

JOHN DEERE
WORLDWIDE COMMERCIAL & CONSUMER
EQUIPMENT DIVISION

Garden Tractors
X495 and X595

TM2158 MAY 2004

TECHNICAL MANUAL



JOHN DEERE

Export Version
Litho in U.S.A.

INTRODUCTION

Manual Description

This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Specifications and Information
- Identification Numbers
- Tools and Materials
- Component Location
- Schematics and Harnesses
- Theory of Operation
- Operation and Diagnostics
- Diagnostics
- Tests and Adjustments
- Repair
- Other

NOTE: Depending on the particular section or system being covered, not all of the above groups may be used.

The bleed tabs for the pages of each section will align with the sections listed on this page. Page numbering is consecutive from the beginning of the Safety section through the last section.

We appreciate your input on this manual. If you find any errors or want to comment on the layout of the manual please contact us.

Safety

Specifications and Information

Engine - Diesel

Electrical

Power Train - Hydrostatic

Hydraulics

Steering

Brakes

Attachments

Miscellaneous

All information, illustrations and specifications in this manual are based on the latest information at the time of publication. The right is reserved to make changes at any time without notice.

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INTRODUCTION

SAFETY

Recognize Safety Information



MIF

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

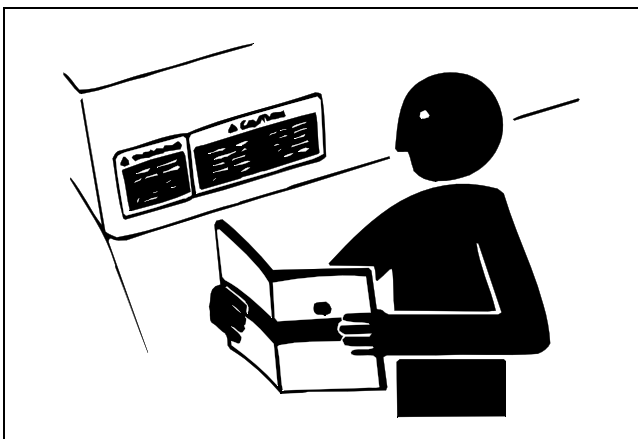
Follow recommended precautions and safe servicing practices.

Understand Signal Words

A signal word - DANGER, WARNING, or CAUTION - is used with the safety - alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

Replace Safety Signs

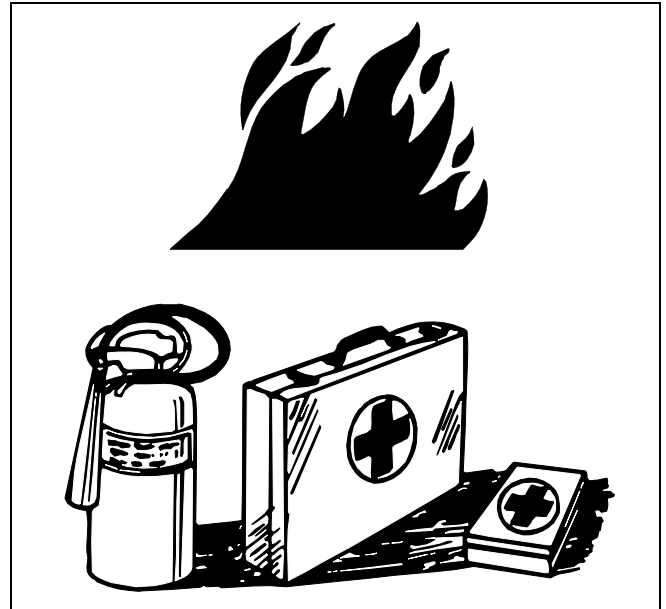


MIF

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Handle Fluids Safely - Avoid Fires

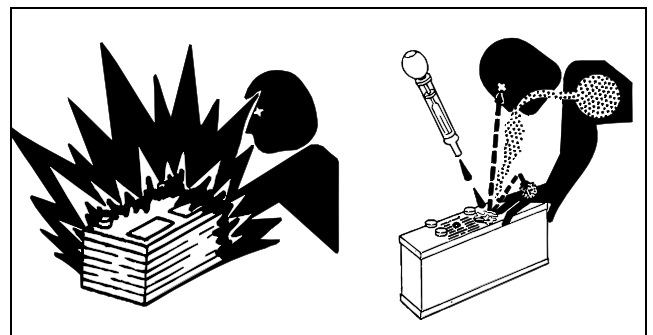
Be Prepared For Emergencies



MIF

- When you work around fuel, do not smoke or work near heaters or other fire hazards.
- Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.
- Make sure machine is clean of trash, grease, and debris.
- Do not store oily rags; they can ignite and burn spontaneously.
- Be prepared if a fire starts.
- Keep a first aid kit and fire extinguisher handy.
- Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Use Care In Handling and Servicing Batteries



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SAFETY

Prevent Battery Explosions

- Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.
- Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.
- Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

Prevent Acid Burns

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid acid burns by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

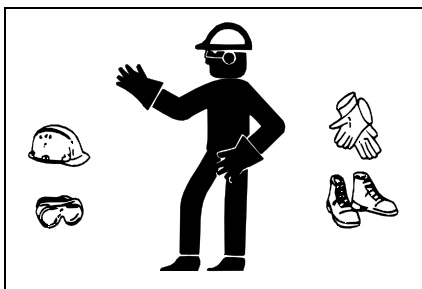
If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10 - 15 minutes.
4. Get medical attention immediately.

If acid is swallowed:

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

Wear Protective Clothing



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Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device

such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

Use Care Around High-pressure Fluid Lines

Avoid High-Pressure Fluids



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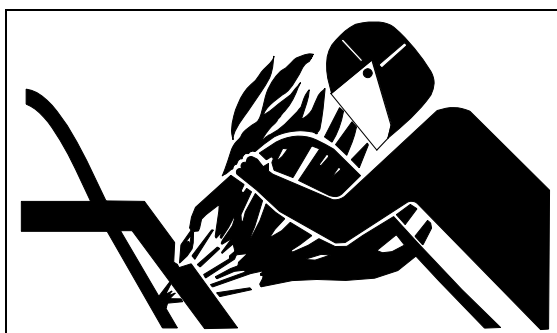
Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid injury from escaping fluid under pressure by stopping the engine and relieving pressure in the system before disconnecting or connecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

Avoid Heating Near Pressurized Fluid Lines

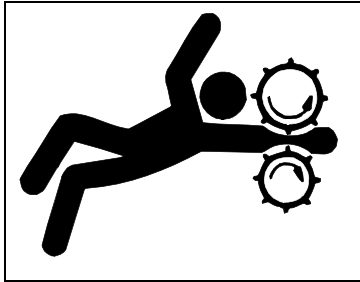


MIF

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

SAFETY

Service Machines Safely



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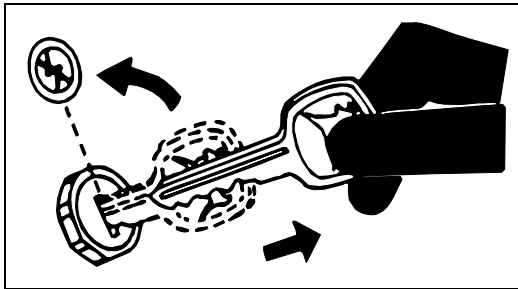
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards. Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, use the correct size tools. **DO NOT** use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches. Use only service parts meeting John Deere specifications.

Park Machine Safely

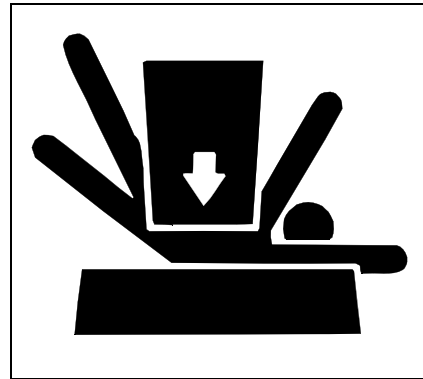


MIF

Before working on the machine:

1. Lower all equipment to the ground.
2. Stop the engine and remove the key.
3. Disconnect the battery ground strap.
4. Hang a "DO NOT OPERATE" tag in operator station.

Support Machine Properly and Use Proper Lifting Equipment



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If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

Lifting heavy components incorrectly can cause severe injury or machine damage. Follow recommended procedure for removal and installation of components in the manual.

Work In Clean Area

Before starting a job:

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

Using High Pressure Washers

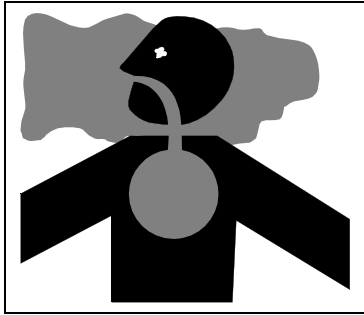
Directing pressurized water at electronic/electrical components or connectors, bearings, hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure and spray at a 45 to 90 degree angle.

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

SAFETY

Work In Ventilated Area



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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.

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. Do all work outside or in a well ventilated area. Dispose of paint and solvent properly. Remove paint before welding or heating: If you sand or grind paint, avoid breathing the dust. Wear an approved respirator. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

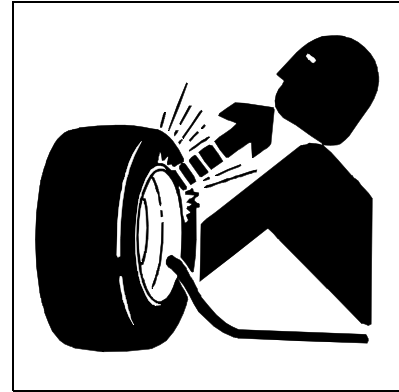
Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos. Keep bystanders away from the area.

Service Tires Safely



MIF

Explosive separation of a tire and rim parts can cause serious injury or death.

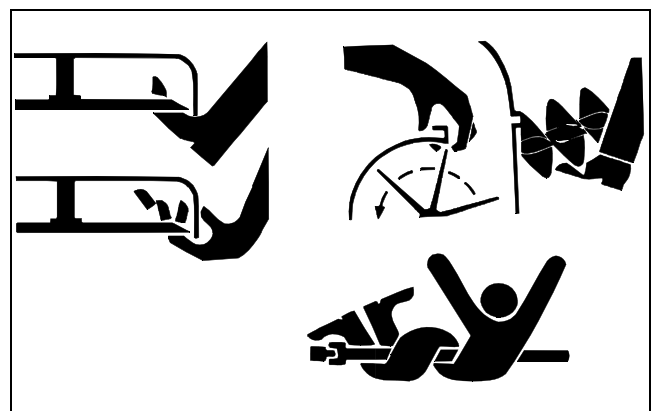
Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

Avoid Injury From Rotating Blades, Augers and PTO Shafts

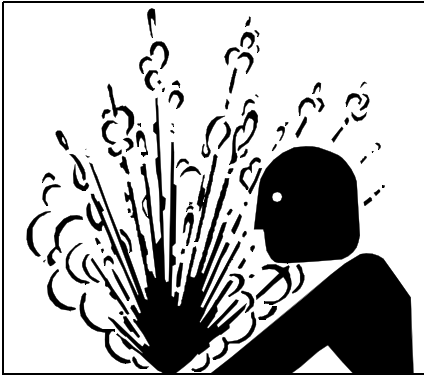


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Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

SAFETY

Service Cooling System Safely

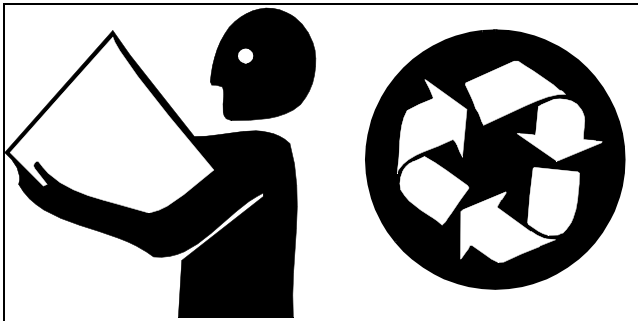


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Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off machine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Handle Chemical Products Safely



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Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques. Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Dispose Of Waste Properly

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries. Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them. Do not pour waste onto the ground, down a drain, or into any water source. Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

Live With Safety



MIF

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

SAFETY



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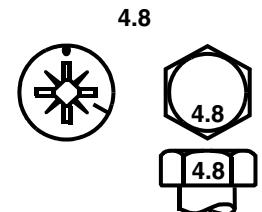
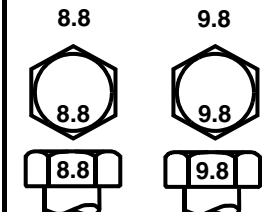
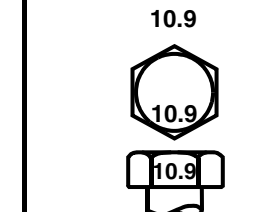
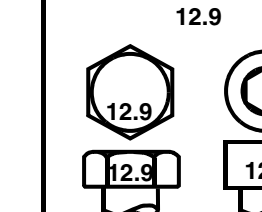
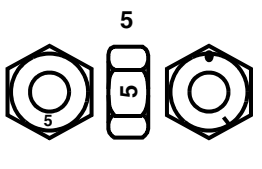
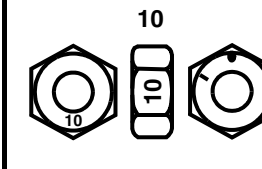
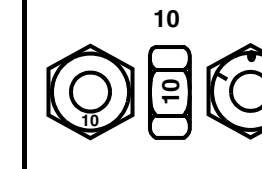
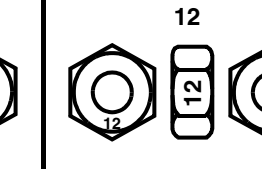
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SPECIFICATIONS & INFORMATION FASTENER TORQUES

Fastener Torques

Metric Fastener Torque Values

Property Class and Head Markings				
Property Class and Nut Markings				

MIF

SIZE	Class 4.8		Class 8.8 or 9.8				Class 10.9				Class 12.9					
	Lubricated a		Dry a		Lubricated a		Dry a		Lubricated a		Dry a		Lubricated a		Dry a	
	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	109
M16	100	73	125	92	190	140	240	175	275	200	350	225	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a $\pm 10\%$ variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the NUT instead of the bolt head.

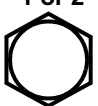
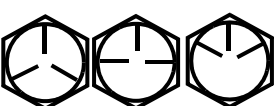




Tighten toothed or serrated-type lock nuts to the full torque value.

a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.

Reference: JDS - G200.

SPECIFICATIONS & INFORMATION FASTENER TORQUES

Inch Fastener Torque Values

SAE Grade and Head Markings	1 or 2 ^b No Marks 	5 5.1 5.2 	8 8.2 
SAE Grade and Nut Markings	No Marks 	5 	8 

MIF

SIZE	Grade 1		Grade 2b				Grade 5, 5.1 or 5.2				Grade 8 or 8.2					
	Lubricated a		Dry a		Lubricated a		Dry a		Lubricated a		Dry a		Lubricated a		Dry a	
	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	215	160	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	470	300	510	375	470	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a $\pm 10\%$ variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the NUT instead of the bolt

head.

Tighten toothed or serrated-type lock nuts to the full torque value.

a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.

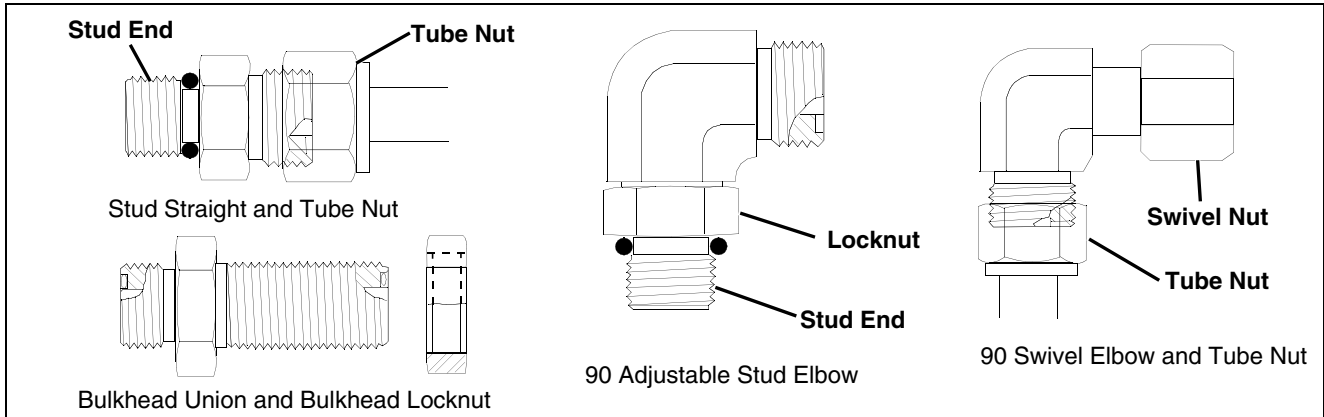
b "Grade 2" applies for hex cap screws (Not Hex Bolts) up to 152 mm (6 in.) long. "Grade 1" applies for hex cap screws over 152 mm (6 in.) long, and for all other types of bolts and screws of any length.

Reference: JDS - G200

SPECIFICATIONS & INFORMATION O-RING SEAL SERVICE

O-Ring Seal Service Recommendations

Face Seal Fittings With Inch Stud Ends Torque



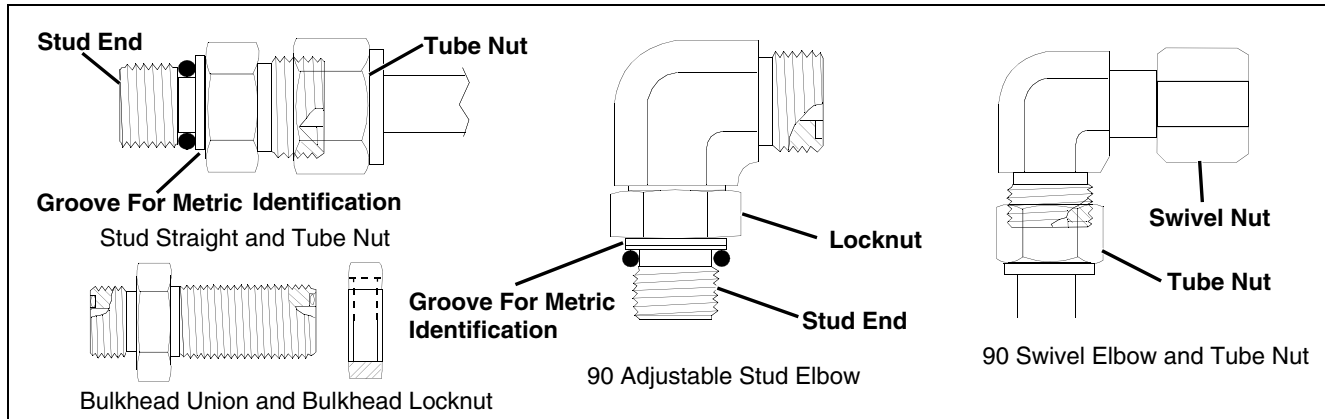
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Nominal Tube OD/Hose ID				Face Seal Tube/Hose End					O-Ring Stud Ends		
Metric Tube OD	Inch Tube OD			Thread Size	Tube Nut/ Swivel Nut Torque		Bulkhead Lock Nut Torque		Thread Size	Straight Fitting or Lock Nut Torque	
	Dash Size	in.	mm		in.	N•m	lb-ft	N•m		lb-ft	in.
5	-3	0.188	4.76						3/8-24	8	6
6	-4	0.250	6.35	9/16-18	16	12	12	9	7/16-20	12	9
8	-5	0.312	7.94						1/2-20	16	12
10	-6	0.375	9.52	11/16-16	24	18	24	18	9/16-18	24	18
12	-8	0.500	12.70	13/16-16	50	37	46	34	3/4-16	46	34
16	-10	0.625	15.88	1-14	69	51	62	46	7/8-14	62	46
19	-12	0.750	19.05	1-3/16-12	102	75	102	75	1-1/16-12	102	75
22	-14	0.875	22.22	1-3/16-12	102	75	102	75	1-3/16-12	122	90
25	-16	1.000	25.40	1-7/16-12	142	105	142	105	1-5/16-12	142	105
32	-20	1.25	31.75	1-11/16-12	190	140	190	140	1-5/8-12	190	140
38	-24	1.50	38.10	2-12	217	160	217	160	1-7/8-12	217	160

NOTE: Torque tolerance is +15%, -20%

SPECIFICATIONS & INFORMATION O-RING SEAL SERVICE

Face Seal Fittings With Metric Stud Ends Torque



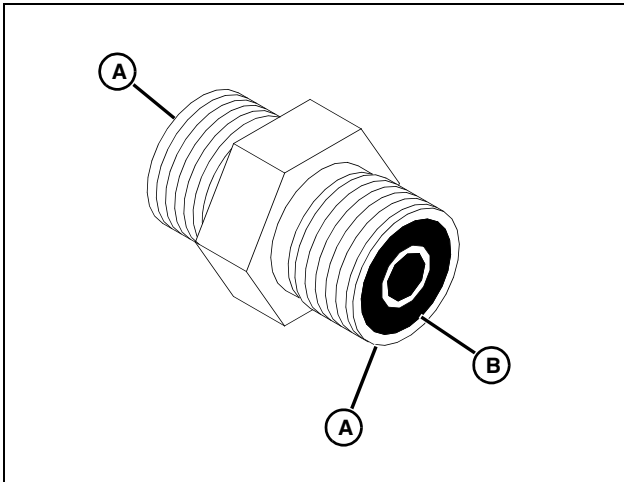
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Nominal Tube OD/Hose ID				Face Seal Tube/Hose End						O-Ring Stud Ends, Straight Fitting or Lock Nut					
Metric Tube OD	Inch Tube OD			Thread Size	Hex Size	Tube Nut/ Swivel Nut Torque		Bulkhead Lock Nut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
	mm	Dash Size	in.			mm	in.	N•m	lb-ft			N•m	lb-ft	mm	mm
6	-4	0.250	6.35	9/16-18	17	16	12	12	9	M12X1.5	17	21	15.5	9	6.6
8	-5	0.312	7.94												
										M14X1.5	19	33	24	15	11
10	-6	0.375	9.52	11/16-16	22	24	18	24	18	M16X1.5	22	41	30	18	13
12	-8	0.500	12.70	13/16-16	24	50	37	46	34	M18X1.5	24	50	37	21	15
16	-10	0.625	15.88	1-14	30	69	51	62	46	M22X1.5	27	69	51	28	21
	-12	0.750	19.05	1-3/16-12	36	102	75	102	75	M27X2	32	102	75	46	34
22	-14	0.875	22.22	1-3/16-12	36	102	75	102	75	M30X2	36				
25	-16	1.000	25.40	1-7/16-12	41	142	105	142	105	M33X2	41	158	116	71	52
28										M38X2	46	176	130	79	58
32	-20	1.25	31.75	1-11/16-12	50	190	140	190	140	M42X2	50	190	140	85	63
38	-24	1.50	38.10	2-12	60	217	160	217	160	M48X2	55	217	160	98	72

NOTE: Torque tolerance is +15%, -20%

SPECIFICATIONS & INFORMATION O-RING SEAL SERVICE

O-ring Face Seal Fittings



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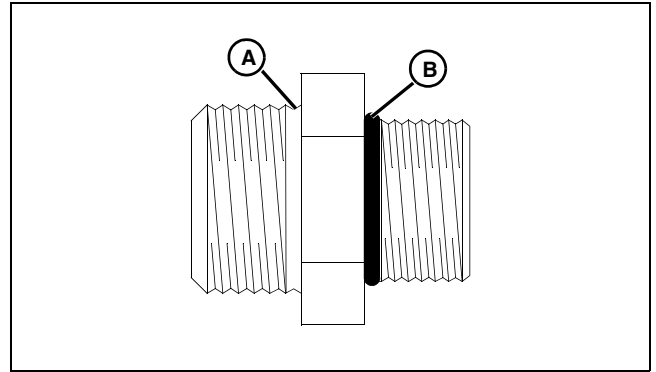
1. Inspect the fitting sealing surfaces (A). They must be free of dirt or defects.
2. Inspect the O-ring (B). It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place during assembly.
4. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.

IMPORTANT: Avoid damage! DO NOT allow hoses to twist when tightening fittings. Use two wrenches to tighten hose connections; one to hold the hose, and the other to tighten the swivel fitting.

5. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting.

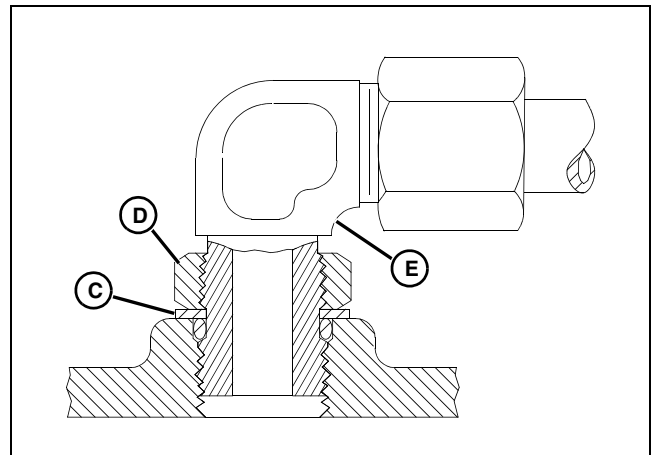
O-Ring Boss Fittings

1. Inspect boss O-ring boss seat. It must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. Some raised defects can be removed with a slip stone.



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2. Put hydraulic oil or petroleum jelly on the O-ring (B). Place electrical tape over the threads to protect O-ring from nicks. Slide O-ring over the tape and into the groove (A) of fitting. Remove tape.



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3. For angle fittings, loosen special nut (D) and push special washer (C) against threads so O-ring can be installed into the groove of fitting.
4. Turn fitting into the boss by hand until special washer or washer face (straight fitting) contacts boss face and O-ring is squeezed into its seat.
5. To position angle fittings (E), turn the fitting counter-clockwise a maximum of one turn.
6. Tighten straight fittings to torque value shown on chart. For angle fittings, tighten the special nut to value shown in the chart while holding body of fitting with a wrench.

SPECIFICATIONS & INFORMATION GENERAL INFORMATION

Straight Fitting or Special Nut Torques

Thread Size	Torque ^a		Number of Flats ^b
	N•m	lb-ft	
3/8-24 UNF	8	6	2
7/16-20 UNF	12	9	2
1/2-20 UNF	16	12	2
9/16-18 UNF	24	18	2
3/4-16 UNF	46	34	2
7/8-14 UNF	62	46	1-1/2
1-1/16-12 UN	102	75	1
1-3/16-12 UN	122	90	1
1-5/16-12 UN	142	105	3/4
1-5/8-12 UN	190	140	3/4
1-7/8-12 UN	217	160	1/2

^aTorque tolerance is ± 10 percent.

^bTo be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark on nut or boss; then tighten special nut or straight fitting the number of flats shown.

Metric Fastener Torque Value - Grade 7 (Special)

Size	Steel or Gray Iron Torque	Aluminum Torque
	N•m (lb-ft)	N•m (lb-ft)
M6	11 (8)	8 (6)
M8	24 (18)	19 (14)
M10	52 (38)	41 (30)
M12	88 (65)	70 (52)
M14	138 (102)	111 (82)
M16	224 (165)	179 (132)

General Information

Diesel Fuel



CAUTION: Avoid Injury! California Proposition 65 Warning: Diesel engine exhaust and some of its elements from this product are known to the State of California to cause cancer, birth defects, or other reproductive harm.

In general, diesel fuels are blended to satisfy the low air temperature requirements of the geographical area in which they are sold.

In North America, diesel fuel is usually specified to **ASTM D975** and sold as either **Grade 1** for cold air temperatures or **Grade 2** for warm air temperatures.

If diesel fuels being supplied in your area DO NOT meet any of the above specifications, use diesel fuels with the following equivalent properties:

- **Cetane Number 40 (minimum)**

A cetane number **greater than 50 is preferred**, especially for air temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

- **Cold Filter Plugging Point (CFPP)**

The air temperature at which diesel fuel **begins to cloud or jell** - at least 5°C (9°F) below the expected low air temperature range.

- **Sulfur Content of 0.05% (maximum)**

Diesel fuels for highway use in the United States now require sulfur content to be **less than 0.05%**.

If diesel fuel being used has a sulfur content **greater than 0.05%**, **reduce the service interval for engine oil and filter by 50%**.

Consult your local diesel fuel distributor for properties of the diesel fuel available in your area.

Diesel Fuel Lubricity

Diesel fuel must have adequate lubricity to ensure proper operation and durability of fuel injection system components. Fuel lubricity should pass a **minimum of 3300 gram load level** as measured by the **BOCLE** scuffing test.

SPECIFICATIONS & INFORMATION GENERAL INFORMATION

Diesel Fuel Storage

IMPORTANT: Avoid damage! DO NOT USE GALVANIZED CONTAINERS - diesel fuel stored in galvanized containers reacts with zinc coating in the container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters and damage fuel injectors and fuel pumps.

It is recommended that diesel fuel be stored **ONLY** in a clean, approved **POLYETHYLENE PLASTIC** container **WITHOUT** any metal screen or filter. This will help prevent any accidental sparks from occurring. Store fuel in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark, this includes any appliance with a pilot light.

IMPORTANT: Avoid damage! Keep all dirt, scale, water or other foreign material out of fuel.

Keep fuel in a safe, protected area and in a clean, properly marked (“**DIESEL FUEL**”) container. **DO NOT** use de-icers to attempt to remove water from fuel. **DO NOT** depend on fuel filters to remove water from fuel. It is recommended that a water separator be installed in the storage tank outlet. **BE SURE** to properly discard unstable or contaminated diesel fuel and/or their containers when necessary.

4 - Cycle Diesel Engine Oil

Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

The following John Deere oils are **PREFERRED**:

- **PLUS-50® - SAE 15W-40;**
- **TORQ-GARD SUPREME® - SAE 5W-30.**

The following John Deere oils are **also** recommended, based on their specified temperature range:

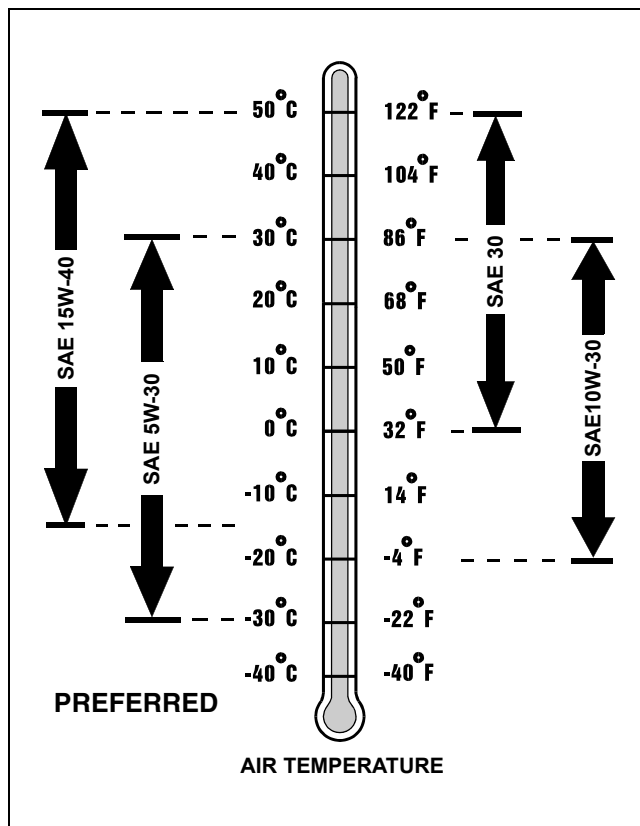
- **TURF-GARD® - SAE 10W-30;**
- **PLUS-4® - SAE 10W-30;**
- **TORQ-GARD SUPREME® - SAE 30.**

Other oils may be used if above John Deere oils are not available, provided they meet one of the following specifications:

- SAE 15W-40 - API Service Classifications CF - 4 or higher;
- SAE 5W-30 - API Service Classification CC or higher;

- SAE 10W-30 - API Service Classification CF or higher;
- SAE 30 - API Service Classification CF or higher.

IMPORTANT: Avoid damage! If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval for oil and filter by 50%.



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Break-In Engine Oil - Diesel

IMPORTANT: Avoid damage! ONLY use this specified break-in oil in rebuilt or remanufactured engines for the first 100 hours (maximum) of operation. DO NOT use PLUS - 50®, SAE 15W40 oil or oils meeting specifications API CG - 4 or API CF - 4, these oils will not allow rebuilt or remanufactured engines to break-in properly.

The following John Deere oil is **PREFERRED**:

- **BREAK - IN ENGINE OIL.**

John Deere **BREAK - IN ENGINE OIL** is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions should be followed closely to determine if special requirements are necessary.

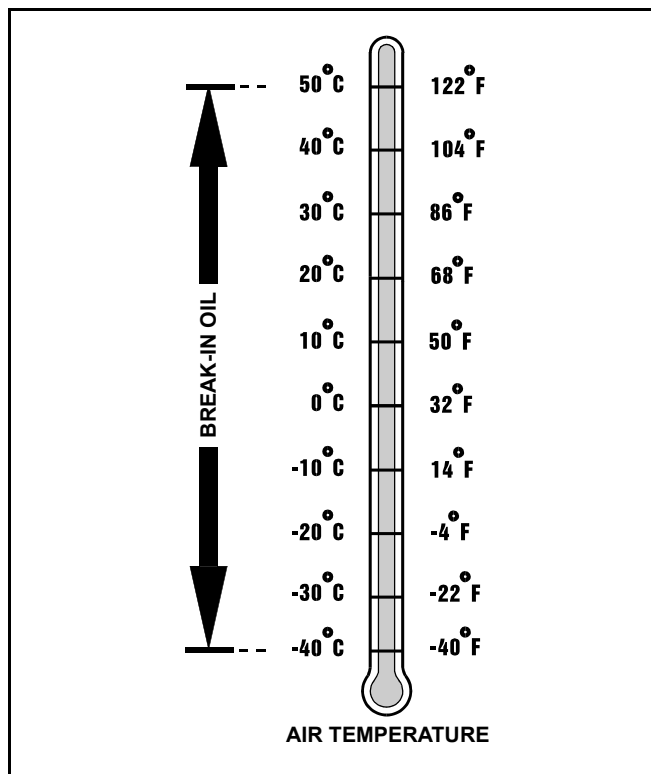
SPECIFICATIONS & INFORMATION GENERAL INFORMATION

John Deere BREAK - IN ENGINE OIL is also recommended for non-John Deere engines, both aluminum and cast iron types.

If this preferred John Deere oil is not available, use a break-in engine oil meeting the following specification during the first 100 hours of operation:

- API Service Classification CE or higher.

IMPORTANT: Avoid damage! After the break-in period, use the John Deere oil that is recommended for this engine.



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Hydrostatic Transmission and Hydraulic Oil

Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission or hydraulic system failures.

IMPORTANT: Avoid damage! Mixing of LOW VISCOSITY HY - GARD® and HY - GARD® oils is permitted. DO NOT mix any other oils in this transmission. DO NOT use engine oil or "Type F" (Red) Automatic Transmission Fluid in this transmission. DO NOT use BIO-HY-GARD® in this transmission.

The following John Deere transmission and hydraulic oil is **PREFERRED**:

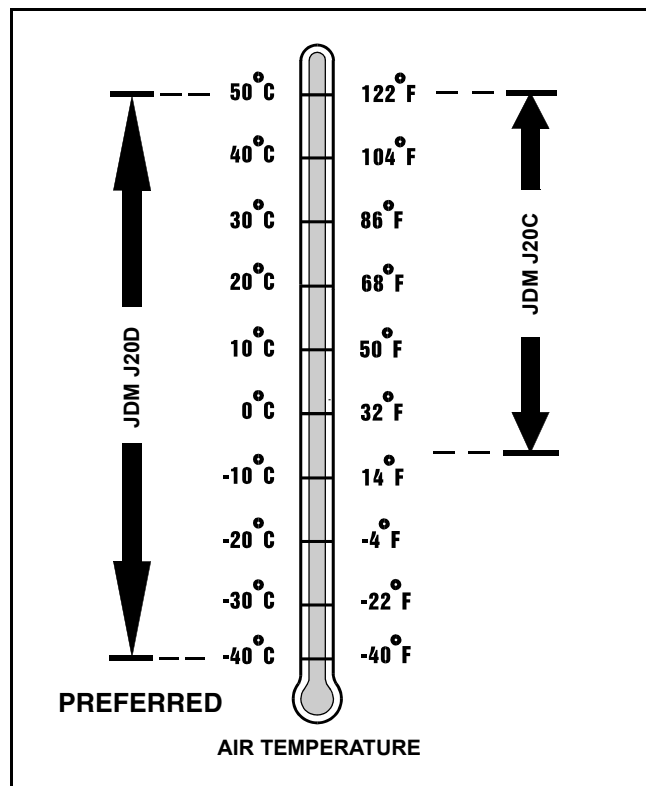
- **LOW VISCOSITY HY - GARD® - JDM J20D.**

The following John Deere oil is also recommended if above preferred oil is not available:

- **HY - GARD® - JDM J20C.**

Other oils may be used if above recommended John Deere oils are not available, provided they meet one of the following specifications:

- John Deere Standard JDM J20D;
- John Deere Standard JDM J20C.



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SPECIFICATIONS & INFORMATION GENERAL INFORMATION

Gear Case Oil

Use the appropriate oil viscosity based on the air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature gear case failure.

IMPORTANT: Avoid damage! ONLY use a quality oil in this gear case. DO NOT mix any other oils in this gear case. DO NOT use BIO-HY-GARD® in this gear case.

The following John Deere gear case oil is **PREFERRED**:

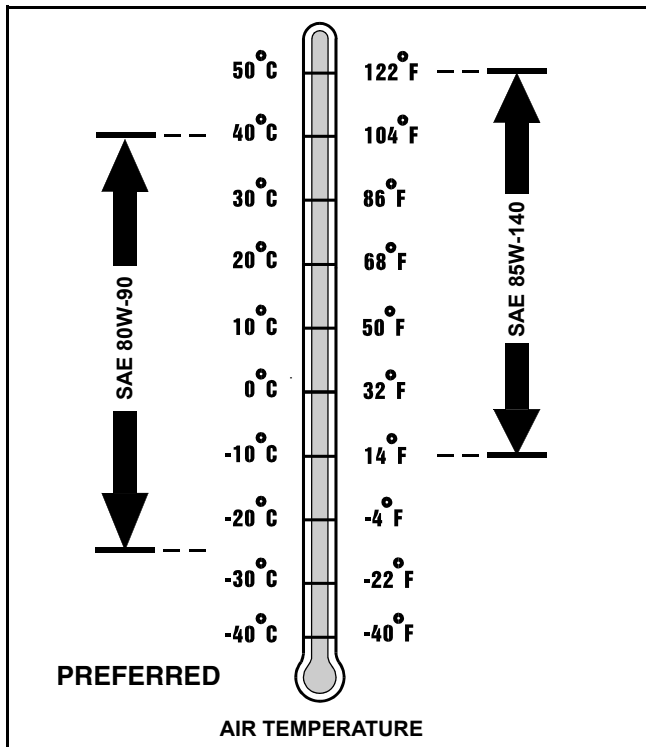
- **GL-5 GEAR LUBRICANT® - SAE 80W-90.**

The following John Deere gear case oil is also recommended if above preferred oil is not available:

- **GL-5 GEAR LUBRICANT® - SAE 85W-140.**

Other gear case oils may be used if above recommended John Deere gear case oils are not available, provided they meet the following specification:

- API Service Classification GL - 5.



MIF

Gear Transmission Grease

Use the following gear grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature gear transmission failure.

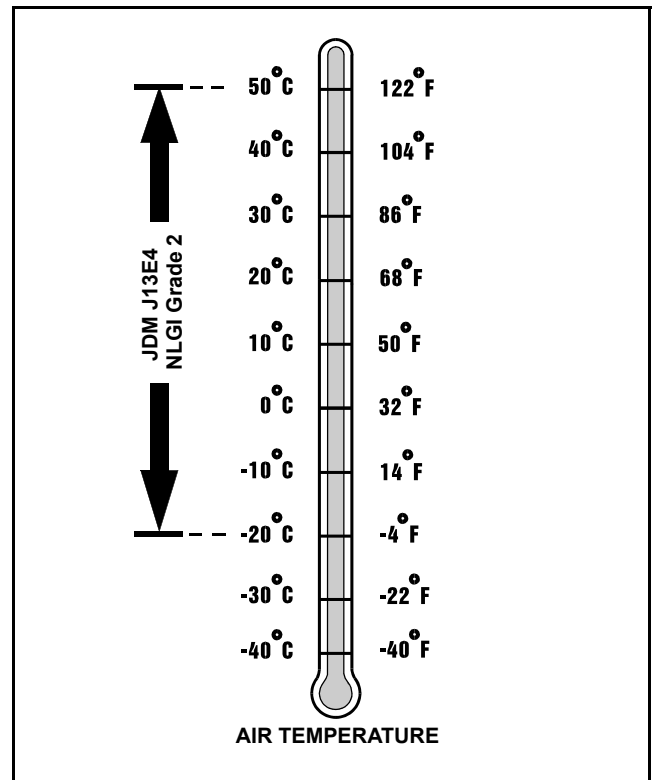
IMPORTANT: Avoid damage! ONLY use a quality gear grease in this transmission. DO NOT mix any other greases in this transmission. DO NOT use any BIO - GREASE in this transmission.

The following John Deere gear grease is **PREFERRED**:

- **NON-CLAY HIGH-TEMPERATURE EP GREASE® - JDM J13E4, NLGI Grade 2.**

Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

- John Deere Standard JDM J13E4, NLGI Grade 2.



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Alternative Lubricants

Use of alternative lubricants could cause reduced life of the component.

If alternative lubricants are to be used, it is recommended that the factory fill be thoroughly removed before switching to any alternative lubricant.

SPECIFICATIONS & INFORMATION COOLANT SPECIFICATIONS

Synthetic Lubricants

Synthetic lubricants may be used in John Deere equipment if they meet the applicable performance requirements (industry classification and/or military specification) as shown in this manual.

The recommended air temperature limits and service or lubricant change intervals should be maintained as shown in the operator's manual, unless otherwise stated on lubricant label.

Avoid mixing different brands, grades, or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements. Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Lubricant Storage

All machines operate at top efficiency only when clean lubricants are used. Use clean storage containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides. Make sure all containers are properly marked as to their contents. Dispose of all old, used containers and their contents properly.

Mixing of Lubricants

In general, avoid mixing different brands or types of lubricants. Manufacturers blend additives in their lubricants to meet certain specifications and performance requirements. Mixing different lubricants can interfere with the proper functioning of these additives and lubricant properties which will downgrade their intended specified performance.

Oil Filters

IMPORTANT: Avoid damage! Filtration of oils is critical to proper lubrication performance. Always change filters regularly.

The following John Deere oil filters are PREFERRED:

- AUTOMOTIVE AND LIGHT TRUCK ENGINE OIL FILTERS.

Most John Deere filters contain pressure relief and anti-drainback valves for better engine protection.

Other oil filters may be used if above recommended John Deere oil filters are not available, provided they meet the following specification:

- ASTB Tested In Accordance With SAE J806.

Coolant Specifications

Diesel Engine Coolant

The engine cooling system when filled with a proper dilution mixture of anti-freeze and deionized or distilled water provides year-round protection against corrosion, cylinder or liner pitting, and winter freeze protection down to **-37°C (-34°F)**.

The following John Deere coolant is **PREFERRED**:

- **PRE-DILUTED DIESEL ENGINE ANTI-FREEZE/ SUMMER COOLANT™ (TY16036)**.

This coolant satisfies specifications for "Automobile and Light Duty Engine Service" and is safe for use in John Deere Lawn and Grounds Care/Golf and Turf Division equipment, including aluminum block gasoline engines and cooling systems.

The above preferred pre-diluted anti-freeze provides:

- adequate heat transfer
- corrosion-resistant chemicals for the cooling system
- compatibility with cooling system hose and seal material
- protection during extreme cold and extreme hot weather operations
- chemically pure water for better service life
- compliance with ASTM D4656 (JDM H24C2) specifications

If above preferred pre-diluted coolant is not available, the following John Deere concentrate is recommended:

- **DIESEL ENGINE ANTI-FREEZE/SUMMER COOLANT CONCENTRATE™ (TY16034)**.

If either of above recommended engine coolants are available use any Automobile and Light Duty Engine Service ethylene glycol base coolant, meeting the following specification:

- ASTM D3306 (JDM H24C1).

Read container label completely before using and follow instructions as stated.

SPECIFICATIONS & INFORMATION SERIAL NUMBER LOCATIONS

IMPORTANT: Avoid damage! To prevent engine damage, DO NOT use pure anti-freeze or less than a 50% anti-freeze mixture in the cooling system. DO NOT mix or add any additives/conditioners to the cooling system in Lawn and Grounds Care/Golf and Turf Division equipment. Water used to dilute engine coolant concentrate must be of high quality - clean, clear, potable water (low in chloride and hardness - Table 1) is generally acceptable. DO NOT use salt water. Deionized or distilled water is ideal to use. Coolant that is not mixed to these specified levels and water purity can cause excessive scale, sludge deposits, and increased corrosion potential.

Property	Requirements
Total Solids, Maximum	340 ppm (20 grns/gal)
Total Hardness, Maximum	170 ppm (10 grns/gal)
Chloride (as Cl), Maximum	40 ppm (2.5 grns/gal)
Sulfate (as SO ₄), Maximum	100 ppm (5.8 grns/gal)

Mix 50 percent anti-freeze concentrate with 50 percent distilled or deionized water. This mixture and the pre-diluted mixture (TY16036) will protect the cooling system down to -37°C (-34°F) and up to 108°C (226°F).

Certain geographical areas may require lower air temperature protection. See the label on your anti-freeze container or consult your John Deere dealer to obtain the latest information and recommendations.

Diesel Engine Coolant Drain Interval

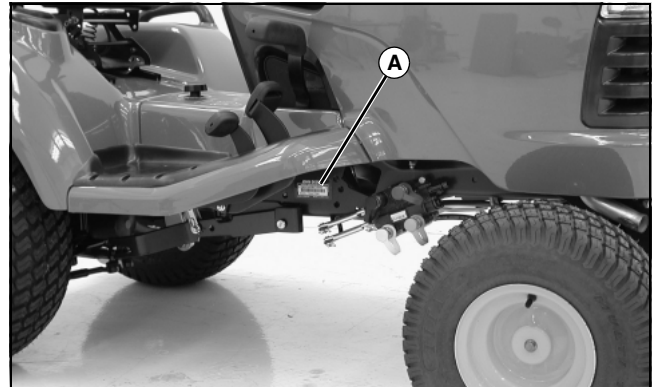
When using John Deere Pre-Diluted (TY16036) Automobile and Light Duty Engine Service coolants, drain and flush the cooling system and refill with fresh coolant mixture every 36 months or 3,000 hours of operation, whichever comes first.

When using John Deere Concentrate (TY16034) Automobile and Light Duty Engine Service coolants, drain and flush the cooling system and refill with fresh coolant mixture every 24 months or 2,000 hours of operation, whichever comes first.

If above John Deere Automobile and Light Duty Engine Service coolants are not being used; drain, flush, and refill the cooling system according to instructions found on product container or in equipment operator's manual or technical manual.

Serial Number Locations

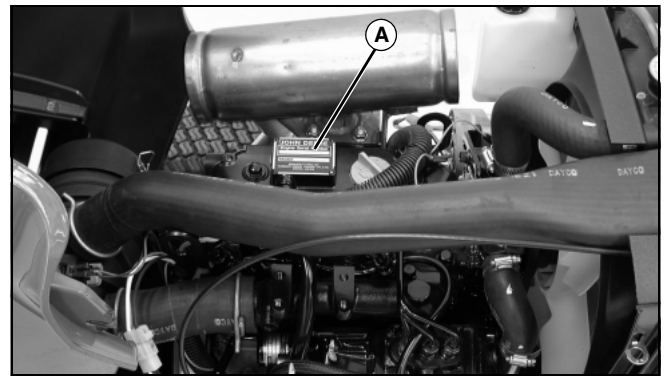
Product Serial Number



MX13553

The 13-digit product identification number (A) is located on the right-hand side frame, just below engine compartment.

Diesel Engine Serial Number Location



M13561

The engine serial number (A) is located on valve cover. The model number will designate the engine type.

X495 and X595 Model Numbers 3TNE74



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ENGINE - DIESEL SPECIFICATIONS

Specifications

General

Make	Yanmar
Model	3TNE74
Type	4-Cycle Diesel
Gross Power	17.9 kW (24 HP)
Torque @2650 rpm	53.8 N•m (39.7 lb-ft)
Number of Cylinders	3
Bore	74 mm (2.91 in.)
Stroke	78 mm (3.07 in.)
Displacement	1.006 L (61.4 cu in.)
Firing Order	1 - 3 - 2
Direction of Rotation	Counterclockwise (viewed from flywheel)
Combustion System	Indirect Injection Type
Compression Ratio	23 : 1
Cooling	Liquid
Oil Capacity (w/filter)	Approximately 2.8 L (3.0 qt)
Governor	Centrifugal
Slow Idle (no-load)	1600 ±25 rpm
High Idle (no-load)	3475 ±25 rpm

Repair Specifications

Valve Train:

Rocker Arm Shaft OD	11.966 - 11.984 mm (0.471 - 0.472 in.)
Wear Limit	11.95 mm (0.470 in.)
Rocker Arm and Shaft Support Bushings ID	12.00 - 12.02 mm (0.472 - 0.473 in.)
Wear Limit	12.09 mm (0.476 in.)
Oil Clearance	0.016 - 0.054 mm (0.0006 - 0.0021 in.)
Wear Limit	0.14 mm (0.006 in.)
Push Rod Bend (maximum)	0.0 - 0.03 mm (0.0 - 0.001 in.)

Cylinder Head:

Cylinder Head Flatness	0.000 - 0.05 mm (0.000 - 0.002 in.)
Service Limit	0.15 mm (0.006 in.)

Valves:

Valve Seat Width (Non-Removable):

Intake	1.44 mm (0.057 in.)
Wear Limit	1.98 mm (0.078 in.)
Exhaust	1.77 mm (0.070 in.)
Wear Limit	2.27 mm (0.089 in.)

ENGINE - DIESEL SPECIFICATIONS

Valve Seat Angles:

Exhaust Valve	45°
Intake Valve	30°
Lower Seat Surface	70°
Upper Seat Surface	15°
Intake Valve Head Margin	0.99 - 1.29 mm (0.004 - 0.005 in.)
Exhaust Valve Head Margin	0.95 - 1.25 mm (0.004 - 0.005 in.)
Wear Limit	0.50 mm (0.002 in.)

Valve Recession:

Intake	0.40 - 0.60 mm (0.016 - 0.024 in.)
Exhaust	0.75 - 0.95 mm (0.030 - 0.0374 in.)
Wear Limit (Intake and Exhaust)	1.0 mm (0.039 in.)

Valve Stem Diameter:

Intake	6.960 - 6.975 mm (0.274 - 0.274 in.)
Exhaust	6.945 - 6.960 mm (0.273 - 0.276 in.)
Wear Limit (Intake and Exhaust)	6.90 mm (0.272 in.)

Valve Guide ID	7.005 - 7.020 mm (0.275 - 0.276 in.)
Valve Guide Wear Limit	7.08 mm (0.279 in.)
Valve Guide Installed Height	9 mm (0.354 in.)

Valve Stem-To-Guide Oil Clearance:

Intake	0.030 - 0.060 mm (0.001 - 0.002 in.)
Exhaust	0.045 - 0.075 mm (0.002 - 0.003 in.)
Wear Limit	0.18 mm (0.007 in.)

Valve Springs:

Free Length	37.4 mm (1.472 in.)
Maximum Inclination	1.0 mm (0.032 in.)
Tension (Measured With Spring Compressed 1.0 mm (0.039))	2.37 - 1.87 kg (5.22 - 4.12 lb)

Connecting Rod:

Large End Bearing ID	43.000 - 43.016 mm (1.693 - 1.694 in.)
Large End Bearing Thickness	1.487 - 1.500 mm (0.058 - 0.059 in.)
0.25 mm (0.010 in.) Oversize Bearing Thickness	1.625 mm (0.064 in.)
Large End Bearing Oil Clearance	0.033 - 0.059 mm (0.001 - 0.002 in.)
Large End Bearing Wear Limit	0.15 mm (0.006 in.)
Connecting Rod Side Play	0.20 - 0.40 mm (0.008 - 0.016 in.)
Twist and Parallelism	0.00 - 0.03 mm per 100 mm (0.00 - 0.001 in. per 6 in.)
Wear Limit	0.08 mm per 100 mm (0.005 in. per 6 in.)

(For Connecting Rod Small End Specifications, See "Piston Pin" Below)

Top Piston Ring Specifications:

Ring Groove Width	1.550 - 1.570 mm (0.061 - 0.062 in.)
Ring Width	1.470 - 1.490 mm (0.058 - 0.059 in.)
Minimum Side Clearance	0.060 - 0.100 mm (0.002 - 0.004 in.)
Ring End Gap	0.200 - 0.400 mm (0.008 - 0.016 in.)

ENGINE - DIESEL SPECIFICATIONS

2nd Piston Ring Specifications:

Piston Groove Width	1.520 - 1.535 mm (0.059 - 0.060 in.)
Ring Width	1.410 - 1.430 mm (0.055 - 0.056 in.)
Minimum Side Clearance	0.090 - 0.125 mm (0.004 - 0.005 in.)
Ring End Gap	0.200 - 0.400 mm (0.008 - 0.015 in.)

Oil Control Ring Specifications:

Piston Groove Width	3.010 - 3.025 mm (0.118 - 0.119 in.)
Ring Width	2.970 - 2.990 mm (0.117 - 0.118 in.)
Minimum Side Clearance	0.020 - 0.055 mm (0.0008 - 0.002 in.)
Ring End Gap	0.150 - 0.350 mm (0.006 - 0.014 in.)
Ring End Gap Wear Limit (All Rings)	1.5 mm (0.059 in.)

Piston:

Piston Pin OD	20.991 - 21.000 mm (0.826 - 0.827 in.)
Wear Limit	20.90 mm (0.823 in.)

Connecting Rod Bushing ID	21.025 - 21.038 mm (0.828 - 0.828 in.)
Wear Limit	21.10 mm (0.831 in.)

Piston Pin-To-Rod Bushing:

Oil Clearance	0.025 - 0.047 mm (0.001 - 0.002 in.)
Wear Limit	0.2 mm (0.008 in.)

Piston Pin Bore (In Piston) ID	21.000 - 21.008 mm (0.827 - 0.827 in.)
Wear Limit	21.02 mm (0.828 in.)

Piston Pin-To-Piston Oil Clearance	0.000 - 0.017 mm (0 - 0.0007 in.)
Wear Limit	0.12 mm (0.005 in.)

Piston (Measured 24 mm (0.945 in.) up from bottom of piston skirt, perpendicular to piston pin.):

Standard Piston OD	73.955 - 73.980 mm (2.912 - 2.913 in.)
Wear Limit	73.90 mm (2.909 in.)

Oversize Piston - 0.25 mm (0.010 in.) OD	74.205 - 74.230 mm (2.921 - 2.922 in.)
Wear Limit	74.15 mm (2.919 in.)

Cylinder Bore:

Standard ID	74.00 - 74.03 mm (2.913 - 2.915 in.)
Wear Limit	74.20 mm (2.921 in.)

Oversize Bore - 0.25 mm (0.010 in.) ID	74.25 - 74.28 mm (2.923 - 2.924 in.)
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Clearance (Piston-To-Cylinder)	0.030 - 0.060 mm (0.001 - 0.002 in.)
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Cylinder Roundness	0.00 - 0.01 mm (0 - 0.0004 in.)
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Cylinder Roundness Wear Limit	0.03 mm (0.001 in.)
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Cylinder Taper	0.00 - 0.01 mm (0 - 0.0004 in.)
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Cylinder Taper Wear Limit	0.03 mm (0.001 in.)
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Deglazing	30 - 40° crosshatch pattern
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Reboring	30 - 40° crosshatch pattern
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ENGINE - DIESEL SPECIFICATIONS

Crankshaft:

Connecting Rod Crankpin Journal:

OD	39.970 - 39.980 mm (1.573 - 1.574 in.)
Wear Limit	39.91 mm (1.571 in.)
0.25mm (0.010 in.) Undersize	39.72 - 39.73 mm (1.563 - 1.564 in.)
Wear Limit	39.66 mm (1.561 in.)

Connecting Rod Bearing:

Inside Diameter	43.000 - 43.016 mm (1.693 - 1.694 in.)
Thickness	1.487 - 1.500 mm (0.058 - 0.059 in.)
0.25 mm (0.010 in.) Oversize Bearing Thickness	1.625 mm (0.064 in.)
Oil Clearance	0.033 - 0.059 mm (0.001 - 0.002 in.)
Wear Limit	0.15 mm (0.006 in.)

Main Bearing Journal:

Outside Diameter	43.970 - 43.980 mm (1.731 - 1.732 in.)
Wear Limit	43.90 mm (1.728 in.)
0.25 mm (0.010 in.) Undersize	43.72 - 43.73 mm (1.721 - 1.722 in.)
Wear Limit	43.65 mm (1.719 in.)

Main Bearing:

Insert Thickness	1.987 - 2.000 mm (0.078 - 0.079 in.)
0.25 mm (0.010 in.) Under Size Bearing Thickness	2.125 mm (0.084 in.)
Oil Clearance	0.033 - 0.059 mm (0.001 - 0.002 in.)
Wear Limit	0.15 mm (0.006 in.)

Thrust Bearing Insert Thickness	1.93 - 1.98 mm (0.076 - 0.078 in.)
0.25 mm (0.010 in.) Oversize Thrust Bearing Thickness	2.125 mm (0.084 in.)
Crankshaft Maximum Bend	0.02 mm (0.0008 in.)
Crankshaft End Play	0.090 - 0.271 mm (0.004 - 0.011 in.)

Camshaft:

Camshaft End Play	0.05 - 0.25 mm (0.002 - 0.010 in.)
Maximum Camshaft Bend	0 - 0.02 mm (0 - 0.0008 in.)
Camshaft Wear Limit	0.05 mm (0.002 in.)

Front Journal:

OD (Camshaft Gear Side)	35.940 - 35.960 mm (1.572 - 1.573 in.)
Wear Limit	39.85 mm (1.569 in.)
Oil Clearance	0.040 - 0.085 mm (0.002 - 0.003 in.)

Intermediate Journals:

OD	39.910 - 39.935 mm (1.571 - 1.572 in.)
Wear Limit	39.85 mm (1.569 in.)
Oil Clearance	0.065 - 0.115 mm (0.002 - 0.005 in.)

ENGINE - DIESEL SPECIFICATIONS

Rear Journal:

OD (Flywheel Side)	39.940 - 39.960 mm (1.572 - 1.573 in.)
Wear Limit	39.85 mm (1.569 in.)
Oil Clearance	0.040 - 0.125 mm (0.002 - 0.005 in.)

Bushing:

ID	40.075 - 40.140 mm (1.578 - 1.580 in.)
Wear Limit	40.18 mm (1.582 in.)
Clearance	0.040 - 0.125 mm (0.002 - 0.005 in.)

Cam Lobes:

Lobe Height (Intake and Exhaust Lobes)	33.950 - 34.050 mm (1.33 - 1.34 in.)
Wear Limit	33.75 mm (1.329 in.)

Tappets:

OD	20.927 - 20.960 mm (0.824 - 0.825 in.)
Wear Limit	20.90 mm (0.823 in.)
Cylinder Block Guide Hole ID	21.000 - 21.021 mm (0.827 - 0.828 in.)
Wear Limit	21.05 mm (0.829 in.)
Oil Clearance	0.040 - 0.094 mm (0.002 - 0.004 in.)
Wear Limit	0.15 mm (0.006 in.)

Timing Gear Backlash:

All Except Crankshaft Gear-to-Oil Pump Gear	0.04 - 0.12 mm (0.0016 - 0.0047 in.)
Crankshaft Gear-to-Oil Pump Gear	0.11 - 0.19 mm (0.004 - 0.008 in.)

Idler Gear:

Shaft Outside Diameter	19.959 - 19.980 mm (0.786 - 0.787 in.)
Shaft Wear Limit	19.93 mm (0.785 in.)
Bushing Inside Diameter	20.000 - 20.021 mm (0.787 - 0.788 in.)
Oil Clearance	0.020 - 0.062 mm (0.0008 - 0.002 in.)
Oil Clearance Wear Limit	0.15 mm (0.006 in.)

Flywheel:

Maximum Distortion	0.02 mm (0.0008 in.)
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Oil Pump:

Rotor Shaft OD-to-Back Plate ID Clearance	0.013 - 0.043 mm (0.0005 - 0.002 in.)
Wear Limit	0.20 mm (0.008 in.)
Outer Rotor-to-Pump Body Clearance	0.10 - 0.16 mm (0.004 - 0.006 in.)
Wear Limit	0.25 mm (0.010 in.)
Inner Rotor-to-Outer Rotor Clearance Wear Limit	0.15 mm (0.006 in.)
Inner and Outer Rotor-to-Back Plate Side Clearance	0.03 - 0.09 mm (0.001 - 0.004 in.)
Inner and Outer Rotor-to-Back Plate Side Clearance Wear Limit	0.13 mm (0.005 in.)

Oil Pressure Regulating Valve:

Spring:

Compressed Length	14.70 mm (0.580 in.) @12 N (2.7 lb)
Free Length	21.90 - 24.50 mm (0.860 - 0.960 in.)

ENGINE - DIESEL SPECIFICATIONS

Fuel Injection Pump:

Fuel Pump Pressure.....	29 kPa (4.3 psi)
Fuel Pump Flow Volume	118 cc/minute (4 ounces/minute)

Fuel Injection Pump Camshaft:

Bearing Retaining Screw Torque	20 N•m (180 lb-in.)
Minimum Lobe Height	30.90 mm (1.217 in.)

Fuel Control and Governor Linkage:

Governor Shaft OD (Minimum)	7.90 mm (0.311 in.)
Sleeve ID (Maximum)	8.25 mm (0.325 in.)
Injection Pump Camshaft OD (Minimum).....	7.90 mm (0.311 in.)

Fuel Injection Nozzles:

Separator Plate Nozzle Contact Surface Maximum Wear.....	0.10 mm (0.0039 in.)
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Cooling System:

Coolant Temperature Switch (On Engine):

Continuity (Closing) Temperature.....	107 - 113 °C (225 - 235 °F)
Radiator Bubble Test (Maximum Air Pressure Into Cylinder)	2448 kPa (355 psi)

Tests and Adjustment Specifications

Valve Clearance	0.15 - 0.25 mm (0.006 - 0.010 in.)
Connecting Rod Side Play.....	0.2 - 0.4 mm (0.008 - 0.016 in.)
Connecting Rod Bearing Clearance.....	0.03 - 0.06 mm (0.001 - 0.002 in.)
Crankshaft End Play.....	0.09 - 0.27 mm (0.004 - 0.011 in.)
Crankshaft Main Bearing Clearance.....	0.04 - 0.09 mm (0.002 - 0.004 in.)
Camshaft End Play.....	0.05 - 0.25 mm (0.002 - 0.010 in.)
Fuel Injection Pump Timing.....	16 ±1.5 Before TDC
Fuel Injection Nozzle:	
Opening Pressure.....	11800 ± 1000 kPa (1712 ± 145 psi)
Leakage at 11032 kPa (1600 psi).....	None for a minimum of 10 seconds
Chatter and Spray Pattern at 19600 ± 1000 kPa (2843 ± 145 psi):	
Slow Hand Lever Movement	Chatter Sound
Slow Hand Lever Movement	Fine Stream
Fast Hand Lever Movement.....	Fine Atomized Spray; 150° Spray Pattern
Alternator Drive Belt Deflection (@98 N (22 lb) Applied Force).....	10 - 15 mm (0.4 - 0.6 in.)

ENGINE - DIESEL SPECIFICATIONS

Operational Tests

Cylinder Compression Pressure (@250 RPM Cranking Speed)	3432 kPa (498 psi)
(Minimum)	2746 kPa (398 psi)
Difference Between Cylinders	245 kPa (36psi)
Radiator Cap Opening Pressure	0.9 ± 0.15 kg/cm ² , 88.3 ± 14.7 kPa, (12.8 ± 2.2 psi)
Cooling System Pressure Test	0.9 ± 0.15 kg/cm ² , 88.3 ± 14.7 kPa, (12.8 ± 2.2 psi)
Thermostat Opening Temperature	69.5 - 72.5 °C (157 - 163 °F)
Thermostat Minimum Lift Height above 85 °C (185 °F)	8 mm (0.315 in.)

Oil Pressure:

Rated Speed	290 ± 50 kPa (42 ± 7 psi)
Slow Idle (Minimum)	60 kPa (9 psi)
Oil Relief Valve Opening Pressure	294 - 392 kPa (43 - 57 psi)
Oil Pressure Switch Opening Pressure	3 - 4 kPa (6 - 9 psi)

Tightening Torques

Cylinder Head Bolts (Lubricating Oil Applied)	59 - 64 N•m (44 - 47 lb-ft)
Connecting Rod Bolts (Lubricating Oil Applied)	23 - 27 N•m (17 - 20 lb-ft)
Flywheel Mounting Bolts (Lubricating Oil Applied)	78 - 88 N•m (58 - 65 lb-ft)
Main Bearing Bolts (Lubricating Oil Applied)	58 - 61 N•m (43 - 45 lb-ft)
Crankshaft Pulley Cap Screw (Lubricating Oil Applied)	113 - 122 N•m (83 - 90 lb-ft)
Fuel Injector Nozzle Nut	36 - 39 N•m (27 - 29 lb-ft)
Glow Plugs	15 - 20 N•m (11 - 15 lb-ft)
Governor Weight Support Nut	69 - 74 N•m (51 - 55 lb-ft)
Fuel Injector Line Nuts	36 - 39 N•m (27 - 29 lb-ft)
Rocker Arm Cover Special Nut	18 N•m (159 lb-in.)
Shaft Nut	27 N•m (20 lb-ft)
Mounting Cap Screw	25 N•m (18 lb-ft)
Fan Mounting Cap Screw	11 N•m (97 lb-in.)
Timing Cover Mounting Cap Screw	9 N•m (78 lb-in.)
Injector Pump-to-Timing Cover Cap Screw	20 N•m (15 lb-ft)
Exhaust Manifold Mounting Cap Screw and Nut	25 N•m (221 lb-in.)
Intake Manifold Mounting Cap Screw	11 N•m (97 lb-in.)
Rear Crankcase Oil Seal Case-to-Block Cap Screw	11 N•m (97 lb-in.)
Oil Pan-to-Seal Case Cap Screw	9 N•m (78 lb-in.)
Fuel Injection Nozzle Fitting Torque	40 N•m (30 lb-ft)
Fuel Injection Nozzle Torque	50 N•m (37 lb-ft)
Oil Pump Housing-to-Valve Body Retaining Nut	30 N•m (22 lb-ft)
Flywheel Mounting Cap Screw	79 - 88 N•m (58 - 65 lb-ft)
Engine Back Plate Mounting Cap Screw	91 N•m (67 lb-ft)
Oil Pan-to-Block	11 N•m (97 lb-in.)
Oil Pan-to-Seal Case	9 N•m (80 lb-in.)
Oil Pan-to-Timing Gear Housing	9 N•m (80 lb-in.)
Oil Strainer-to-Block	11 N•m (97 lb-in.)

ENGINE - DIESEL SPECIFICATIONS

Other Materials

Other Material

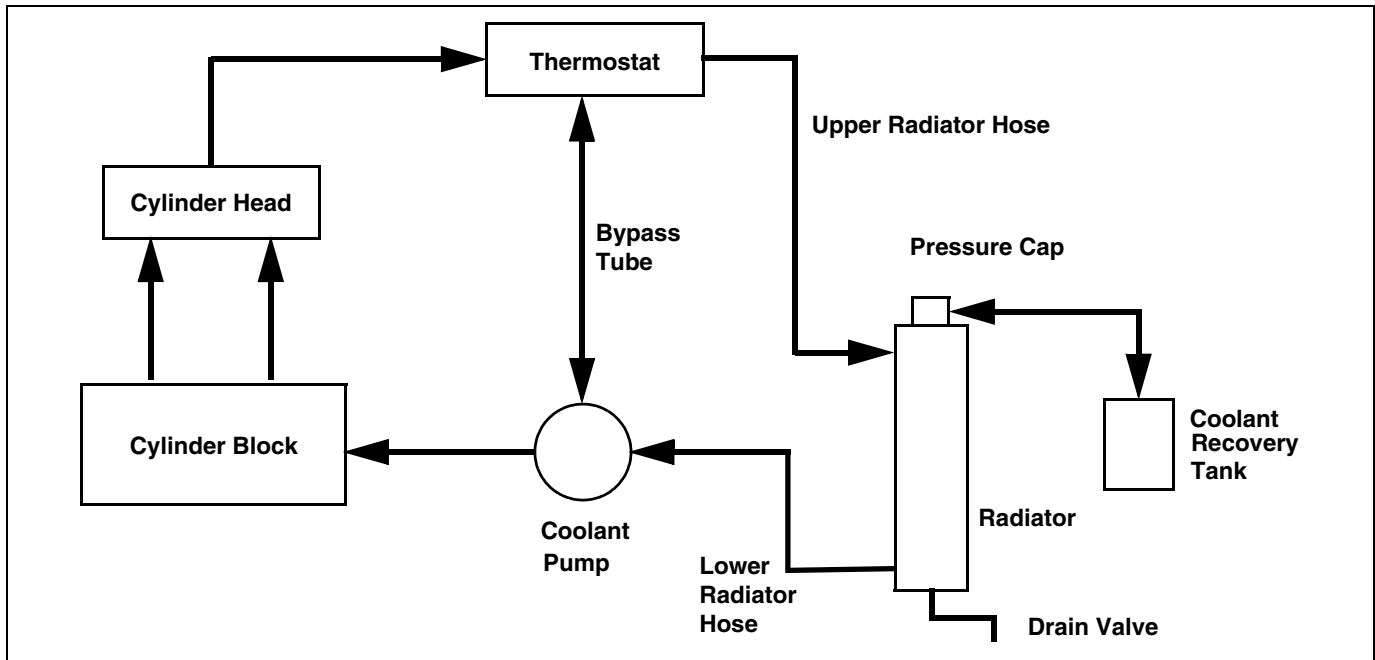
Part No.	Part Name	Part Use
TY15130 LOCTITE® No. 595	John Deere Form-In-Place Gasket	Seals crankcase extension housing, rear oil seal case and flywheel housing to engine block. Seals oil pan to timing gear housing and engine block.

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ENGINE - DIESEL THEORY OF OPERATION

Theory of Operation

Cooling System Theory of Operation



Function:

The cooling system allows the engine to rise to full operating temperature when engine is started cold, but keeps the engine from overheating once engine reaches operating temperature. The thermostat opens when operating temperature has been reached, circulating coolant from the hot engine to the radiator to prevent engine overheating. The cooling system is pressurized, which raises the boiling point of the coolant, and allows more heat to be carried away from the engine.

Theory of Operation:

The cooling system includes the following components: radiator, radiator cap, upper and lower radiator hoses, coolant pump, fan, thermostat, coolant recovery tank, drain hoses and drain valve.

When the engine is started cold, the thermostat is closed. The impeller type coolant pump pulls coolant from the cylinder head and through the bypass tube inside the water pump housing. The water pump then pushes the coolant into the cylinder block water jacket. The coolant absorbs heat from the cylinder walls, and is then pushed up into the cylinder head, and sucked back into the water pump. This provides a fast warm-up period, as engine heat is retained and evenly distributed throughout the engine.

As the engine has reaches operating temperature, **69.5 - 72.5°C (157 - 163°F)**, the thermostat opens, and the hot

coolant from the cylinder head passes through the thermostat and into the top tank of the radiator. As coolant flows down through the tubes of the radiator core, heat is transferred from the coolant to the air stream being drawn through the core by the engine fan. When the coolant reaches the bottom radiator tank, it is sucked through the lower radiator hose and into the water pump, and pushed back into the cylinder block.

When coolant system pressure exceeds **88.3 ± 14.7 kPa (12.8 ± 2.2 psi)**, the spring in the radiator cap pushes open to allow coolant to discharge into the coolant recovery tank. As the engine cools after shutdown, a vacuum is produced in the cooling system, and coolant is drawn back out of the coolant recovery tank through a small valve in the bottom of the radiator cap.

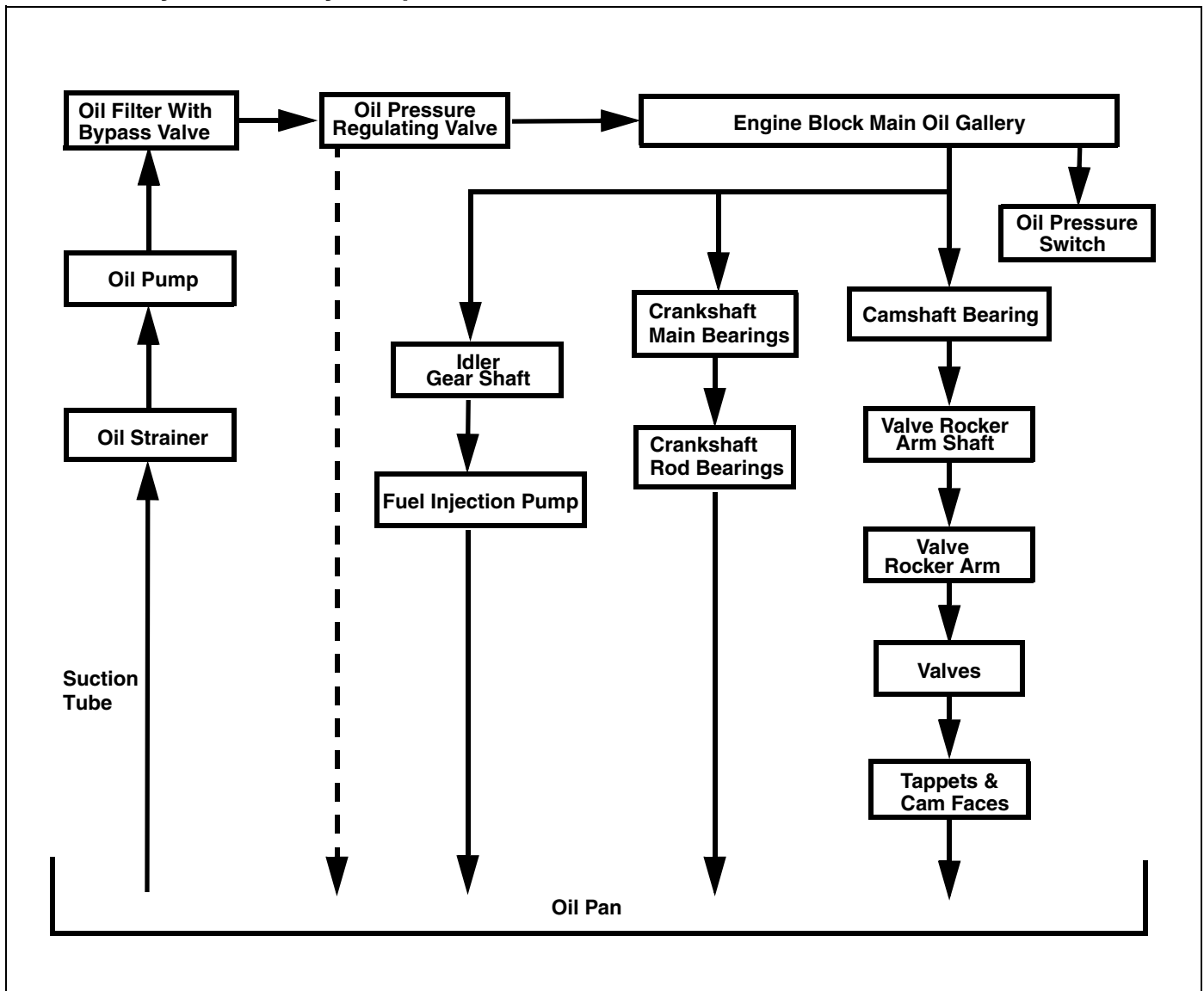
Air is pulled by the engine fan through a removable debris guard on the front of the radiator, through the radiator and fan, and back over engine block. The engine fan belt drives both the water pump and the cooling fan.

An electrical coolant temperature switch is located in the thermostat housing. When the coolant temperature reaches **107 - 113°C (225 - 235°F)**, the coolant temperature switch closes, lighting the coolant warning lamp on the instrument panel. This informs the operator of the high temperature condition.

The radiator can be drained with a drain valve on the bottom right side of the engine. The coolant recovery tank can be drained from a removable rubber plug on the bottom of the recovery tank.

ENGINE - DIESEL THEORY OF OPERATION

Lubrication System Theory of Operation



MIF

Function:

A full pressure system lubricates engine parts with clean oil.

Theory of Operation:

The pressure lubrication system consists of a positive displacement gear-driven pump, oil strainer, full flow oil filter, oil pressure regulating valve, and an electrical oil pressure warning switch.

The oil pump is mounted on the front plate of the engine, under the engine front cover, and is driven by the crankshaft. The oil pump draws oil from the oil pan through the strainer and suction tube. The oil is then pumped through an oil passage to the oil filter, oil pressure regulating valve, and through the engine block main oil gallery.

From the main oil gallery, oil is pushed to the crankshaft main bearing journals and idler gear shaft. Drilled cross-passages in the crankshaft distribute the oil from the main bearings to the connecting rod bearing journals.

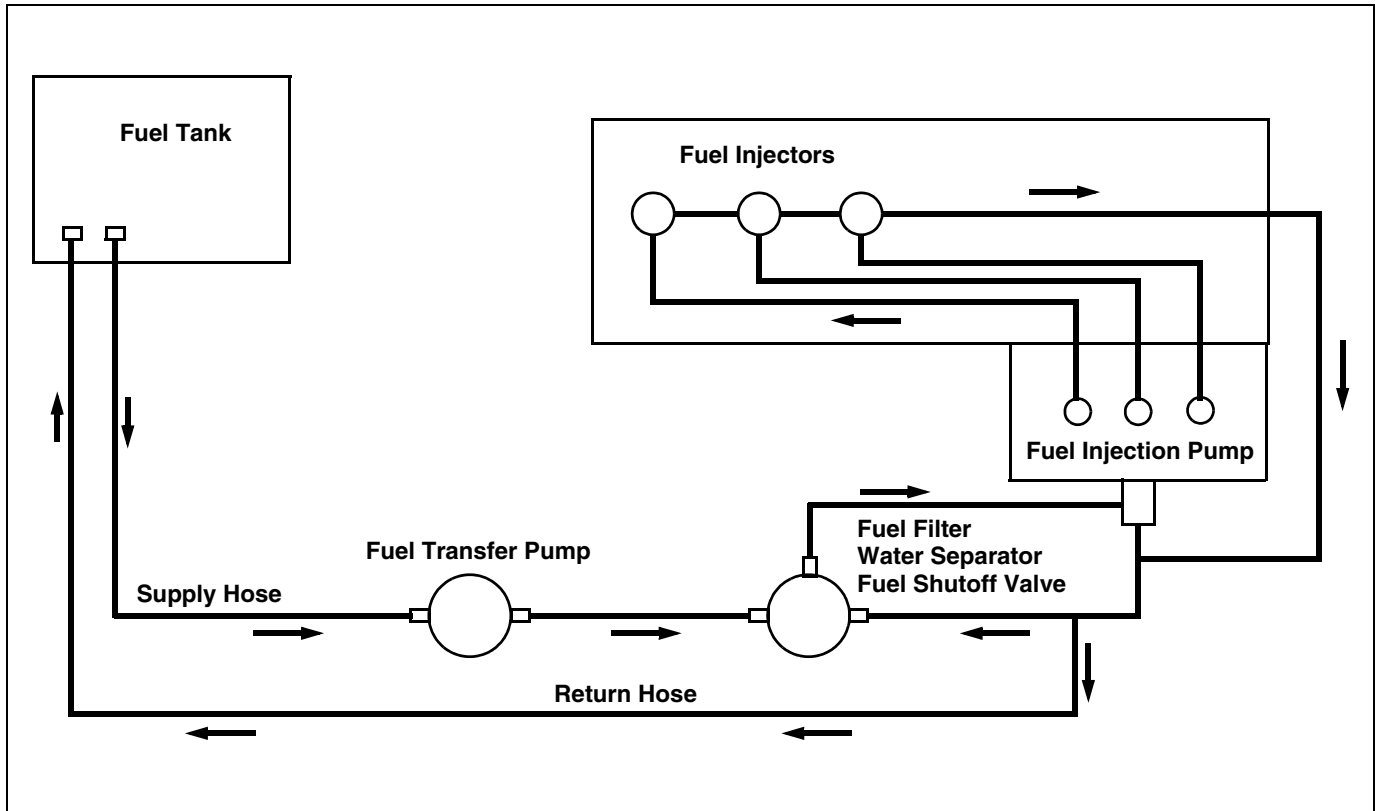
Lube oil holes in the main bearing oil grooves send oil through drilled passages to the camshaft bearings.

A drilled passage from the rear camshaft bearing through the cylinder block and cylinder head supplies lubricating oil to the rocker arm shaft. The hollow rocker shaft distributes oil to the rocker arms, tappets and valves.

If oil pressure drops below specification, a pressure switch activates the engine oil pressure light to alert the operator to shut down the engine.

ENGINE - DIESEL THEORY OF OPERATION

Fuel System Theory of Operation



MIF

Function:

The fuel system supplies clean fuel to injection pump and nozzles, and circulates unused fuel back to the tank. An instrument panel mounted electric fuel gauge shows the operator amount of fuel remaining.

Theory of Operation:

The engine driven mechanical fuel transfer pump draws fuel from the tank and pumps it to the combination glass bowl fuel filter/water separator/fuel shutoff valve. If the fuel valve is on, fuel flows to the fuel injection pump. After the injection pump housing is full, excess fuel is recirculated, along with excess leakoff fuel from the injectors, through the fuel filter. Excess fuel is returned to the fuel tank.

The engine speed is controlled by the hand throttle lever. The throttle linkage is connected to the injection pump/governor control lever.

The fuel shutoff solenoid controls the flow of fuel inside the injection pump. When the solenoid is energized (ignition key to START position), the solenoid pulls in and allows fuel to be pumped to the injectors. When the key is turned off, return springs extend the solenoid to the shutoff position. The solenoid stops the flow of fuel inside the fuel injector pump by forcing the governor rack linkage to the NO FUEL position, causing the fuel injector pump to stop supplying fuel to the injectors.

The injection pump meters fuel as determined by the governor and delivers it at high pressure to the injection nozzles. The injection nozzle prevents flow until high pressure is reached, opening the valve and spraying atomized fuel into the pre-combustion swirl chamber. Injection lines have trapped fuel inside whenever injection is not taking place.

A small amount of fuel leaks past the nozzle valve to lubricate the fuel injection nozzle. This leakage combines with excess fuel from the injection pump and is returned to tank. Any air in the fuel system is bled out with return fuel to the fuel tank.

A float-type fuel level sensor mounted in the tank drives a instrument panel mounted gauge, informing the operator of the fuel level.

The fuel shutoff solenoid has two coils inside; one pull-in, and one hold-in coil. The hold-in coil is energized whenever the key switch is in the ON or START position. The pull-in coil is energized only when in the START position and start criteria are met.

ENGINE - DIESEL THEORY OF OPERATION

Air System Theory of Operation

Function:

The air intake system filters air needed for combustion. The system components include: air inlet tube, air cleaner housing and cover, unloader valve (and rubber clean-out valve), primary air filter element, secondary (or safety) air cleaner element, air cleaner restriction indicator, and outlet tube.

Theory of Operation:

Air enters the air cleaner inlet tube and into the air cleaner housing, and is directed into the side of a shield. This starts a high-speed centrifugal motion of air which continues around the element until it reaches the far end of the air cleaner housing, to an unloader valve.

Most of the dust is separated from the air by centrifugal force that causes heavy dust particles to enter the opening at the top of the unloader valve. The air flows through the primary air filter element. The primary filter element filters the larger dirt particles before the air enters the secondary air filter element. The finer dirt particles are filtered out by the secondary air filter before the air enters the intake manifold.

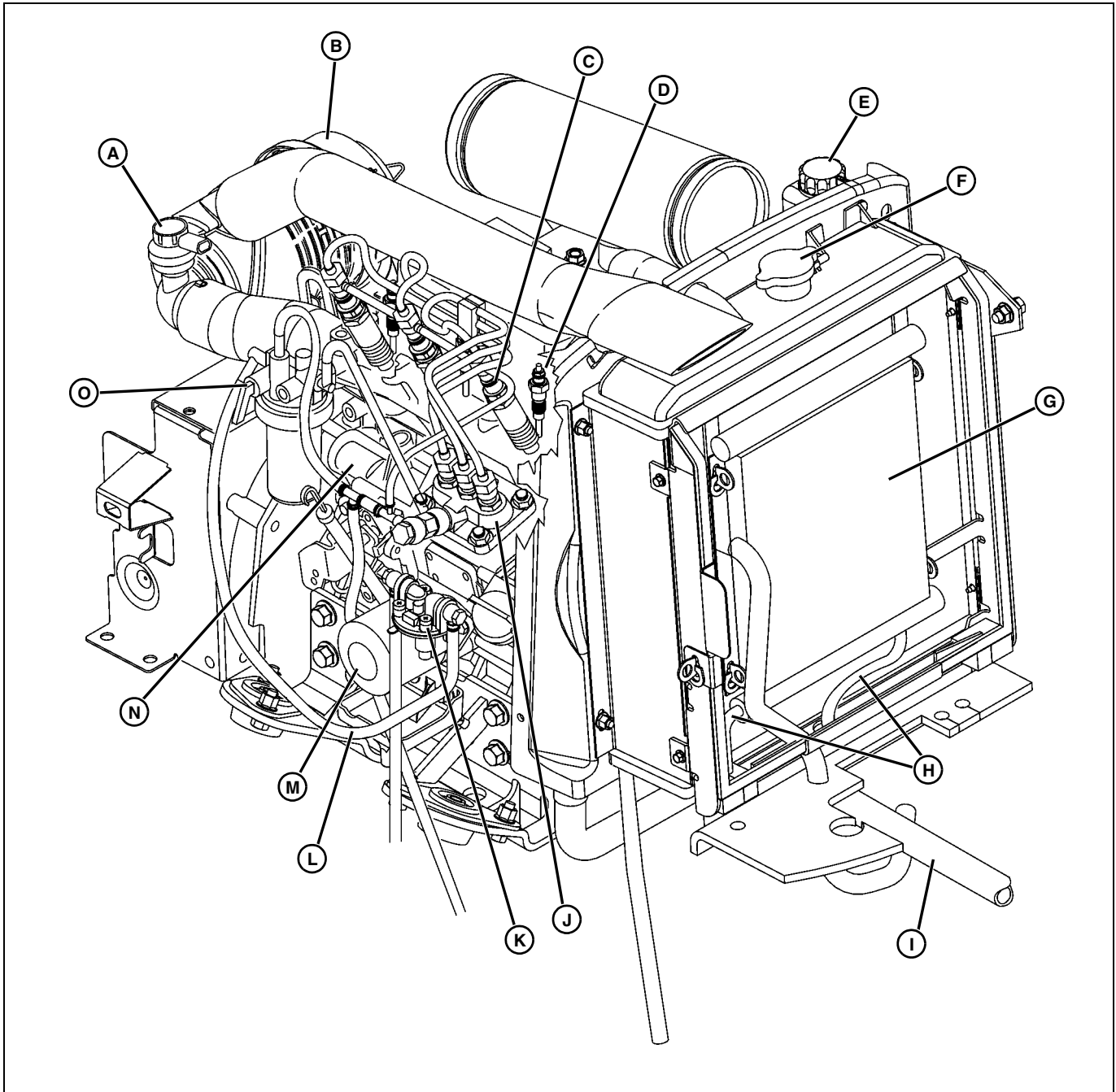
The dirt that is deposited in the unloader valve is removed through the rubber diaphragm at the base of the air cleaner. When the engine is running, a pulsing action is created in the intake system by each intake stroke of the engine. This pulsing action causes the rubber diaphragm to open and close, thus emptying the unloader valve. The operator can squeeze the valve to let the large particles out.

The difference in pressure between the intake manifold and air cleaner is monitored by the Air Cleaner Restriction Indicator. As the air filters become clogged, and intake manifold vacuum increases, the restriction indicator piston is pulled down against spring tension, and it shows when it's time to change air cleaner.

ENGINE - DIESEL COMPONENT LOCATION

Component Location

Diesel Engine Component Location



MX14299

- A - Air Restriction Sensor
- B - Air Filter
- C - Fuel Injector
- D - Glow Plug
- E - Coolant Reservoir
- F - Radiator Cap
- G - Hydraulic Oil Cooler

- H - Hydraulic Oil Hoses
- I - Drive Shaft to Transaxle
- J - Fuel Injector Pump
- K - Fuel Pump
- L - Fuel Line (Fuel Pump Out to Filter)
- M - Oil Filter
- N - Fuel Shutoff Solenoid
- O - Fuel Filter On/Off Valve

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for your reading.**

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