indicator.
2. Take measurements at A, B, and C positions in the bore on axis **90 °** apart as shown in the illustration to check the diameter, out-of-round and taper.

NOTE: *If the bores exceed the service limit for diameter, out of round and taper, increase the bore for oversized pistons.*

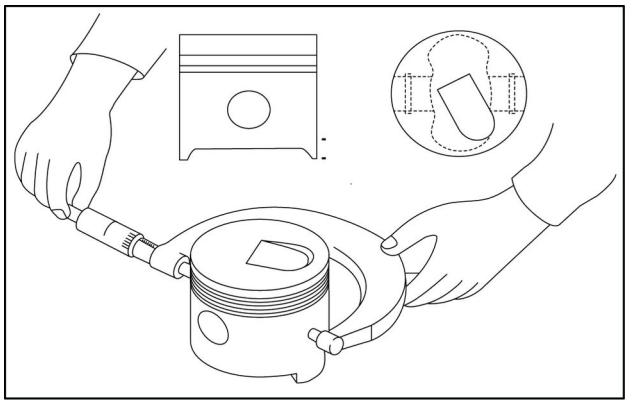


NHIL14ENG0302AA 1

L3AL		Assembly standard	Service Limit
Cylinder internal measurement	Standard	**90 mm** (**3.543 in**) + **0.035 mm** (**0.00138 in**)	Standard
	0.25 mm (**0.0098 in**)	**90.25 mm** (**3.5531 in**) + **0.035 mm** (**0.00138 in**)	+ **0.2 mm** (**0.0078 in**)
	0.50 mm (**0.0196 in**)	**90.50 mm** (**3.5629 in**) + **0.035 mm** (**0.00138 in**)	
Out-of-round and taper of bores		Maximum	**0.015 mm** (**0.0006 in**)

Boring and honing

1. Determine an oversize to which the bores are to be increased by boring and honing on the basis of the maximum measurement taken on the bores.
2. Bore, then finish honing the bores to the oversize determined in instruction one.



NHIL14ENG0303AA 2

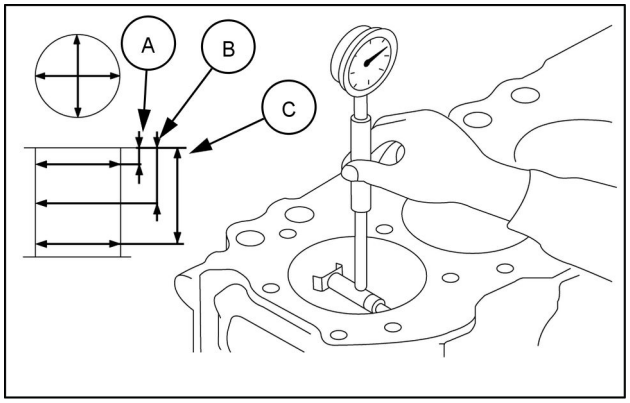
Engine and crankcase - Check cylinder bores

L3BL	

Checking bores

1. Measure the engine bore with a cylinder bore gauge having a dial indicator.
2. Take measurements at A, B, and C positions in the bore on axis **90 °** apart as shown in the illustration to check the diameter, out-of-round and taper.

NOTE: *If the bores exceed the service limit for diameter, out of round and taper, increase the bore for oversized pistons.*

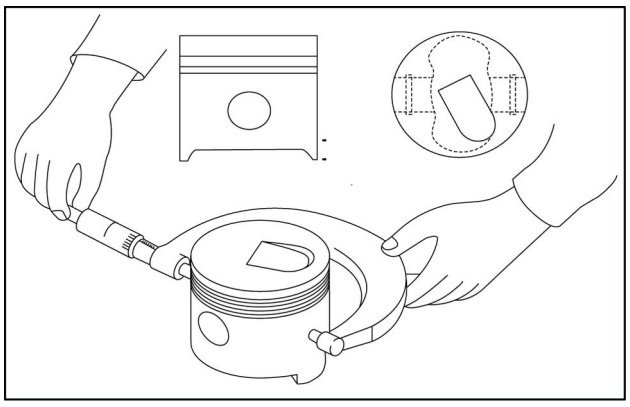


NHIL14ENG0302AA 1

L3BL		Assembly standard	Service Limit
Cylinder internal measurement	Standard	**88 mm** (**3.464 in**) + **0.035 mm** (**0.00138 in**)	Standard + **0.2 mm** (**0.0078 in**)
	0.25 mm (**0.0098 in**)	**88.25 mm** (**3.474 in**) + **0.035 mm** (**0.00138 in**)	
	0.50 mm (**0.0196 in**)	**88.50 mm** (**3.484 in**) + **0.035 mm** (**0.00138 in**)	
Out-of-round and taper of bores		Maximum	**0.015 mm** (**0.0006 in**)

Boring and honing

1. Determine an oversize to which the bores are to be increased by boring and honing on the basis of the maximum measurement taken on the bores.
2. Bore, then finish honing the bores to the oversize determined in instruction one.



NHIL14ENG0303AA 2

Engine - Test

Test

- An engine should be tested on a dynamometer. This test is also for “break in” of the major running parts of the engine.

Start-up procedure

- Check the fluid levels in the radiator, oil pan and fuel tank. Bleed the fuel and cooling system.
- Crank the engine with the starter for **5 s** to permit lube oil to circulate through the engine. For this cranking, do not supply fuel to the engine.
- Slightly move the speed control lever in the direction of increasing the injection quantity and turn the starter switch to the START position. (Do not move the speed control lever to the full injection position).
- After the engine starts, allow it to idle by operating the speed control lever.

Inspection after starting the engine

- After starting the engine, check the following items. Upon discovery of any faulty condition, immediately stop the engine and investigate for this cause.
- Lube oil pressure – should be **2 - 4 bar** (**28 - 57 psi**) when the engine is running at the rated speed. It should be **1 bar** (**14 psi**) when the engine is running at low idle speed.
- Coolant temperature – should be **75 - 85 °C** (**167 - 185 °F**).
- Lube oil temperature – Should be **70 - 90 °C** (**158 - 194 °F**).
- Oil, coolant or fuel leaks.
- Knocking – Should die away as the coolant temperature increases. No other defects should be noted.
- Abnormal exhaust smoke and smell.

Test condition

- Follow the table shown below :

Step	Speed (rpm)	Load - %	Time / minutes
1		No load	**30 min**
2	**1000 RPM**	**25 %**	**30 min**
3	Rated (varies according to specifications)	**25 %**	**10 min**
4		**50 %**	**10 min**
5		**75 %**	**30 min**
6		**100 %**	**20 min**

Inspection after break-in

- Check under and around the engine for loose bolts or nuts.
- Check and adjust the valve clearance.
- Check and adjust the injection timing.