

Product: CNH NEF Four Cylinder Mechanical Service Repair Manual
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SERVICE MANUAL

NEF Four Cylinder Mechanical Tier 2 and Stage II Engine

See the following page for engine model numbers



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SERVICE MANUAL

F4GE0404B*D602

F4GE0454B*D601

F4GE0454B*D651

F4GE0454E*D601

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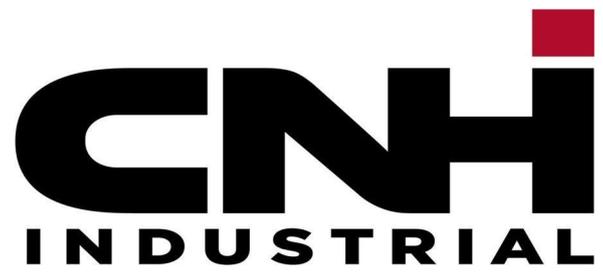
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47899763 14/07/2015

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INTRODUCTION

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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 manufacturer reserves the right to make improvements in design and changes in specifications at any time without notice and without incurring any obligation to install them on units previously sold. Specifications, descriptions, and illustrative material herein are as accurate as known at time of publication but are subject to change without notice.

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 and on machine decals, 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 which, if not avoided, will result in death or serious injury. The color associated with DANGER is RED.

 WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. The color associated with WARNING is ORANGE.

 CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. The color associated with CAUTION is YELLOW.

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

Machine safety

NOTICE: Notice indicates a situation which, if not avoided, could result in machine or property damage. The color associated with Notice is BLUE.

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 which 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

Torque

Component	Size	Specification
Cylinder Head and Components		
Rocker Assembly	M8	20 - 28 Nm (14.8 - 20.7 lb ft)
Cylinder Head	M12x70	
Phase 1		50 Nm (36.9 lb ft)
Phase 2		90 °
Cylinder Head	M12x140	
Phase 1		40 Nm (29.5 lb ft)
Phase 2		180 °
Cylinder Head	M12x180	
Phase 1		70 Nm (51.6 lb ft)
Phase 2		180 °
Valve Cover	M8x1.25x25	20 - 28 Nm (14.8 - 20.7 lb ft)
Intake manifold	M8x1.25	20 - 28 Nm (14.8 - 20.7 lb ft)
Air intake elbow	M8x1.25	20 - 28 Nm (14.8 - 20.7 lb ft)
Exhaust manifold	M10x1.5x65	37 - 49 Nm (27.3 - 36.1 lb ft)
Rear lifting bracket	M12x1.75x30	65 - 89 Nm (47.9 - 65.6 lb ft)
Turbocharger	M10	37 - 49 Nm (27.3 - 36.1 lb ft)
Front Case		
Front cover assembly	M8x1.25x45	20 - 28 Nm (14.8 - 20.7 lb ft)
	M8x1.25x30	20 - 28 Nm (14.8 - 20.7 lb ft)
Rear Case		
Gear Case	M8x1.25x40	20 - 28 Nm (14.8 - 20.7 lb ft)
	M8x1.25x25	20 - 28 Nm (14.8 - 20.7 lb ft)
	M10x1.5	44 - 54 Nm (32.5 - 39.8 lb ft)
Flywheel housing	M12x120	75 - 95 Nm (55.3 - 70.1 lb ft)
	M12x80	75 - 95 Nm (55.3 - 70.1 lb ft)
	M10x80	44 - 54 Nm (32.5 - 39.8 lb ft)
	M10x40	44 - 54 Nm (32.5 - 39.8 lb ft)
Engine flywheel		
Phase 1	M12x1.25	26 - 34 Nm (19.2 - 25.1 lb ft)
Phase 2	M12x1.25	55 - 65 °
Cylinder Block and Crankshaft Components		
Main bearing cap		
Phase 1		44 - 56 Nm (32.5 - 41.3 lb ft)
Phase 2		74 - 86 Nm (54.6 - 63.4 lb ft)
Phase 3		85 - 95 °
Connecting rod		
Phase 1		50.0 - 55.0 N·m (36.9 - 40.6 lb ft)
Phase 2		55 - 65 °
Timing Pin		4 - 6 Nm (3.0 - 4.4 lb ft)
Crankshaft pulley	M12x1.75	105 - 115 Nm (77.4 - 84.8 lb ft)
Camshaft retaining plate	M8	20 - 28 Nm (14.8 - 20.7 lb ft)
Camshaft gear	M8	32 - 40 Nm (23.6 - 29.5 lb ft)
Lubrication System and Components		

INTRODUCTION

Component	Size	Specification
Piston Cooling Nozzles	M8x1.25x10	12 - 18 Nm (8.9 - 13.3 lb ft)
Oil pump	M8x1.25x30	7 - 9 Nm (5.2 - 6.6 lb ft)
Stiffening Plate	M10x1.25x25	38 - 48 Nm (28.0 - 35.4 lb ft)
Oil plug	M10x1	5 - 7 Nm (3.7 - 5.2 lb ft)
	M14x1.5	9 - 13 Nm (6.6 - 9.6 lb ft)
Oil Pick up tube	M8x1.25x20	20 - 28 Nm (14.8 - 20.7 lb ft)
Oil Pan	M8x1.25x25	20 - 28 Nm (14.8 - 20.7 lb ft)
	M18x1.50	51 - 69 Nm (37.6 - 50.9 lb ft)
Oil Bypass Valve	M22x1.5x10	72 - 88 Nm (53.1 - 64.9 lb ft)
Turbo Lubrication Lines		
Turbo end	M12x1.5	20 - 28 Nm (14.8 - 20.7 lb ft)
Filter base end		20 - 28 Nm (14.8 - 20.7 lb ft)
Drain	M8x1.25x16	20 - 28 Nm (14.8 - 20.7 lb ft)
Electrical Components		
Alternator		
	M8x1.25x30	20 - 28 Nm (14.8 - 20.7 lb ft)
	M10x1.25x25	20 - 28 Nm (14.8 - 20.7 lb ft)
	M10	44 - 54 Nm (32.5 - 39.8 lb ft)
	M12x1.75x120	37 - 49 Nm (27.3 - 36.1 lb ft)
Alternator wiring	M6x1.0 nut	8 - 11 Nm (5.9 - 8.1 lb ft)
Starter	M10	54 - 44 Nm (39.8 - 32.5 lb ft)
Fuel System and Components		
Fuel pump		
	M8 screw	20 - 28 Nm (14.8 - 20.7 lb ft)
	M6 screw	9 - 11 Nm (6.6 - 8.1 lb ft)
	M6 nut	9 - 11 Nm (6.6 - 8.1 lb ft)
Fuel Pump Drive Gear		
Phase 1		15 - 20 Nm (11.1 - 14.8 lb ft)
Phase 2		85 - 90 Nm (62.7 - 66.4 lb ft)
Timing Pin Cap		30 - 35 Nm (22.1 - 25.8 lb ft)
Fuel injectors		55 - 65 Nm (40.6 - 47.9 lb ft)
Fuel lift pump		20 - 28 Nm (14.8 - 20.7 lb ft)
Cooling System and Components		
Water Pump	M8x1.25x25	20 - 28 Nm (14.8 - 20.7 lb ft)
Water outlet connection	M8x1.25x35	20 - 28 Nm (14.8 - 20.7 lb ft)
	M8x1.25x70	20 - 28 Nm (14.8 - 20.7 lb ft)
Fan support	M10x1.5x20	28 - 38 Nm (20.7 - 28.0 lb ft)
Fan pulley	M6	8 - 12 Nm (5.9 - 8.9 lb ft)
	M10	27 - 49 Nm (19.9 - 36.1 lb ft)

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)

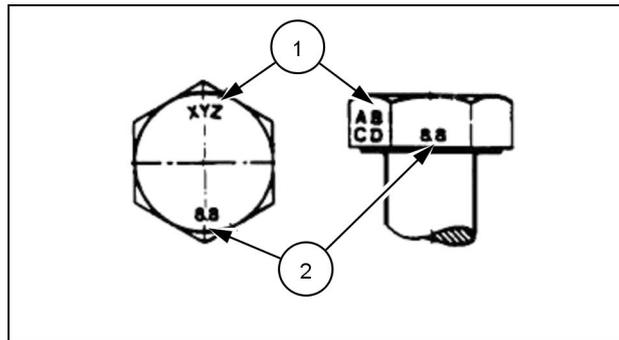
NOTE: M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.

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

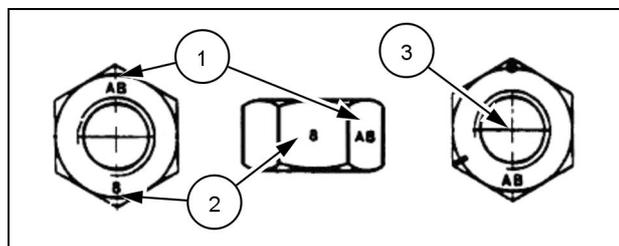
Metric Hex head and carriage bolts, classes 5.6 and up



20083680 1

1. Manufacturer's Identification
2. Property Class

Metric Hex nuts and locknuts, classes 05 and up



20083681 2

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)

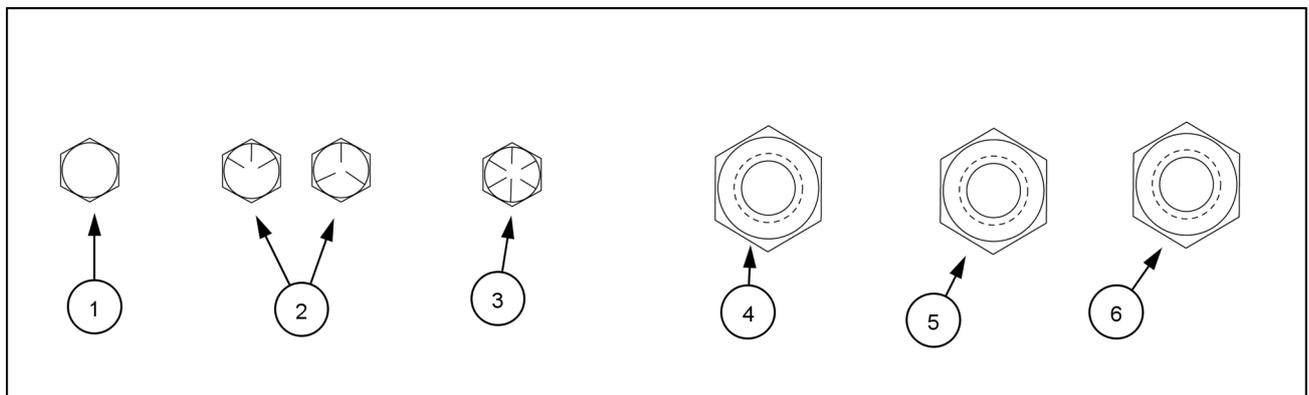
NOTE: For Imperial Units, *1/4 in* and *5/16 in* hardware torque specifications are shown in pound-inches. *3/8 in* through *1 in* hardware torque specifications are shown in pound-feet.

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

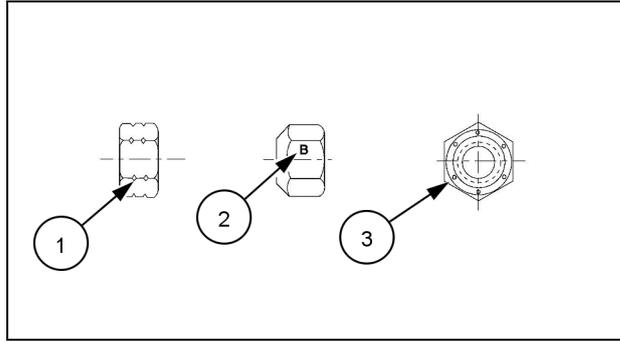


NHIL13ENG1271EA 3

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)



20090268 4

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

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 CNH Industrial 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 CNH Industrial 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.

⚠ 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

Special tools

The special tools that CNH Industrial suggests and illustrate in this manual have been specifically researched and designed for use with CNH Industrial 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



SERVICE MANUAL

Engine

F4GE0404B*D602

F4GE0454B*D601

F4GE0454B*D651

F4GE0454E*D601

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Engine - 10

Engine and crankcase - 001

**F4GE0404B*D602
F4GE0454B*D601
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F4GE0454E*D601**

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Engine and crankcase - 001

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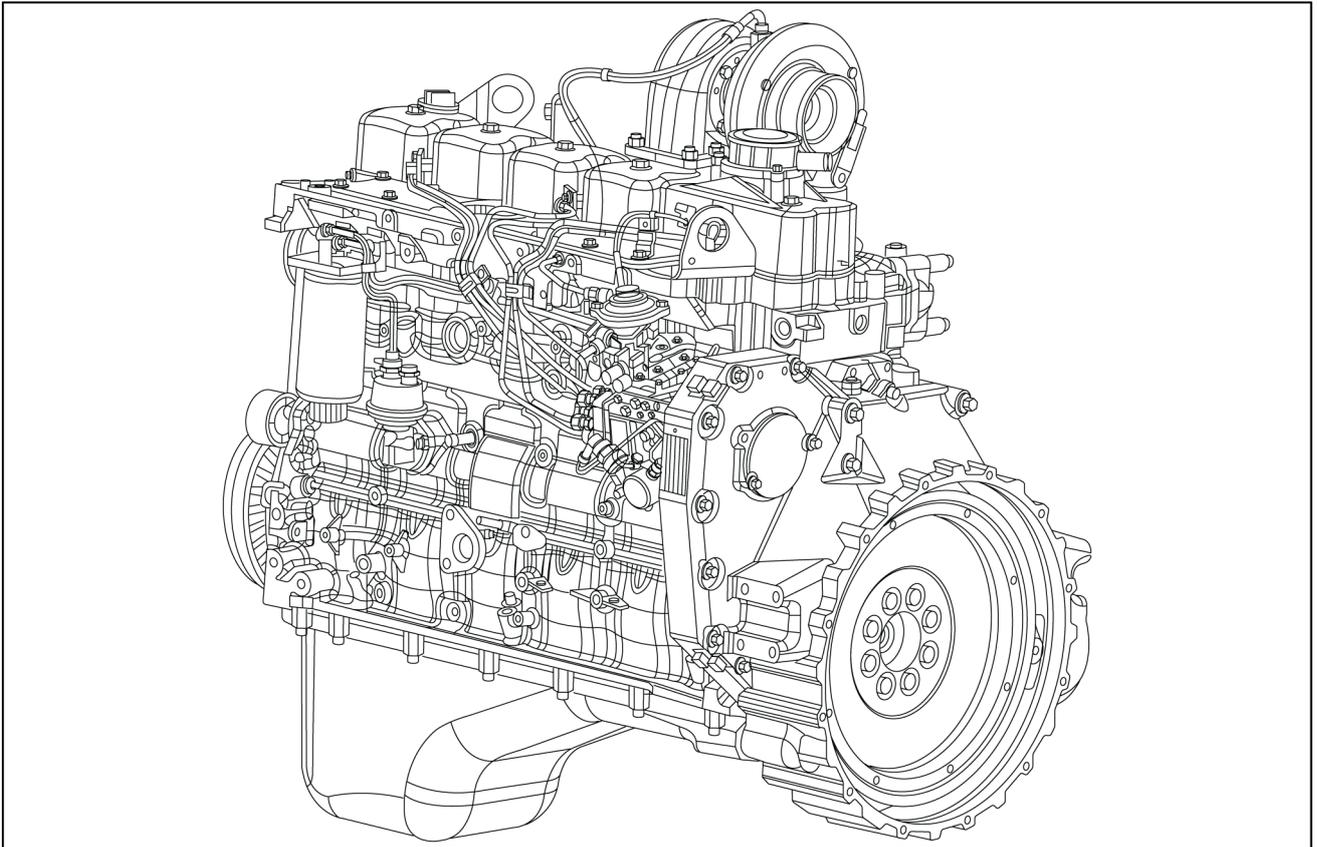
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Engine - General specification



NHIL13ENG0292FA 1

NEF engines have been designed and developed by FPT specifically for transportation by land and farming equipment in general.

They are characterized by diesel cycle 4 stroke atmospheric or turbocharged 4 and 6 cylinders each with 2 valves. Fuel is provided by a rotary mechanical pump or in line fuel pump according to the equipment application. It differs from other applications because of the provision of different power, power take-off for the different collector configuration, priming pump, oil pan and boost turbine.

NOTE: The picture shows application designed for 6 cylinder versions, 2 valves per cylinder, having fuel feed by a mechanical pump.

NOTICE: Data, technical specifications and performances granted shall be valid only if the setter will follow and comply with all installation prescriptions provided by FPT.

Furthermore, the use of the unit after overhaul should conform to the original specified power and engine RPM for which the engine has been designed.

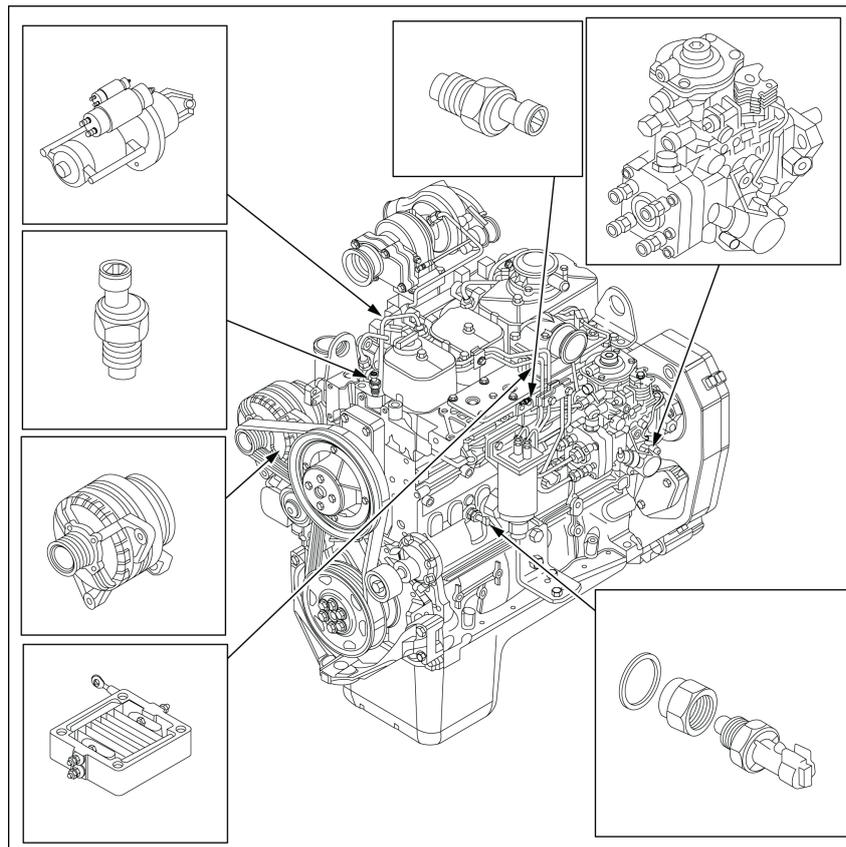
Engine Type	4 cylinder	6 cylinder
Compression ratio	17.5 : 1	
Bore	104 mm (4.1 in)	
Stroke	132 mm (5.2 in)	
Displacement	4485 cm ³	6728 cm ³
Turbocharger type	Intercooled Holset HX25W	Intercooled Holset HX35W
Lubrication		
Oil Pressure (warm engine)		
Idling	0.7 bar (10.2 psi)	
Peak RPM	3.5 bar (50.8 psi)	
Cooling		
Water Pump	Belt Driven	
Thermostat opening temperature	79 - 83 °C (174.2 - 181.4 °F)	
Capacity		
Oil Pan	13 l (13.7 US qt)	15 l (15.9 US qt)
Oil Filter	1 l (1.1 US qt)	1 l (1.1 US qt)

Clearance Data	
Cylinder Block and Crankshaft Components	
Cylinder Barrels	104.000 - 104.024 mm (4.094 - 4.095 in)
Oversize	0.4 mm (0.016 in)
Pistons	103.714 - 103.732 mm (4.083 - 4.084 in) / 103.759 - 103.777 mm (4.085 - 4.086 in) (*)
Skirt Height	55.9 mm (2.201 in) / 49.5 mm (1.949 in) (*)
Pin housing	38.010 - 38.016 mm (1.496 - 1.497 in)
Piston (oversize)	0.4 mm (0.016 in)
Protrusion	0.28 - 0.52 mm (0.011 - 0.020 in)
Pin	37.994 - 38.000 mm (1.496 - 1.496 in)
Piston Pin - Pin Housing	0.01 - 0.022 mm (0.0004 - 0.001 in)
Piston ring landings	
Combustion	2.705 - 2.735 mm (0.106 - 0.108 in)
Intermediate	2.440 - 2.460 mm (0.096 - 0.097 in) / 2.420 - 2.440 mm (0.095 - 0.096 in) (*)
Oil Control	4.030 - 4.050 mm (0.159 - 0.159 in)
Piston Rings	
Combustion	2.560 - 2.605 mm (0.101 - 0.103 in)
Intermediate	2.350 - 2.380 mm (0.093 - 0.094 in)
Oil Control	3.970 - 3.990 mm (0.156 - 0.157 in)
Piston Ring and Ring Landing Clearance	
Combustion	0.100 - 0.175 mm (0.004 - 0.007 in)
Intermediate	0.060 - 0.110 mm (0.002 - 0.004 in) / 0.040 - 0.090 mm (0.002 - 0.004 in) (*)
Oil Control	0.040 - 0.080 mm (0.002 - 0.003 in)
Piston Ring End Gap	
Combustion	0.30 - 0.40 mm (0.012 - 0.016 in)
Intermediate	0.60 - 0.80 mm (0.024 - 0.031 in)
Oil Control	0.30 - 0.55 mm (0.012 - 0.022 in)
Connecting Rod	
Small end housing	40.987 - 41.013 mm (1.614 - 1.615 in)
Big end housing	72.987 - 73.013 mm (2.874 - 2.875 in)
Small end bushing Inside Diameter	38.019 - 38.033 mm (1.497 - 1.497 in)
Big end bearing shell thickness	1.955 - 1.968 mm (0.077 - 0.077 in)
Piston Pin and Bushing Clearance	0.019 - 0.039 mm (0.001 - 0.002 in)

Clearance Data	
Oversize Big end bearing Shells	0.250 mm (0.010 in) ; 0.500 mm (0.020 in)
Crankshaft	
Main Journals	82.99 - 83.01 mm (3.267 - 3.268 in)
Crankpins	68.987 - 69.013 mm (2.716 - 2.717 in)
Main Bearing Shell Thickness	2.456 - 2.464 mm (0.097 - 0.098 in)
Big end Bearing Shell Thickness	1.955 - 1.968 mm (0.077 - 0.078 in)
Main Bearing Bore	
No. 1,5 / 1,7	87.982 - 88.008 mm (3.464 - 3.465 in)
No. 2,3,4 / 2,3,4,5,6	87.977 - 88.013 mm (3.464 - 3.465 in)
Bearing Shell and Journal Clearance	
No. 1,5 / 1,7	0.064 - 0.095 mm (0.003 - 0.004 in)
No. 2,3,4 / 2,3,4,5,6	0.059 - 0.100 mm (0.002 - 0.004 in)
Bearing Shell and Crankpin Clearance	0.064 - 0.090 mm (0.003 - 0.004 in)
Thrust Journal	37.475 - 37.545 mm (1.475 - 1.478 in)
Thrust Bearing Bore	32.180 - 32.280 mm (1.267 - 1.271 in)
Thrust Bearing	37.28 - 37.38 mm (1.468 - 1.472 in)
Crankshaft End Play	0.095 - 0.265 mm (0.004 - 0.010 in)
Cylinder Head and Components	
Valve Guide Bore	8.019 - 8.039 mm (0.3157 - 0.3165 in)
Intake Valves	
Stem diameter	7.960 - 7.980 mm (0.313 - 0.314 in)
Face angle	59.75 - 60.25 °
Exhaust Valves	
Stem diameter	7.960 - 7.980 mm (0.313 - 0.314 in)
Face angle	44.75 - 44.25 °
Valve Stem and Guide Clearance	0.059 - 0.086 mm (0.002 - 0.003 in)
Valve Seat Bore	
Intake	46.987 - 47.013 mm (1.850 - 1.851 in)
Exhaust	43.637 - 43.663 mm (1.718 - 1.719 in)
Valve seat Outside Diameter:	
Intake	47.063 - 47.089 mm (1.853 - 1.854 in)
Exhaust	43.713 - 43.739 mm (1.721 - 1.722 in)
Valve Seat Angle	
Intake	60 °
Exhaust	45 °
Valve Sink	
Intake	1 - 1.52 mm (0.039 - 0.060 in)
Exhaust	1 - 1.52 mm (0.039 - 0.060 in)
Interference Between Valve Seat and Cylinder Head	
Intake	0.050 - 0.102 mm (0.002 - 0.004 in)
Exhaust	0.050 - 0.102 mm (0.002 - 0.004 in)
Valve Spring Height	
Free	63.50 mm (2.500 in)
Under a load equal to: 330.8 - 348.8 N (74.4 - 78.4 lb)	49.02 mm (1.930 in)
Under a load equal to: 702 - 780 N (157.8 - 175.4 lb)	38.20 mm (1.504 in)
Camshaft Bore	
No.1 (flywheel side)	59.222 - 59.248 mm (2.332 - 2.333 in)
No. 2,3,4,5 / 2,3,4,5,6,7	54.089 - 54.139 mm (2.129 - 2.131 in)

Clearance Data	
Camshaft Journals	
1-5 / 1-7	53.995 - 54.045 mm (2.126 - 2.128 in)
Bushing inside diameter	54.083 - 54.147 mm (2.129 - 2.132 in)
Bushing and Journal Clearance	0.038 - 0.162 mm (0.001 - 0.006 in)
Tappet Bore	16.000 - 16.030 mm (0.630 - 0.631 in)
Tappet outside diameter	
Top	15.924 - 15.954 mm (0.627 - 0.628 in)
Middle	15.960 - 15.975 mm (0.628 - 0.629 in)
Bottom	15.924 - 15.954 mm (0.627 - 0.628 in)
Rocker shaft	18.963 - 18.975 mm (0.747 - 0.747 in)
Rockers	19.000 - 19.026 mm (0.748 - 0.749 in)
Rockers and Shaft Clearance	0.025 - 0.063 mm (0.001 - 0.002 in)

Engine - Component localization

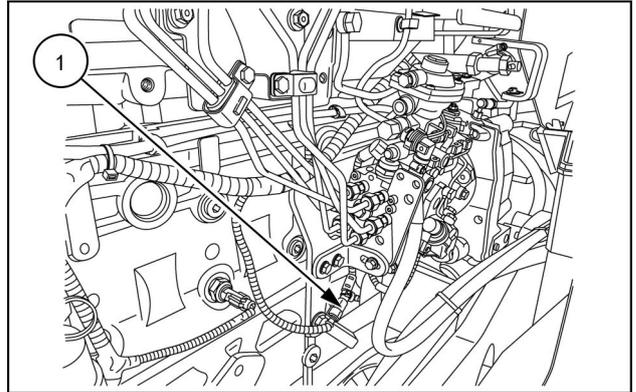


NHIL13ENG0296GA 1

(1) Coolant temperature sensor - (2) Starter - (3) KSB water temperature sensor - (4) Electromagnets assembled on feed pump: (A) on hydraulic head unit (B) on KSB - (5) Oil pressure sensor - (6) Grid heater - (7) Alternator.

Engine - Compression test

1. Make sure that all pressure is relieved from the fuel system.
2. Disable the fuel system by disconnecting the fuel shut off electrical connector (1).



NHIL14ENG0414AA 1

3. Remove all fuel injectors (1) and their O-ring seals (2) from the cylinder head.

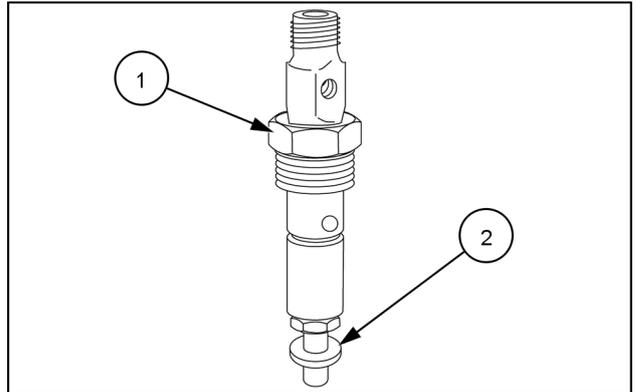
NOTE: Use new injector O-ring seals during reinstallation.

4. Install cylinder compression test adapter 380000989 into cylinder No. 1 fuel injector port.
5. Be sure the compression gauge is reset to zero psi.
6. Crank the engine over until the compression gauge needle meets it's peak level and will not increase further.

NOTICE: Do not crank the engine excessively. This could cause wear to the starter motor.

NOTICE: Keep the compression testing equipment away from all moving parts on the engine.

7. Record the compression test reading and repeat Step 6 until all cylinders have been tested and recorded.
8. The cylinder psi values should be between **24 bar (350 psi) +100/-50**.



NHIL13ENG0602AA 2

Crankcase Bore - Check

Prior operation:

Connecting rod and piston - Remove (10.105)

Once engine is disassembled, perform the following:
 Clean the engine block assembly
 Use the proper rings to handle the cylinder unit.
 Inspect engine block for cracks.
 Check operating plug conditions and replace them in case of uncertain seal or if rusted.
 Inspect cylinder bore surfaces for seizing and scoring.
 Inspect cylinder bores for ovalization, taper, and wear by using a bore dial gauge **OEM1032 (1)** fitted with the dial gauge previously set to zero on the ring gauge **(2)** of the cylinder bore diameter.

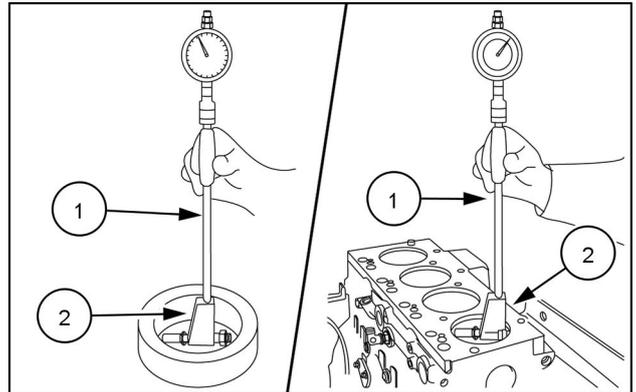
NOTE: Should a ring gauge not be available, use a micrometer for zero-setting.

Measurements should be performed on each cylinder at three different heights in the cylinder and on two planes perpendicular with each other: one parallel to the longitudinal axis of the engine **(A)**, and the other perpendicular **(B)**.

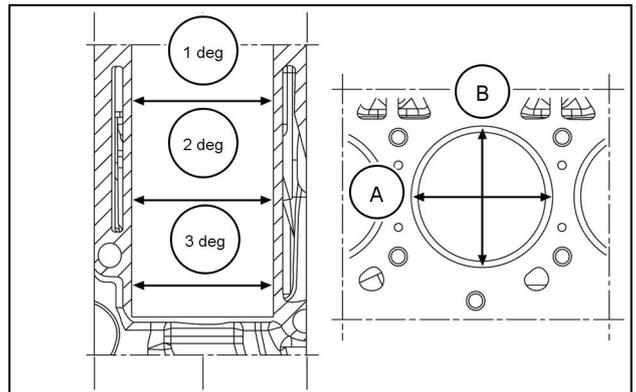
Maximum wear is usually found on plane **(B)** in correspondence with the first measurement.

Should ovalization, taper, or wear be found, bore and hone the cylinder bores. Cylinder boring should be performed according to the new piston diameter oversize by **0.4 mm (0.016 in)** and to the specified assembling clearance.

NOTE: In case of boring, all cylinder bores should have the same oversize **0.4 mm (0.016 in)**.



NHIL13ENG0270AA 1



NHIL13ENG0286AA 2

Crankcase - Check

Prior operation:

Crankshaft - Remove (10.103)

Main bearing housings

Check main bearing housings as follows:

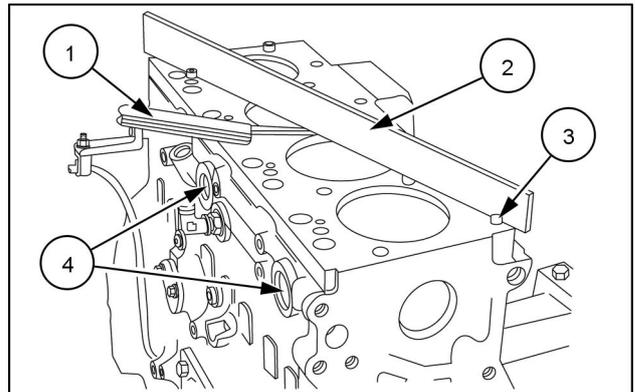
1. Install the main bearing caps onto the engine block without bearings.
2. Torque the main cap bolts in the following three stages.
 - Stage 1: **44 - 55 N·m (32 - 41 lb ft)**.
 - Stage 2: **74 - 86 N·m (55 - 63 lb ft)**.
 - Stage 3: Use the angular torquing gauge tool **380001001** and turn the bolts an additional **85 - 95 °**.
3. Use a dial bore gauge **380000827** to check main bearing bore diameter. The values for four and six cylinder engines should be as follows:
 - No. 1,5 or 1,7 should be within **87.982 - 88.008 mm (3.464 - 3.465 in)**.
 - No. 2,3,4 or 2,3,4,5,6 should be within **87.977 - 88.013 mm (3.464 - 3.465 in)**.
4. Replace if a higher value is found.

Checking head supporting surface on cylinder unit

1. Use a straightedge (2) placed diagonally across the cylinder head dowel pins (3) and use a feeler gauge (1) to check across the cylinder block for distortion.

NOTE: The planar surface distortion should not exceed **0.075 mm (0.003 in)**. If the value is higher than the specified value, the cylinder block will need to be resurfaced.

2. Check the condition of the freeze plugs (4), replace them in case of uncertain seal or if rusted.



NHIL13ENG1388AA 1

Engine - Troubleshooting

Problem	Possible Cause	Correction
Engine will not start	An engine no start is defined as an engine that will crank but will not start. The most likely causes of this failure are issues related to the battery, fuel system or low engine compression.	<ol style="list-style-type: none"> 1. Faulty battery, voltage too low 2. Insufficient fuel level 3. Contaminated fuel (water or air) 4. Clogged fuel filter 5. Faulty fuel injectors 6. Faulty glow plugs (if equipped) 7. Faulty fuel lift pump (if equipped) 8. Faulty high pressure pump, (if equipped) 9. Faulty mechanical pump, (if equipped) 10. Low engine compression 11. Engine timing incorrect
The engine starts then stalls	This symptom is usually caused by fuel leakage or a clogged fuel filter.	Visually inspect the fuel system for external leakage. If leakage is found, repair as necessary. Check fuel system pressure for adequate pressure. If fuel pressure is lower than expected, repair as necessary.
Engine will not crank	An engine no-crank condition is defined as an engine that will not crank. Possible failures include a dead or weak battery, an open battery disconnect switch (if equipped) or a starting system failure.	<ol style="list-style-type: none"> 1. Check battery voltage. Charge or replace the battery as necessary. 2. Verify the status of the battery disconnect switch (if equipped). The switch must be closed. 3. Check the starting system for possible failures. Check the starter relay and battery voltage at the starter. Perform a voltage drop test between the battery and the engine starter to check the starter wiring. Repair as necessary.
The engine is difficult to start	The cause of an engine hard start condition is similar to those of an engine no start condition. Failures can include inadequate fuel pressure, air supply, engine compression, faulty glow plugs or incorrect injection timing during start up.	<ol style="list-style-type: none"> 1. Faulty battery, voltage too low. 2. Insufficient fuel level 3. Contaminated fuel (water or air) 4. Clogged fuel filter 5. Faulty fuel injectors 6. Faulty glow plugs (if equipped) 7. Faulty fuel lift pump (if equipped) 8. Faulty high pressure pump 9. Restricted air induction system 10. Low engine compression 11. Engine timing incorrect
Engine has a slow cranking condition	A slow engine crank condition can be caused by a weak battery, worn starter internal engine resistance. Extremely cold operating temperatures can also be a factor in a slow engine crank condition.	<ol style="list-style-type: none"> 1. Load test the battery. Charge or replace the battery as necessary. 2. Perform a voltage drop test on the starting circuit. There should be a drop less than 0.5 V on both the positive and negative circuits. If the drop is greater than 0.5 V, repair as necessary. 3. Bench test the starter. If the starter operates slower than expected, replace the starter.

Sample of manual. Download All 295 pages at:

<https://www.arepairmanual.com/downloads/cnh-nef-four-cylinder-mechanical-service-repair-manual/>