MID-MOUNT ZTRAK M653/655/665

Serial No. (010001 -)

TECHNICAL MANUAL

John Deere
Worldwide Commercial and
Consumer Equipment Division

TM1778 (Sep99)

Litho in U.S.A

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
- General Diagnostic Information
- Specifications
- Electrical Wiring Harness Legend
- Component Location
- System Schematic
- Wiring Harness
- Troubleshooting Chart
- Theory of Operation
- Diagnostics
- Tests & Adjustments
- Repair

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

Each section will be identified with a symbol rather than a number. The groups and pages within a section will be consecutively numbered.

We appreciate your input on this manual. To help, there are postage paid post cards included at the back. If you find any errors or want to comment on the layout of the manual please fill out one of the cards and mail it back to us.

Safety

Specifications and Information

Engine

Electrical

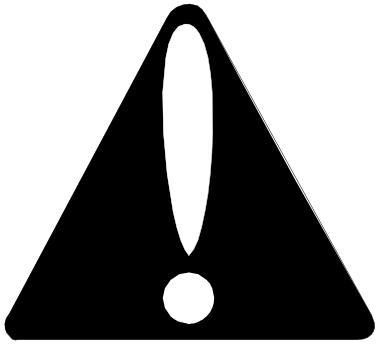
Hydrostatic Power Train

Brakes

Attachments

Miscellaneous M

RECOGNIZE SAFETY INFORMATION



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.

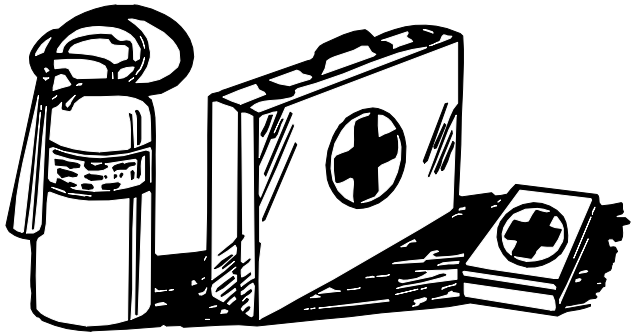
DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

REPLACE SAFETY SIGNS

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



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.

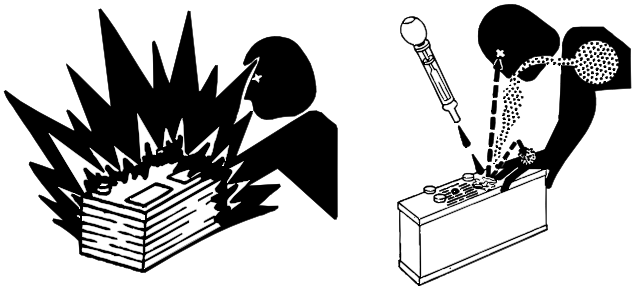
Do not store oily rags; they can ignite and burn spontaneously.

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



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:**

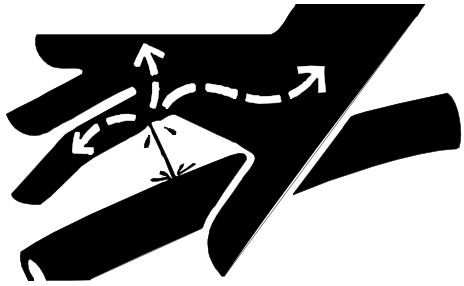
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10—15 minutes.
4. Get medical attention immediately.

- **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.

USE CARE AROUND HIGH-PRESSURE FLUID LINES

Avoid High-pressure Fluids



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.

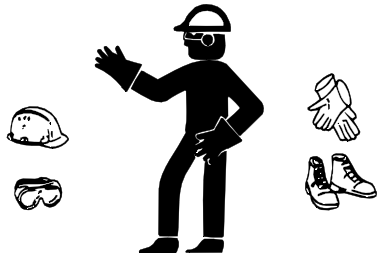
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

Avoid Heating Near Pressurized Fluid Lines

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.

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

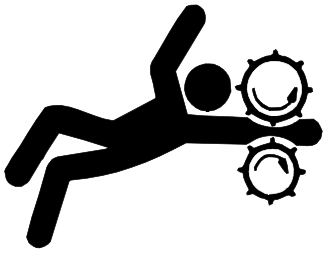


Wear close fitting clothing and safety equipment appropriate to the job.

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.

Service Machines Safely



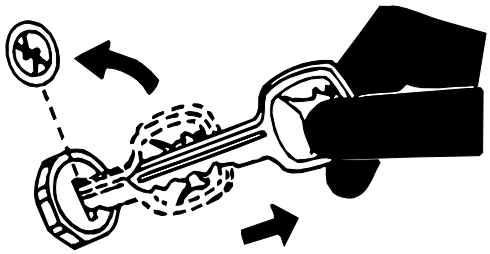
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

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.

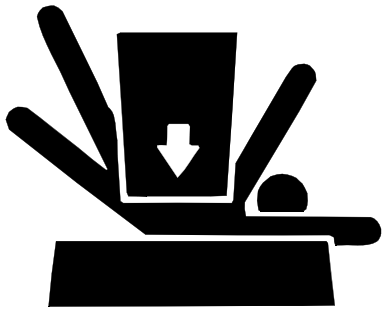
Park Machine Safely



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



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.

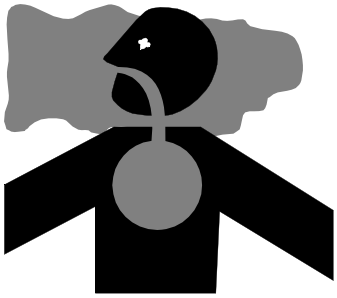
Using High Pressure Washers

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.

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.

WARNING: California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

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

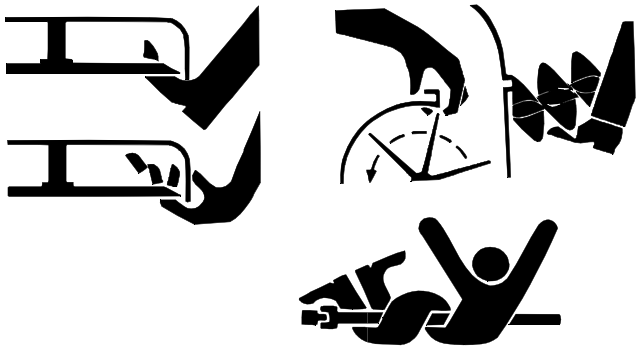
Explosive separation of a tire and rim parts can cause serious injury or death.

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.

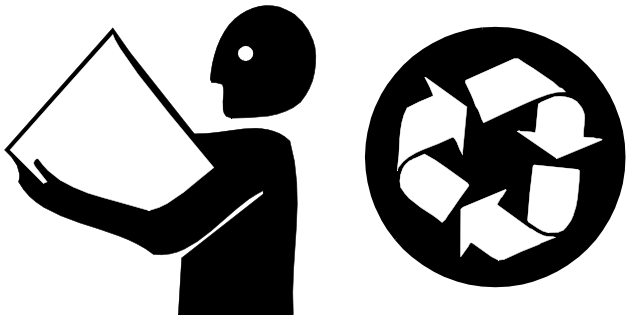
Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

AVOID INJURY FROM ROTATING BLADES, AUGERS AND PTO SHAFTS



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

HANDLE CHEMICAL PRODUCTS SAFELY



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

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

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SERIAL NUMBER LOCATION

MACHINE IDENTIFICATION NUMBER 15
ENGINE SERIAL NUMBER 15

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GENERAL VEHICLE SPECIFICATIONS

ENGINE—M653

Make	Kohler
Type	4 Cycle, V-Twin
Model	CH22S
Power Output	16.4 kW (22 hp)
Displacement	674 cm^3 (41.1 cu in.)
Aspiration	Natural
Cooling System	Air Cooled
Lubrication	Full Pressure
Engine Oil Capacity (with Filter)	1.9 L (2.0 qt)
Oil Filter	Replaceable, Full Flow
Valving	Overhead Valves
Air Cleaner	Heavy-Duty, Dry, Replaceable Filter Element with Cyclone Pre-Cleaner
Bore	80 mm (3.15 in.)
Stroke	67 mm (2.64 in.)
Compression Ratio	8.5:1
Slow Idle	1400 ±50 rpm
Fast Idle (No Load)	3600 +50/-0 rpm

ENGINE—M655 and 665

Make	Kohler
Type	4 Cycle, V-Twin
Model	CH25S
Power Output	18.6 kW (25 hp)
Displacement	725 cm^3 (44.2 cu in.)
Aspiration	Natural
Cooling System	Air Cooled
Lubrication	Full Pressure
Engine Oil Capacity (with Filter)	2.0 L (2.1 qt)
Oil Filter	Replaceable, Full Flow
Valving	Overhead Valves
Air Cleaner	Heavy-Duty, Dry, Replaceable Filter Element with Cyclone Pre-Cleaner
Bore	83 mm (3.27 in.)
Stroke	67 mm (2.64 in.)
Compression Ratio	9:1
Slow Idle	1400 ±50 rpm
Fast Idle (No Load)	3600 +50/-0 rpm

FUEL SYSTEM

Fuel Tank Location	On Each Side of the Operator
Fuel Tank Capacity (Total)	30.0 L (10.0 gal)
Fuel (Minimum Octane)	Unleaded Gasoline, 87 Octane
Fuel Delivery	Pulse
Carburetor	Externally Vented Downdraft
Fuel Filter	Replaceable In-Line
Gasoline/Alcohol Blends	Up to 10% Ethyl Alcohol/90% Unleaded (By Volume)
Gasoline/Ether Blends	Up to 15% MTBE/85% Unleaded (By Volume)
Fuel Shutoff Solenoid	Below Carburetor Float Bowl

DRIVE TRAIN

Hydraulic System Oil Capacity . . . . . 7.6 L (2.0 gal)
Type. . . . . Hydrostatic
Travel Speeds:
Forward. . . . . 0—14.4 km/h (0—9.0 mph)
Reverse. . . . . 0—6.4 km/h (0—4.0 mph)

STEERING

Type. . . . . Individual Wheel Motor Speed Control
Control. . . . . Twin Hand Control Lever

BRAKES

Main Breaking . . . . . Hydrostatic (Dynamic)
Park Brake. . . . . Dual Band
Park Brake Actuation. . . . . Hand Lever

MOWER DECK (54-INCH)

Number of Blades 3
Cutting Height . . . . . 38—127 mm (1.50—5.00 in.)
Cutting Width. . . . . 1372 mm (54 in.)
Drive . . . . . Belt

MOWER DECK (60-INCH)

Number of Blades 3
Cutting Height . . . . . 38—127 mm (1.50—5.00 in.)
Cutting Width. . . . . 1524 mm (60 in.)
Drive . . . . . Belt

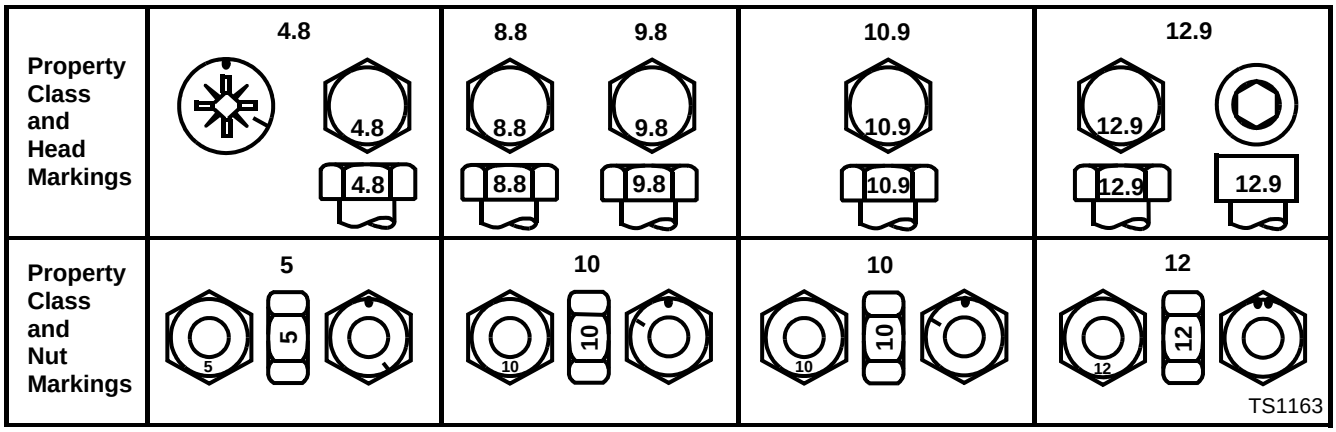
WHEELS AND TIRES

Front Wheels . . . . . 13 x 5.00-6 Pneumatic
Drive Wheels (Rear) . . . . . 23 x 10.5-12 Turf
Load Rating. 4-Ply

WEIGHTS AND DIMENSIONS

Weight . . . . . 476 kg (1050 lbs)
Overall Width - Discharge Chute Up (54-Inch Mower Deck) . . . . . 1460 mm (57 in.)
Overall Width - Discharge Chute Up (60-Inch Mower Deck) . . . . . 1613 mm (63.5 in.)
Overall Length. . . . . 2006 mm (79 in.)
Overall Height . . . . . 1940.3 mm (76.5 in.)

METRIC FASTENER TORQUE VALUES



	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]	
SIZE	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 ±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 class. 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.

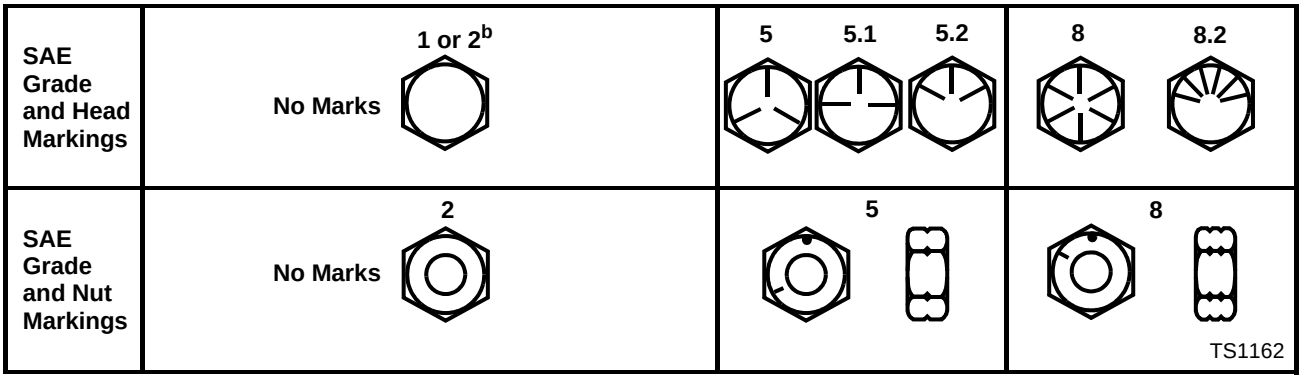
[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.*

Reference: JDS—G200.

METRIC FASTENER TORQUE VALUE—GRADE 7

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

INCH FASTENER TORQUE VALUES



	Grade 1				Grade 2[b]				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]	
SIZE	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

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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.*

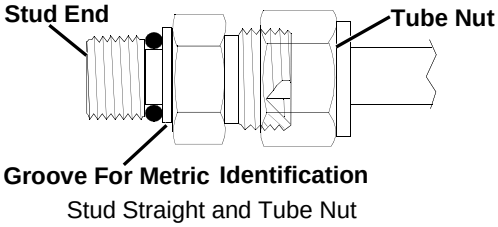
b *"Grade 2" applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. "Grade 1" applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.*

Reference: JDS—G200.

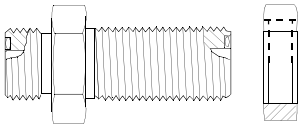
NOTE: Torque tolerance is + 15 minus 20%.

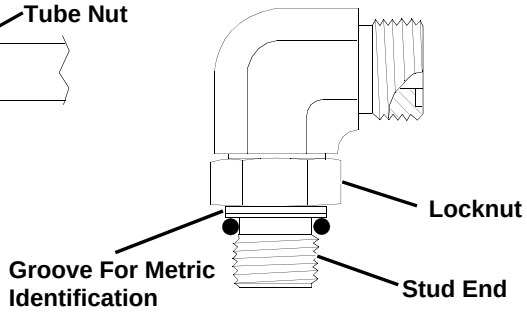
O-RING SEAL SERVICE RECOMMENDATIONS

FACE SEAL FITTINGS WITH METRIC STUD ENDS TORQUE

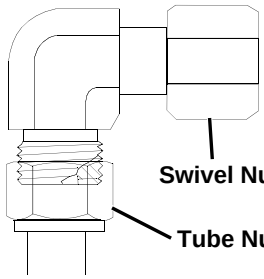


Stud Straight and Tube Nut


Bulkhead Union and Bulkhead Lucknut



90 Adjustable Stud Elbow

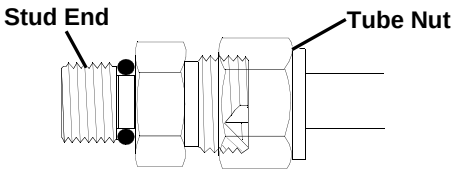


90 Swivel Elbow and Tube Nut

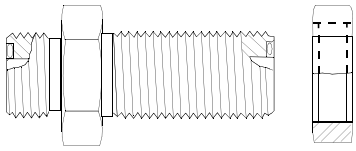
Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End						O-ring Stud Ends, Straight Fitting or Locknut					
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Hex Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
mm	Dash Size	in.	mm	in.	mm	N•m	lb-ft	N•m	lb-ft	mm	mm	N•m	lb-ft	N•m	lb-ft
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 minus 20%.

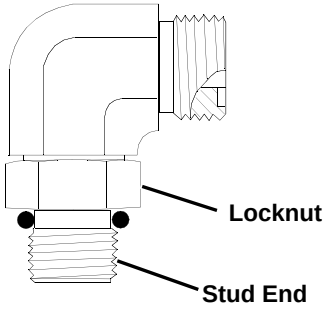
FACE SEAL FITTINGS WITH INCH STUD ENDS TORQUE



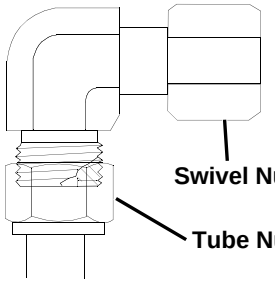
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Locknut



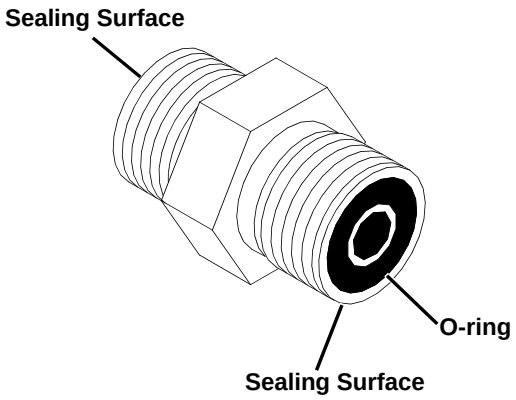
90 Adjustable Stud Elbow



90 Swivel Elbow and Tube Nut

Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End					O-ring Stud Ends		
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Straight Fitting or Locknut Torque	
mm	Dash Size	in.	mm	in.	N•m	lb-ft	N•m	lb-ft	in.	N•m	lb-ft
	-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
	-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

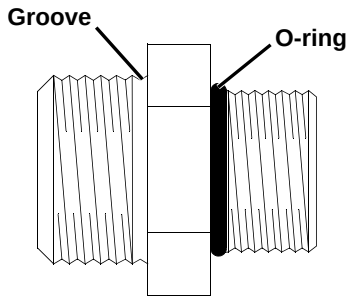
O-RING FACE SEAL FITTINGS



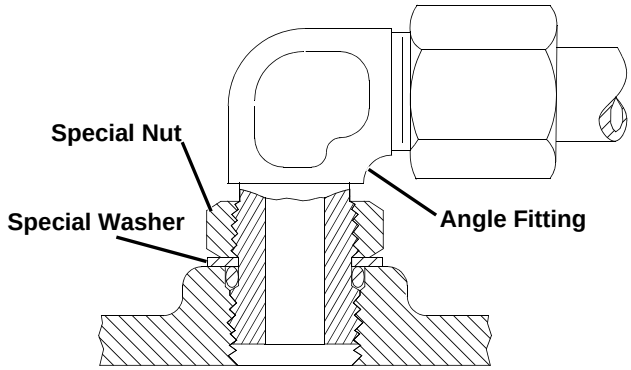
1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.
2. Inspect the O-ring. It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.
5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.
6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.

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.



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



3. For angle fittings, loosen special nut and push special washer 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, 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.

STRAIGHT FITTING OR SPECIAL NUT TORQUE

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

a. Torque tolerance is ± 10 percent.
b. To 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.

GASOLINE SPECIFICATIONS

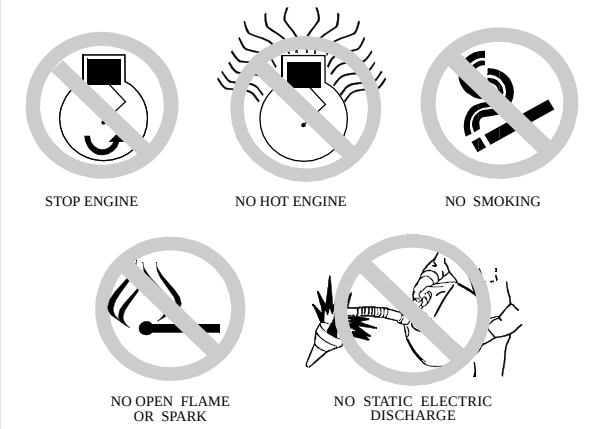
4-CYCLE ENGINES—NORTH AMERICA

⚠ CAUTION

Gasoline is HIGHLY FLAMMABLE, handle it with care.

DO NOT refuel machine while:

- **indoors, always fill gas tank outdoors;**
- **machine is near an open flame or sparks;**
- **engine is running, STOP engine;**
- **engine is hot, allow it to cool sufficiently first;**
- **smoking.**



Help prevent fires:

- **fill gas tank to no more than 1” below bottom of filler neck;**
- **be sure fill cap is tight after fueling;**
- **clean up any gas spills IMMEDIATELY;**
- **keep machine clean and in good repair—free of excess grease, oil, debris, and faulty or damaged parts;**
- **any storage of machines with gas left in tank should be 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.**

To prevent fire or explosion caused by STATIC ELECTRIC DISCHARGE during fueling:

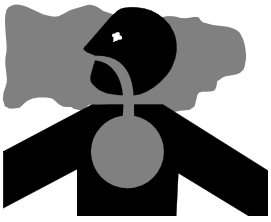
- **ONLY use a clean, approved POLYETHYLENE PLASTIC fuel container and funnel WITHOUT any metal screen or filter.**

To avoid engine damage:

- DO NOT mix oil with gasoline;
- **ONLY use clean, fresh unleaded gasoline with an octane rating (anti-knock index) of 87 or higher**;
- fill gas tank at the end of each day's operation to help prevent condensation from forming inside a partially filled tank;
- keep up with specified service intervals.

Use of alternative oxygenated, gasohol blended, unleaded gasoline is acceptable as long as:

- the ethyl or grain alcohol blends DO NOT exceed 10% by volume or
- methyl tertiary butyl ether (MTBE) blends DO NOT exceed 15% by volume.



IMPORTANT: DO NOT use METHANOL gasolines because METHANOL is harmful to the environment and to your health.

⚠ WARNING

<u>California Proposition 65 Warning:</u> Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

GASOLINE STORAGE

IMPORTANT: Keep all dirt, scale, water or other foreign material out of gasoline.

Keep gasoline stored in a safe, protected area. Storage of gasoline in a clean, properly marked (“UNLEADED GASOLINE”) POLYETHYLENE PLASTIC container WITHOUT any metal screen or filter is recommended. DO NOT use de-icers to attempt to remove water from gasoline or depend on fuel filters to remove water from gasoline. Use a water separator installed in the storage tank outlet. BE SURE to properly discard unstable or contaminated gasoline. When storing unit or gasoline, it is recommended that you add **John Deere Gasoline Conditioner and Stabilizer (TY15977)** or an equivalent to the gasoline. BE SURE to follow directions on container and to properly discard empty container.

OIL AND LUBRICANT SPECIFICATIONS

4–CYCLE GASOLINE ENGINE OIL—NORTH AMERICA

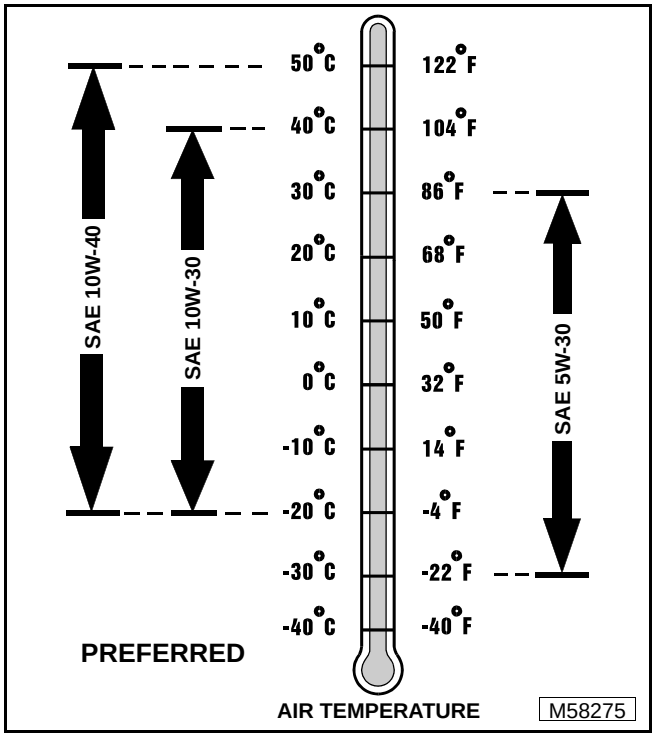
Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

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

- **TURF–GARD®—SAE 10W-30;**
- **PLUS–4®—SAE 10W-30**;

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

- SAE 10W-30—API Service Classification SG or higher;



HYDROSTATIC TRANSMISSION AND HYDRAULIC OIL—NORTH AMERICA

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

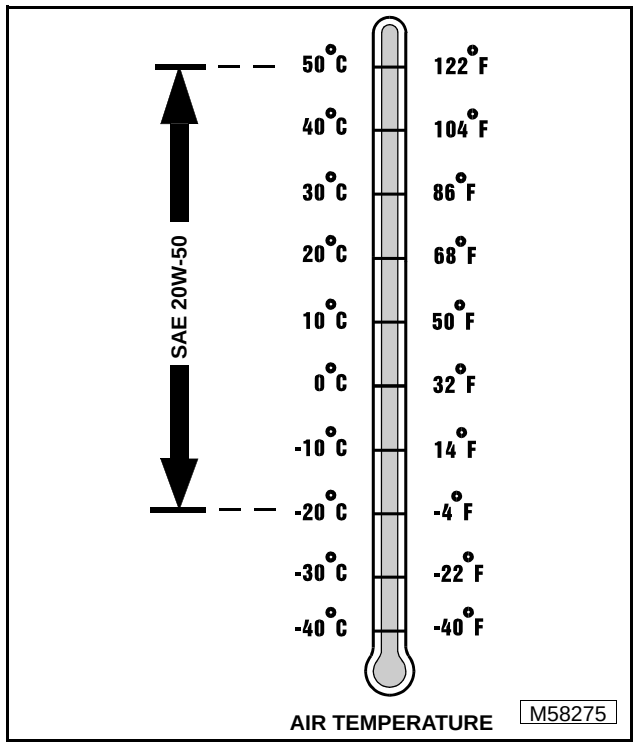
IMPORTANT: DO NOT use engine oil or "Type F" (Red) Automatic Transmission Fluid in this transmission. DO NOT mix any other oils in this transmission. DO NOT use BIO–HY–GARD® in this transmission.

The following oil is **REQUIRED**:

- **SAE 20W-50**.

Oils must meet the following specification:

- API Service Specification SG or higher.



ANTI-CORROSION GREASE SPECIFICATIONS

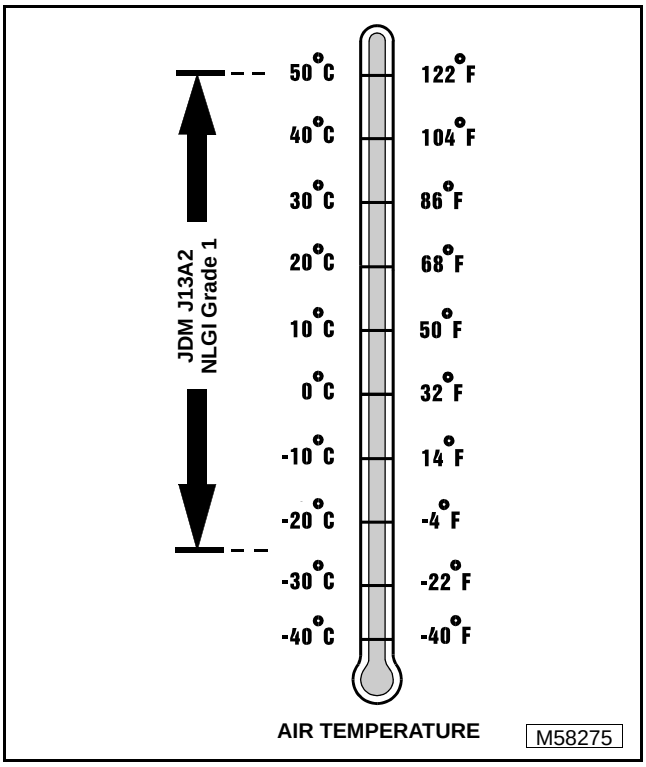
This anti-corrosion grease is formulated to provide the best protection against absorbing moisture, which is one of the major causes of corrosion. This grease is also superior in its resistance to separation and migration.

The following anti-corrosion grease is **PREFERRED**:

- **DuBois MPG-2® Multi-Purpose Polymer Grease—M79292.**

Other greases may be used if they meet or exceed the following specifications:

- John Deere Standard JDM J13A2, NLGI Grade 1.



CHASSIS AND MOWER SPINDLE GREASE

This premium, multi-purpose grease is specially formulated as a high-temperature, extreme-pressure grease, especially effective in rolling contact applications.

The following water resistant grease is **PREFERRED**:

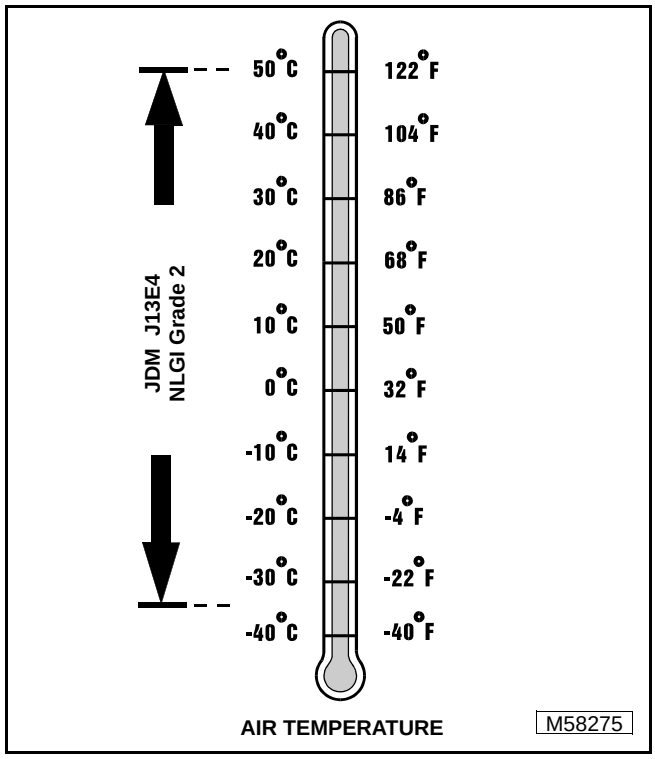
- **Multi-Purpose SD Polyurea Grease—TY6341.**

The following multi-purpose grease may also be used:

- **Multi-Purpose HD Lithium Complex Grease—TY24416.**

Other greases may be used if they meet or exceed the following specifications:

- John Deere Standard JDM J13E4, NLGI Grade 2.



ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than the ones printed in this technical manual or the operator's manual. Consult with your John Deere Dealer, or Sales Branch, to obtain the alternative lubricant recommendations.

IMPORTANT: 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.

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.

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: 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:

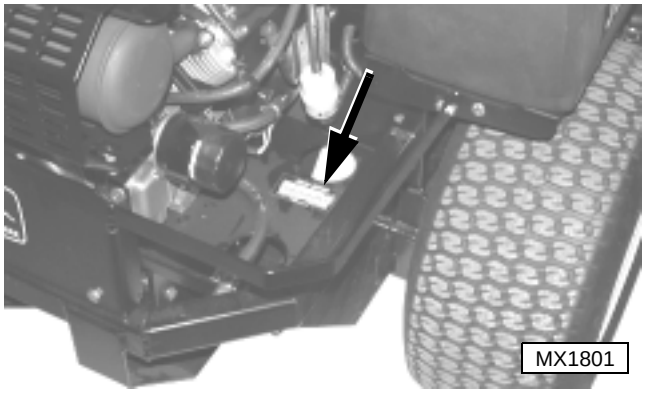
- ASTB Tested In Accordance With SAE J806.

SERIAL NUMBER LOCATIONS

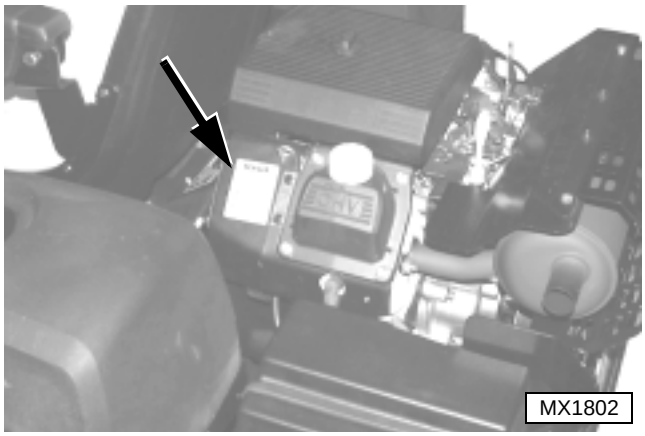
When ordering parts or submitting a warranty claim, it is IMPORTANT the machine product identification number and component serial number are included.

The location of the machine identification number and component numbers are shown.

MACHINE IDENTIFICATION NUMBER



ENGINE SERIAL NUMBER



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SPECIFICATIONS

TEST AND ADJUSTMENT SPECIFICATIONS

Crankcase Vacuum (Minimum at Operating Temp.)	10.2 cm (4 in.) of Water Movement
Fuel Pump Minimum Fuel Flow	10.4 mL (0.35 oz.) in 10 seconds
Oil Pressure (Minimum at 1250 rpm)	124 kPa (18 psi)
Carburetor Slow Idle Mixture Screw Initial Setting	Lightly Seat, then 1 Turn Out
Slow Idle Speed	1400 ±50 rpm
Fast Idle Speed	3600 +50/-0 rpm
Spark Plug:	
Type	Champion® RC12YC (or Equivalent)
Gap	1.02 mm (0.040 in.)
Installation Torque	27 N•m (20 lb-ft)

REPAIR SPECIFICATIONS

Fuel Tank Capacity	30 L (10 gal)
Muffler Mounting Nut Torque	24.4 N•m (216 lb-in.)
PTO Drive Sheave Installation Distance (Rear of sheave flange to Blower Screen)	76 mm (3.0 in.)
Engine Oil Capacity (with Filter, Dry Engine):	
CH22S	1.9 L (2.0 qt)
CH25S	2.0 L (2.1 qt)
Oil Filter Torque	7.5 ±1.5 N•m (65 ±15 lb-in.)
Oil Drain Hose Fitting Torque	14 N•m (124 lb-in.)
Engine Mounting Cap Screw Torque	32 N•m (24 lb-ft)
PTO Clutch Retainer Screw Torque	136 N•m (100 lb-ft)
Air Cleaner Assembly Base Plate Mounting Cap Screw Torque	10 N•m (88 lb-in.)
Carburetor:	
Carburetor Air Horn Cap Screws	1.7 N•m (15 lb-in.)
Carburetor Mounting Fasteners Torque	10 N•m (88 lb-in.)
Float Height	22 mm (0.86 in.)
Throttle Plate Assembly Mounting Cap Screw Torque	10 N•m (88 lb-in.)
Intake Manifold Mounting Cap Screw Torque	10 N•m (88 lb-in.)
Fuel Pump Mounting Cap Screw Torque	2.3 N•m (20 lb-in.)
Oil Cooler Mounting Cap Screw Torque	4.7 N•m (35 lb-in.)
Voltage Regulator/Rectifier Mounting Cap Screw Torque	4.7 N•m (35 lb-in.)
Blower Housing and Shields:	
Mounting Cap Screw Torque (M5 Fasteners)	4.7 N•m (35 lb-in.)
Mounting Cap Screw Torque (M6 Fasteners)	8.6 N•m (65 lb-in.)
Flywheel Screen Cap Screw Torque	10 N•m (88 lb-in.)
Breather Mounting Cap Screw Torque	8.6 N•m (65 lb-in.)
Ignition Modules:	
Mounting Cap Screw Torque	4.0 N•m (35 lb-in.)
Resistance—Primary Side	5—1000 ohms
Resistance—Primary Side (Lead Reversed)	30 000 ohms (Minimum)
Resistance—Secondary Side	7.9—10.85 ohms.
Initial Air Gap	0.25 mm (0.010 in.)
Final Air Gap	0.203—0.305 mm (0.008—0.012 in.)
Flywheel Retaining Screw Torque	66.4 N•m (49 lb-ft)
Stator Mounting Cap Screw Torque	4.0 N•m (35 lb-in.)
Rocker Arm Cover Cap Screw Torque	8 N•m (70 lb-in.)

REPAIR SPECIFICATIONS (Continued)

- Rocker Arm Pivot Bolt Torque . . . . . 14 N•m (124 lb-in.)
- Push Rod —Maximum Bend . . . . . 0.76 mm (0.030 in.)
- Cylinder Head:
  - Spark Plug Installation Torque . . . . . 27.5 N•m (20 lb-ft)
  - Cylinder Head Cap Screw Torque . . . . . 40.7 N•m (30 lb-ft)
  - Cylinder Head Flatness (Maximum Warping) . . . . . 0.076 mm (0.003 in.)
  - Valve Seat Angle . . . . . 45°
  - Valve Seating Width . . . . . 0.50—1.10 mm (0.20—0.043 in.)
- Valve Guides:
  - Intake Valve Guide ID:
    - New . . . . . 7.038—7.058 mm (0.2771—0.2779 in.)
    - Maximum Wear Limit (Standard) . . . . . 7.134 mm (0.2809 in.)
    - Maximum Wear Limit (0.25 mm [0.010 in.] Reamed) . . . . 7.384 mm (0.2907 in.)
  - Exhaust Valve Guide ID:
    - New . . . . . 7.038—7.058 mm (0.2771—0.2779 in.)
    - Maximum Wear Limit (Standard) . . . . . 7.159 mm (0.2819 in.)
    - Maximum Wear Limit (0.25 mm [0.010 in.] Reamed) . . . . 7.409 mm (0.2917 in.)
  - Valve Guide Reamer:
    - Standard . . . . . 7.048 mm (0.2775 in.)
    - Oversize (0.25 mm) . . . . . 7.298 mm (0.2873 in.)
- Intake Valves:
  - Valve Stem-to-Valve Guide Running Clearance . . . . . 0.038—0.076 mm (0.0015—0.0030 in.)
  - Valve Lift (Minimum—Engine Cold) . . . . . 8.07 mm (0.3177 in.)
  - Maximum Valve Stem Bend . . . . . 0.076 mm (0.003 in.)
- Exhaust Valves:
  - Valve Stem-to-Valve Guide Running Clearance . . . . . 0.050—0.088 mm (0.0020—0.0035 in.)
  - Valve Lift (Minimum—Engine Cold) . . . . . 8.07 mm (0.3177 in.)
  - Maximum Valve Stem Bend . . . . . 0.076 mm (0.003 in.)
- Crankcase Cover:
  - Mounting Cap Screw Torque . . . . . 24.4 N•m (216 lb-in.)
  - Crankshaft Bore ID (Wear Limit) . . . . . 41.003 mm (1.6143 in.)
  - Oil Seal Installation Depth . . . . . 2.03 mm (0.08 in.)
- Governor:
  - Control Lever Cap Screw/Nut Torque . . . . . 10 N•m (88 lb-in.)
  - Cross Shaft OD:
    - New . . . . . 5.975—6.012 mm (0.2352—0.2367 in.)
    - Wear Limit . . . . . 5.962 mm (0.235 in.)
  - Crankcase-to-Cross Shaft Running Clearance . . . . . 0.013—0.075 mm (0.0005—0.0030 in.)
  - Gear Shaft OD:
    - New . . . . . 5.990—6.000 mm (0.2358—0.2362 in.)
    - Wear Limit . . . . . 5.977 mm (0.235 in.)
  - Gear Shaft-to-Governor Gear Running Clearance . . . . . 0.015—0.140 mm (0.0006—0.0055 in.)
  - Gear Shaft Installation Depth . . 34.0 mm (1.34 in.) above Flat on Crankcase Cover
- Oil Pump:
  - Relief Valve Spring Free Length . . . . . 47.4 mm (1.80 in.)
  - Oil Pump Screws:
    - First Time (Installation in a new cover) . . . . . 10.7 N•m (95 lb-in.)
    - Reinstallation . . . . . 6.7 N•m (60 lb-in.)

REPAIR SPECIFICATIONS, continued

- Camshaft:
  - Maximum End Play (with Shim) . . . . . 0.076—0.127 mm (0.003—0.005 in.)
  - Bearing-to-Bore Clearance . . . . . 0.025—0.063 mm (0.0010—0.0025 in.)
  - Bore ID:
    - New . . . . . 20.000—20.025 mm (0.7874—0.7884 in.)
    - Wear Limit . . . . . 20.038 mm (0.7889 in.)
  - Bearing Surface OD:
    - New . . . . . 19.962—19.975 mm (0.7859—0.7864 in.)
    - Wear Limit . . . . . 19.959 mm (0.7858 in.)
- Hydraulic Lifter-to-Crankcase
  - Running Clearance . . . . . 0.0124—0.0501 mm (0.0005—0.0020 in.)
- Pistons:
  - Piston-to-Pin Clearance . . . . . 0.006—0.017 mm (0.0002—0.0007 in.)
  - Piston Pin Bore ID:
    - New . . . . . 17.006—17.012 mm (0.6695—0.6698 in.)
    - Wear Limit . . . . . 17.025 mm (0.6703 in.)
  - Piston Pin OD:
    - New . . . . . 16.995—17.000 mm (0.6691—0.6693 in.)
    - Wear Limit . . . . . 16.994 mm (0.6691 in.)
  - Top Compression Ring-to-Groove Side Clearance
    - CH22S . . . . . 0.040—0.080 mm (0.0016—0.0031 in.)
    - CH25S . . . . . 0.025—0.048 mm (0.0010—0.0019 in.)
  - Middle Compression Ring-to-Groove Side Clearance
    - CH22S . . . . . 0.040—0.072 mm (0.0016—0.0028 in.)
    - CH25S . . . . . 0.015—0.037 mm (0.0006—0.0015 in.)
  - Oil Control Ring-To-Groove Side Clearance
    - CH22S . . . . . 0.060—0.202 mm (0.0024—0.0080 in.)
    - CH25S . . . . . 0.026—0.176 mm (0.0010—0.0070 in.)
  - Top and Center Compression Ring End Gap—CH22S:
    - New Bore . . . . . 0.25—0.45 mm (0.0098—0.0177 in.)
    - Used Bore (Maximum Wear Limit) . . . . . 0.77 mm (0.030 in.)
  - Top and Center Compression Ring End Gap—CH25S:
    - New Bore . . . . . 0.25—0.56 mm (0.0100—0.0224 in.)
    - Used Bore (Maximum Wear Limit) . . . . . 0.94 mm (0.037 in.)
  - Piston Thrust Face OD—CH22S:
    - Standard:
      - New . . . . . 76.967—76.985 mm (3.0302—3.0309 in.)
      - Wear Limit . . . . . 76.840 mm (3.0252 in.)
    - 0.50 mm (0.020 in.) Oversize Piston:
      - New . . . . . 76.967—76.985 mm (3.0302—3.0309 in.)
      - Wear Limit . . . . . 77.34 mm (3.0452 in.)
  - Piston Thrust Face OD—CH25S:
    - Standard:
      - New . . . . . 82.986 mm (3.3194 in.)
      - Wear Limit . . . . . 82.841 mm (3.3136 in.)
    - 0.50 mm (0.020 in.) Oversize Piston:
      - New . . . . . 83.486 mm (3.339 in.)
      - Wear Limit . . . . . 83.341 mm (3.336 in.)
  - Piston Thrust Face-to-Cylinder Bore Clearance:
    - CH22S . . . . . 0.015—0.058 mm (0.0006—0.0023 in.)
    - CH25S . . . . . 0.002—0.045 mm (0.001—0.0018 in.)