JOHN DEERE
AG & TURF DIVISION

Gator™ Utility Vehicle
HPX 4X2 and 4X4 Gas and Diesel

TM2195 JULY 2011

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 (Gas)

Engine (Diesel)

Electrical

Power Train

Steering

Brakes

Miscellaneous

Safety

Recognize Safety Information

MIF

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

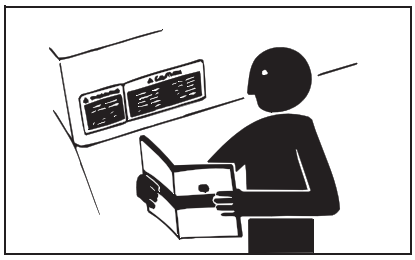
Follow recommended precautions and safe servicing practices.

Understand Signal Words

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

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

Replace Safety Signs



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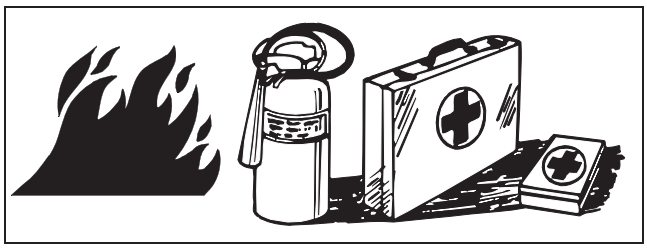
Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Handle Fluids Safely - Avoid Fires

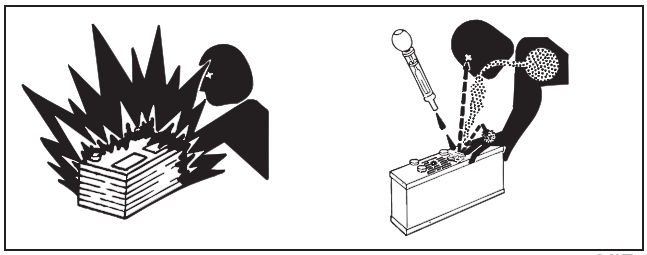
Be Prepared For Emergencies



MIF

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

Use Care In Handling And Servicing Batteries



MIF

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.

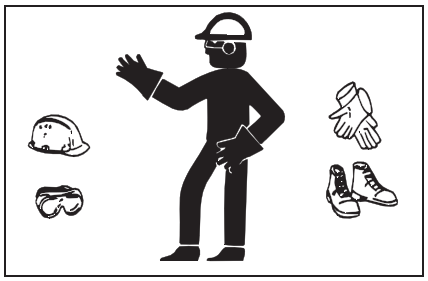
If you spill acid on yourself:

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



MIF

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

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

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

Use Care Around High-pressure Fluid Lines

Avoid High-Pressure Fluids

MIF

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

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

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

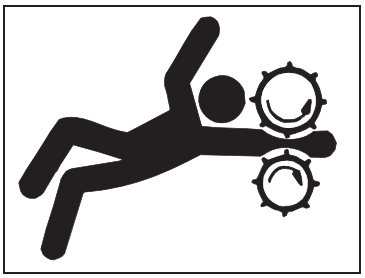
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

Avoid Heating Near Pressurized Fluid Lines

MIF

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

Service Machines Safely

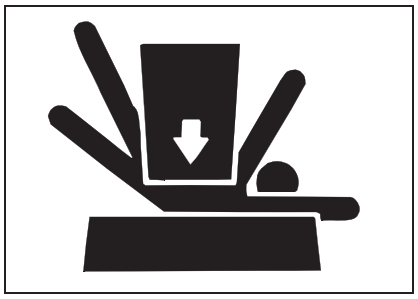


MIF

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.

Support Machine Properly and Use Proper Lifting Equipment



MIF

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.

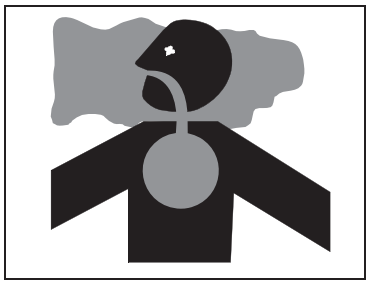
Using High Pressure Washers

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



MIF

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.

Service Tires Safely

MIF

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

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

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

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

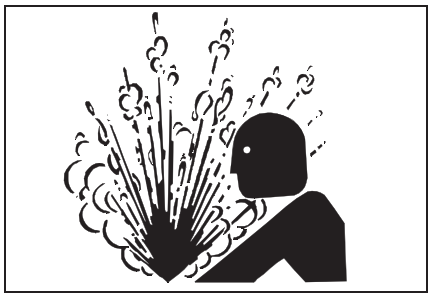
Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

Avoid Injury From Rotating Blades, Augers And PTO Shafts

MIF

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

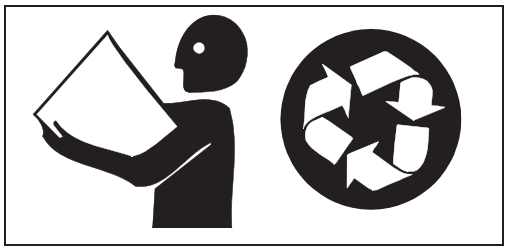


MIF

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

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

Handle Chemical Products Safely



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

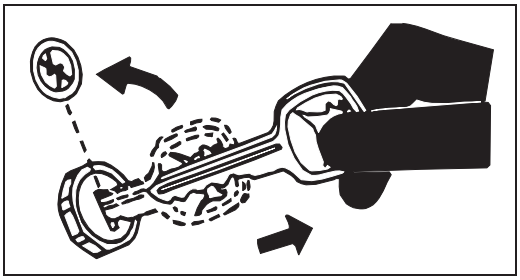
A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Dispose of Waste Properly

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

Park Machine Safely



MIF

Before working on the machine:

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

Live With Safety

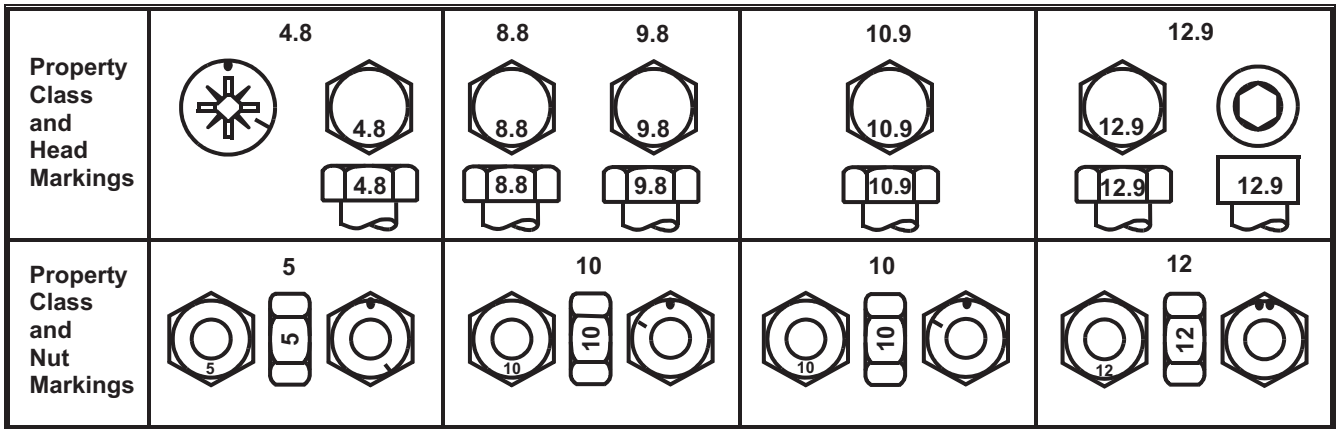
MIF

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

Table of Contents

Specifications

Metric Fastener Torque Values



MIF

	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 grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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

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

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

Reference: JDS - G200.

Inch Fastener Torque Values

SAE Grade and Head Markings	**No Marks** 		
SAE Grade and Nut Markings	**No Marks** 		

MIF

	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.

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.

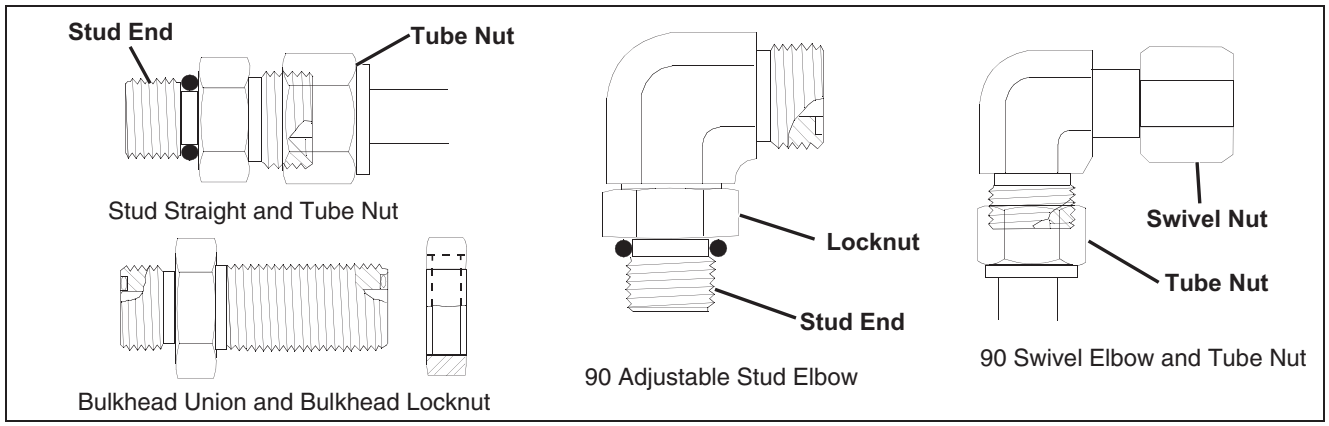
a *“Lubricated” means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. “Dry” means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication*.

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

O-Ring Seal Service Recommendations

Face Seal Fittings With Inch Stud Ends Torque

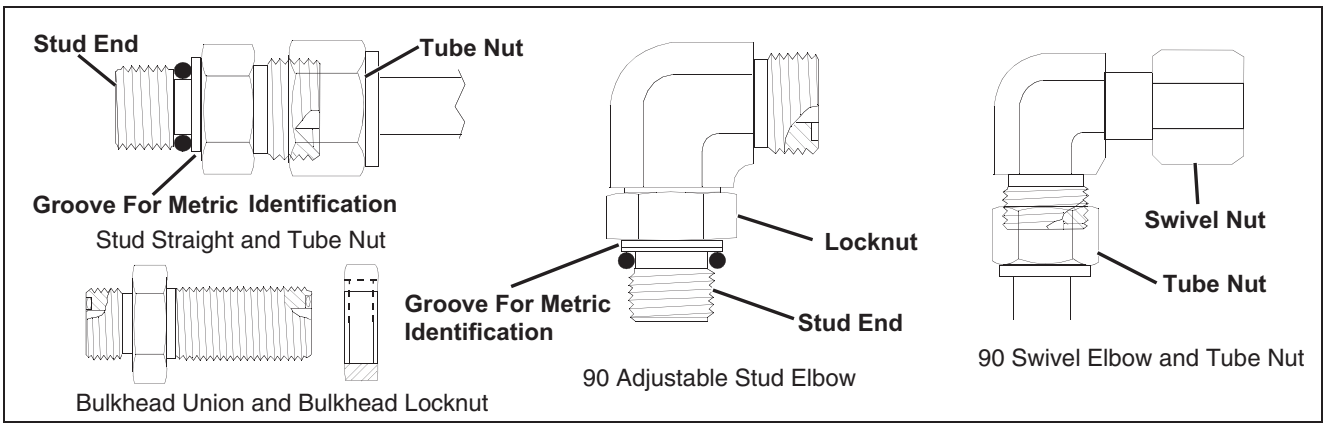


MIF

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

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

Face Seal Fittings With Metric Stud Ends Torque

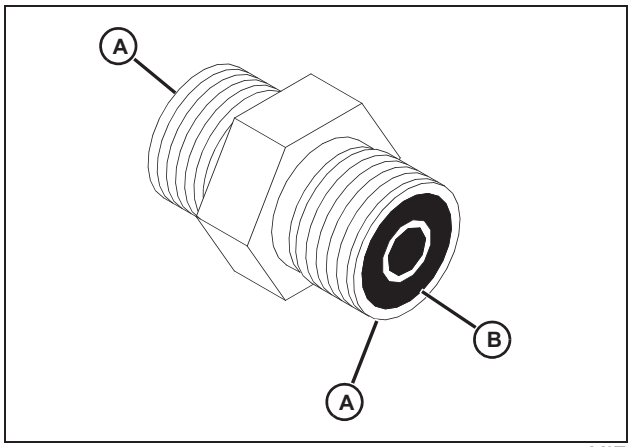


MIF

Nominal Tube OD/Hose ID				Face Seal Tube/Hose End						O-Ring Stud Ends, Straight Fitting or Lock Nut					
Metric Tube OD	Inch Tube OD			Thread Size	Hex Size	Tube Nut/ Swivel Nut Torque		Bulkhead Lock Nut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
mm	Dash Size	in.	mm	in.	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%, -20%

O-Ring Face Seal Fittings



MIF

1. Inspect the fitting sealing surfaces (A). They must be free of dirt or defects.

2. Inspect the O-ring (B). It must be free of damage or defects.

3. Lubricate O-rings and install into groove using petroleum jelly to hold in place during assembly.

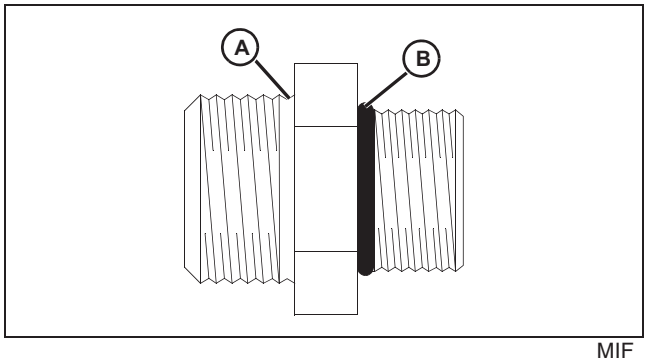
4. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.

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

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

O-Ring Boss Fittings

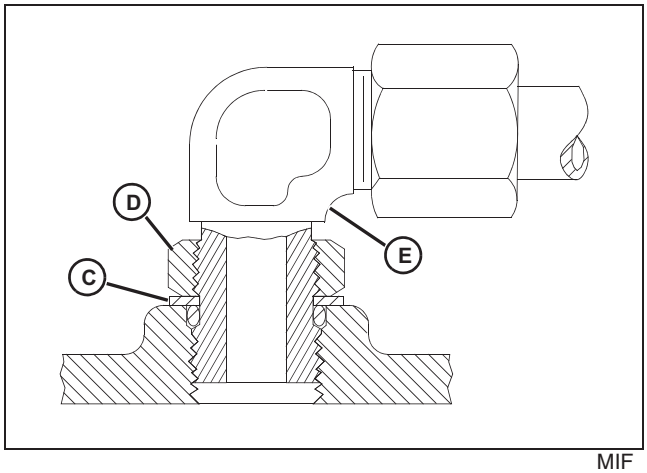
1. Inspect boss O-ring boss seat. It must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. Some raised defects can be removed with a slip stone.



MIF

2. Put hydraulic oil or petroleum jelly on the O-ring (B).

Place electrical tape over the threads to protect O-ring from nicks. Slide O-ring over the tape and into the groove (A) of fitting. Remove tape.



MIF

3. For angle fittings, loosen special nut (D) and push special washer (C) against threads so O-ring can be installed into the groove of fitting.

4. Turn fitting into the boss by hand until special washer or washer face (straight fitting) contacts boss face and O-ring is squeezed into its seat.

5. To position angle fittings (E), turn the fitting counter-clockwise a maximum of one turn.

6. Tighten straight fittings to torque value shown on chart. For angle fittings, tighten the special nut to value shown in the chart while holding body of fitting with a wrench.

Straight Fitting or Special Nut Torques

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

[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.

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)

General Information

Gasoline

4 - Cycle Engines

Caution: Avoid Injury! 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 bottom of filler neck only; 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.

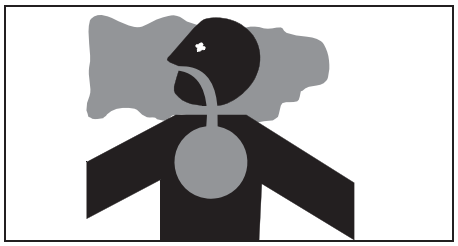
To avoid engine damage:

- 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

RFG (reformulated) gasoline is acceptable for all machines designed for use of regular unleaded fuel. Older machines (that were designed for leaded fuel) may see some accelerated valve and seat wear.



MIF

Important: Avoid Damage! 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.

Gasoline Storage

Important: Avoid Damage! 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 the machine 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.

Diesel Fuel

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

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

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

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

- **Cetane Number 40 (minimum)**

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

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

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

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

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

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

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

Diesel Fuel Lubricity

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

Diesel Fuel Storage

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

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

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

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

4 - Cycle Gasoline 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.

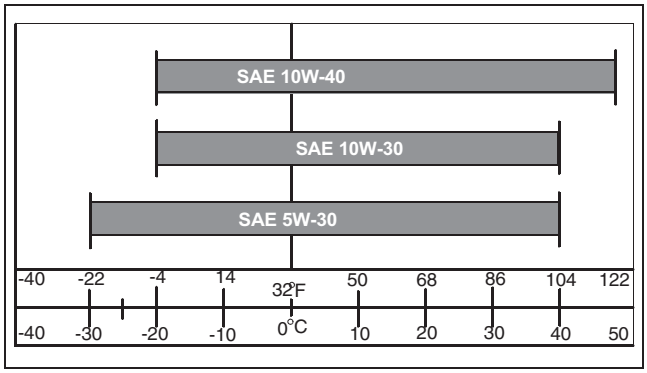
The following John Deere oils are PREFERRED:

PLUS - 4™

TURF - GARD™

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

- API Service Classifications SG or higher



Break-In Engine Oil - 4-Cycle Gasoline

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.

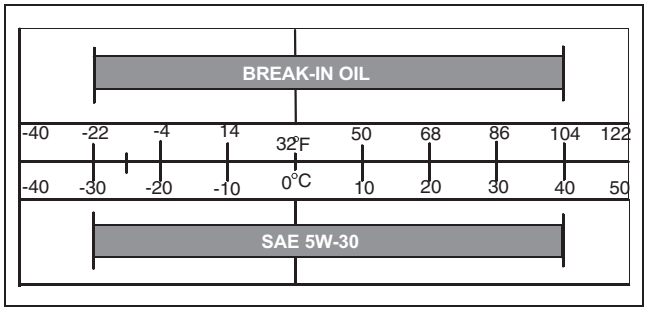
The following John Deere oil is **also recommended**:

- **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.



4 - Cycle Diesel Engine Oil

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

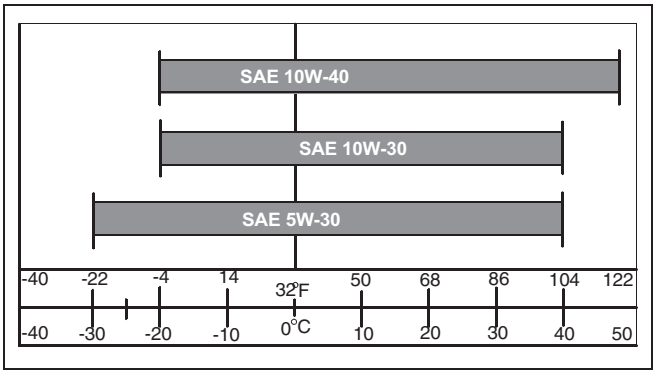
The following John Deere oils are PREFERRED**:**

TORQ-GARD SUPREME™
PLUS-50™

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

- API Service Classifications CF - 4 or higher;

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



Break-In Engine Oil - Diesel

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

The following John Deere oil is PREFERRED:

- **BREAK - IN ENGINE OIL**.

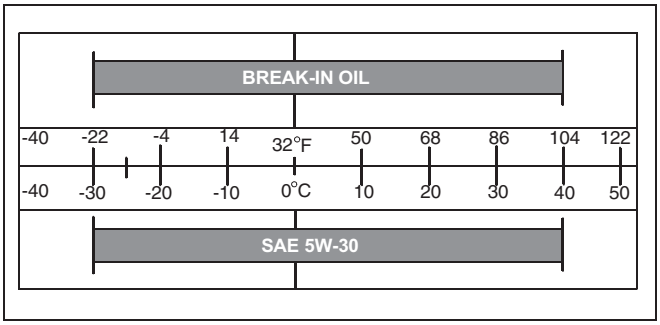
John Deere BREAK - IN ENGINE OIL is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions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

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

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

- API Service Classification CE or higher.

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



Transaxle and MFWD Differential Oil

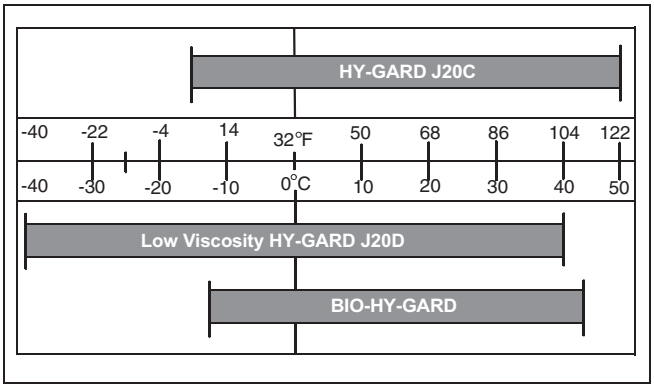
Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission or hydraulic system failures.

Important: Avoid Damage! Mixing of LOW VISCOSITY HY - GARD™ and HY - GARD™ oils is permitted. DO NOT mix any other oils in this transmission. DO NOT use engine oil or “Type F” (Red) Automatic Transmission Fluid in this transmission.

John Deere J20C HY-GARD™ transmission and hydraulic oil is recommended. John Deere J20D Low Viscosity HY-GARD™ transmission and hydraulic oil may be used, if within the specified temperature range.

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

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



Alternative Lubricants

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

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

Synthetic Lubricants

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

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

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

Lubricant Storage

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

Mixing of Lubricants

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

Oil Filters

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

The following John Deere oil filters are PREFERRED:

- AUTOMOTIVE AND LIGHT TRUCK ENGINE OIL FILTERS.

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

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

- ASTB Tested In Accordance With SAE J806.

Brake Fluid

The following John Deere heavy duty brake fluid is PREFERRED for all drum and disc brakes:

- Brake Fluid - DOT3

Other brake fluids may be used if the above John Deere brake fluid is not available and they provide the following:

- DOT3 certified.
- Conforms to Motor Vehicle Safety Standard No. 116.
- Minimum wet boiling point 140°C (284°F).
- Minimum dry boiling point 232°C (450°F) to prevent vapor lock.

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:

- Multi-Purpose SD Polyurea Grease
- Multi-Purpose HD Lithium Complex Grease
- **Moly High-Temperature EP 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.

Coolant

Recommended Engine Coolant

Important: Avoid Damage! Using incorrect coolant mixture can cause overheating and damage to the radiator and engine:

- **Do not operate engine with plain water.**
- **Do not exceed a 50% mixture of coolant and water.**
- **Aluminum engine blocks and radiators require approved ethylene-glycol based coolant.**

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37 degrees C (-34 degrees F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

The following coolants are preferred:

- John Deere COOL-GARD II™ Premix
- John Deere COOL-GARD Premix
- John Deere COOL-GARD PG Premix

John Deere COOL-GARD II Premix and John Deere COOL-GARD Premix are available in a concentration of 50% propylene glycol.

John Deere COOL-GARD PG Premix is available in a concentration of 55% propylene glycol.

Additional recommended coolants:

- John Deere COOL-GARD II Concentrate in a 40% to 60% mixture of concentrate with water.
- John Deere COOL-GARD Concentrate in a 40% to 60% mixture of concentrate with water.

If the recommended coolants are unavailable, use an ethylene glycol or propylene glycol base coolant that meets the following specification:

- ASTM D3306 prediluted (50%) coolant.
- ASTM D3306 coolant concentrate in a 40% to 60% mixture of concentrate with water.

Check container label before using to be sure it has the appropriate specifications for your machine. Use coolant with conditioner or add conditioner to coolant before using.

Water Quality

- Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended with ethylene glycol base engine coolant concentrate.

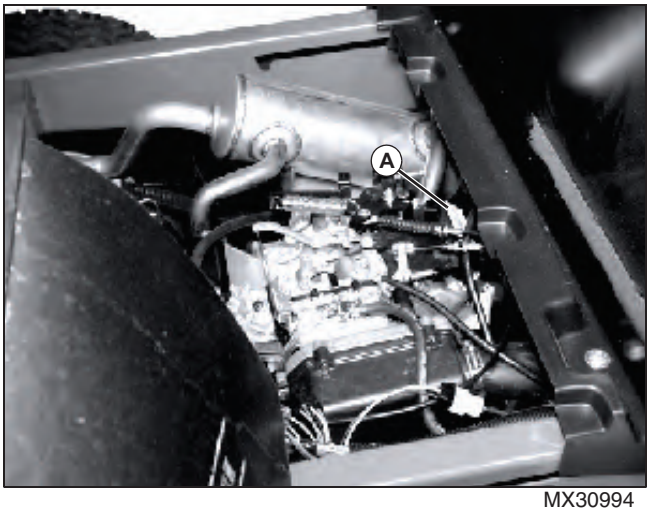
Serial Number Locations

Product Serial Number

MX30993

The 13-digit product identification number (A) is located on the right-hand side frame.

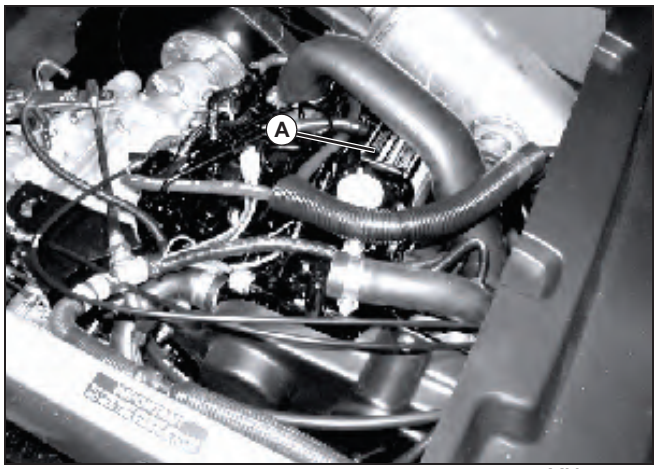
Gasoline Engine Serial Number Location



MX30994

Engine serial number (A) is located on the flywheel cover.

Diesel Engine Serial Number Location



MX31115

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

ENGINE - GAS (LIQUID-COOLED) TABLE OF CONTENTS

Table of Contents

Specifications

General Specifications

Make	Kawasaki
Model	FD620D
Type	4-cycle gas/Liquid Cooled
Cylinders	2
Bore	74 mm (2.900 in.)
Stroke	68 mm (2.660 in.)
Displacement	617 cm^3 (37.7 cu-in.)
Spark Plug	NGK BPR2ES (M138938)
Spark Plug Gap	0.80 mm (0.031 in.)
Fuel Tank	20.0 L (5.25 gal)
Crankcase (with filter)	1.3 L (1.37 qt)
Engine Oil	John Deere PLUS-4 SAE 10W-40
	John Deere TURF-GARD SAE 10W-40
Cooling system (Including recovery tank)	5.0 L (5.2 qt)

Test and Adjustment Specifications

Engine:

Low Speed Idle (Governed)	1125 ± 75 rpm
Carburetor SLOW idle stop screw setting	100 rpm less than governed idle setting
High Speed Idle	3750 ± 75 rpm
Oil pressure sensor activates	98 kPa (14.2 psi)
Oil pressure (minimum)	276 kPa (40 psi)
Oil filter bypass valve opening pressure	78.5 - 117.5 kPa (11.4 - 17.1 psi)
Cylinder compression pressure (minimum)	1171 kPa (170 psi)
Maximum compression pressure variation between cylinders	138 kPa (20 psi)
Crankcase vacuum (minimum)	25 mm (1 in.) H_2O
Intake and exhaust valve clearance (cold)	0.25 mm (0.01 in.)
Intake and exhaust valve adjustment interval	300 hrs
Valve clearance adjusting nut torque	9 N•m (79 lb-in.)

Fuel/Air System:

Fuel Pump

Minimum flow	105 ml (3.5 oz) in 15 seconds
Minimum pressure	10 kPa (1.5 psi)

Cooling System:

Radiator Cap Maximum test pressure	117 kPa (17 psi)
Radiator Cap Minimum pressure after 15 seconds	90 kPa (13 psi)
Radiator Cap Nominal Opening pressure	83 - 96 kPa (12 - 14 psi)
Radiator Cap Minimum pressure	83 kPa (12 psi)
Thermostat Begin-to-open temperature	approximately 82°C (180°F)
Thermostat Full-open temperature	approximately 96°C (205°F)

Repair Specifications

Cylinder Head:

Cylinder Head Flatness	0.06 mm (0.002 in.)
Compression (Minimum)	1171 kPa (170 psi)
Cap Screw Torque In Sequence	
Initial Torque	13 N•m (115 lb-in.)
Final Torque	21 N•m (186 lb-in.)
Spark Plug Torque	25 N•m (221 lb-in.)
Intake Manifold Cap Screw Torque	6 N•m (53 lb-in.)

Rocker Arm:

Minimum Shaft OD	11.95 mm (0.470 in.)
Maximum Bearing ID	12.07 mm (0.475 in.)
Adjusting Nut Torque	9 N•m (79 lb-in.)

Push Rod:

Maximum Bend	0.80 mm (0.031 in.)

Valves and Springs:

Valve Clearance	0.25 mm (0.010 in.)
Spring Free Length	29.70 mm (1.170 in.)
Minimum Valve Stem OD	
Intake	5.95 mm (0.234 in.)
Exhaust	5.92 mm (0.233 in.)
Maximum Valve Guide ID	6.05 mm (0.238 in.)
Maximum Valve Stem Bend	0.03 mm (0.001 in.)
Standard Valve Seating Surface	0.5 - 1.10 mm (0.020 - 0.043 in.)
Valve Seating Width Tolerance	2.0 mm (0.08 in.)
Valve Seat and Face Angle	45°
Minimum Valve Margin	0.60 mm (0.024 in.)
Valve Narrowing Angle	30°

Crankcase:

Cover Cap Screw Torque	21 N•m (186 lb-in.)
Drain Plug Torque	23 N•m (204 lb-in.)
Plain Bearing	
Maximum Crankcase Cover ID	34.07 mm (1.341 in.)
Maximum Crankcase ID	34.11 mm (1.343 in.)
Governor Arm Nut Torque	8 N•m (72 lb-in.)

Crankshaft:

Drive Clutch to Crankshaft Cap Screw	37 N•m (26 lb-ft)
Minimum Side Journal OD	33.91 mm (1.335 in.)
Minimum Connecting Rod Journal	33.93 mm (1.336 in.)
Maximum Total Indicated Runout	0.05 mm (0.002 in.)

Flywheel:

Flywheel Nut Torque	108 N•m (80 lb-ft)
Sheave Half Cap Screw	15 N•m (130 lb-in.)

Camshaft:

Minimum End Journals	25.21 mm (0.993 in.)
Minimum Lobe OD	
Intake	25.21 mm (0.993 in.)
Exhaust	25.46 mm (1.002 in.)
Maximum Cover and Crankcase Bearing ID	16.07 mm (0.633 in.)

Piston:

Maximum Ring Groove Clearance	
Top Ring	0.15 mm (0.006 in.)
Second Ring	0.12 mm (0.005 in.)
Oil Ring	Not Measured
Ring Thickness (Top, Second)	1.12 mm (0.044 in.)
Maximum Ring End Gap (Top, Second)	1.20 mm (0.050 in.)
Oil Ring	1.5 mm (0.06 in.)
Minimum Pin OD	16.98 mm (0.668 in.)
Maximum Pin Bore ID	17.04 mm (0.671 in.)
Piston OD (measured at 11 mm (0.433 in.)) from bottom of piston skirt)	75.93 - 75.95 mm (2.989 - 2.99 in.)
Piston-to-Cylinder Bore Clearance	0.03 - 0.17 mm (0.001 - 0.007 in.)

Connecting Rod:

Maximum Crankshaft Bearing ID	34.06 mm (1.341 in.)
Maximum Piston Pin Bearing ID	17.05 mm (0.671 in.)
End-Cap Screw Torque	21 N•m (186 lb-in.)

Cylinder Bore:

Standard ID	75.98 - 76 mm (2.991 - 2.992 in.)
Maximum ID	76.07 mm (2.995 in.)
Out of Round	0.056 mm (0.0022 in.)

Cylinder Oversize Diameter:

0.50 mm	76.46 - 76.48 mm (3.010 - 3.011 in.)

Oil Pump:

Minimum Rotor Shaft OD	10.92 mm (0.430 in.)
Maximum Rotor Shaft Bearing ID	11.07 mm (0.436 in.)
Minimum Outer Rotor OD	40.43 mm (1.592 in.)
Minimum Outer Rotor Bearing ID	40.80 mm (1.606 in.)
Minimum Valve Spring Free Length	19.50 mm (0.768 in.)

Water Pump:

Minimum Shaft OD	9.94 mm (0.391 in.)
Maximum Pump and Crankcase Housing Bore ID	10.09 mm (0.397 in.)
Cap Screw Torque (Bolt M6 all lengths)	9.5 N•m (84 lb-in.)
Cap Screw Torque (Bolt M8)	25 N•m (222 lb-in.)
Crankcase Cover Cap Screw Torque	21 N•m (186 lb-in.)

Special or Essential Tools

Special or Required Tools

Tool Name	Tool No.	Tool Use
Digital Tachometer	JT05719	Slow idle mixture screw and speed adjustments, and fast idle speed adjustment.
Fuel Pump Pressure Test Kit	JDG356	Fuel pump pressure test.
Compression Gauge Spark Plug Test Tool	JDM-59 JDM-74A-5	Cylinder compression test, and valve clearance adjustment.
Pressure Gauge Assembly Hose Assembly Connector 1/8” BSP Thread	JT05577 JT03017 JT03349	Oil pressure test.
Valve Spring Compressor	JDM70	Cylinder head disassembly and assembly.
Valve Guide Driver Tool	JDG504	Replace valve guides.

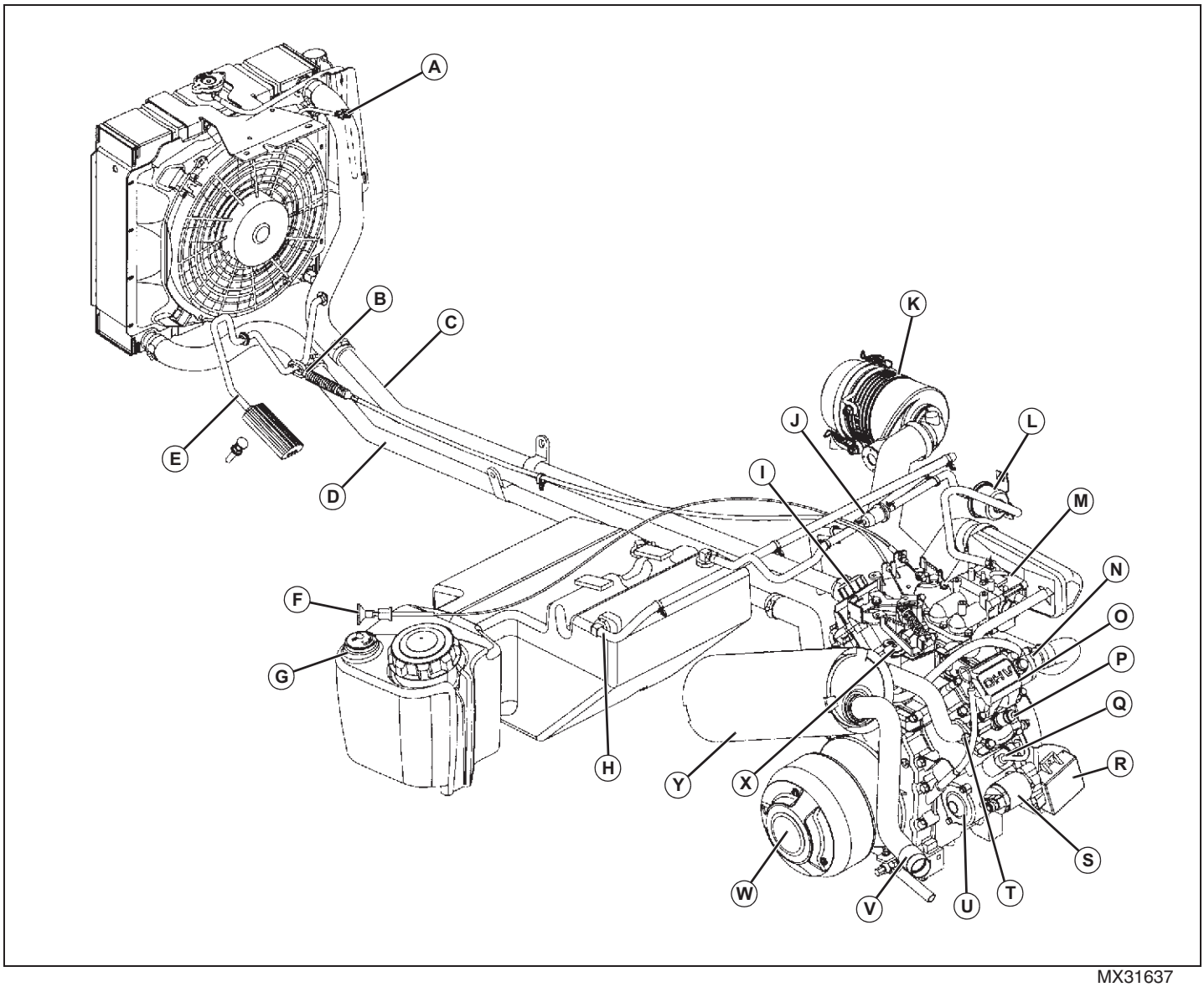
Other Materials

Other Material

Part No.	Part Name	Part Use
	SCOTCH-BRIGHT® Abrasive Sheets/ Pads	Clean cylinder head.
	Valve Guide Cleaner	Clean valve guides.
	Stanisol or Kerosene	Finish ream valve guide.
	Prussion Blue Compound	Check valve seat contact.
	Lithium Base Grease	Pack oil seals.
	Zinc Oxide/Wood Alcohol	Check block for cracks.
	Mineral Spirits	Clean electric starter armature.

Component Location

Engine Component Location

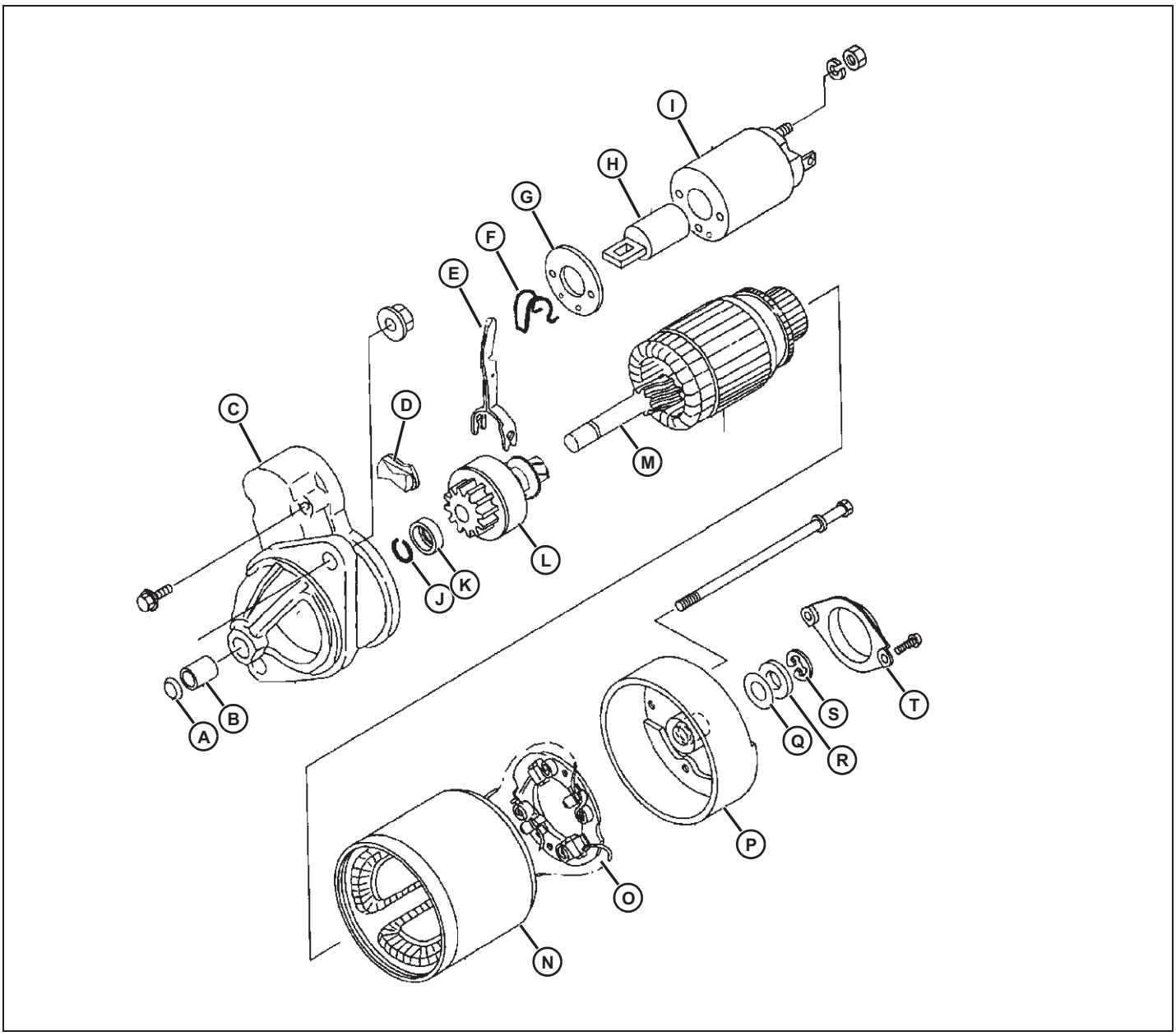


MX31637

A- Thermostat Connector
B- Throttle Cable
C- Radiator Hose
D- Radiator Return Hose
E- Throttle Pedal
F- Choke Cable Control Knob
G- Fuel Gauge
H- Fuel Line
I- Oil Fill Cap
J- Fuel Filter
K- Air Filter Assembly
L- Fuel Pump

M- Carburetor
N- Water Pump
O- Valve Cover
P- Spark Plug
Q- Igniter
R- Engine Control Module
S- Starting Motor Solenoid
T- Exhaust Port
U- Starting Motor
V- Spark Arrester
W- Drive Clutch
X- Governor Assembly
Y- Muffler

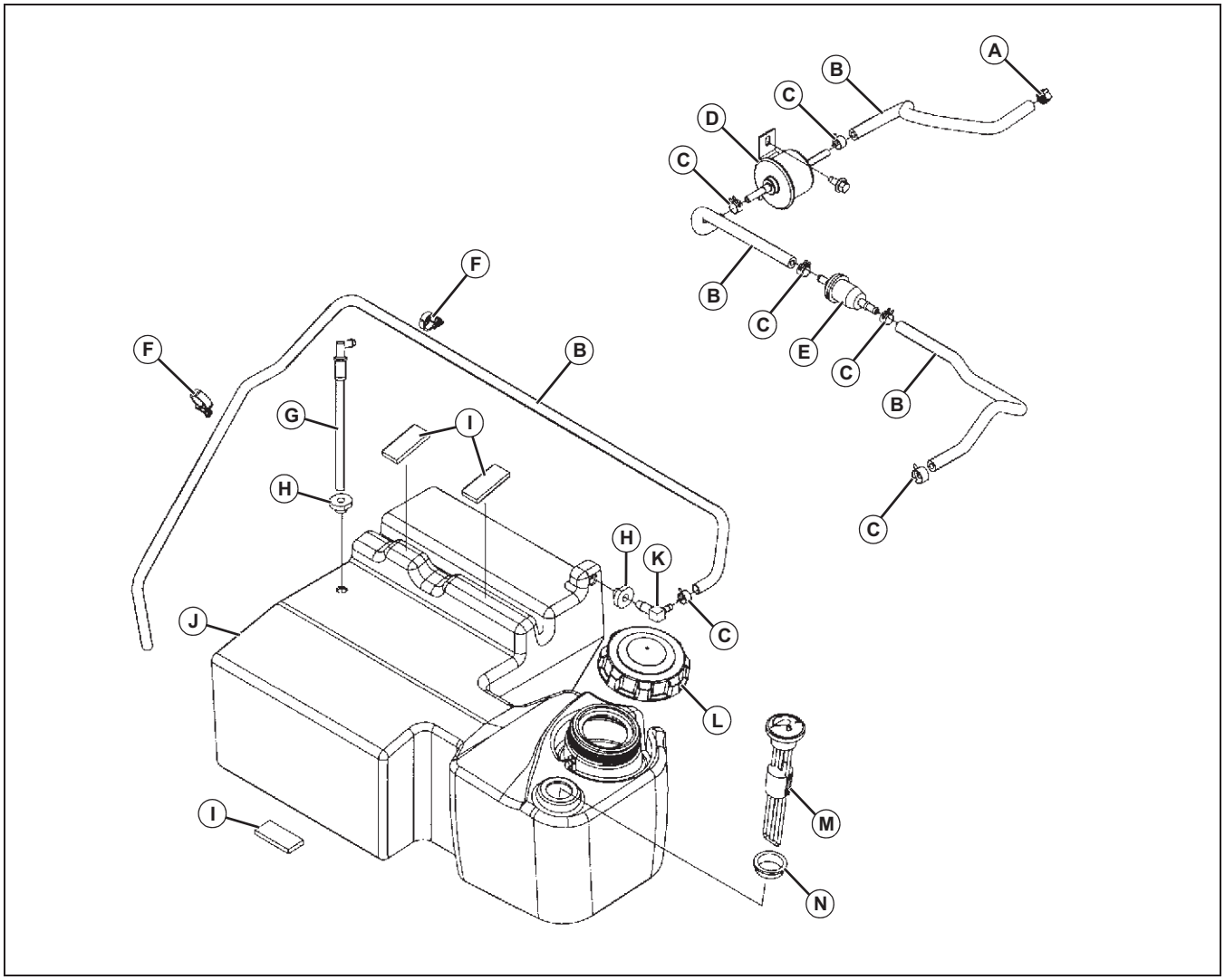
Starting Motor



M76762

A- End Cap
B- Cover Bushing
C- End Frame
D- Dust Cap
E- Shift Fork
F- Clutch Fork Pivot
G- Shim Plate
H- Plunger
I- Solenoid
J- Retaining Ring
K- Pinion Stopper
L- Clutch
M- Armature
N- Field Coil Housing
O- Filed Brush Holder
P- Rear Cover
Q- Shim
R- Shim
S- E-Clip
T- Cap

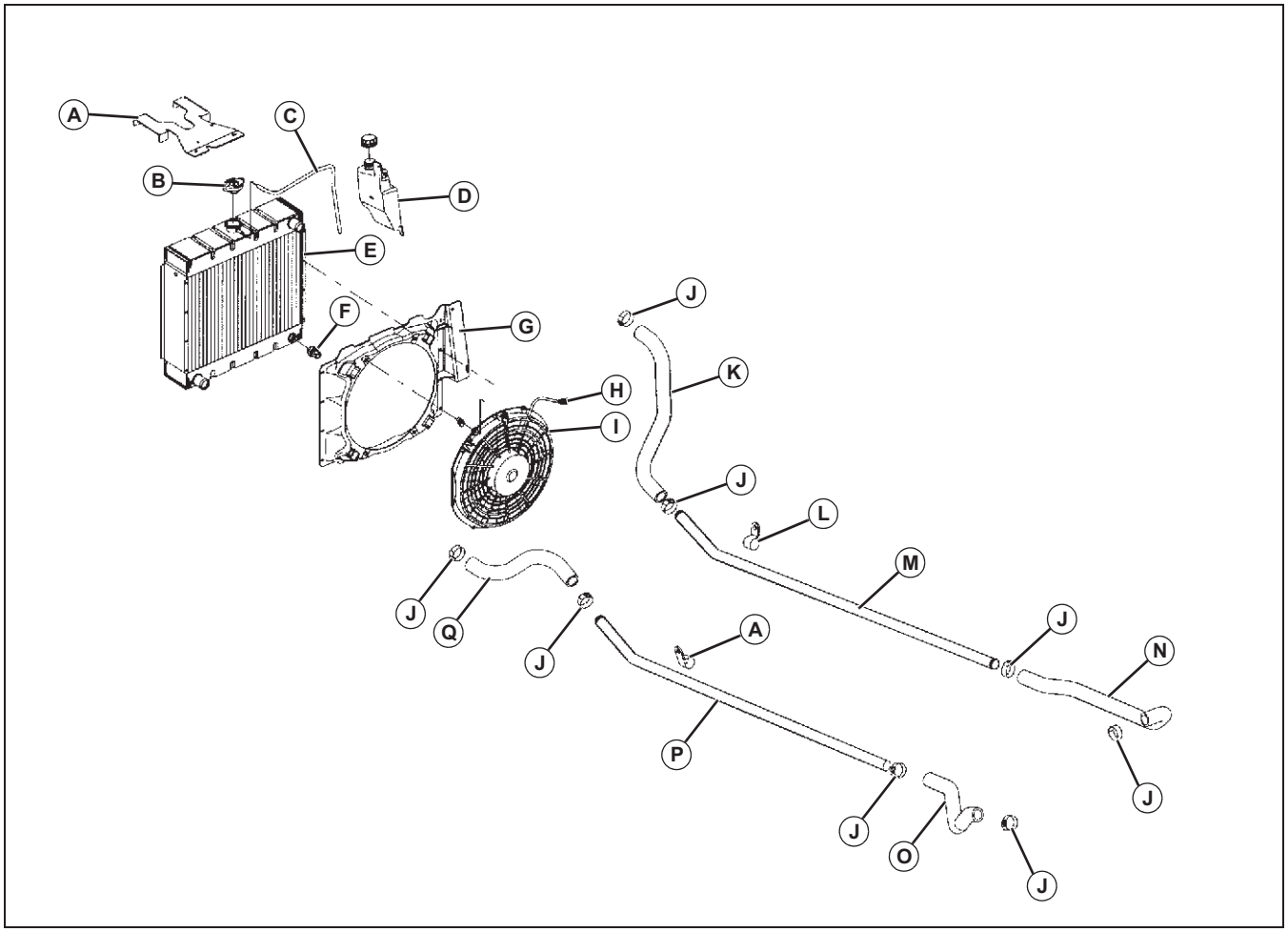
Fuel System Components



MX31875

A- Clamp
B- Hose (TY22551)
C- Clip
D- Fuel Pump
E- Fuel Filter
F- Retainer
G- Pick Up Tube
H- Bushing
I- Pad
J- Fuel Tank
K- Elbow Fitting
L- Filler Cap
M- Fuel Gauge
N- Bushing

Coolant System Components



MX31876

A- Support Bracket
B- Radiator Cap
C- Vent Tube
D- Overflow Reservoir
E- Radiator
F- Temperature Sensor
G- Shroud
H- Cooling Fan Electrical Connector
I- Cooling Fan
J- Clamp
K- Upper Radiator Hose
L- Retainer
M- Coolant Supply Tube
N- Coolant Supply Hose
O- Coolant Return Hose
P- Coolant Return Tube
Q- Lower Radiator Hose

Diagnostics

Engine Troubleshooting Guide

Caution: Avoid Injury! The engine may start to rotate at any time. Keep hands away from moving parts when testing.

Note: To test specific electrical components, see Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance.

Test Conditions:

- Operator On Seat
- Transmission in Neutral
- Brake On

Engine Doesn't Crank**:**

1. Are battery cables loose or dirty?

Yes: Tighten or clean.

No: Go to next step.

2. Is battery fully charged? See "Battery Test" in the Electrical section.

Yes: Go to next step.

No: Charge battery. See "Charge Battery" in the Electrical section).

3. Is key switch working correctly?

Yes: Go to next step.

No: Test switch. See "Cranking Circuit Operation," for the appropriate machine, in the Electrical section. Replace as needed.

4. Is starting motor or solenoid defective?

Yes: Repair or replace. See "Starting Motor Solenoid Test" or "Starting Motor No-Load Amperage and RPM Test" in the Electrical section,

No: Go to next step.

5. Has engine seized?

Yes: See Engine Repair Section.

No: Go to next step.

Caution: Avoid Injury! Keep spark plug as far away from the plug hole as possible. Gasoline spray from the open cylinders may be ignited by ignition spark and cause an explosion or fire.

Engine Hard To Start:

1. Is there a strong blue spark?

Yes: Go to step 3.

No: Replace spark plug. Recheck for spark and go to next step.

2. Is there a strong blue spark?

Yes: Check engine starting.

No: Check if sparks are produced between high tension lead and ignition block. Check high tension lead, ignition coil air gap, pulser coil.

3. Check compression. See "Cylinder Compression Test" on page 36. Is compression sufficient?

Yes: Make starting attempts a number of times, remove spark plug and observe electrodes. Go to next step.

No: Go to step 5.

4. After starting attempts, are spark plug electrodes wet?

Yes: Check for excessive use of choke, plugged air cleaner, carburetor float level too high.

No: Check fuel tank and lines.

5. Compression is low?

Yes: Check piston rings and cylinder for wear. Inspect cylinder head. See "Pistons and Cylinders Removal" on page 51.

Engine Runs Erratically:

1. Is fuel delivery correct? See "Fuel Pump Flow Test" on page 36.

No: Check for plugged air/fuel passages in carburetor. See "Carburetor Repair" on page 42.

No: Check for contamination, or an air or vapor lock in the fuel tank and lines. Check fuel filter and pump.

Engine Malfunctions At Low Speed:

1. Is unusual smoke emitted out of muffler?

Yes: Check choke. See "Choke Cable Adjustment" on page 35.

No: Go to next step.

2. Does engine rpm drop or engine stall at a certain point when throttle is gradually opened by hand?

Yes: Plugged passage in carburetor, clean carburetor. See "Carburetor Repair" on page 42.

No: Go to next step.

3. Is air sucked through carburetor or intake manifold flanges?

Yes: Tighten manifold flange nuts or replace damaged gasket.

No: Go to next step.

4. Are valve clearances set correctly? See “Valve Clearance Adjustment” on page 37.

No: Adjust valves.

Oil Consumption Is Excessive:

1. Check compression. See “Cylinder Compression Test” on page 36. Is compression sufficient?

No: Check for oil leaks, high oil level, plugged oil ring groove, oil seals, clogged breather valve, plugged drain back hole in breather, incorrect oil viscosity.

No: Check for worn, stuck or broken piston rings, or worn cylinder bore.

Starting Motor Troubleshooting Guide

Starting Motor Troubleshooting

Caution: Avoid Injury! The engine may start to rotate at any time. Keep hands away from moving parts when testing.

Important: Avoid Damage! If starting motor does not by turning ignition switch to Off position, disconnect negative (-) lead from battery as soon as possible.

Note: To test specific electrical components, see Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance.

Starter Does Not Rotate**:**

1. Is there a click sound from starter solenoid?

Yes: Repair starting motor. See “Starting Motor Removal and Installation” on page 58.

No: Check that all starting conditions are met. Go to next step.

2. Are battery cables loose or dirty?

Yes: Tighten or clean.

No: Go to next step

3. Is battery fully charged? See “Battery Test” in the Electrical section.

Yes: Charge battery. See “Charge Battery” in the Electrical section.

No: Go to next step

4. Is key switch working correctly?

Yes: Go to next step

No: Test switch. See “Cranking Circuit Operation,” for the appropriate machine, in the Electrical section. Replace as needed.

5. Has engine seized?

Yes: See Engine Repair Section.

Starter Rotates Slowly:

1. Are battery cables loose or dirty?

Yes: Tighten or clean.

No: Go to next step

2. Is battery fully charged? See “Battery Test” in the Electrical section.

Yes: Charge battery. See “Charge Battery” in the Electrical section.

No: Go to next step

3. Is starting motor or solenoid defective?

Yes: Test solenoid, repair or replace. See “Starting Motor Solenoid Test” or “Starting Motor No-Load Amperage and RPM Test” in the Electrical section.

No: Go to nest step.

4. Has engine seized?

Yes: See Engine Repair Section.

Tests and Adjustments

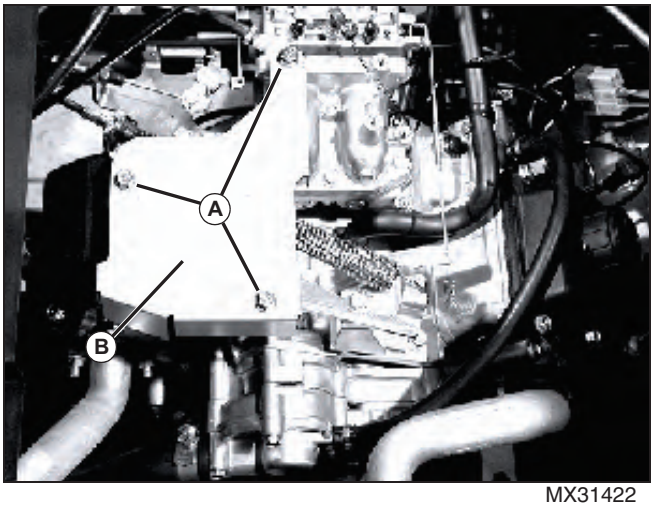
Governor: Static Adjustment

Reason:

To properly position governor arm to governor shaft for proper governor operation.

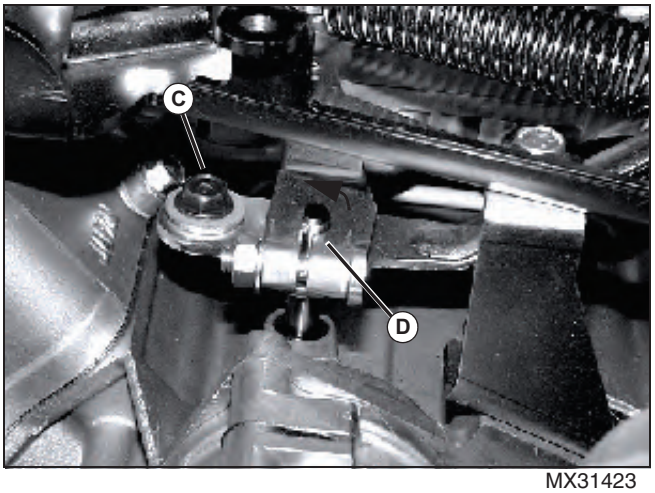
Procedure:

1. Park machine safely. See "Park Machine Safely" in the Safety section. Raise cargo box.



MX31422

2. Remove three cap screws (A) and throttle control arm cover (B).



MX31423

3. Press accelerator pedal down and place a heavy weight on pedal.

Important: Avoid Damage! Cap screw has left-hand threads.

4. Loosen cap screw (C) on governor arm. Turn governor shaft and bracket (D) counterclockwise to remove any slack in governor linkage and arm.

Important: Avoid Damage! DO NOT move throttle control arm by hand, this will kink the wire cable and damage it. Use throttle pedal only.

5. Hold shaft and tighten cap screw (C).

High Idle Speed Adjustment

Reason:

To ensure engine is running at proper high idle speed.

Equipment:

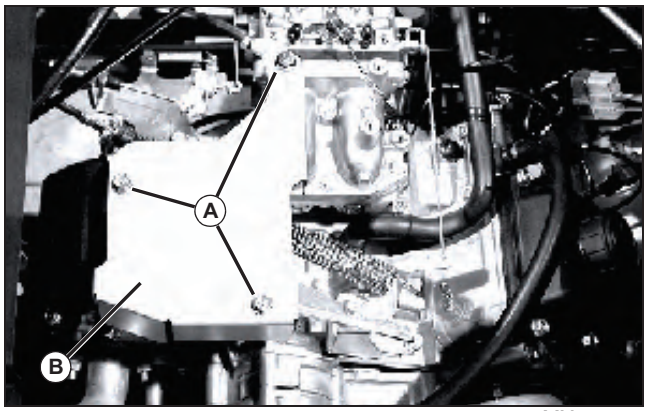
- JT05801 Induction Tachometer

-or-

- JT05719 Digital Tachometer

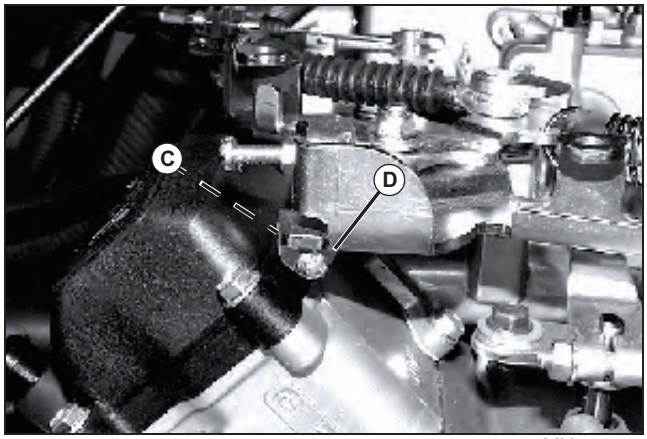
Procedure:

1. Park machine safely and raise cargo box. See "Park Machine Safely" in the Safety section.



MX31422

2. Remove three cap screws (A) and throttle control arm cover (B).



MX31544

3. Start and warm up engine. Run engine at full throttle and check rpms with tachometer. Record reading.

4. High idle speed should be 3750 ±75 rpm. If rpms are not within specification, loosen jam nut behind bracket (C) and adjust screw (D) until proper rpm is obtained and tighten jam nut.

Slow Idle Mixture and Governed Low Idle Adjustments

Reason:

To ensure correct fuel/air mixture and engine is running at proper slow idle speed

Note: Adjust fast idle before slow idle and mixture speed adjustment.

Equipment:

- JT05801 Induction Tachometer

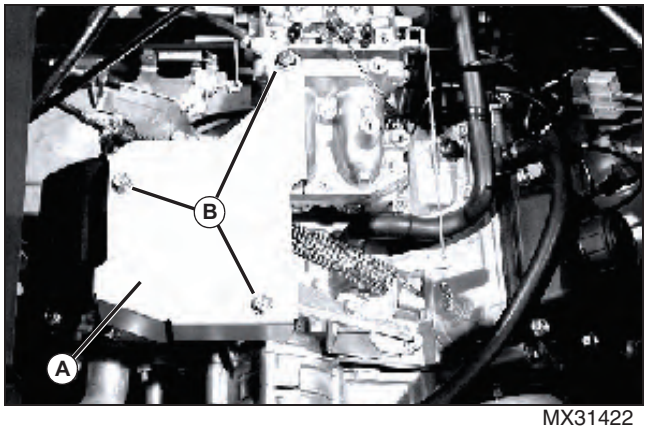
-or-

- JT05719 Digital Tachometer

Procedure:

1. Park machine safely and raise cargo box. See “Park Machine Safely” in Safety section.

Important: Avoid Damage! Do not move the throttle control arm by hand. This will kink the wire cable and damage it. Use throttle pedal only.



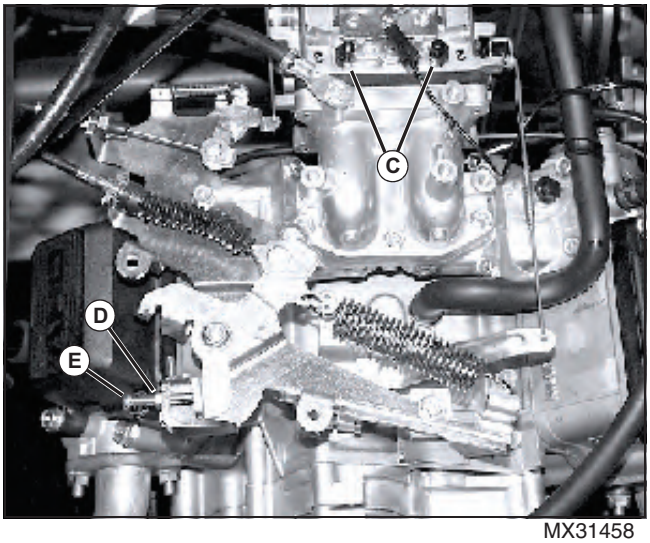
MX31422

2. Remove throttle control arm cover (A) by removing three cap screws (B).

Note: When throttle pedal is released, it takes approximately 30 seconds for idle speed to stabilize.

3. Run engine at fast idle until cooling fan starts. Release throttle pedal.

Caution: Avoid Injury! Engine components are HOT. Be extra careful not to touch the exhaust pipe or muffler while making adjustments. Wear protective eye glasses and clothing.



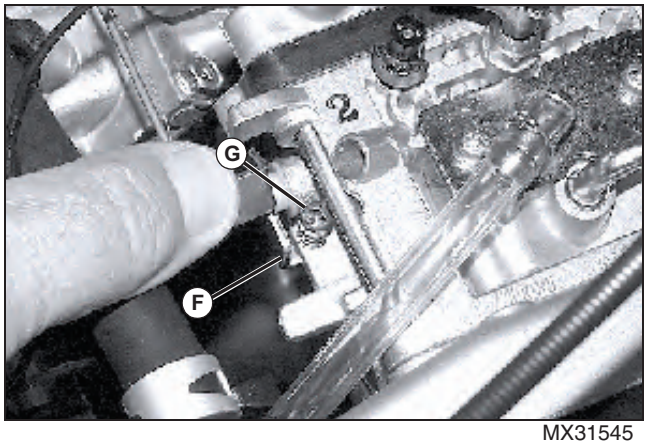
MX31458

4. Check governed idle speed with tachometer. Engine should be idling at 1125 ±75 rpm. If idle speed is not within specification, loosen jam nut (D) and adjust slow idle stop screw (E) until proper idle speed is obtained and tighten jam nut.

Note: Do not remove mixture screw limiter caps or force beyond stops.

5. Turn slow idle mixture screws (C), until smoothest idle is obtained.

6. Repeat step 4 if necessary.



MX31545

7. Push and hold throttle so that tab (F) is against slow idle stop screw (G). While checking idle speed with tachometer, adjust screw until engine speed is 100 rpm less than governed idle speed (Step 4).

Throttle Cable Adjustment

Reason:

To ensure that throttle cable is allowing throttle lever on governor to reach full high idle and slow idle positions.

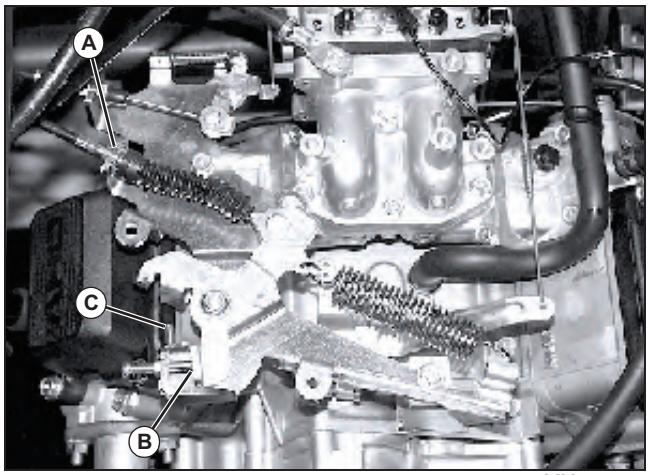
Equipment:

- 1/2 in. Wrenches

Procedure:

1. Park machine safely with park brake locked. See Park Machine Safely in Safety section.

2. Accelerator pedal should have 2-6 mm (0.080 - 0.240 in.) free travel before cable moves.



MX31458

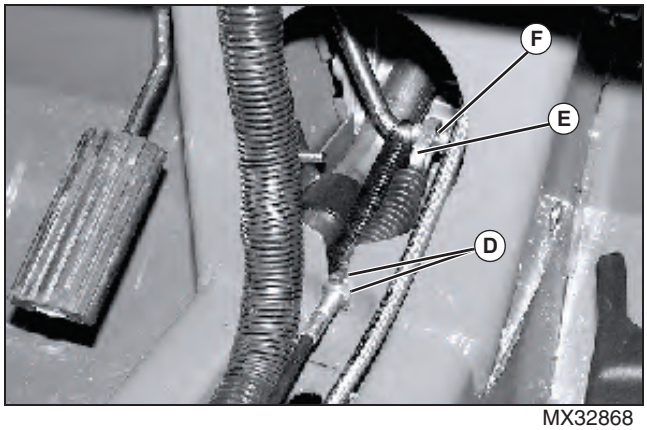
3. Inspect cable and bracket on engine (A).

4. When accelerator pedal is up, make sure the tab on the throttle lever is contacting the idle stop screw (B).

5. Press accelerator pedal all the way down to high speed position. Check that throttle cable is pulling throttle lever all the way to the fast idle stop screw (C).

To Adjust Cable:

1. Remove tunnel cover from machine.

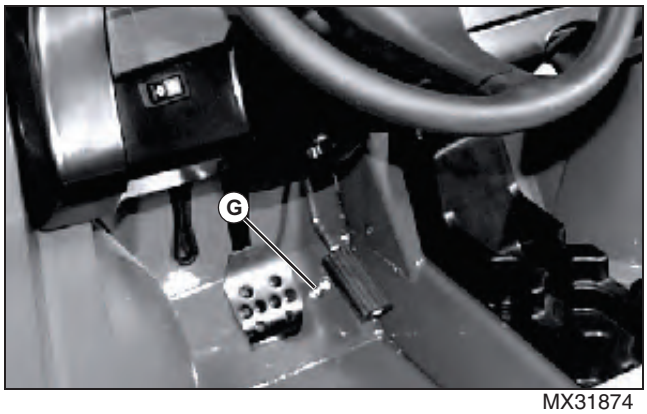


MX32868

1. Pull cable eyelet (E) to get slack out of cable and measure free play between eyelet and pedal rod (F). Gap should be 1-3 mm (0.039 - 0.118 in.).

2. If free play is not 1-3 mm (0.039 - 0.118 in.) loosen nuts (D) and adjust until proper freeplay is obtained.

3. Install tunnel cover.



MX31874

4. Adjust pedal stop (G) to limit pedal travel, preventing throttle cable from being stretched.

- Depress throttle pedal to full FAST idle position (throttle control arm touching fast idle stop screw (C) on engine).

Note: Using a five pound weight on pedal will make adjustment easier.

- Loosen jam nuts on pedal stop (G) and turn stop bolt until just touching back of pedal.
- Turn pedal stop bolt ONE TURN until there is a 1 to 1-1/2 mm gap between pedal and stop bolt.
- Tighten pedal stop jam nut. Recheck adjustment.

Choke Cable Adjustment

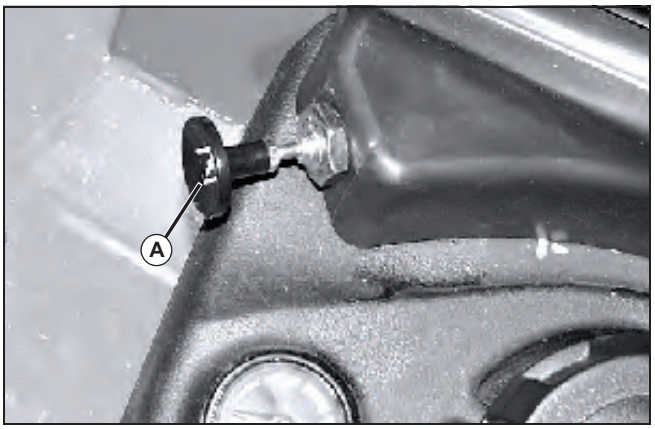
Reason:

To get full choke operation and prolong choke cable life

Note: Adjust fast idle, slow idle and mixture, before adjusting choke cable.

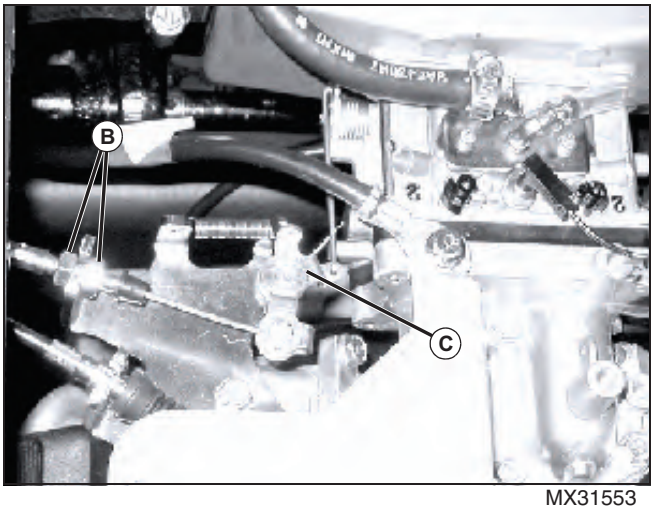
Procedure:

1. Park machine safely. See "Park Machine Safely" in the Safety section.



MX31546

2. Be sure choke knob (A) is in OFF (pushed in) position.



MX31553

3. Loosen jam nuts (B) and lift choke cable out of the bracket.

4. Make sure choke spring, arm, and linkage (C) operate freely and choke is in open (off) position.

5. Hold cable and jam nuts over bracket and position jam nuts and cable housing to where there is almost no slack in the cable and no movement of the choke linkage. Tighten jam nuts.

6. Re check that choke is completely open when choke knob is in off position.

Fuel Pump Pressure Test

Reason:

To determine condition of fuel pump.

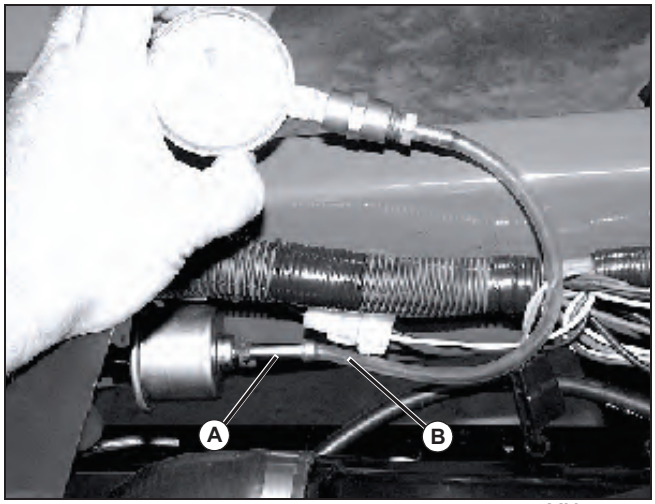
Equipment:

- JDG356 Fuel Pump Pressure Test Kit

Procedure:

1. Park machine safely. See "Park Machine Safely" in the Safety section.

Caution: Avoid Injury! Gasoline vapor is explosive. Do not expose to spark or flame. Serious personal injury can result.



MX31548

2. Disconnect and plug fuel hose from fuel pump outlet (A).

3. Connect hose and gauge (B) to fuel pump outlet.

Note: DO NOT start engine.

4. Turn key switch to ON position only.

5. Observe pressure reading, a **minimum pressure of 10 kPa (1.5 psi)** should be seen.

Results:

- If fuel pressure BELOW minimum, check in-line filter and hoses for debris or restrictions. Replace filter, then test again.
- If pressure is still BELOW minimum, replace fuel pump.

Fuel Pump Flow Test

Reason:

To determine condition of fuel pump.

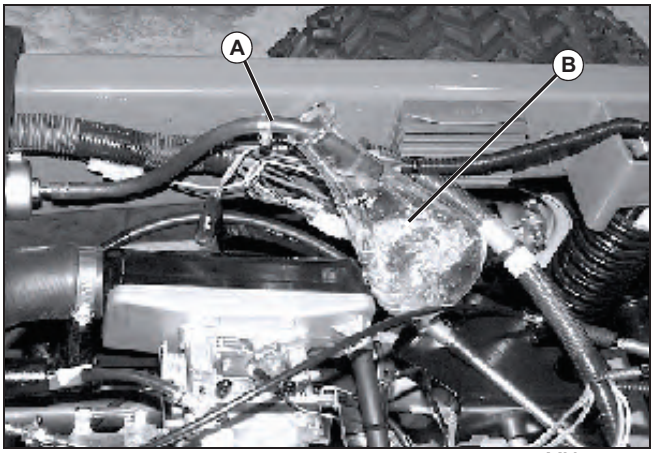
Equipment:

- Graduated container.

Procedure:

1. Park machine safely. See "Park Machine Safely" in the Safety section.

Caution: Avoid Injury! Gasoline vapor is explosive. Do not expose to spark or flame. Serious personal injury can result.



MX31549

2. Disconnect fuel supply hose (A) from carburetor inlet port and put end in a graduated container (B).

Note: DO NOT start engine. Watch container DO NOT let it fill to overflowing. Stop test early if necessary.

3. Turn key switch to ON position for 15 seconds.

4. The graduated container should show a minimum fuel flow of **105 mL (3.5 oz) in 15 seconds**.

Results:

- If fuel pressure BELOW minimum, check in-line filter, hoses, and fuel shutoff valve for debris or restrictions. Replace filter, then test again.
- If pressure is still BELOW minimum, replace fuel pump.

High Altitude Operation

High altitude performance can be improved by installing a smaller diameter main jet in the carburetor; changing the pilot air jets from #56.3 to #60; and readjusting the idle mixture screws. Main jets available: #70 (greater than 2000 m), #72.5 (1000-2000 m) and #75 (less than 1000m).

Cylinder Compression Test

Reason:

To determine condition of pistons, rings, cylinder walls and valves.

Equipment:

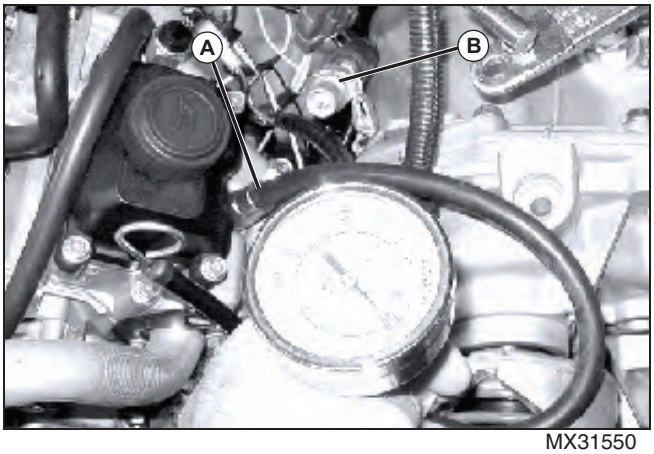
- JDM59 Compression Gauge
- JDM74A-5 Spark Tester (2)

Procedure:

1. Park machine safely. See "Park Machine Safely" in the Safety section.

2. Adjust valve clearance to 0.25mm (0.010 in.) with engine at top-dead center (TDC) of compression stroke. Engine must be cold (60-85° F).

3. Start and run engine until operating temperature is reached.



MX31550

4. Remove spark plugs and install JDM74-A spark tester (B) on each spark plug wire, or ground spark plug wires to engine block. Install JDM59 Compression Gauge (A) in one cylinder.

5. Move and hold throttle pedal in FAST idle position.

6. Be sure choke is OFF.

Important: Avoid Damage! DO NOT overheat starting motor during test. Starting motor Duty Cycle is five seconds ON and ten seconds OFF.

7. Crank engine for five to ten compression strokes.

8. Record pressure reading for that cylinder.

   - If pressure reading is BELOW specification, squirt clean engine oil into cylinders through spark plug hole and repeat test.
   - If pressure INCREASES significantly, check piston, rings, and cylinder walls for wear or damage.