PowerTech™ 4.5L & 6.8L Diesel Engines Base Engine

COMPONENT TECHNICAL MANUAL
PowerTech™ 4.5L & 6.8L Diesel Engines— Base Engine

CTM104 17DEC09 (ENGLISH)

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For complete service information also see:

PowerTech™ Diesel Engines—Mechanical Fuel Systems	CTM207
PowerTech™ Diesel Engines—Level 4 Electronic Fuel Systems with Bosch VP44 Pump	CTM170
PowerTech™ Diesel Engines—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump	CTM331
PowerTech™ Diesel Engines—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump	CTM284
PowerTech™ Diesel Engines—Level 11 Electronic Fuel Systems with Denso HPCR	CTM220
PowerTech™ Diesel Engines and PowerTech™ Plus—Level 14 Electronic Fuel Systems with Denso HPCR	CTM320
PowerTech™ Diesel Engines and PowerTech™ Plus—Level 16 Electronic Fuel Systems with Denso HPCR	CTM502
Alternators and Starter Motors	CTM77
OEM Engine Accessories	CTM67 (English Only)
Application List	CTM106819 (English)

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Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 —UN—23AUG88

DX,AIR -19-17FEB99-1/1

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



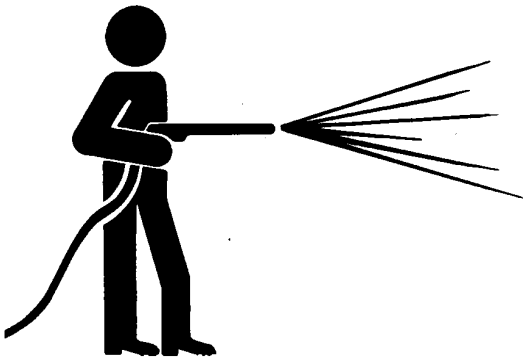
T81389 —UN—07DEC88

DX,ALERT -19-29SEP98-1/1

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



T6642EJ —UN—18OCT88

DX,CLEAN -19-04JUN90-1/1

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Engine Serial Number Plate Information

IMPORTANT: The engine serial number plate (A) can be easily destroyed. Before "hot tank" cleaning the block, remove the plate.

NOTE: Four-valve head engines have "16V" (for 16 valves total on 4-cylinder engine) or "24V" (for 24 valves total on 6-cylinder engine) printed on a plate located on the rocker arm cover.

Engine Serial Number (B)

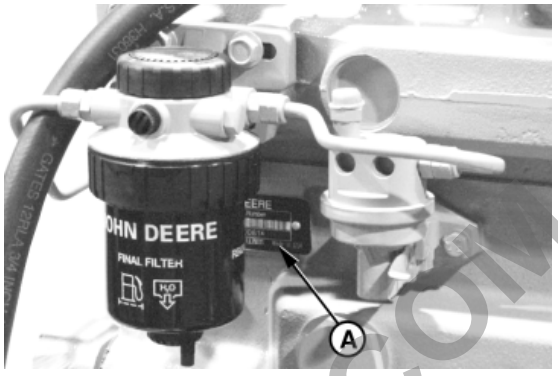
Each engine has a 13-digit John Deere engine serial number identifying the producing factory, engine model designation, and a 6-digit sequential number. The following is an example:

CD4045L123456

CD	**Engine Manufacturing Location**
CD	Saran, France
T0	Dubuque, Iowa
PE	Torreon, Mexico
J0	Rosario, Argentina
4	**Number of Cylinders**
045	**Displacement in Liters** (4.5 Liters)
L	**Aspiration Code** (Early Engines) or **Emission Tier Level** (Later Engines)
D	Naturally aspirated
T	Turbocharged, no aftercooling
A	Turbocharged and air-to-coolant aftercooled
H	Turbocharged and air-to-air aftercooled
S	Turbocharged and air-to sea water aftercooled
B	Non-certified engine
C,E or F.....	Tier 1/Stage I emission certified engine
G, J or K....	Tier 2/Stage II emission certified engine
L, M, N or P	Tier 3/Stage IIIA emission certified engine
123456.....	**6-digit unique sequence number**

Engine Model Designation (C)

The second line of information on the serial number plate identifies the engine/machine or OEM relationship. See Application manual, CTM106819.

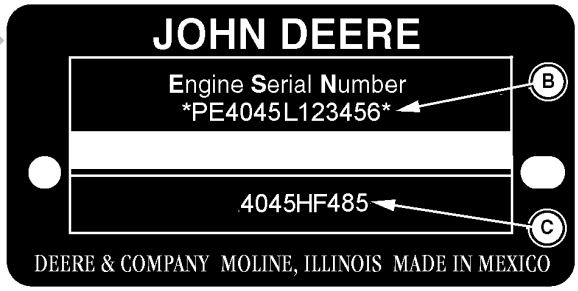


RG7778 —UN—11NOV97



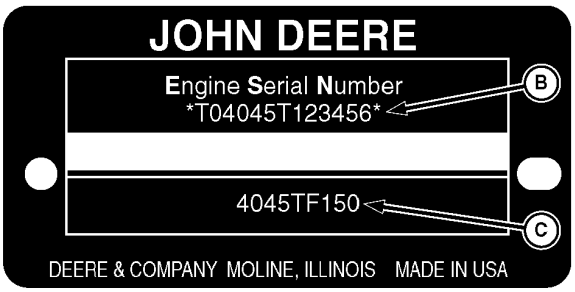
RG13806 —UN—23JAN06

Saran Serial Number Plate



RG13716 —UN—23JAN06

Torreon Serial Number Plate



RG9060A —UN—18MAY09

Dubuque Engine Serial Number Plate

A—Engine Serial Number Plate
B—Engine Serial Number
C—Engine Application Data
D—Empty, Coefficient of Absorption or Saran internal factory identification

Continued on next page

RG19661,0000005 -19-09DEC09-1/2

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Biodiesel Fuel

Biodiesel is a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. Biodiesel blends are biodiesel mixed with petroleum diesel fuel on a volume basis.

Biodiesel users in the U.S. are strongly encouraged to purchase biodiesel blends from a BQ-9000 Certified Marketer and sourced from a BQ-9000 Accredited Producer (as certified by the National Biodiesel Board). Certified Marketers and Accredited Producers can be found at the following website: http://www.bq-9000.org.

While 5% blends are preferred (B5), biodiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used in all John Deere engines. Biodiesel blends up to B20 can be used ONLY if the biodiesel (100% biodiesel or B100) meets ASTM D6751 (US), EN 14214 (EU), or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

John Deere approved fuel conditioners containing detergent/dispersant additives are recommended when using lower biodiesel blends, but are required when using blends of B20 or greater.

John Deere engines can also operate on biodiesel blends above B20 (up to 100% biodiesel) ONLY if the biodiesel meets the EN 14214 specification (primarily available in Europe). Engines operating on biodiesel blends above B20 may not fully comply with all applicable emissions regulations. Expect up to a 12% reduction in power and an 18% reduction in fuel economy when using 100% biodiesel. John Deere approved fuel conditioners containing detergent/dispersant additives are required.

The petroleum diesel portion of biodiesel blends must meet the requirements of ASTM D975 (US) or EN 590 (EU) commercial standards.

Biodiesel blends up to B20 must be used within 90 days of the date of biodiesel manufacture. Biodiesel blends from B21 to B100 must be used within 45 days of the date of biodiesel manufacture.

Request a certificate of analysis from your fuel distributor to ensure that the fuel is compliant with the above specifications.

Consult your John Deere dealer for approved biodiesel fuel conditioners to improve storage and performance with biodiesel fuels.

When using biodiesel fuel, the engine oil level must be checked daily. If oil becomes diluted with fuel, shorten oil change intervals. Refer to Diesel Engine Oil and Filter Service Intervals for more details regarding biodiesel and engine oil change intervals.

The following must be considered when using biodiesel blends up to B20:

- Cold weather flow degradation
- Stability and storage issues (moisture absorption, oxidation, microbial growth)
- Possible filter restriction and plugging (usually a problem when first switching to biodiesel on used engines.)
- Possible fuel leakage through seals and hoses
- Possible reduction of service life of engine components

The following must also be considered when using biodiesel blends above B20.

- Possible coking and/or blocked injector nozzles, resulting in power loss and engine misfire if John Deere approved fuel conditioners containing detergent/dispersant additives are not used
- Possible crankcase oil dilution, requiring more frequent oil changes
- Possible corrosion of fuel injection equipment
- Possible lacquering and/or seizure of internal components
- Possible formation of sludge and sediments
- Possible thermal oxidation of fuel at elevated temperatures
- Possible elastomer seal and gasket material degradation (primarily an issue with older engines)
- Possible compatibility issues with other materials (including copper, lead, zinc, tin, brass, and bronze) used in fuel systems and fuel handling equipment
- Possible reduction in water separator efficiency
- Potential high acid levels within fuel system
- Possible damage to paint if exposed to biodiesel

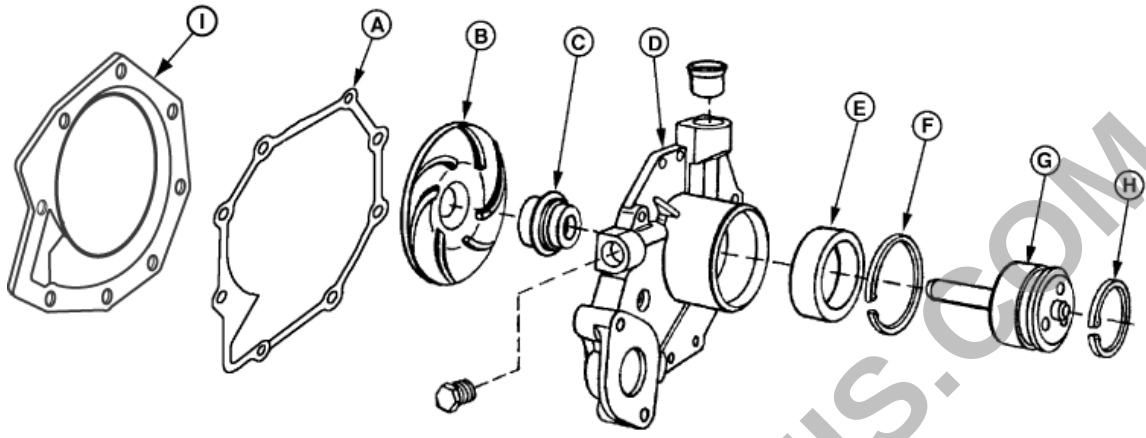
IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as fuel in any concentration in John Deere engines. Their use could cause engine failure.

DX,FUEL7 -19-04OCT07-1/1

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Coolant Pump Assembly



RG8114 —UN—16JUN05

Coolant Pump Assembly

A—Gasket
B—Impeller
C—Seal
D—Housing
E—Bearing
F—Internal Snap Ring
G—Shaft
H—External Snap Ring
I— Insert

RG,25,JW7557 -19-02OCT01-1/1

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Install Adapters on Engine Repair Stand

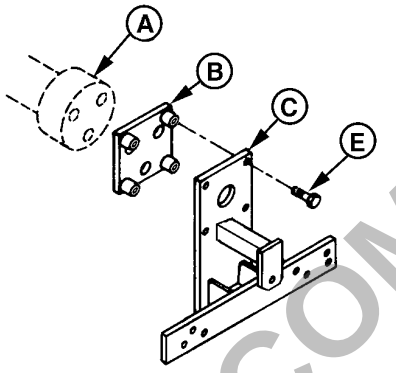
1. Attach the D05226ST Special Adapter (B) to mounting hub (A) of the engine repair stand, using SAE Grade 8 socket head cap screws (D), to the following specifications.

Specification
D05226ST Special Adapter-to-Mounting Hub SAE Grade 8 Socket Head Cap Screws. —Torque..... 600 N·m (450 lb-ft).

2. Attach the 62835 [1] Engine Adapter (C) to the special adapter, using four SAE Grade 8 caps screws (E), to the following specifications.

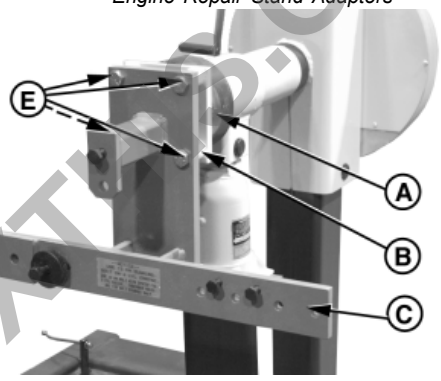
Specification
62835[1] Engine Adapter-to-Special Adapter SAE Grade 8 Cap Screws.—Torque..... 135 N·m (100 lb-ft).

A—Mounting Hub
B—D05226ST Special Adapter
C—62835 Engine Adapter
D—Socket Head Cap Screws
E—Cap Screws



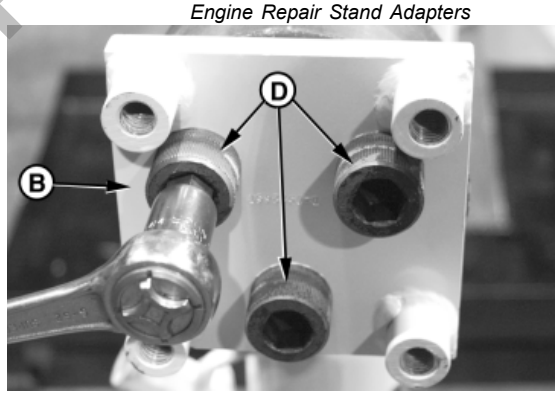
RG7783 —UN—11NOV97

Engine Repair Stand Adapters



RG7781 —UN—11NOV97

Engine Repair Stand Adapters



RG7938 —UN—13NOV97

Engine Repair Stand Adapters

[1]Part of JT07268 Engine Repair Stand Adapter Kit

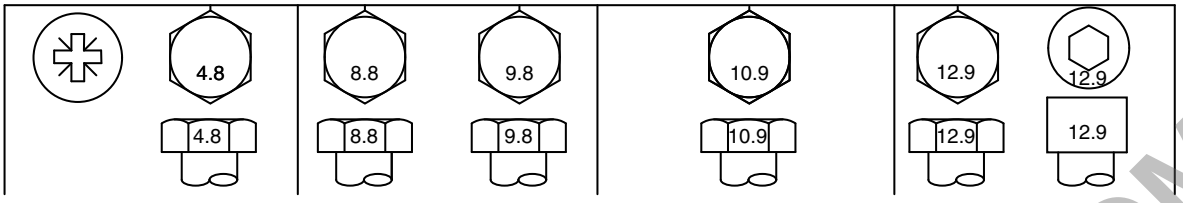
RG,01,DT7049 -19-07NOV03-1/1

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Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
Screw	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
Size	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.
[b] "Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.

DX,TORQ2 -19-08DEC09-1/1

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Turbocharger Failure Analysis

The following is a guide for diagnosing the cause of turbocharger failures after removal from the engine.

Problem	Possible Cause	Suggested Remedy
COMPRESSOR HOUSING INLET DEFECTS		
Foreign Object Damage	Objects left in intake system.	Disassemble and inspect intake system for foreign objects (this group).
		Inspect engine for internal damage.
	Leaking and/or defective intake system.	Inspect air intake system connections including air filter; repair as required (this group).
		Inspect air intake related engine components.
Compressor Wheel Rub	Bearing failure.	Determine if engine and/or operator contributed to lack of lubrication, contaminated lubrication, excessive temperature, or debris generating engine failure in progress. Correct as required.
	Manufacturing defects.	Correct as required (this group).
COMPRESSOR HOUSING OUTLET DEFECTS		
Oil and/or Dirt in Housing	Restricted air intake system.	Inspect and clean air cleaner.
	Prolonged periods of low rpm engine idling.	Check with operator to confirm conditions. (See Operator's Manual.)
	Defective oil seal ring.	Repair as required (this group).
	Restricted oil drain line.	Inspect and clear oil drain line as required.
TURBINE HOUSING INLET DEFECTS		
Oil in Housing	Internal engine failure.	Inspect and repair engine as required.
	Oil leaking from compressor housing seal.	Verify that oil is in compressor housing and refer to "Compressor Housing Outlet Defects" as listed earlier in this chart.
Center Wall Deteriorated	Excessive operating temperature.	Check for restricted air intake.
		Check engine for overfueling.
		Check injection pump timing.
TURBINE HOUSING OUTLET DEFECTS		
Turbine Wheel Rub	Bearing failure.	Determine if engine and/or operator contributed to lack of lubrication, contaminated lubrication, excessive temperature, or debris generating engine failure in progress. Correct as required.
	Manufacturing defect.	Correct as required (this group).
Foreign Object Damage	Internal engine failure.	Inspect and repair engine as required.
	Objects left in intake system.	Disassemble and inspect air intake system (this group).
	Leaking air intake system.	Correct as required (this group).
Oil and/or Excessive Carbon	Internal engine failure.	Verified by oil in turbine housing. Correct as required.
	Turbine seal failure.	Inspect for excessive heat from overfueling and/or restricted air intake.

Continued on next page

RG,RG34710,1258 -19-23OCT97-1/2

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General OEM Engine Specifications

Tier 1 Engines

ITEM	ENGINE								
	4045DF150	4045TF150	4045TF250	4045HF150	6068DF150	6068TF150	6068TF250	6068HF150	6068HF250
Number of Cylinders	4	4	4	4	6	6	6	6	6
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)
Compression	17.6:1	17.0:1	17.0:1	17.0:1	17.6:1	17.0:1	17.0:1	17.0:1	17.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Governor Regulation (Industrial)	7—10 %	7—10 %	7—10 %	7—10 %	7—10 %	7—10 %	7—10 %	7—10 %	7—10 %
Governor Regulation (Generator)	3—5 %	3—5 %	3—5 %	3—5 %	3—5 %	3—5 %	3—5 %	3—5 %	3—5 %
Oil Pressure Rated Speed	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)
Oil Pressure Low Idle	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	1117 mm (44.0 in.)	1117 mm (44.0 in.)	1117 mm (44.0 in.)	1116 mm (43.9 in.)	1141 mm (44.9 in.)
Width	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	623 mm (24.5 in.)	623 mm (24.5 in.)
Height	854 mm (33.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	956 mm (37.6 in.)	984 mm (38.7 in.)	984 mm (38.7 in.)	1009 mm (39.7 in.)	1009 mm (39.7 in.)
Weight	387 kg (851 lb)	396 kg (872 lb)	396 kg (872 lb)	396 kg (872 lb)	522 kg (1149 lb)	533 kg (1172 lb)	533 kg (1172 lb)	550 kg (1210 lb)	568 kg (1250 lb)

Tier 2 Engines (2-Valve Head Design - Non-HPCR)

ITEM	Engine			
	4045TF275	4045HF275	6068TF275	6068HF275
Number of Cylinders	4	4	6	6
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	4.5 L (276 cu in.)	4.5 L (276 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)
Compression Ratio	17.0:1	17.0:1	17.0:1	17.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Governor Regulation (Industrial)	7—10 %	7—10 %	7—10 %	7—10 %
Governor Regulation (Generator)	3—5 %	3—5%	3—5%	3—5 %
Oil Pressure At Rated Speed, Full Load (minimum)	275 kPa (40 psi)	275 kPa (40 psi)	275 kPa (40 psi)	275 kPa (40 psi)
Oil Pressure At Low Idle (Minimum)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	860 mm (33.9 in.)	860 mm (33.9 in.)	1119 mm (43.9 in.)	1123 mm (44.2 in.)
Width	612 mm (24.1 in.)	612 mm (24.1 in.)	623 mm (24.5 in.)	623 mm (24.5 in.)
Height	994 mm (39.1 in.)	994 mm (39.1 in.)	1012 mm (39.9 in.)	1015 mm (40.0 in.)
Weight	451 kg (993 lb)	451 kg (993 lb)	587 kg (1290 lb)	587 kg (1290 lb)

Tier 2 Engines (4-Valve Head Design)

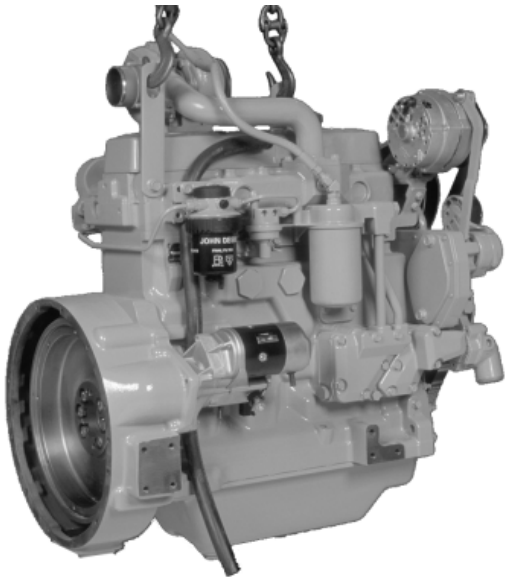
ITEM	Engine	
	4045HF475	6068HF475
Number of Cylinders	4	6

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DPSG,OUO1004,102 -19-25SEP07-1/3

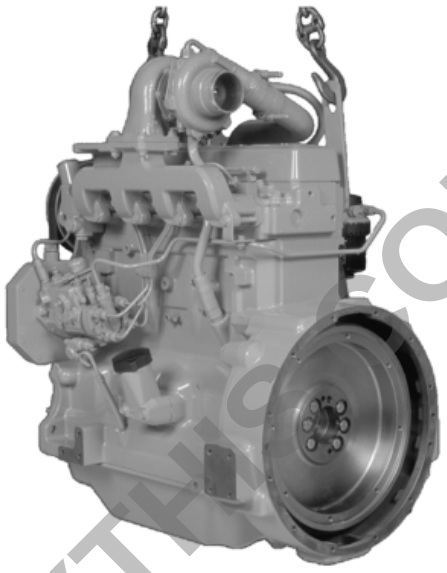
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PowerTech™ 4.5L Engine—Tier 1/Stage I



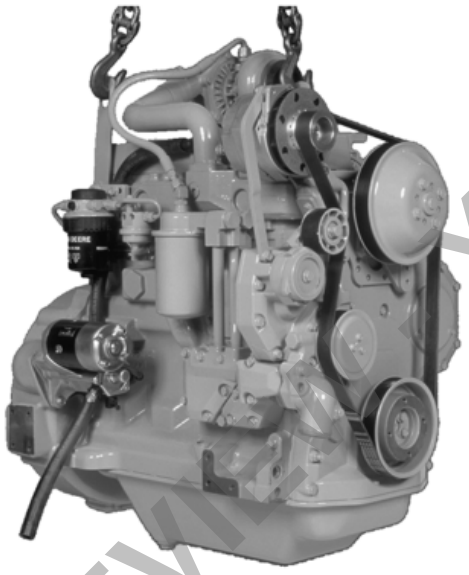
RG7636 —UN—23NOV97

3/4 Right Rear View



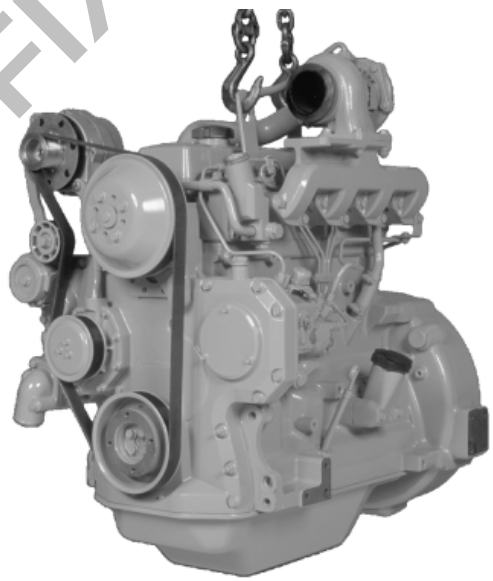
RG7638 —UN—23NOV97

3/4 Left Rear View



RG7639 —UN—23NOV97

3/4 Right Front View



RG7637 —UN—23NOV97

3/4 Left Front View

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DPSG,OUO1004,129 -19-03DEC07-1/1

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Grease

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

John Deere SD POLYUREA GREASE is preferred.

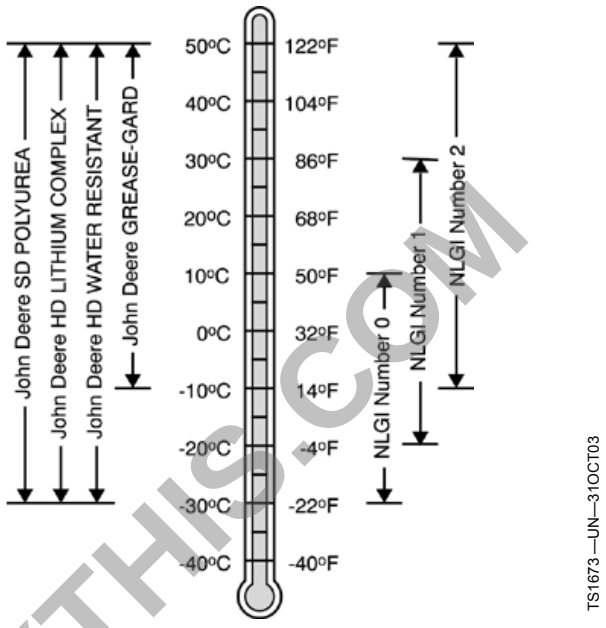
The following greases are also recommended

- John Deere HD LITHIUM COMPLEX GREASE
- John Deere HD WATER RESISTANT GREASE
- John Deere GREASE-GARD™

Other greases may be used if they meet the following:

NLGI Performance Classification GC-LB

IMPORTANT: Some types of grease thickeners are not compatible with others. Consult your grease supplier before mixing different types of grease.



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DX,GREA1 -19-07NOV03-1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

Avoid mixing different brands or types of oils. Oil manufacturers blend base stock and additives to create their oils and to meet certain specifications and performance requirements. Mixing different oils can interfere with proper functioning of these formulations and degrade lubricant performance.

Consult your authorized John Deere dealer to obtain specific information and recommendations.

DX,ALTER -19-11NOV09-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

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Preliminary Cylinder Head and Valve Checks

Make preliminary inspection of cylinder head and valve assembly during disassembly.

Look for the following conditions:

Sticking Valves:

- Carbon deposits on valve stem.
- Worn valve guides.
- Scored valve stems.
- Warped valve stems.
- Misaligned or broken valve springs.
- Worn or distorted valve seats.
- Insufficient lubrication.

Warped, Worn, or Distorted Valve Guides:

- Lack of lubrication.
- Cylinder head distortion.
- Excessive heat.
- Unevenly tightened cylinder head cap screws.

Distorted Cylinder Head and Gasket Leakage:

- Loss of cylinder head cap screw torque.
- Broken cylinder head cap screw(s).
- Overheating from low coolant level operation.
- Insufficient liner standout.
- Coolant leakage into cylinder causing hydraulic failure of gasket.
- Leaking aftercooler.
- Cracked cylinder head.
- Cracked cylinder liner.
- Damaged or incorrect gasket.
- Overpowering or overfueling.
- Damaged cylinder head or block surfaces.
- Improper surface finish on cylinder head.
- Improperly tightened cylinder head cap screws.
- Faulty gasket installation (misaligned).

Worn or Broken Valve Seats:

- Misaligned valves.
- Distorted cylinder head.
- Carbon deposits on seats due to incomplete combustion.
- Valve spring tension too weak.
- Excessive heat.
- Improper valve clearance.
- Improper valve timing.
- Incorrect valve or seat installed.

Burned, Pitted, Worn, or Broken Valves:

- Worn or distorted valve seats.
- Loose valve seats.
- Worn valve guides.
- Insufficient cooling.
- Cocked or broken valve springs.
- Improper engine operation.
- Improper valve train timing.
- Faulty valve rotators.
- Warped or distorted valve stems.
- “Stretched” valves due to excessive spring tension.
- Warped cylinder head.
- Bent push rods.
- Carbon build-up on valve seats.
- Rocker arm failure.
- Incorrect valve or seat installed.
- Incorrect piston-to-valve clearance.

Improper Valve Clearance:

- Inefficient use of fuel.
- Engine starts harder.
- Maximum engine power will not be achieved.
- Shorter service life of valve train.
- Greater chance for engine to overheat.

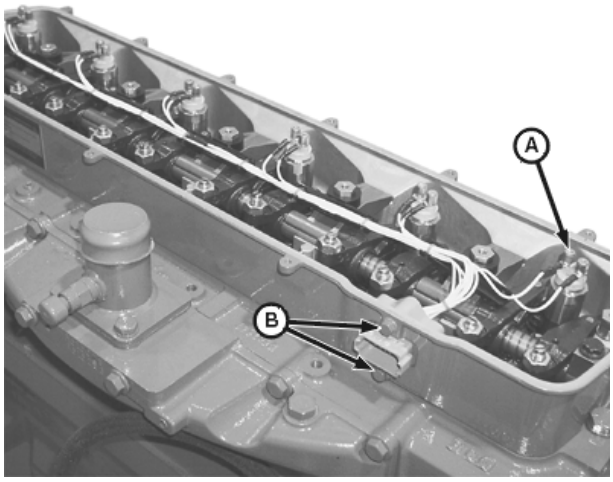
Excessive Recession:

- Worn valve guides.
- Bent valves.
- Debris passed through valve train.

RG,05,DT7367 -19-11NOV97-1/1

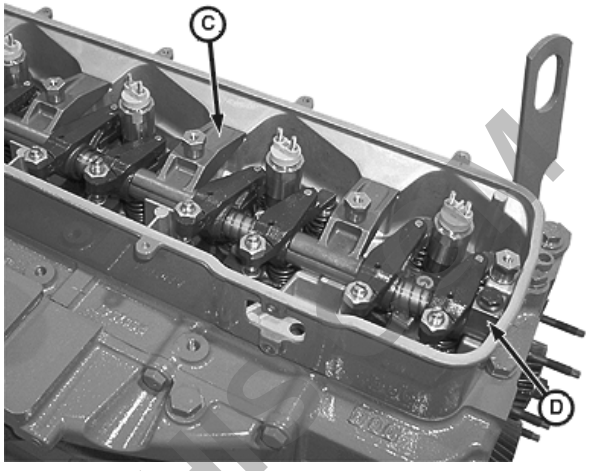
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RG12178 —UN—03JUL02

Remove Fuel Injection Nozzles Harness



RG12360 —UN—03JUL02

Rocker Arm Shaft Removal

22. Remove two cap screws (B) and nut (A) on all fuel injectors. Remove fuel injection nozzle harness.

NOTE: For procedure to remove fuel injectors and electrical harness, refer to appropriate manual as listed below:

- *CTM220 — Level 11 Electronic Fuel System (HPCR/4-Valve Head)*
- *CTM320 — Level 14 Electronic Fuel System (HPCR/4-Valve Head)*

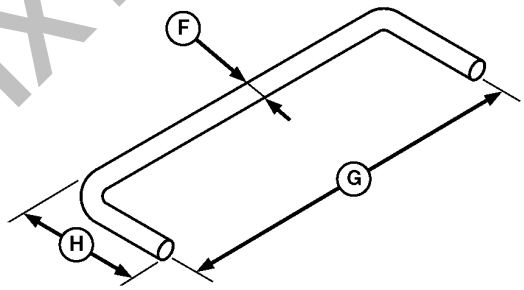
Remove fuel injectors.

NOTE: Loosen all rocker arm adjusting screws prior to removing assembly.

To aid in rocker arm shaft assembly removal, use rocker arm holders (E) as shown.

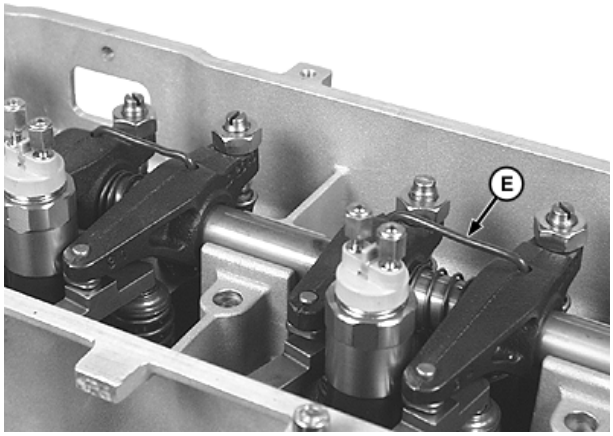
23. Remove both end clamps (D), clamps (C) and rocker arm shaft assembly.

A—Injector stud nut
B—Injector electrical harness cap screw
C—Rocker arm shaft clamp
D—Rocker arm shaft end clamp
E—Rocker arm holder
F—Diameter 3 mm (0.12 in.)
G—Width 50 mm (1.97 in.)
H—Length 15 mm (0.59 in.)



RG12445 —UN—03DEC03

Rocker Arm Holder



RG12446 —UN—03DEC03

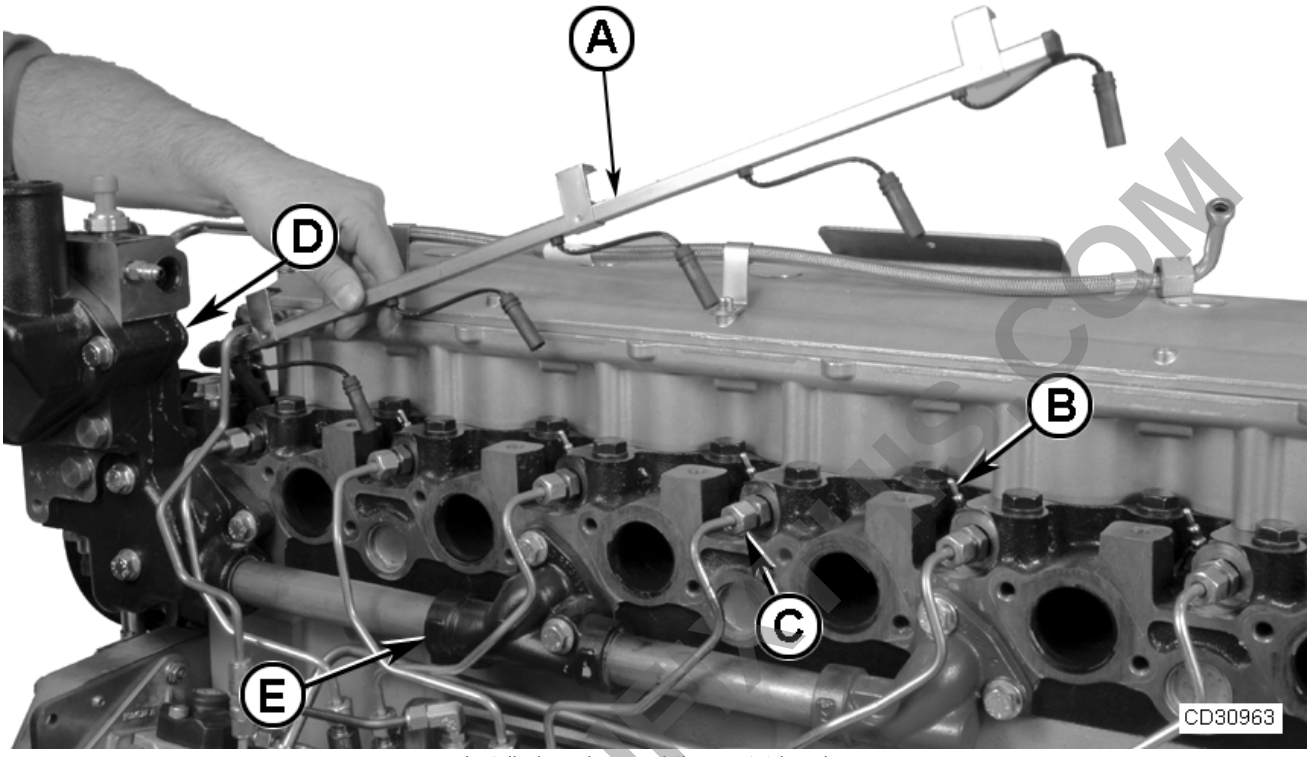
Rocker Arm Holder Installation

Continued on next page

CD03523,000019F -19-27AUG07-9/14

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Install glow plugs and thermostat housing

A—Glow plug harness rail
B—Glow plug (one per cylinder)
C—High pressure fuel line
D—Thermostat housing
E—Coolant manifold

7. Install thermostat housing (D), coolant manifold (E) and side port. (See REMOVE AND INSTALL COOLANT MANIFOLD, THERMOSTATS AND SIDE PORT (FOUR-VALVE HEAD) in Group 070.)
8. Install glow plug harness rail (A). Tighten cap screw to specification.

Specification	
Glow Plug Harness Rail Screws—Torque	10 N•m (90 lb-in.)

Continued on next page

CD03523,00001A5 -19-05SEP07-3/7

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Install Piston Rings

IMPORTANT: Piston rings can be damaged if expanded too far. Expand piston rings only as far as necessary to install rings on piston.

1. When installing new piston rings, use JDE85, JDE135, or KJD10140 Piston Ring Expander. Install oil ring expander in bottom ring groove. Position end gap toward either side of piston pin.
2. Install oil control ring (C) in bottom ring groove over ring expander. Install with end gap on opposite side of piston from ring expander gap.

NOTE: Identify ring top as follows:

If ring has no marks, it can be installed with either side facing top.

If rings are marked with depression ("pip"), mark should be on top as shown (A). Ring with two depression marks goes in the second groove.

If ring is marked with paint strip, hold ring with gap facing you and turn ring so that paint strip is to the left side of gap.

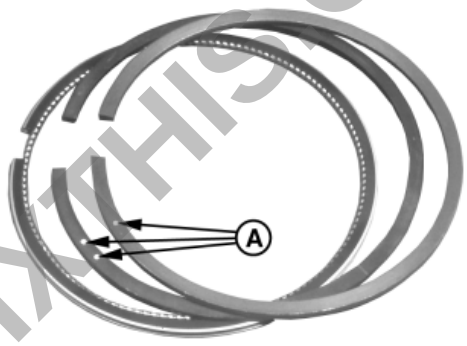
3. Identify top side of compression rings. Top side of rectangular and keystone compression rings will be identified by marks on the top side of two rings.
4. Install rectangular compression ring (B) in center ring groove with top of ring toward top of piston.
5. Position gap in rectangular compression ring on opposite side of piston from oil control ring (C) gap.
6. Install keystone compression ring (D) in top ring groove with top of ring toward top of piston.
7. Position gap in keystone compression ring on opposite side of piston from rectangular compression ring gap.

A—Depression Marks
B—Rectangular Compression Ring
C—Oil Control Ring
D—Keystone Compression Ring



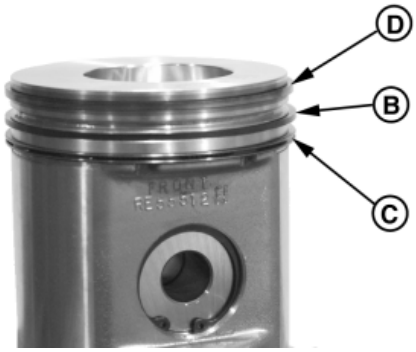
Piston Ring Expander Tool

RG7499 —UN—04NOV97



Compression Rings

RG7797 —UN—11NOV97



Piston Ring Locations

RG7500 —UN—04NOV97

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RG,10,DT7388 -19-11NOV97-1/2

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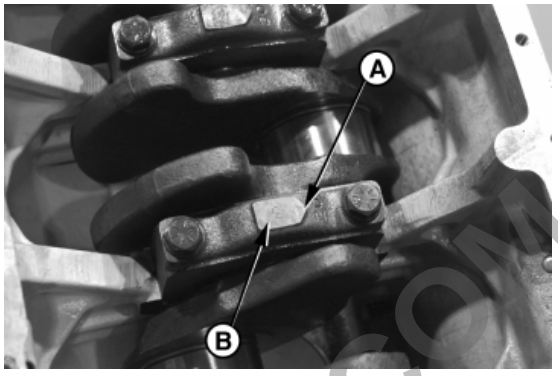
Remove Crankshaft Main Bearings

1. Drain oil from engine crankcase and remove oil pan.
2. Remove timing gear cover. (See REMOVE TIMING GEAR COVER in Group 050.)
3. Remove cylinder block front plate. (See REMOVE CYLINDER BLOCK FRONT PLATE in Group 050.)
4. Remove flywheel housing. (See REMOVE FLYWHEEL HOUSING in this group.)
5. Remove connecting rods from crankshaft. (See REMOVE PISTONS AND CONNECTING RODS in Group 030.)

IMPORTANT: Before removing main bearing caps, check for proper torque on all main bearings.

NOTE: When crankshaft is to be removed, leave front and rear main bearing caps installed until all connecting rod caps have been removed.

6. Check main bearing caps for arrows (A) cast in main bearing cap, and numbers (B) stamped on cap and oil pan rail. Arrow points toward camshaft side of engine.



RG7525A —UN—05NOV97

Crankshaft Main Bearing Caps

A—Cast Arrows **B—Stamped Numbers**

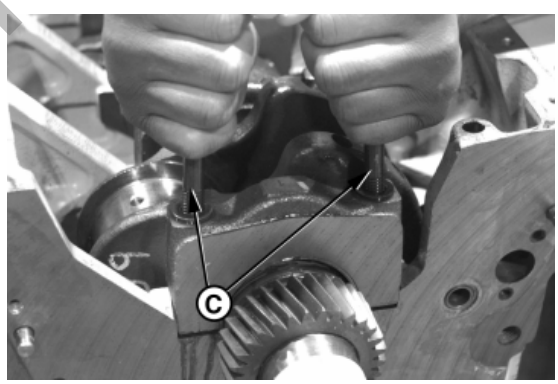
If there are no numbers, stamp corresponding numbers on cap and oil pan rail to ensure correct placement of bearing caps during reassembly.

RG,15,DT7444 -19-14NOV97-1/2

7. Remove main bearing caps by extending cap screws (C) and forcing heads of screws together. Wiggle bearing cap back and forth while applying an upward force with cap screws until free from main bearing cap support.

IMPORTANT: Keep matched bearings with their respective main bearing cap for comparison with crankshaft journal (surface wear) from which removed.

8. Visually inspect condition of bearing inserts and crankshaft main journals as bearing caps are removed.



RG7526 —UN—05NOV97

Crankshaft Main Bearing Cap Screws

C—Cap Screws

RG,15,DT7444 -19-14NOV97-2/2

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Install Idler Gear Bushings

NOTE: Upper idler gear bushing for "wide" 30 mm (1.18 in.) gear and four-valve or HPCR/2-valve head engine upper idler gear, is not replaceable. If bushing is worn, replace gear assembly.

IMPORTANT: Bushing failure will result if upper and lower bushings are interchanged. Lower idler gear bushings are splash lubricated and have a spiral oil groove; upper idler gear bushings are pressure lubricated and DO NOT have oil grooves.

1. Coat ID and OD of idler gear bushing and ID of gear with TY6333 High-Temperature Grease.
2. Install bushing into upper "narrow" 22 mm (0.087 in.) idler gear using JD252 (JD-252)[1] Driver [2] and JDG537 (OTC815) Handle.
3. Install bushing into lower idler gear using discs and driver from D01045AA Master Driver Set.



RG7577 —UN—23NOV97

Upper Idler Gear



RG7578 —UN—23NOV97

Lower Idler Gear

[1]Order JD-252 when tool is ordered from European Parts Distribution Center (EPDC)
[2] Discs from D01045AA Master Driver Set can be used if JD252 (JD-252) Driver is not available.

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Install Dipstick Tube

1. Coat end of new dipstick tube with LOCTITE ® 609 Retaining Compound.

NOTE: On 5524 and 5525 Series Tractors, orient the dipstick tube toward the front of engine.

6010 and 6020 Series Tractors use a straight dipstick tube.

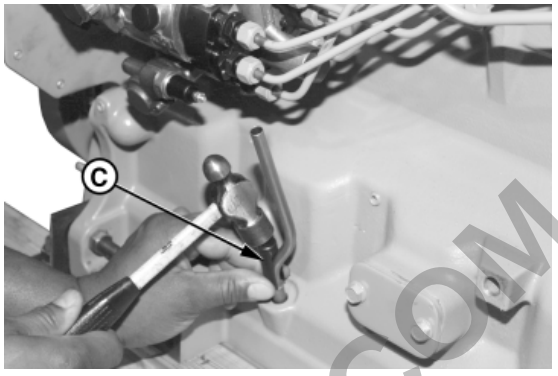
On 7810 Tractors, orient the dipstick tube with the top bend directed toward the front of the engine and the centerline plane of the top bend angled 45 degrees outward from the crankshaft vertical plane.

2. Orient right-hand dipstick tube with first bend directed toward rear of engine and centerline plane of first bend angled 20 degrees toward the crankshaft centerline.

   Orient left-hand dipstick tube with first bend directed toward rear of engine and centerline plane of first bend parallel with the crankshaft centerline.

NOTE: JDG965 Dipstick Driver cannot be used for straight dipstick tube used on 6010 and 6020 Series Tractors. Use Engine Oil Dipstick Tube Driver (dealer fabricated tool) on these tractors. Refer to Section 05, Group 190, Dealer Fabricated Tools.

3. Using JDG965 Dipstick Driver (C), install dipstick tube until shoulder bottoms.



RG7981 —UN—14NOV97

Dipstick Tube Installation Tool

C—Dipstick Driver

4. Install dipstick.

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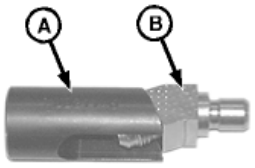
RG,20,DT7527 -19-04JUN09-2/2

Remove and Install Dipstick Tube with Fitting

1. Unscrew dipstick tube from fitting and remove.
2. Remove fitting from block.
3. Coat smooth end of dipstick fitting with LOCTITE® 271 Thread Lock and Sealer (High Strength).
4. Position fitting (B) in JDG1146 Dipstick Fitting Installer (A) as shown.

   Orient fitting with threaded end pointing out and straight up from block.

   Drive fitting flush with block.
5. Install dipstick tube on fitting.



RG9115 —UN—02APR98

Left-Hand Dipstick Tube Fitting

A—JDG1146 Dipstick Fitting Installer Tool

B—Dipstick Fitting (Angled Design)

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Remove and Install Fan Drive Assembly (2254 Combine)

1. Remove parts (A—E) and (H—N) as required.
2. Inspect and replace parts as necessary.
3. Press bearing shaft (A) into fan bracket (B) until bearing face is flush with bracket end face.
4. Place fan bracket under a press so that the thrust, when pressing on pulley, is received only by the bearing shaft end (F). Press pulley until distance (G) is obtained.

Specification

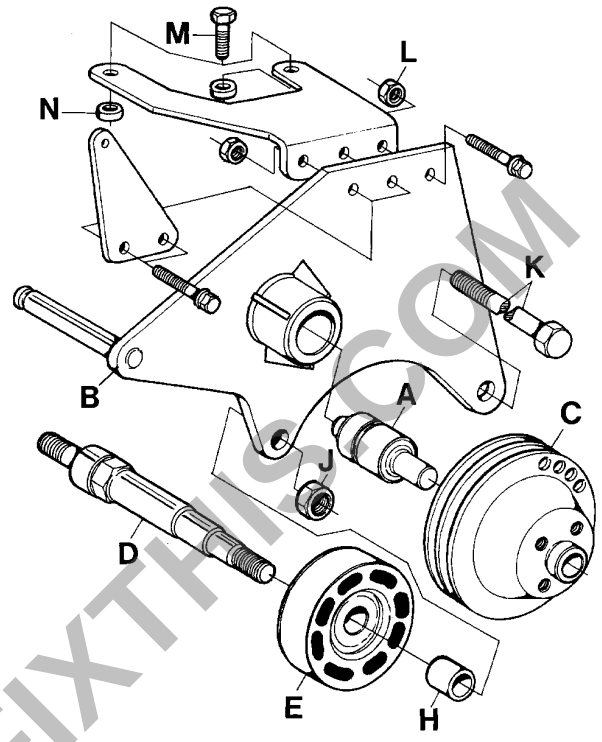
Rear Housing Face-to-Hub Front Face—Distance ..... 123.5 mm (4.862 in.)

5. Install fan bracket on engine and tighten hardware to specifications.

Fan Drive Assembly (2254 Combine)—Specification

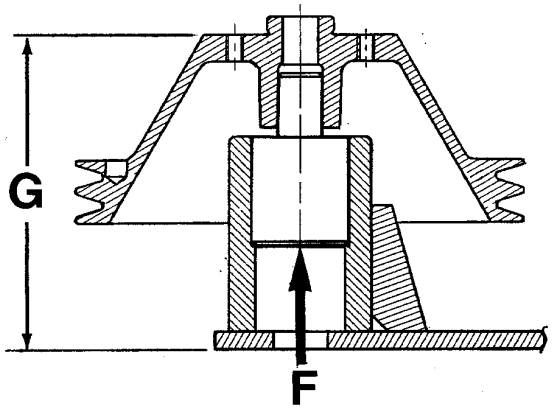
Fan Idler Axle Shaft-to-Block (D)—Torque ..... 340 N·m (251 lb-ft)
Fan Idler-to-Shaft Retaining Nut (J)—Torque ..... 225 N·m (166 lb-ft)
Fan Drive Bracket-to-Block Cap Screw (K)—Torque ..... 340 N·m (251 lb-ft)
Fan Drive Bracket-to-Cylinder Head Cap Screws (M)—Torque ..... 140 N·m (103 lb-ft)
Upper Fan Drive Bracket-to-Lower Bracket Cap Screws/Nuts (L)—Torque ..... 140 N·m (103 lb-ft)

A—Bearing Shaft
B—Fan Bracket
C—Pulley
D—Idler Axle Shaft
E—Idler
F—Bearing Shaft End
G—Distance for Pulley Installation
H—Spacer
J—Nut
K—Screw
L—Nut
M—Cap Screw
N—Spacer



CD30795 —UN—15NOV99

Fan Drive Assembly



CD30722 —UN—22FEB99

Pulley-to-Bracket Distance

DPSG,OUO1004,2508 -19-05JAN00-1/1

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Remove and Install Starting Aid (If Equipped)

1. Disconnect starting aid tube (1).

NOTE: When removing nozzle, note the location of red dot (2) when removing.

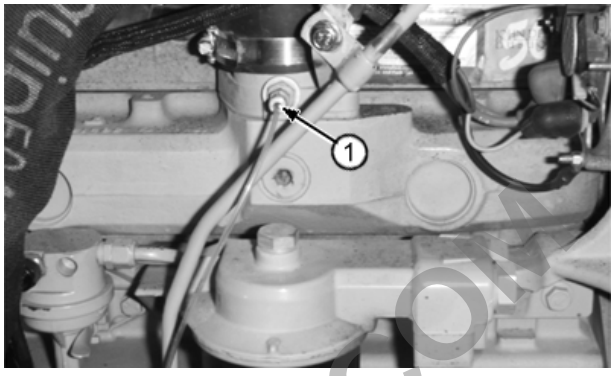
2. Remove nozzle holder from air inlet.
3. Clean or replace nozzle holder as required.
4. If removed, install adapter into air inlet tube and torque to specifications.

Specification	
Adapter-to-Air Inlet Tube—Torque	50 N·m (37 lb-ft)

NOTE: Red dot (2) on nozzle holder must be installed at the 12 o'clock position, facing the incoming air flow. Nozzle orifice (3) needs to be in the path of the air flow to disperse fluid for quick start of engine.

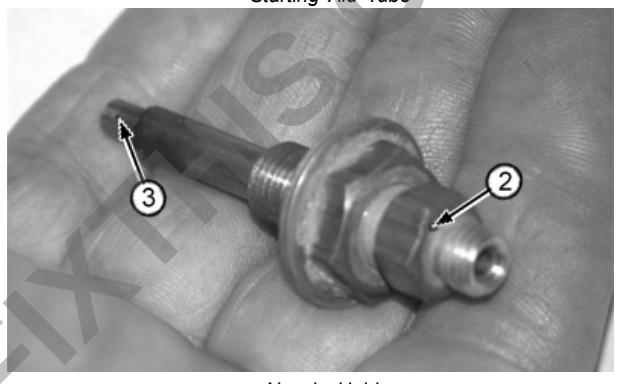
5. Install nozzle and connect starting aid tube.

1— Starting Aid Tube
2— Red Dot for Nozzle Installation
3— Orifice



T117494B —UN—01OCT98

Starting Aid Tube



T117496B —UN—13OCT98

Nozzle Holder

DPSG,OUO1004,995 -19-17OCT01-1/1

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Inspect Thermostat and Test Opening Temperature

Visually inspect thermostat for corrosion or damage. Replace as necessary.

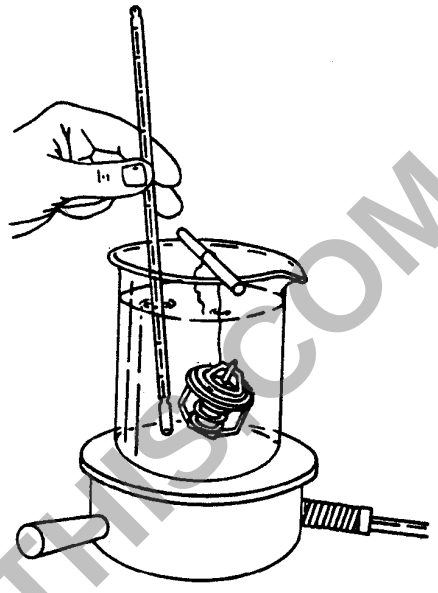
Test thermostat as follows:

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

1. Remove thermostats. (See procedure in Section 02, Group 070.)
2. Suspend thermostat and a thermometer in a container of water.
3. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with specification given in chart below.

NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.

THERMOSTAT TEST SPECIFICATIONS		
Rating	**Initial Opening (Range)**	**Full Open (Nominal)**
71°C (160°F)	69—72°C (156—162°F)	84°C (182°F)
77°C (170°F)	74—78°C (166—172°F)	89°C (192°F)
82°C (180°F)	80—84°C (175—182°F)	94°C (202°F)
89°C (192°F)	86—90°C (187—194°F)	101°C (214°F)
90°C (195°F)	89—93°C (192—199°F)	103°C (218°F)
92°C (197°F)	89—93°C (193—200°F)	105°C (221°F)
96°C (205°F)	94—97°C (201—207°F)	100°C (213°F)
99°C (210°F)	96—100°C (205—212°F)	111°C (232°F)



RG5971 —UN—23NOV97

Test Thermostat Opening Temperature

4. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.
5. If any thermostat is defective on a multiple thermostat engine, replace all thermostats.

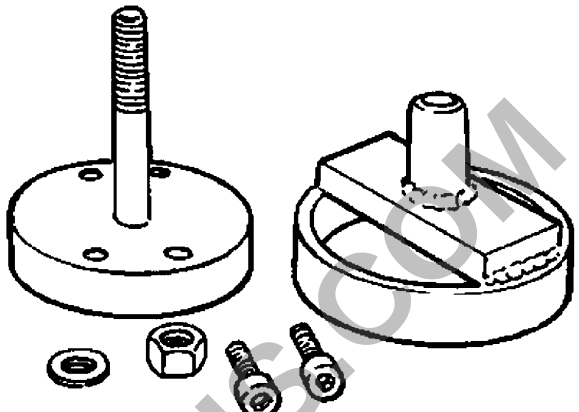
RG,105,JW7648 -19-21NOV97-1/1

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Rear Oil Seal/Wear Sleeve Installer Set..... JDG476

Install unitized teflon crankshaft rear oil seal/wear sleeve assembly.



RG12448 —19—05JAN07

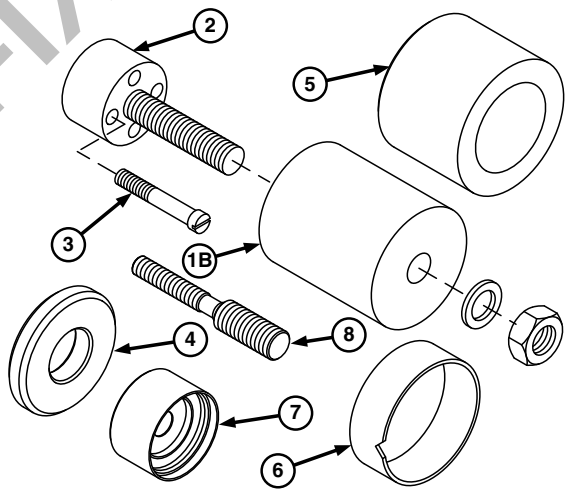
JDG476

DPSG,OUO1004,2715 -19-28SEP07-16/19

Crankshaft Gear and Front Oil Seal Installer..... JDG954B

Used to install the crankshaft gear either prior to, or after installing crankshaft into engine. Also used to install front oil seal with timing gear cover installed on engine and used to install timing wheel on crankshaft.

JDG954-1B—Installer
JDG954-2—Adapter
JDG954-3—Special Cap Screw (4 used)
JDG954-4—Spacer
JDG954-5—Installer
JDG954-6—Guide Sleeve
JDG954-7—Taper Crank Adapter
JDG954-8—Forcing Screw



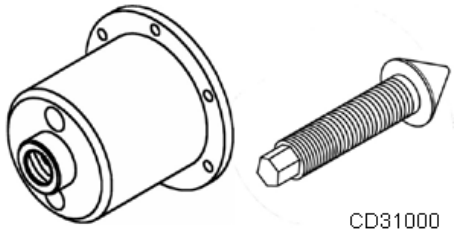
RG12034 —UN—04DEC03

JDG954B

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Front Seal Removal Tool (Limited Access)..... JDG1923

Used to remove front seal when access to front cover is limited.



CD31000 —UN—28SEP07

JDG1923

Continued on next page

DPSG,OUO1004,2715 -19-28SEP07-18/19

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Item	Measurement	Specification
Cylinder Head Cap Screws		
Step 1—Initial	Torque	100 N·m (75 lb-ft)
Step 2—Second	Torque	150 N·m (110 lb-ft)
Step 3—Verify (After 5 Minutes)	Torque	150 N·m (110 lb-ft)
Step 4—Final	Torque-Turn	Tighten each screw an additional 60° ± 10°. (See TORQUE-TURN METHOD FOR PROPER TORQUE in this group.)
Glow Plug	Torque	15 N•m (133 lb-in.)
Rocker Arm Carrier Screws	Torque	60 N•m (44 lb-ft)
Rocker Arm Shaft End Clamps	Torque	30 N•m (22 lb-ft)
Rocker Arm Shaft Clamps	Torque	60 N·m (44 lb-ft)
Rocker Arm Cover Cap Screws	Torque	11 N•m (97 lb-in.)
Glow Plug Harness Rail Screws	Torque	11 N•m (97 lb-in.)
Heat Shield-to-Cylinder Head Screws	Torque	60 N•m (44 lb-ft)
Heat Shield-to-Rocker Arm Cover Screws	Torque	10 N•m (88 lb-in.)

Exhaust Valve Seat Insert Bore Specifications:

A	36.436—36.462 mm (1.4344—1.4355 in.)
B	2.34 mm (0.092 in.) Reference
C	8.715—8.785 mm (0.3431—0.3458 in.)
D	38—42°
E	Maximum Radius 0.5 mm (0.019 in.)
Maximum surface finish of bore "A"	3.2 micrometers (125 micro-in.)

Intake Valve Seat Insert Bore Specifications:

A	37.436—37.462 mm (1.4738—1.4748 in.)
B	2.8 mm (0.110 in.) Reference
C	9.215—9.285 mm (0.3627—0.3655 in.)
D	38—42°
E	Maximum Radius 0.5 mm (0.019 in.)
Maximum surface finish of bore "A"	3.2 micrometers (125 micro-in.) Inspection Reference

Replacement Valve Seat Insert OD:

Intake	37.487—37.513 mm (1.476—1.477 in.)
Exhaust	36.487—36.513 mm (1.436—1.437 in.)

[1]*Free length may vary slightly between valve springs.*

OUO1089,000023E -19-25SEP07-3/3

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Intake Manifold Pressure (Turbocharger Boost) Specifications

NOTE: This test of turbocharger boost is a good indicator of whether a turbocharged engine is performing at its full rated power. For test procedure, see MEASURE INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST/POWER CHECK) in Group 150.

Engine power ratings specify flywheel power for a bare engine without the drag effect of a cooling fan or other accessories like an air compressor.

Power ratings for agricultural tractors also list observed PTO power, at rated speed, under full load.

Altitude, fuel temperature, air temperature, and humidity may affect engine performance. See EFFECTS OF ALTITUDE AND TEMPERATURE ON ENGINE PERFORMANCE later in this group.

For CONSTRUCTION AND FORRESTRY and OEM SPECIFICATIONS, see INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST) SPECIFICATIONS (CONTINUED) in this group.

Some specifications were not available at time of printing.

TURBO BOOST PRESSURES (JOHN DEERE AGRICULTURAL EQUIPMENT)

Machine Model	Engine Model	Rated Power at Full Load Rated Speed kW (hp)	Full Load Rated Speed rpm	Turbo Boost Pressure at Full Load Rated Speed kPa (bar) (psi)
Cane Harvesting Equipment				
100 Loader/ Harvester (Kanaf)	PE6068TT850	138 (185) Eng.	2400	110—134 kPa (1.1—1.3 bar) (16—19 psi)
110 Cane Tractor	PE4045TT851	73 (98) Eng.	2200	66—80 kPa (0.7—0.8 bar) (10—12 psi)
220 Tractor	PE6068TT851	138 (185) Eng.	2400	110—134 kPa (1.1—1.3 bar) (16—19 psi)
220 4WD Tractor/Pineapple Harvester/Sprayer	PE6068TT850	138 (185) Eng.	2400	110—134 kPa (1.1—1.3 bar) (16—19 psi)
404 Vegetable Sprayer	T04045TT850	79 (106) Eng.	2200	72—88 kPa (0.7—0.9 bar) (10—13 psi)
	T04045TT801	79 (106) Eng.	2200	72—88 kPa (0.7—0.9 bar) (10—13 psi)
	T04045TT801	79 (106) Eng.	2200	72—88 kPa (0.7—0.9 bar) (10—13 psi)
884 Cane Loader	CD4045TBE50	66(89)	2200	56—68 kPa (0.6—0.7 bar) 8—10 psi
904 Haul Tractor	CD4045TBE51	66 (89)	2200	56—68 kPa (0.6—0.7 bar) 8—10 psi
1266 Haul Tractor	CD6068TBE50	94 (126)	2200	52—64 kPa (0.5—0.6 bar) 8—9 psi
1866 Haul Tractor	CD6068TBE51	138 (185)	2400	110—134 kPa (1.1—1.2 bar) 16—18 psi
2256 Haul Tractor	CD6068HBE50	168 (225)	2400	117—143 kPa (1.2—1.4 bar) 17—21 psi
SP1850 Cane Loader	PE4045TT852	78 (105)	2300	78—96 kPa (0.8—1.0 bar) (11—14 psi)
SP2252 Cane Loader	PE6068TT850	138 (185) Eng.	2400	110—134 kPa (1.1—1.3 bar) (16—19 psi)
Combine				
1075 Combine	CD6068TYC50 J06068TYC50	117 (157)	2200	Borg Warner/Schwitzer Turbo: 94—114 kPa (1.0—1.2 bar) (14—17 psi)
1165 Combine	J06068TCQ11	112 (150)	2200	62—76 kPa (0.6—0.8 bar) (9—11 psi)
1170 Combine	CD6068TCQ50	133 (178)	2200	95—117 kPa (1.0—1.2 bar) (14—17 psi)
1175 Combine	J06068TCQ12	133 (178)	2200	103—126 kPa (1.0—1.3 bar) (15—18 psi)
1450 Combine	J06068TCQ01	133 (178)	2200	103—126 kPa (1.0—1.3 bar) (15—18 psi)
1450 CWS/WTS Combine	CD6068HCQ60	149 (200)	2400	107—131 kPa (1.1—1.3 bar) (16—19 psi)
1450 CWS Combine	CD6068HCQ82	148 (198)	2400	124—152 kPa (1.2—1.5 bar) (18—22 psi)
1470 Combine	J06068TCQ18	144 (193)	2200	93—113 kPa (0.9—1.1 bar) (13—16 psi)
1550 CWS/WTS Combine	CD6068HCQ61	182 (244)	2400	130—160 kPa (1.3—1.6 bar) (19—23 psi)
1550 CWS Combine	CD6068HCQ81	182 (244)	2400	Not Applicable
1570 Combine	J06068HCQ06	175 (235)	2200	114—139 kPa (1.1—1.4 bar) (16—20 psi)
1650 CTS Combine	J06068HCQ02	175 (234)	2200	134—164 kPa (1.4—1.7 bar) (20—24 psi)
2254 Combine	CD6068HZ050	144 (193)	2200	94—116 kPa (0.9—1.2 bar) (14—17 psi)
3518 Combine	CD6068TYC51	149 (200)	2400	AirResearch/Garrett Turbo: 142—174 kPa (1.4—1.7 bar) (21—25 psi) Borg Warner/Schwitzer Turbo: 161—197 kPa (1.6—2.0 bar) (23—29 psi)
9400 Combine	T06068HH050	138 (185)	2200	93—113 kPa (0.9—1.1 bar) (14—16 psi)

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