JOHN DEERE
WORLDWIDE COMMERCIAL & CONSUMER EQUIPMENT DIVISION

Core Pulverizer
CP48

TM2098 JAN06

TECHNICAL MANUAL

JOHN DEERE

North American 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

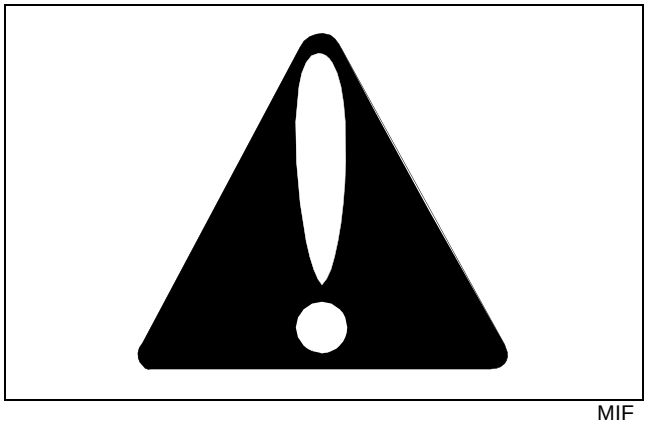
Engine

Electrical

Miscellaneous

INTRODUCTION

Recognize Safety Information



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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.

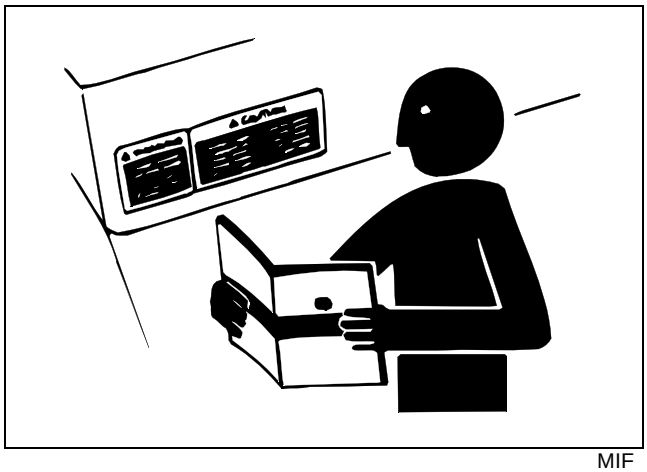
Follow recommended precautions and safe servicing practices.

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



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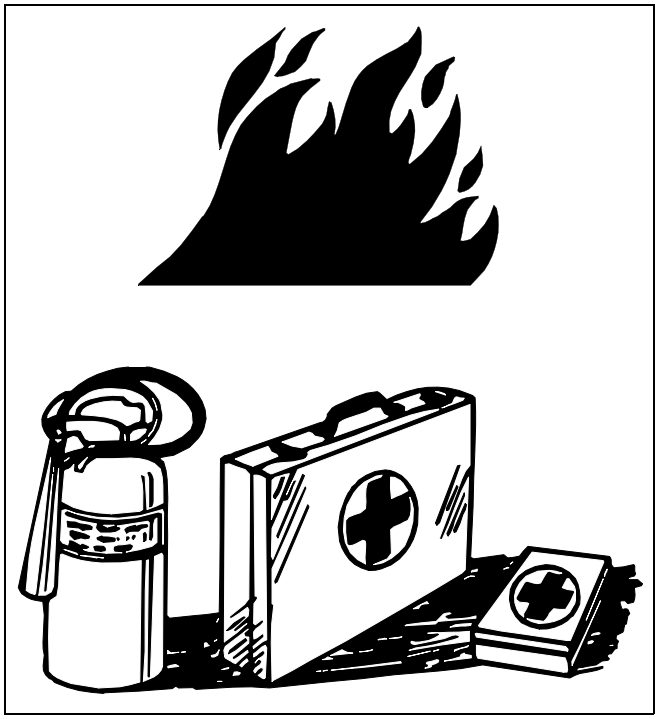
Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Handle Fluids Safely - Avoid Fires

Be Prepared For Emergencies



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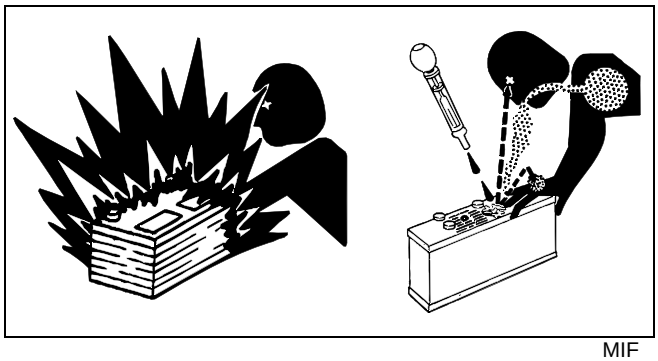
- When you work around fuel, do not smoke or work near heaters or other fire hazards.
- Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.
- Make sure machine is clean of trash, grease, and debris.
- Do not store oily rags; they can ignite and burn spontaneously.
- 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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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.

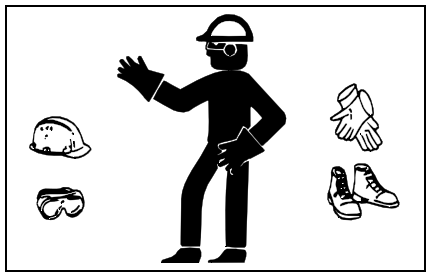
If you spill acid on yourself:

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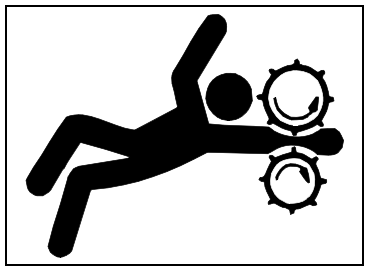
Wear close fitting clothing and safety equipment appropriate to the job.

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.

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.

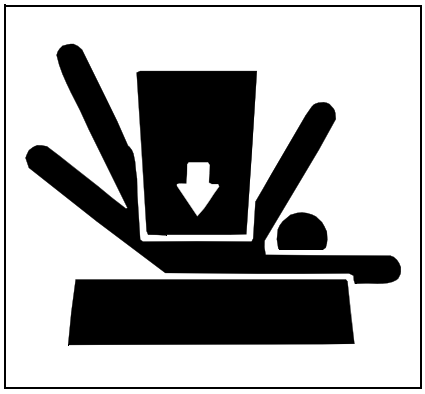
Use Proper Tools

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.

Parking Safely

1. Stop machine on a level surface, not on a slope.
2. Disengage pulverizer PTO.
3. Lock park brake.
4. Stop machine engine.
5. Remove key.
6. Wait for engine and all moving parts to stop before you leave the operator's station.
7. Stop pulverizer engine.
8. Close fuel shut-off valve on pulverizer and machine, if your machine is equipped.
9. Disconnect the negative battery cable or remove the spark plug wire (for gasoline engines) before servicing the machine.
10. Hang a "DO NOT OPERATE" tag in operator station and on pulverizer at engine controls.

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.

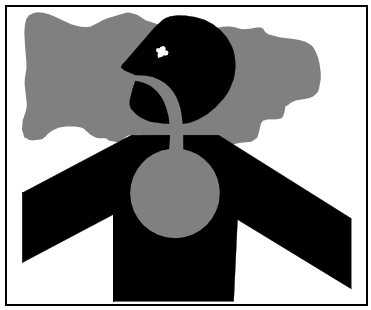
Using High Pressure Washers

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.

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.

Warning: California Proposition 65 Warning

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

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

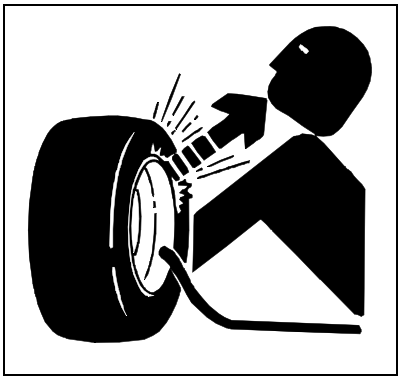
Avoid Harmful Asbestos Dust

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



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

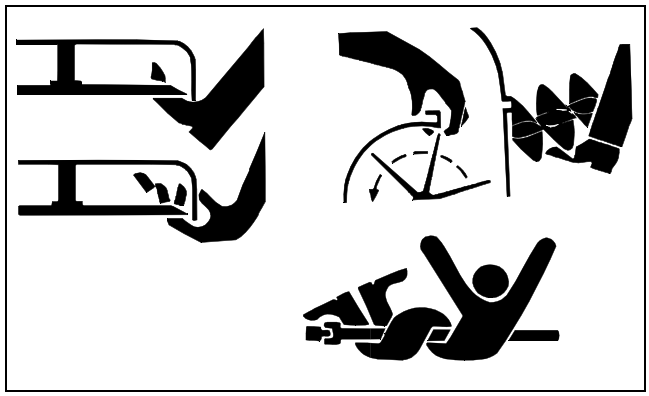
Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

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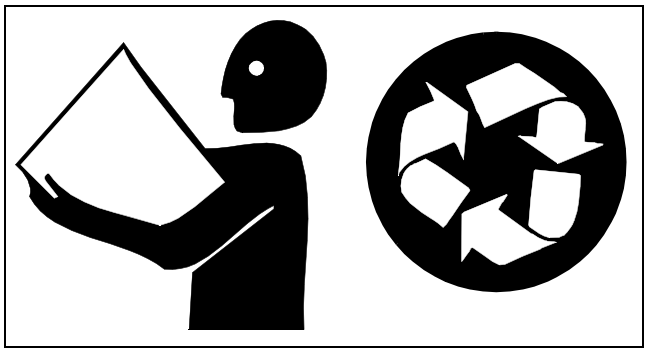
Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

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.

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.

Live With Safety

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

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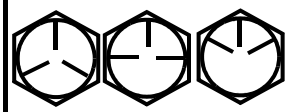
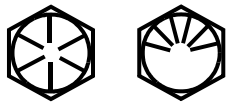
Fastener Torques

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 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	
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

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 for assembly.

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

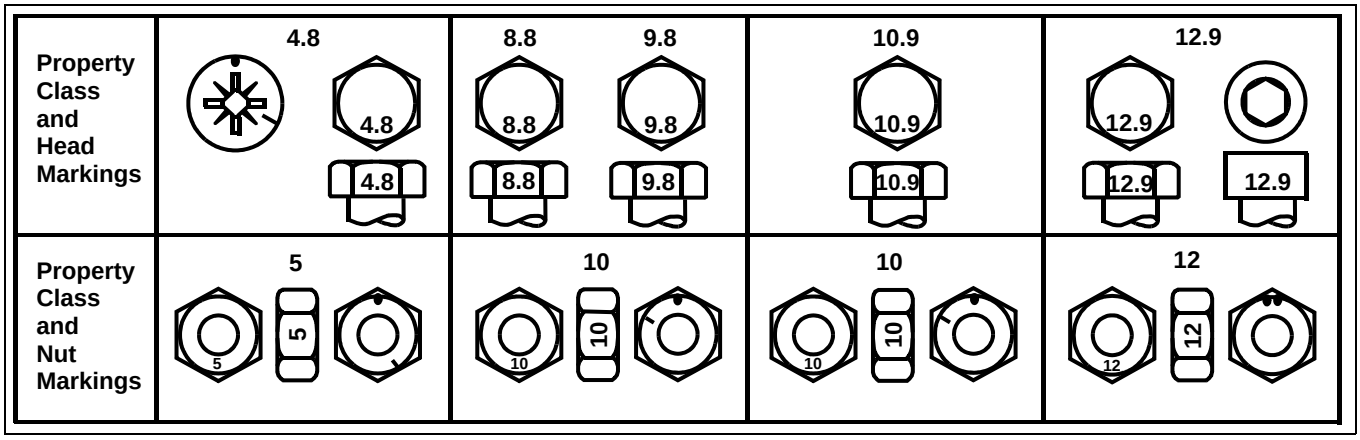
Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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

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

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General Information

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 oil is PREFERRED:

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

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 CH-4 or higher;
- SAE 10W-30 - API Service Classification CG-4 (4-cycle) or higher;

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL2 in JDS - G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

Engine Break - in Oil

IMPORTANT: Avoid damage! ONLY use a quality break-in oil in rebuilt or remanufactured engines for the first 5 hours (maximum) of operation. DO NOT use oils with heavier viscosity weights than SAE 5W-30 or oils meeting specifications API SG or SH, 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.

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

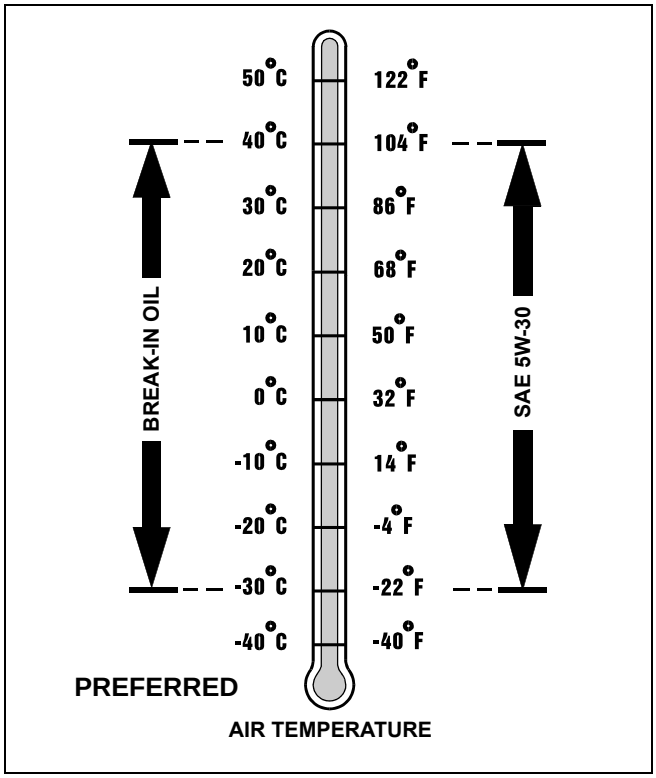
The following John Deere oil is **also recommended as a break-in engine oil**:

- TORQ - GARD SUPREME® - SAE 5W-30.

If the above recommended John Deere oils are not available, use a break-in engine oil meeting the following specification during the first 5 hours (maximum) of operation:

- SAE 5W-30 - API Service Classification SE 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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John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL4 in JDS - G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

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: Avoid damage! 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.

Chassis Grease

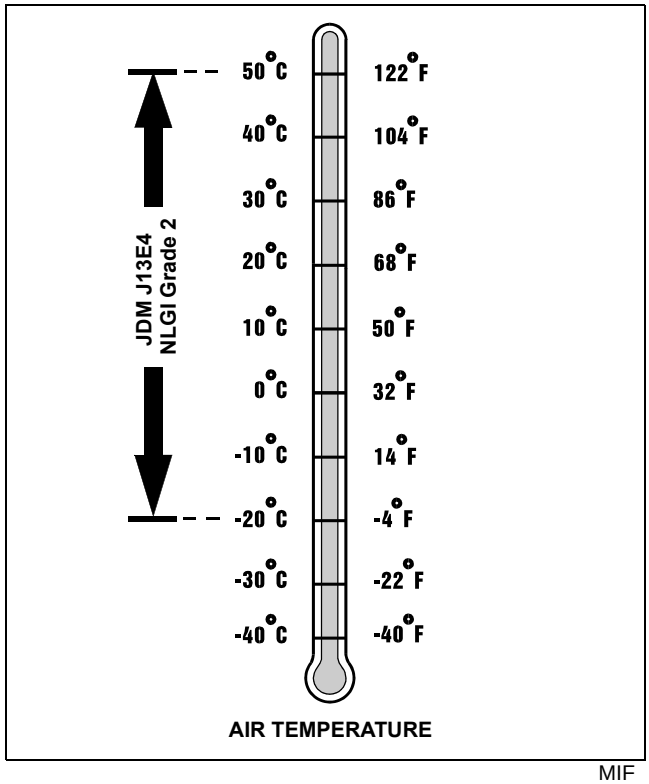
Use the following grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature failures.

The following John Deere grease is PREFERRED:

- NON-CLAY HIGH-TEMPERATURE EP GREASE® - JDM J13E4, NLGI Grade 2.
- Multi-Purpose SD Polyurea Grease
- Multi-Purpose HD Lithium Complex Grease

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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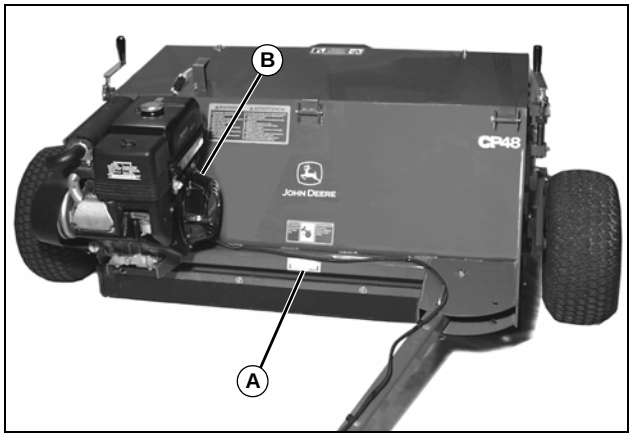
John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS - G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual P17032.

Serial Number Locations

Identification Numbers

When ordering parts or submitting a warranty claim, it is IMPORTANT that the machine product identification number (PIN) and component serial numbers are included. The location of the PIN and component serial numbers are shown.



MX19825

Machine Product Identification Number (A)

Engine Serial Number (B)

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Specifications

General Specifications

Make	Kohler
Model	Command Pro 12 CS12RT
Peak Torque @ 2000 rpm	22.6 N•m (16.7 lb-ft)
High Engine RPM	3450 (±100)
Bore	85.0 mm (3.35 in.)
Stroke	63.0 mm (2.48 in.)
Displacement	360 cc (22 cu in.)
Cylinders	1
Stroke/Cycle	4
Valves	Overhead
Crankshaft Type	Horizontal (Counterbalanced)
Compression Ratio	8.1:1
Standard Compression Pressure (With ACR in Operation)	400 - 600 kPa (57 - 85 psi)
Compression Release	Automatic/Centrifugal
Cooling System	Air Cooled
Air Filter	Paper with Foam
Lubrication	Splash System
Starting	Recoil
Fuel Capacity	6.9 L (7.3 U.S qt)
Weight (Approximate)	31.9 kg (70.5 lb)
Oil Capacity	1.1 L (1.2 U.S. qt)
Angle of Operation (maximum) at Full Oil Level	20°
Spark Plug Type NGK	BPR4ES (13/16 in. hex)
Spark Plug Type Champion®	RN14YC (13/16 in. hex)
Spark Plug Type Champion®	RC14YC (5/8 in. hex)

Adjustment Specifications

Spark Plug Gap	0.76 mm (0.030 in.)
Ignition Module Air Gap	0.4 - 0.6 mm (0.015 - 0.023 in.)

Repair Specifications

Camshaft:	
End Play	0.05 mm (0.0020 in.)
Bore ID	15.965 - 15.990 mm (0.6285 - 0.6295 in.)
Bore ID - Maximum Wear LImit	15.95 mm (0.628 in.)
Camshaft Bearing Surface OD - Maximum Wear LImit	16.05 mm (0.649 in.)
Cam Lobe Lift - Intake and Exhaust	32.55 ± 0.05 mm (1.28 ± 0.002 in.)
Cam Lobe Diameter - Intake and Exhaust	26.08 ± 0.05 mm (1.03 ± 0.002 in.)

Connecting Rod:

Connecting Rod to Crankpin Running Clearance New. . . . . 0.016 - 0.046 mm (0.0006 - 0.0018 in.)
Connecting Rod to Crankpin Running Clearance Maximum Wear Limit . . . . . 0.1 mm (0.004 in.)
Connecting Rod to Crankpin Side Clearance . . . . . 0.20 - 0.65 mm (0.0079 - 0.0256 in.)
Connecting Rod to Piston Pin Running Clearance. . . . . 0.006 - 0.025 mm (0.0002 - 0.0001 in.)

Piston Pin End ID:

New . . . . . 20.006 - 20.020 mm (0.7867 - 0.7882 in.)
Maximum Wear Limit . . . . . 20.10 mm (0.791 in.)

Connecting Rod Journal End ID:

New . . . . . 36.000 - 36.015 mm (1.4173 - 1.4179 in.)
Maximum Wear Limit . . . . . 36.115 mm (1.4219 in.)

Crankshaft:

End Play (Free) . . . . . 0.04 mm (0.0015 in.)

Flywheel End Main Bearing Journal ID:

New . . . . . 80 mm (3.149 in.)
Maximum Wear Limit . . . . . 80.05 mm (3.1515 in.)

PTO End Main Bearing Journal ID:

New . . . . . 72 mm (2.834 in.)
Maximum Wear Limit . . . . . 72.05 mm (2.836 in.)

Connecting Rod Journal OD:

New . . . . . 35.969 - 35.984 mm (1.4161 - 1.4167 in.)
Maximum Wear Limit . . . . . 35.9 mm (1.4134 in.)

Crankshaft:

Runout (Either End) . . . . . 0.02 mm (0.0008 in.)
Limit (Either End) . . . . . 0.04 mm (0.0016 in.)

Cylinder Bore ID:

New . . . . . 85.00 - 85.02 mm (3.3465 - 3.3472 in.)
Maximum Wear Limit . . . . . 85.65 mm (3.372 in.)
Maximum Out of Round . . . . . 0.05 mm (0.002 in.)

Cylinder Head:

Maximum Out of Flatness . . . . . 0.1 mm (0.004 in.)

Governor Shaft:

Governor Shaft Position Exposed Length . . . . . 36.0 ± 0.6 mm (1.47 ± 0.023 in.)

Piston to Piston Pin:

Clearance . . . . . 0.004 - 0.020 mm (0.0002 - 0.0008 in.)

Piston Pin Bore ID:

New . . . . . 20.004 - 20.015 mm (0.7876 - 0.7880 in.)
Maximum Wear Limit . . . . . 20.03 mm (0.7886 in.)

Piston Pin OD:

New . . . . . 19.995 - 20.000 mm (0.7872 - 0.7874 in.)
Maximum Wear Limit . . . . . 19.98 mm (0.787 in.)

Ring to Groove Side Clearance:

Top Compression Ring . . . . . 0.04 - 0.08 mm (0.0016 - 0.003 in.)
Middle Compression Ring . . . . . 0.03 - 0.07 mm (0.0012 - 0.0028 in.)
Maximum Wear Limit . . . . . 0.1 mm (0.004 in.)

Ring End Gap:

Top Compression Ring . . . . . 0.25 - 0.4 mm (0.010 - 0.016 in.)
Middle Compression Ring . . . . . 0.25 - 0.4 mm (0.010 - 0.016 in.)
Oil Control Ring . . . . . 0.2 - 0.7 mm (0.0079 - 0.028 in.)

Piston Thrust Face OD:

New . . . . . 84.954 - 84.998 mm (3.3446 - 3.3464 in.)
Maximum Wear Limit . . . . . 84.898 mm (3.3424 in.)

Piston Thrust Face to Cylinder Bore Running Clearance . . . . . 0.002 - 0.066 mm (0.0001 - 0.0026 in.)

Intake Valve:

Head Diameter . . . . . 32.0 mm (1.26 in.)
Stem Diameter . . . . . 5.948 - 5.963 mm (0.2342 - 0.2348 in.)
Length . . . . . 88.1 mm (3.47 in.)
Face/Seat Width . . . . . 0.7 - 0.9 mm (0.0276 - 0.354 in.)
Face/Seat Limit . . . . . 1.4 mm (0.055 in.)
Face Seat Angle (Insert Area) . . . . . 90°
Valve Stem Bend Limit . . . . . 0.01 mm (0.0004 in.)
Valve Seat Contact Width (Standard) . . . . . 0.7 mm (0.03 in.)
Valve Seat Contact Width (Limit) . . . . . 1.7 mm (0.067 in.)

Intake Valve Guide ID:

New . . . . . 6.0 - 6.012 mm (0.2362 - 0.2367 in.)
Maximum Wear Limit . . . . . 6.10 mm (0.240 in.)
Valve Stem to Valve Guide Clearance. . . . . 0.037 - 0.064 mm (0.0015 - 0.0025 in.)

Exhaust Valve:

Head Diameter . . . . . **27.0 mm (1.06 in.)**
Stem Diameter . . . . . **5.940 - 5.955 mm (0.2339 - 0.2344 in.)**
Length . . . . . **87.9 mm (3.46 in.)**
Face/Seat Width . . . . . **0.7 - 0.9 mm (0.0276 - 0.0354 in.)**
Face/Seat Limit . . . . . **1.4 mm (0.055 in.)**
Face/Seat Angle (Insert Area) . . . . . **90°**
Valve Stem Bend Limit . . . . . **0.01 mm (0.0004 in.)**
Valve Seat Contact Width (Standard) . . . . . **0.7 mm (0.03 in.)**
Valve Seat Contact Width (Limit) . . . . . **1.7 mm (0.067 in.)**

Exhaust Valve Guide ID:

New . . . . . **6.0 - 6.012 mm (0.2362 - 0.2367 in.)**
Maximum Wear Limit . . . . . **6.0 mm (0.236 in.)**
Valve Stem to Valve Guide Clearance . . . . . **0.045 - 0.072 mm (0.0018 - 0.0028 in.)**

Valve Guide Reamer Size . . . . . **6.0 mm (0.236 in.)**
Intake Valve Minimum Lift . . . . . **2.7 mm (0.106 in.)**
Exhaust Valve Minimum Lift . . . . . **2.9 mm (0.114 in.)**
Nominal Valve Seat Angle . . . . . **45°**
Valve to Tappet Clearance (Cold) . . . . . **0.1 mm (0.004 in.)**

Torque Specifications

Air Cleaner:

Base Bolt Torque . . . . . **5 - 8 N•m (44 - 71 lb-in.)**
Base Nut Torque . . . . . **10 - 12 N•m (88 - 106 lb-in.)**

Carburetor:

Fuel Bowl Retaining Screw Torque . . . . . **9 N•m (79 lb-in.)**
Throttle/Choke Plate Screws . . . . . **1.5 - 2.5 N•m (13 - 22 lb-in.)**

Engine Block and Internal:

Closure Plate Fastener Torque . . . . . **30 N•m (265 lb-in.)**
Oil Drain Plug Torque . . . . . **20 N•m (177 lb-in.)**
Cylinder Head Bolt Torque . . . . . **50 N•m (36 lb-ft)**
Timing Drive Gear Mounting Bolt . . . . . **60 - 70 N•m (44 - 51 lb-ft)**
Connecting Rod Fastener Torque . . . . . **20 N•m (177 lb-in.)**

Flywheel:

Flywheel Retaining Screw Torque . . . . . **120 N•m (85 lb-ft)**

Governor:

Governor Lever Bolt Torque . . . . . **10 N•m (88.5 lb-in.)**

ENGINE SPECIFICATIONS

Ignition:

Spark Plug Torque	**20 N•m (177 lb-in.)**
Ignition Module Mounting Screws Torque	**10 N•m (88 lb-in.)**

Muffler:

Muffler Torque (Flange Nuts & Bracket Bolts)	**18 - 22 N•m (159 - 195 lb-in.)**

Retractable Starter:

Mounting Screws to Blower Housing Torque	**7 N•m (62 lb-in.)**
Retractable Starter Center Screw	**5 - 6 N•m (44 - 53 lb-in.)**
Retractable Starter Housing Mounting Screws	**5.5 N•m (48 lb-in.)**

Rocker Arm:

Stud Into Cylinder Head Torque	**10 N•m (88 lb-in.)**
Adjusting Jam Nut Torque	**7 N•m (62 lb-in.)**

Throttle Control:

Throttle Control Lever Fastener Torque	**9 - 11 N•m (80 - 97 lb-in.)**

Valve Cover:

Valve Cover Fastener Torque	**11 N•m (97 lb-in.)**

Tools and Materials

Special or Required Tools

Special or Required Tools

Tool Name	Tool No.	Tool Use
Compression Gauge	JDM59	Used to check engine compression.
Crankcase Vacuum Test Kit	JTO3503	Used to measure crankcase vacuum.
Valve Spring Compressor	JDM70	Used to remove and install valve springs.
Dial Indicator	Obtain Locally	Automatic compression relief test, valve inspection, and crankshaft end play
Digital Pulse Tachometer	JTO7270	Slow and/or fast idle adjustment
Photo Tachometer	JTO5719	Slow and/or fast idle adjustment
Spark Plug Ground	JDM74A5	Used to prevent accidental engine starting during tests.
Oil Pressure Test Adapter	JTO7262	Oil pressure test
Lapping Tool	Obtain Locally	Valve lapping
Flywheel Puller Kit	Obtain Locally	Flywheel Removal
Rocker Arm Spanner Wrench	Obtain Locally	Lifting Rocker Arms and Turning Flywheel
Water Manometer	JTO5690	Engine Crankcase Vacuum Test
Flywheel Holding Tool	Fabricate Locally	Flywheel Removal and Installation

Other Materials

Other Material

Part No.	Part Name	Part Use
M79792	MPG-2® Multipurpose Grease	Apply to engine crankshaft.
PT569	John Deere NEVER-SEEZ® Lubricant	Apply to crankshaft end.
TY9375/TY9480/LOCTITE® 592	Thread sealant (General Purpose) with TEFLON®	Apply to threads of oil pressure switch.
	SCOTCH-BRITE® Abrasive Sheets/Pads	Clean cylinder head
TY15130/LOCTITE® 395	Form-n-Place Gasket	Rocker arm cover mating surfaces
T43512/TY9473/LOCTITE® 242	Thread Lock and Sealer (Medium Strength)	Apply to governor shaft and stator support bracket.

MPG-2® is a registered trademark of DuBois USA.

LOCTITE® is a registered trademark of the Loctite Corp.

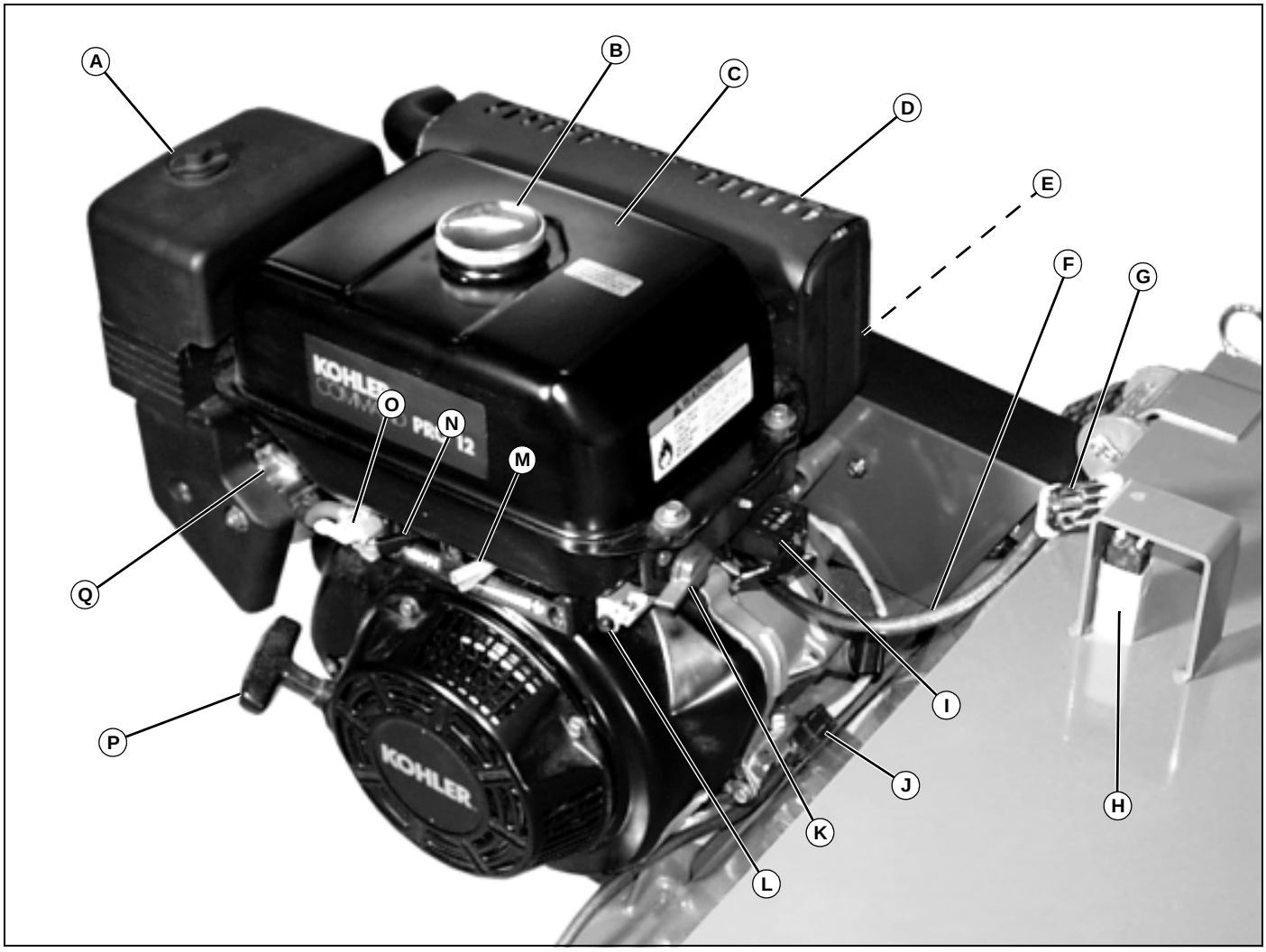
TEFLON® is a registered trademark of DuPont.

SCOTCH-BRITE® is a registered trademark of the 3M Co.

NEVER-SEEZ® is a registered trademark of Bostik Findley Inc.

Component Location

Engine Components



MX19812

A - Air Cleaner Assembly
B - Fuel Filler Cap
C - Fuel Tank
D - Muffler
E - PTO Clutch
F - W4 Engine Interlock Wiring Harness
G - X3 Connector
H - Safety Switch
I - Oil Warning Module
J - X2 Connector
K - Ignition On/Off Switch
L - Oil Warning Light
M - Throttler Lever
N - Choke Lever
O - Fuel Shutoff Valve and Screen Assembly
P - Retractable Starter Handle
Q - Carburetor

Diagnostics

Engine Troubleshooting

- Remove spark plug and inspect.
- Perform a compression test on the engine.

Engine is hard to start

Symptom: Engine is hard to start

(1) Does the engine run but is hard to start?

Yes - Check for dirt or water in the fuel system.

Yes - Restricted fuel filter or clogged fuel line.

Yes - Loose or faulty wires or connections.

Yes - Faulty choke or throttle controls. Check carburetor adjustment.

Yes - Faulty spark plug or weak spark. Check ignition system.

Yes - Check for low compression. Check cylinder compression.

Yes - Faulty ACR mechanism. Test ACR.

Engine Does Not Start

Symptom: Engine does not start (fuel system).

(1) Ensure that there is adequate fuel in the tank.

Yes - Go to next step.

(2) Is fuel getting to the carburetor?

Yes - Go to next step.

No - Check fuel level in tank.

No - Fuel shut-off valve closed.

No - Restricted fuel cap vent.

No - Test fuel filter for restrictions.

No - Check the fuel line.

(3) Check the air filter for restrictions.

Symptom: Engine does not start (ignition system).

(1) Test for proper ignition spark. Is the spark good?

Yes - Faulty spark plug.

Yes - Go to next step.

No - Check the ignition coil air gap.

Symptom: Engine does not start (ignition system).

No - Loose wires or connections that short the kill terminal of the ignition module to ground.

(2) Test the ignition switch. Does it work correctly?

No - Repair or replace switch.

(3) Test the safety switch. Does it work correctly?

No - Repair or replace switch.

Symptom: Engine does not start (electrical system).

(1) Test the engine run - start switch. Is the switch good?

No - Repair or replace switch.

Yes - Go to next step.

(2) Check engine oil level and oil switch. Is the level OK and the switch functioning?

No - Add oil as needed or repair or replace switch.

Engine Runs Poorly

Start engine and run for 3 minutes to allow it to reach operating temperature.

Symptom: Engine runs poorly (idle control).

(1) Does the engine idle but stops?

Yes - The idle fuel adjusting needle is improperly set.

Yes - The idle speed adjusting screw is improperly set.

Yes - Check the engine for low compression.

Yes - Check the fuel supply for contamination.

(2) Place throttle lever in idle position. Does engine rpm decrease to normal idle speed?

No - Engine appears to be under load or engine rpm remains at high speed. Check governor adjustment. Check PTO clutch.

Engine oil problems

Symptom: Engine uses excessive amounts of oil.

(1) Does the engine consume excessive amounts of oil?

Yes - Incorrect viscosity or type of oil being used in engine.

Yes - The crankcase is overfilled.

Yes - Check the breather for clogging.

Yes - Worn or broken piston rings.

Yes - The cylinder bore is worn.

Yes - The valve stems and/or valve guides are worn.

(2) Does oil leak from seals or gaskets?

Yes - Check the crankcase breather for restrictions.

Yes - Loose or improperly tightened fasteners.

Yes - Piston blowby or leaky valves.

Yes - Check the exhaust for restrictions.

Engine Knocks

Symptom: Engine Knock

(1) Does the engine knock while running?

Yes - Excessive engine load.

Yes - Low crankcase oil level.

Yes - The fuel could be old, improper, or contaminated.

Yes - Check for internal engine wear.

Engine Overheats

Symptom: Engine is overheating

(1) Does the engine run but overheats?

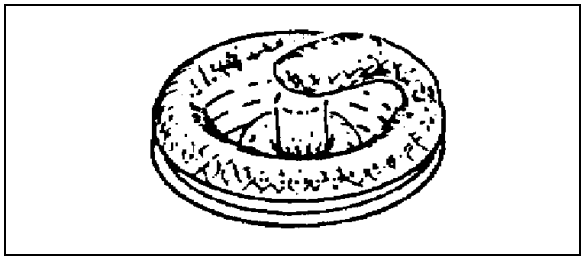
Yes - Check air intake/grass screen, cooling fins, or cooling shroud for clogs.

Yes - The crankcase oil level is either too high or too low.

No - The carburetor is faulty or set improperly.

Spark Plug Troubleshooting

Symptom: Poor engine performance



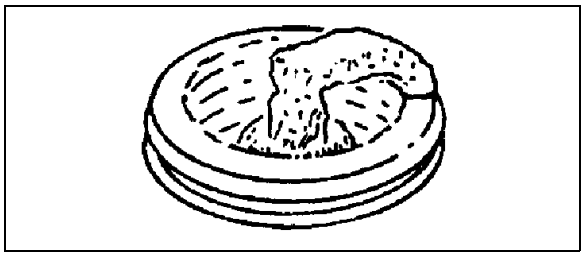
M91490

(1) Are there excessive deposits on the electrodes yet the electrodes aren't worn (Oxide Fouling)?

Yes - Inspect the combustion chamber for excessive deposits.

Yes - Inspect muffler and exhaust for clogging.

Yes - Verify that the air/fuel mixture is correct and that the recommended oils are used.

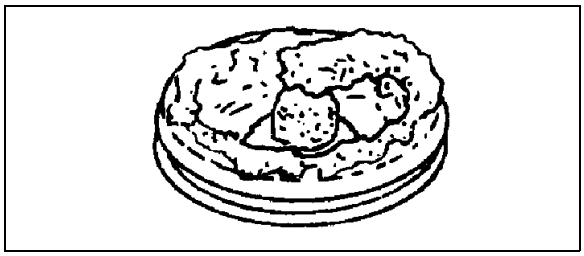


M91491

(2) Is the sparking gap shorted out by combustion particles fused between electrodes (Gap Bridging)?

Yes - Ensure that the recommended oils and/or fuels are used.

Yes - Inspect muffler and exhaust for clogging.



M91492

(3) Is the insulation tip black with a carbon layer over the entire nose and a damp oily film over the firing end (Wet Fouling)?

Yes - Engine may be running too rich. Check air/fuel mixture.

Yes - Check idle speed.

Symptom: Poor engine performance

Yes - Test ignition module.

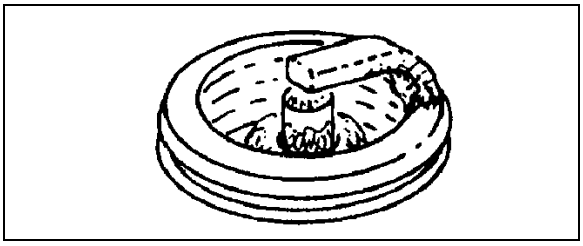
Yes - Check air filter for clogging.

Yes - Verify that the recommended oils are used.

Yes - The plug may be too cold for the type of work being performed.

Yes - The low speed jet may not be adjusted properly (too rich).

Yes - The idle speed may be too low.



M91493

(4) Is the electrode burned with the insulator tip color light grey or chalk white (Overheated)?

Yes - Inspect muffler and exhaust for clogging.

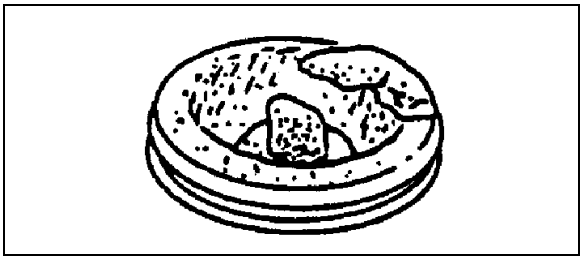
Yes - Check the cylinder fins for dirt. Clean as required.

Yes - Carburetor may be adjusted too lean.

Yes - Check for an air leak in the fuel line.

Yes - Inspect the carburetor for a ruptured fuel hose or filter diaphragm.

Yes - Ensure that the spark plug heat range is correct (too hot).



M91494

(5) Do the electrodes appear to be worn out?

Yes - This condition requires more voltage than the ignition system can produce. Replace with new plug of the same heat range.