990 Compact Utility Tractor

TECHNICAL MANUAL

John Deere
Worldwide Commercial and
Consumer Equipment Division

TM1848 (27Jul00)

Litho in U.S.A

990 Compact Utility Tractor

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:

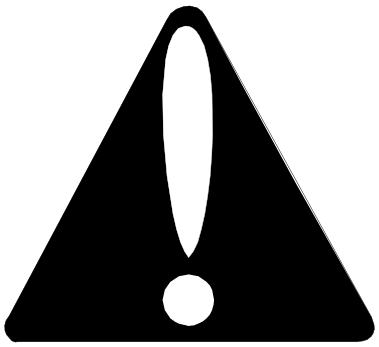
- Table of Contents
- Specifications
- Component Location
- System Schematic
- Theory of Operation
- Troubleshooting Chart
- Diagnostics
- Tests & Adjustments
- Repair

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.

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.

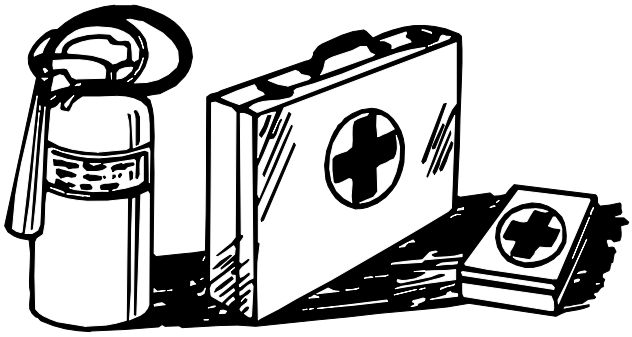
DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

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.

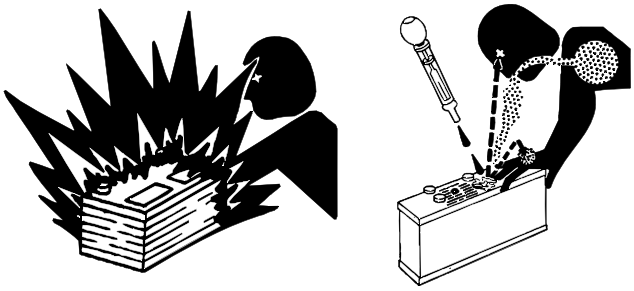
Do not store oily rags; they can ignite and burn spontaneously.

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:**

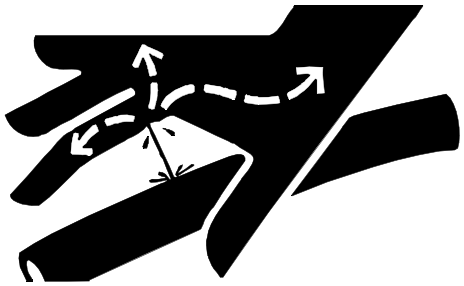
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10_15 minutes.
4. Get medical attention immediately.

- **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.

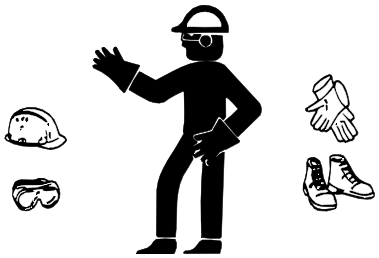
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

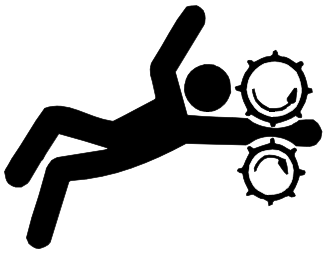


Wear close fitting clothing and safety equipment appropriate to the job.

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



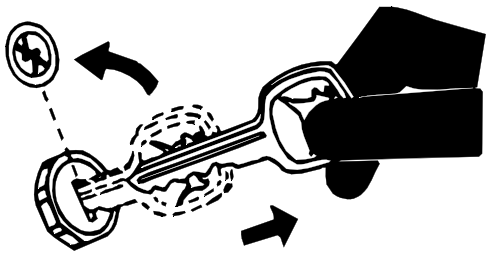
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

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.

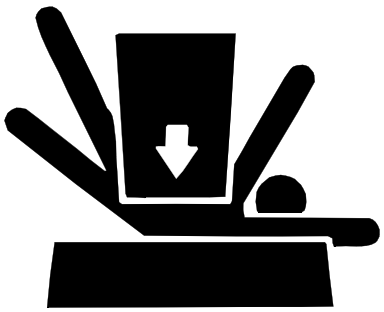
Park Machine Safely



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.

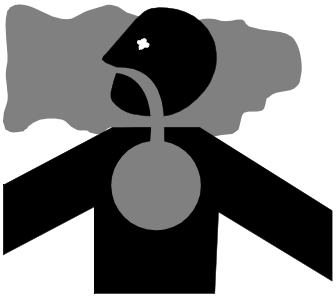
Using High Pressure Washers

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

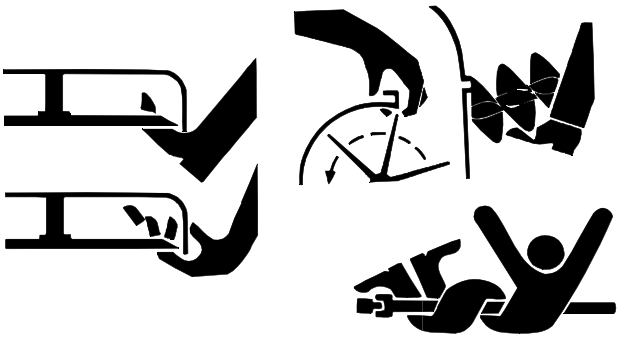
Explosive separation of a tire and rim parts can cause serious injury or death.

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



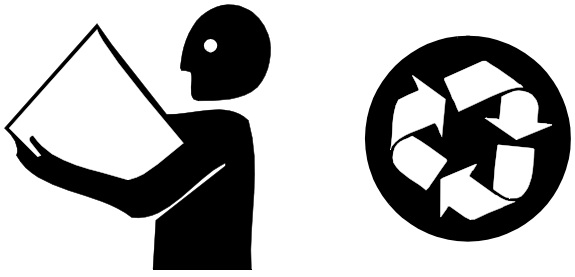
Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

SERVICE COOLING SYSTEM SAFELY

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



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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GENERAL VEHICLE SPECIFICATIONS[1]

ENGINE – DIESEL

Make	Yanmar
Model	4TNE84 - EJK
Type	4-cycle Diesel
Bore and Stroke	84x90 mm (3.31x3.54 in.)
Cylinders	4
Valves	Overhead
Displacement	1995 cm^3 (121.7 cu in.)
Firing Order	1—3—4—2
Compression Ratio	18.0:1
Gross Output Power	30.1 kW (40.4 hp)
Net Output Power	28.7 kW (38.5 hp)
PTO Output Power @ Rated Speed	26.1 kW (35.0 hp)
Lubrication	Full Pressure
Oil Filter	Spin On (Standard)
Oil Capacity (w/filter)	Approximately 5.3 L (5.6 qt)
Engine Rated Speed	2700 rpm
Engine Slow Idle	1000 rpm
Cooling System	Liquid w/Pump and Radiator
Cooling System Capacity	5.8 L (6.1 U.S. qt)
Air Cleaner	Dry Replaceable Dual Element w/Safety Element

ELECTRICAL

Volts	12 VDC
Battery Rating (CCA @ 0°F)	45 amp-hr (650 amp)
Alternator	20 amps
Regulator	External
Starting Motor	2.0 kW (2.7 hp)

FUEL SYSTEM

System Type	Direct Fuel Injection
Injection Pump	In-Line w/Electric Shutoff
Fuel Tank Capacity	32.0 L (8.5 gal)
Fuel Filter	Glass Bowl with Disposable Paper Element
Fuel Pump	Mechanical

1. Specifications and design subject to change without notice.

DRIVE TRAIN

Transmission

Type . . . . . 9 x 3 Collar Shift

Differential Lock . . . . . Standard

Number of Speeds . . . . . 9 Forward, 3 Reverse

Clutch Type . . . . . Dry, Dual Stage

Final Drive

Final DriveType . . . . . Planetary

Brake Type . . . . . Wet Disk

REAR PTO

Type . . . . . Collar Shift / Continuous Live

Speed at Engine Rated Speed . . . . . 547 rpm

HYDRAULIC SYSTEM

System Type . . . . . Open Center

Pump Type . . . . . Dual Gear

System Capacity . . . . . 26.0 L (6.9 gal)

Main Pump Capacity . . . . . 32.1 liters/min (8.5 gpm)

Working Pressure . . . . . 15582 kPa (2260 psi)
Relief Valve Setting (Main System) . . . . . 15170 - 15860 kpa (2200 - 2300 psi)

Steering (Standard) . . . . . Hydrostatic Power
Type . . . . . Open System
Working Pressure . . . . . 9495 kPa (1377 psi)
Relief Valve Setting . . . . . 8274 - 9653 kpa (1200 - 1400 psi)
Pump Capacity @ 2700 rpm . . . . . 17.0 liters/min (4.5 gpm)

Lift/Lower System (SCV)
Type . . . . . Open Center
Working Pressure . . . . . 1514 kPa (2250 psi)

CAPACITIES

Fuel Tank Capacity . . . . . 32.0 L (8.5 gal)

Hydraulic System Capacity . . . . . 26.0 L (6.9 gal)

Crankcase Oil Capacity (w/filter) . . . . . Approximately 5.3 L (5.6 qt)

Cooling System . . . . . 5.8 L (6.1 qt)

Front Axle Gear Case . . . . . 7.5 L (7.9 qt)

FASTENER TORQUE VALUES

JIS FASTENER TORQUE VALUES

J.I.S. Grade and Head Markings			

	Grade 7T				Grade 8.8T				Grade 11T			
	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
8mm	--	--	23-29	17-22	--	--	25-35	19-26	--	--	29-41	22-30
10mm	--	--	44-59	33-43	--	--	51-67	38-49	--	--	61-80	45-59
12mm	--	--	78-98	58-72	--	--	83-113	61-83	--	--	103-132	76-98
14mm	--	--	118-147	87-109	--	--	127-167	94-123	--	--	152-201	112-148
16mm	--	--	167-206	123-152								

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 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.

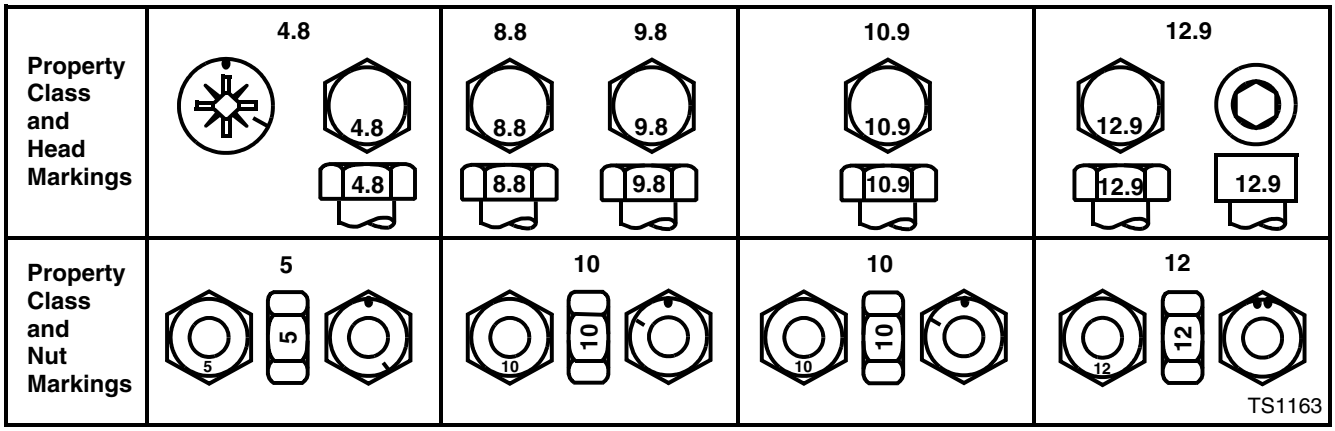
Tighten toothed or serrated-type lock nuts to the full torque value.

[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. At the time of printing, these numbers were not available.*

[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.

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	48	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

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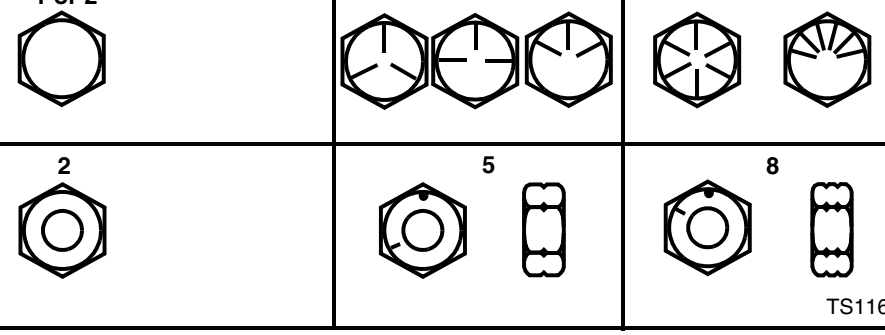
Reference: JDS—G200.

INCH FASTENER TORQUE VALUES

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



	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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Reference: JDS—G200.

DIESEL FUEL SPECIFICATIONS

DIESEL FUEL

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 temperature at which diesel fuel **begins to cloud or jell.** Use diesel fuels with a CFPP which is at least 5 °C (9 °F) below the expected low air temperature.

• 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 0.5%, 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.

WARNING

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.

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.

DIESEL FUEL STORAGE

IMPORTANT: 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: 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 deicers 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.

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**.
- **TORQ–GARD SUPREME®—SAE 15W-40;**
- **UNI–GARD™—SAE 15W-40;**
- **UNI–GARD™—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.**
- **UNI–GARD™—SAE 10W-30;**
- **UNI–GARD™—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 Classification 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.
- CCMC Specification D4 or Mercedes Benz MB228.1 or higher.

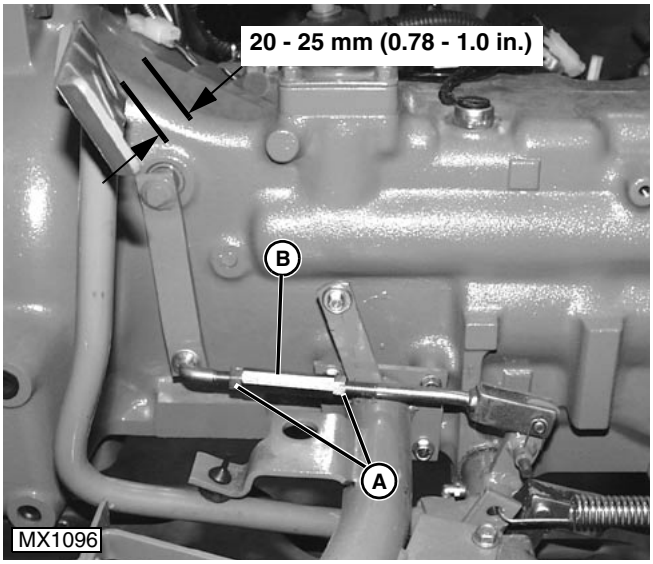
TESTS AND ADJUSTMENTS

CLUTCH PEDAL ADJUSTMENT

Purpose:

To make sure the traction clutch is fully engaged when the clutch pedal is released and fully disengaged when the pedal is depressed.

Procedure:



1. Check clutch pedal free travel.
2. If free travel is not to specification, loosen jam nuts (A) and adjust the turnbuckle (B) until free travel meets specification.

Specification: . . . . . 20 - 25 mm (0.78 - 1.0 in.)

DIFFERENTIAL BACKLASH ADJUSTMENT

Reason:

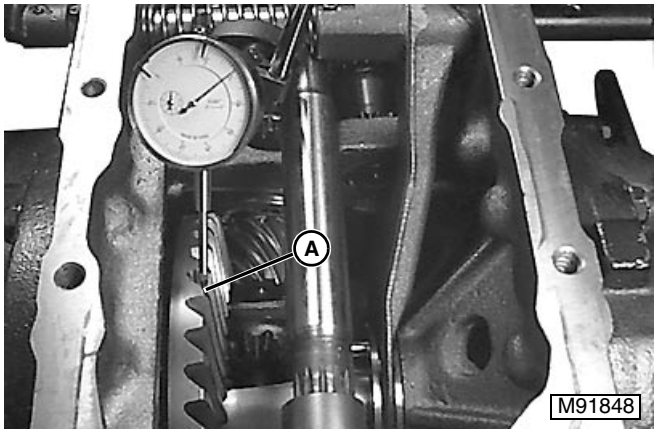
To place the differential ring gear in proper relationship with the differential input pinion shaft.

IMPORTANT: It is necessary to adjust the backlash if the ring gear and pinion was replaced, or if the backlash measurement is not within specification.

Procedure:

1. Access the differential ring gear.
2. While slowly rotating the differential housing carrier, use a soft faced mallet to lightly tap the face of the ring gear to move it and the carrier toward the left-side bearing cover.

NOTE: This is to ensure that the carrier and bearings are seated.



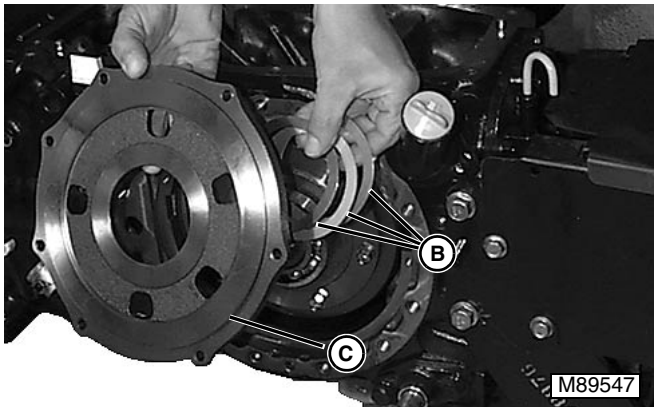
3. Attach a dial indicator to the transmission housing.
4. Locate the contact point of the dial indicator toward the outer part of the ring gear tooth (A) and as close to perpendicular to the tooth as possible.
5. While holding the differential pinion shaft stationary at the pinion, rotate the ring gear and note the backlash reading on the dial indicator.

Specification:

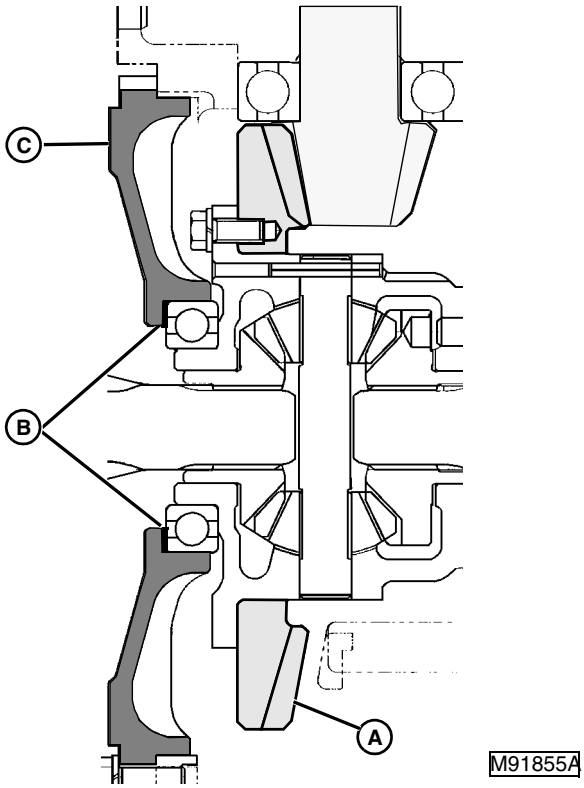
Backlash . . . . . 0.13 - 0.18 mm (0.005 - 0.007 in.)

To Adjust Backlash:

1. Remove the left side final drive. See “FINAL DRIVE” on page 42.



2. The shim(s) (B) are located between the differential bearing carrier (C) and bearing. Remove shims to increase the backlash, or add shim(s) to decrease the backlash.



NOTE: Shims (B) are available in 0.1 mm (0.004 in.), 0.3 mm (0.012 in.), and 0.5 mm (0.020 in.) thicknesses.

3. Install the differential bearing carrier.
4. Recheck the backlash.

NOTE: If the backlash is within specification, finish installation of the differential bearing carrier and the final drive. If the backlash is not within specification, adjust the shim thickness until the backlash is within specifications.

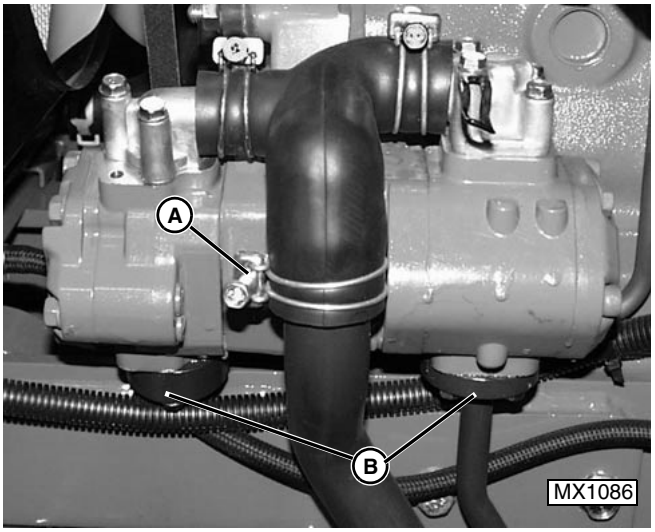
REPAIR

TRACTOR SPLITTING (FRONT)

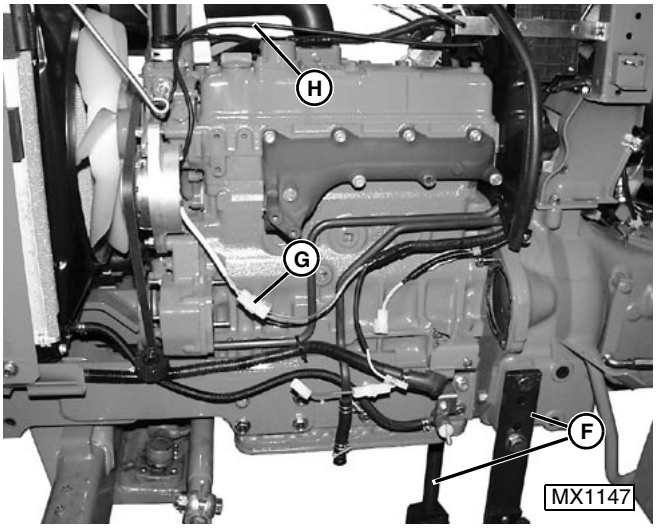
Procedure:

1. Park tractor on a level surface. Engage park brake, shut off engine.
2. Disconnect battery cables.
3. Remove side panels.
4. Remove hood.
5. Remove lower control panel. (See “CONTROL PANEL” on p a g e8 in Miscellaneous Section.)
6. Remove key switch panel.
7. Remove starting motor.
8. Remove muffler and gasket.
9. **4-WD Models**: Disconnect and remove drive shaft.
10. **Models with SCV kit**: Disconnect front bracket securing hydraulic lines.
11. Remove foot rests.
12. Lower rockshaft and drain hydraulic oil from reservoir.

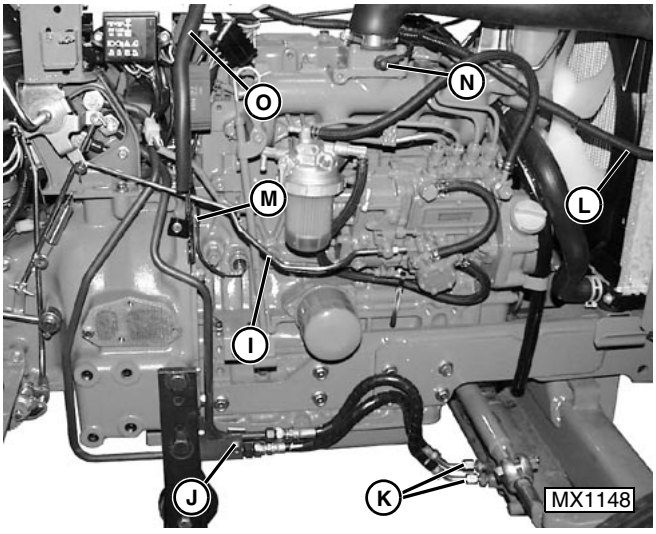
*NOTE: Capacity of the hydraulic reservoir is **26 liters (6.9 gal)**.*



13. Put a drain pan under the pumps to catch remaining oil.
14. Loosen clamp (A) and disconnect suction line from pumps. Remove suction tube from oil filter to pumps.
15. Disconnect pressure tubes (B) from pump(s) and remove hydraulic pressure tubes from tractor.



16. Install splitting stands (F) on transmission tunnel.
17. Disconnect electrical connector (G) and tachometer cable (H).
18. Close shutoff valve on fuel filter.
19. Disconnect fuel lines and close openings with caps and plugs.

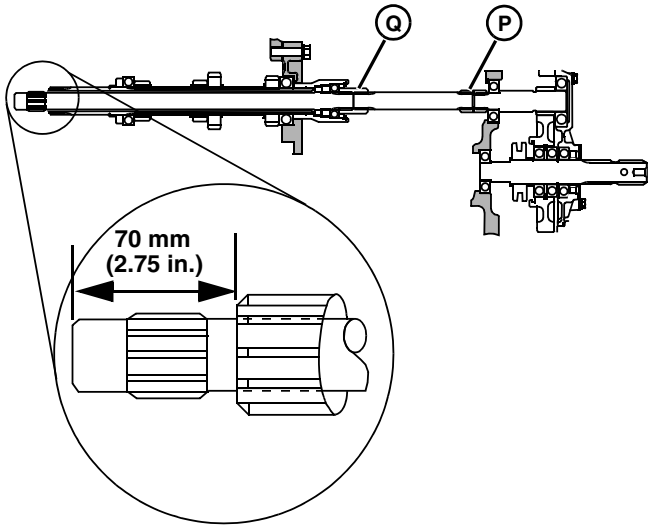


20. Remove throttle control rod (I).
21. Remove clamp (J) securing hydraulic lines to engine.
22. Disconnect hydraulic lines (K).
23. Remove wiring harness (L) connectors from headlights and pull wiring harness out from front.
24. Remove cap screw securing ground wire (M) to transmission tunnel.
25. Disconnect wire (N) from manifold heater.
26. Remove four cap screws securing air shield (O) to cylinder head.
27. Install splitting stands onto engine.
28. Loosen seven bolts securing transmission tunnel to engine.

IMPORTANT: When separating the engine, the splined coupling on the rear end or middle of the PTO shaft may fall off into transmission tunnel.

29. Slightly separate tunnel and engine, ensure all connections that may interfere all out of the way.
30. Remove all bolts securing sections and slowly separate engine from rear of tractor. As soon as possible, secure PTO shaft and keep it from moving forward with the engine.

NOTE: If the splined coupling (P) on the rear of the PTO shaft falls off, it can be accessed by removing the rear PTO. See "REAR PTO SHAFT ASSEMBLY" on page 51.
If the splined coupling (Q) in the middle of the PTO shaft falls off, it can be accessed by removing the mid-PTO plate on the bottom of the transmission tunnel.



31. Verify that the PTO shaft couplings are engaged by measuring the distance that the PTO shaft extends out of the front of the drive shaft. The distance should be approximately **70 mm (2.75 in.)**. Engage the PTO and turn the front of the shaft to verify that the rear PTO output also turns.

Assemble Tractor Sections:

NOTE: Splines on all driveshafts and couplers must be aligned before tractor sections will slide together.

1. Align splines on drive shafts and engine flywheel.
2. Move tractor sections together and retain with nine cap screws. Tighten cap screws to **126 - 154 N•m (95 - 115 lb-ft)**.
3. Route electrical harness on rear half of tractor. Connect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor. Fasten wiring harness to cable clips. Replace any plastic tie bands removed during disassembly.
4. Install key switch panel.
5. Install control panel. (See “CONTROL PANEL” on page 8 in Miscellaneous Section.)
6. Install hood. (See “HOOD” on page 8 in Miscellaneous Section.)
7. Install side panels.
8. Connect battery negative terminal.

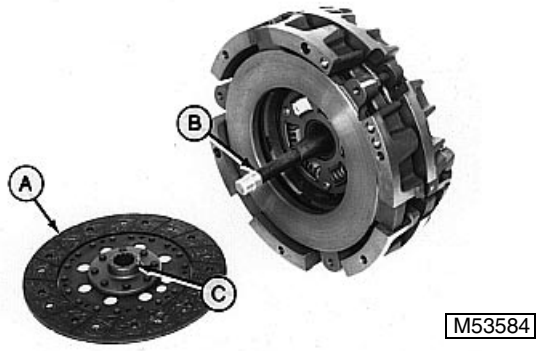
DUAL STAGE CLUTCH

Removal:

1. Separate engine from clutch housing. (See “TRACTOR SPLITTING (FRONT)” on page 20.)

IMPORTANT: Install clutch alignment tool in clutch assembly to keep PTO Clutch disk from falling from assembly.

2. Insert clutch alignment tool (A) into hub and pilot bearing in flywheel. Use JDG689 Universal Clutch Alignment Tool Kit.
3. Remove six cap screws, washers and lock washers (B). Remove clutch assembly.
4. Inspect and repair clutch assembly and flywheel. (See procedure in this group.)



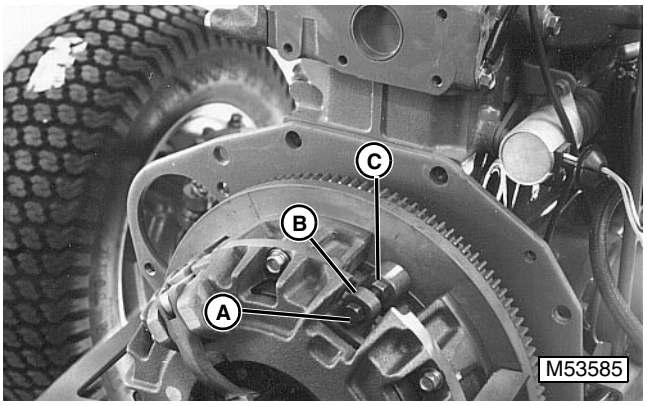
Installation:

1. Install clutch alignment tool (B) into clutch assembly.
2. Place PTO clutch disk (A) on alignment tool with long end of hub (C) facing toward clutch assembly.
3. Install clutch assembly with clutch alignment tool (A) still in place. There will be slight movement (clearance) between the straight (non-tapered) section of the tool hub and the traction clutch hub.

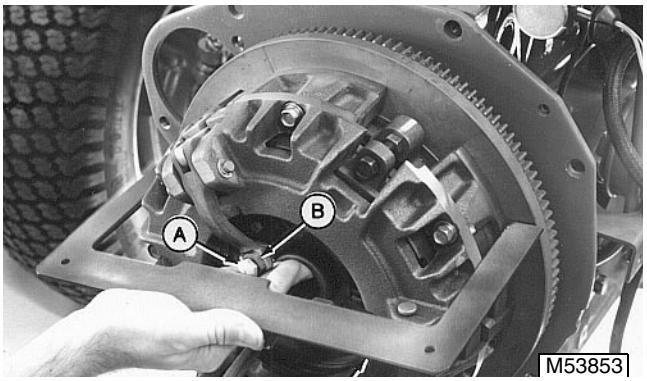
NOTE: Thin tape could also be wrapped around the tool hub to better center the traction clutch.

4. Push the tapered end of the clutch alignment tool forward to hold the PTO clutch in place during tightening of the clutch assembly to the pressure plate. If closer centering is necessary, visually center the traction clutch within the pressure plate by aligning the clutch rivet heads so that they are equally spaced around the inside diameter of the pressure plate.
5. Install cap screws (B) and tighten to 22 N•m (16 lb-ft).
6. Remove clutch alignment tool.

7. Screw in cap screws (A).



8. Set clearance between cap screw head (A) and clutch hub (B) at **1.5 mm (0.060 in.)** using a feeler gauge.
9. Tighten nuts (C) to **18 N•m (159 lb-in)**. Recheck cap screw head clearance.

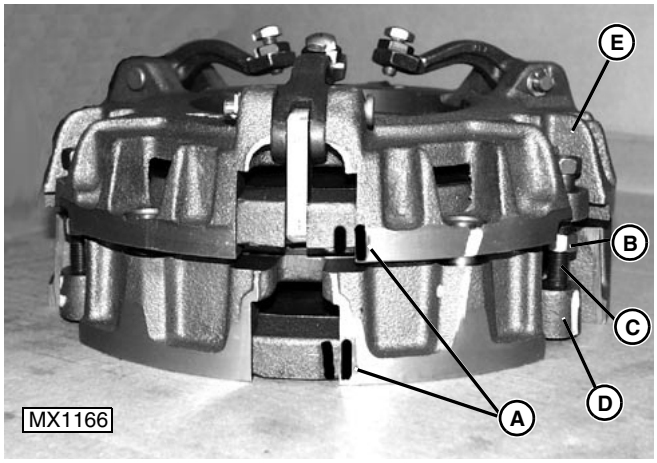


10. Adjust clutch finger screw (A) to touch raised center portion of tool.
11. Tighten nut (B) to **19 N•m (168 lb-in)**.
12. Repeat procedure for each clutch finger.
13. Install engine to clutch housing. See “Assemble Tractor Sections:” on page21".
14. Adjust clutch pedal free-play. See “CLUTCH PEDAL ADJUSTMENT” on page 19.
    - If not equipped with a Clutch Adjusting Gauge, follow adjustment procedures and specifications below.

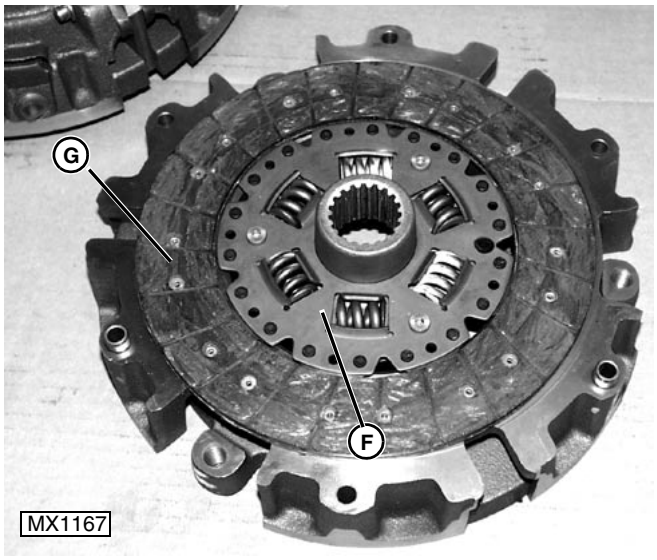
Specifications:

Clutch Finger Screw-to-Flywheel 113 mm (4.452 in.)
Tolerance . . . . . 98.5 mm (3.878 in.)

Repair:



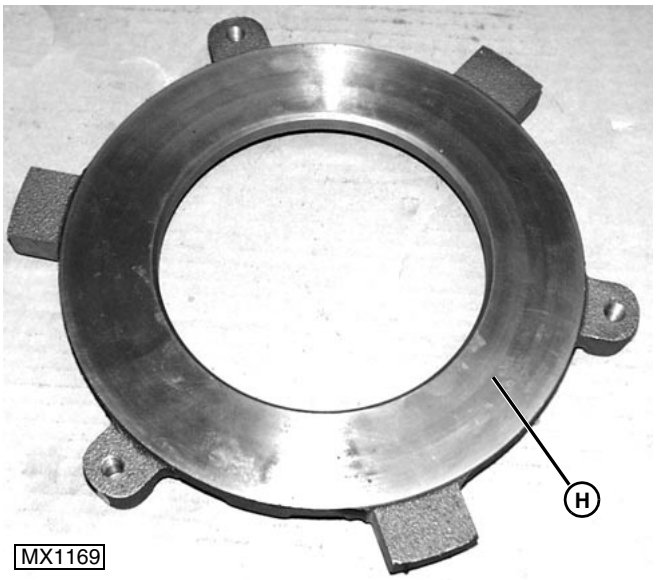
1. Mark clutch cover and pressure plates (A) for correct orientation during reassembly.
2. Loosen jam nuts (B) and turn cap screws (C) out of PTO pressure plate (D).
3. Lift cover (E) from assembly.



4. Lift out clutch disc (F). Inspect for wear or damage. Measure thickness of friction material (G). Replace clutch disc if below specification.

Specification:

Minimum Friction Material Thickness
Transmission Drive Clutch . . . . . 7.6 mm (0.3 in.)
PTO Drive Clutch . . . . . 7 mm (0.270 in.)

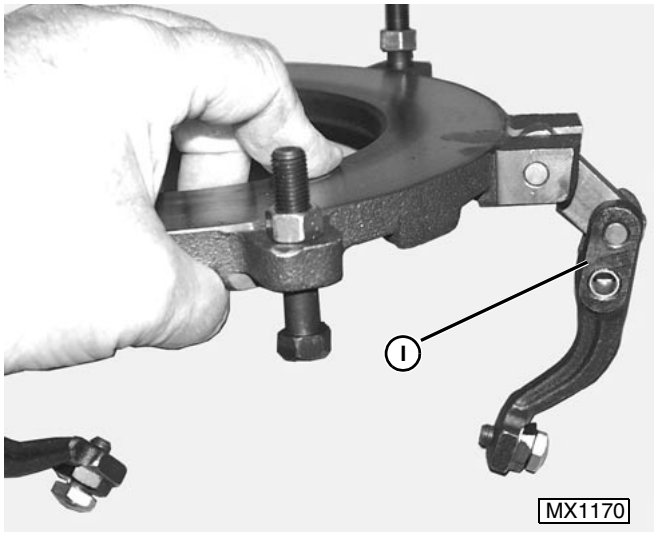


5. Check friction area (H) of center pressure plates for grooves, cracks, and discoloration from heat. Place a straight edge across pressure plate and measure for flatness with a feeler gauge. Replace pressure plate(s) if surfaces are not within specification.

Specification:

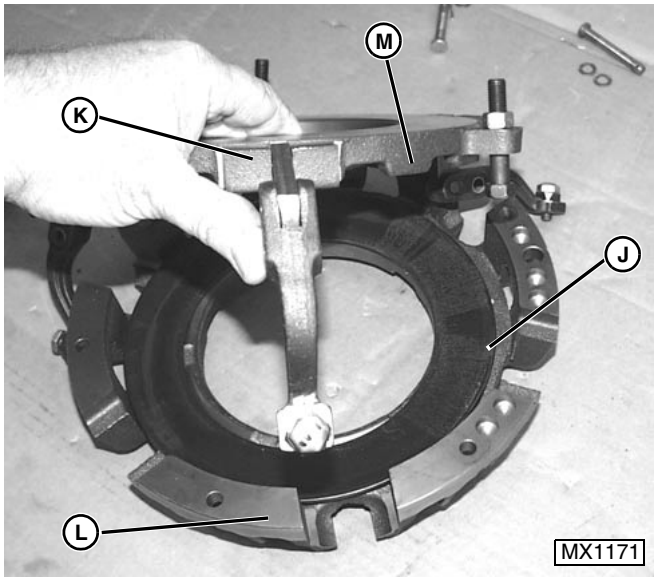
Pressure Plate Flatness

Maximum. . . . . 0.2mm (0.008 in.)



6. Inspect levers, pins, and bushings (I) for wear or damage. Replace parts as needed.

Assembly:



7. Install diaphragm (J) with raised side of outside diameter up toward friction plate.
8. Line up marks on plate (K) and cover (L) and lay plate into cover.
9. Make sure the diaphragm is centered in the plate and inside tabs (M) before securing levers to cover.