JOHN DEERE
WORLDWIDE COMMERCIAL & CONSUMER EQUIPMENT DIVISION

Commercial Walk-Behind Mower
7G18

SN (020001-)

TM2220 OCT05

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

Gear Power Train

Attachments

Miscellaneous

INTRODUCTION

Recognize Safety Information

MIF

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

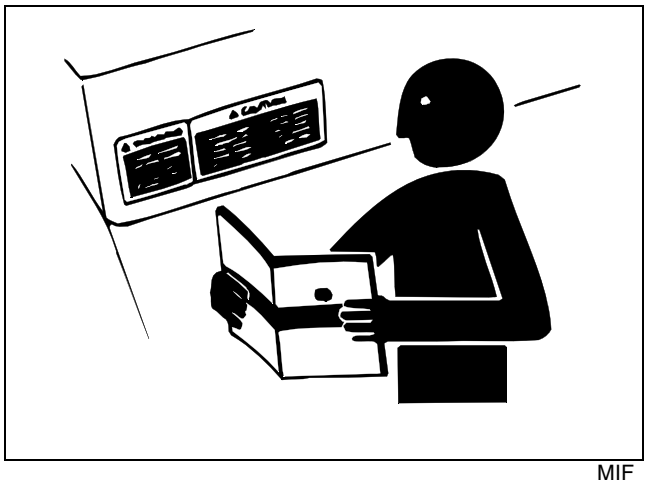
Follow recommended precautions and safe servicing practices.

Understand Signal Words

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

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

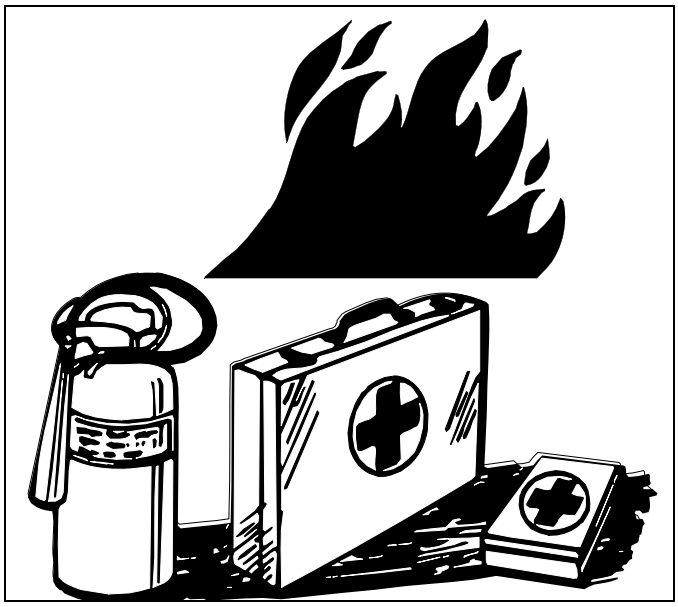
Replace Safety Signs



MIF

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

Be Prepared For Emergencies



Handle fluids safely - Avoid fires

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.

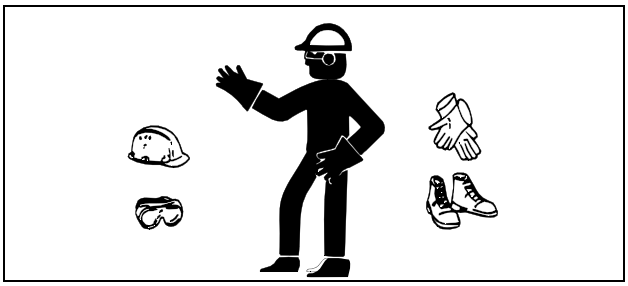
Do not store oily rags; they can ignite and burn spontaneously.

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.

Wear Protective Clothing

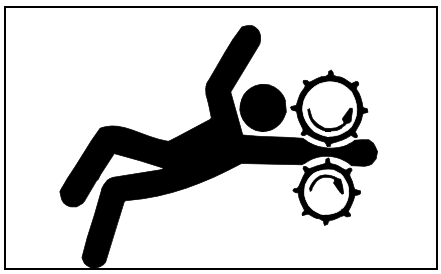


Wear close fitting clothing and safety equipment appropriate to the job.

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

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

Service Machines Safely



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

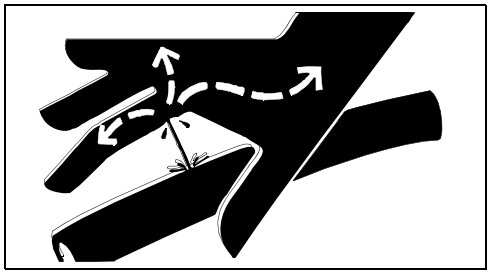
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

Use Proper Tools

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

Use Care Around High-pressure Fluid Lines

Avoid High-Pressure Fluids



MIF

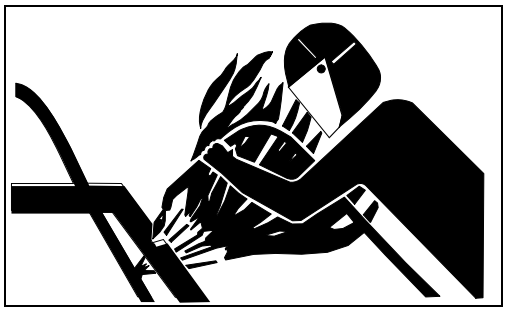
Escaping fluid under pressure can penetrate the skin causing serious injury.

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.

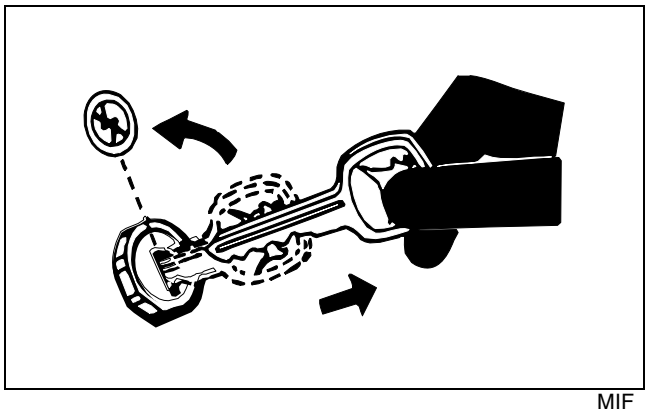
Avoid Heating Near Pressurized Fluid Lines



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.

Park Machine Safely

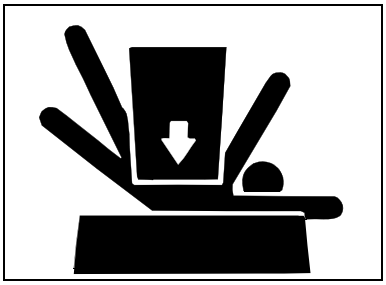


MIF

Before working on the machine:

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

Support Machine Properly And Use Proper Lifting Equipment



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.

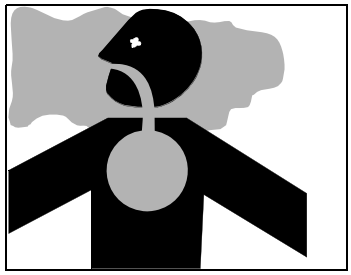
Using High Pressure Washers

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

Illuminate Work Area Safely

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

Work In Ventilated Area



Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

WARNING: California Proposition 65 Warning

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

Remove Paint Before Welding Or Heating

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

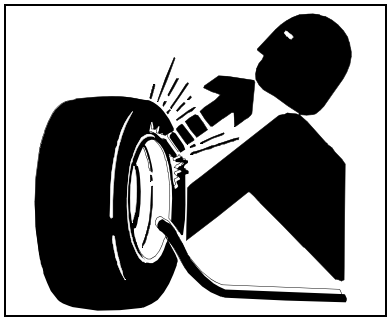
Avoid Harmful Asbestos Dust

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

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

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

Service Tires Safely



MIF

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

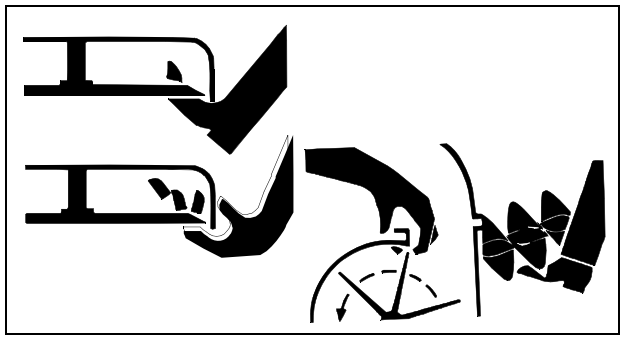
Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

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.

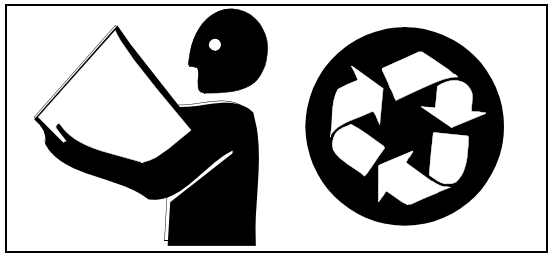
Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

Avoid Injury From Rotating Blades and PTO Shafts



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

Handle Chemical Products Safely



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

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

Dispose of Waste Properly

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

Live With Safety

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

Table of Contents

Specifications

General Vehicle Specifications

NOTE: Specifications and design subject to change without notice.

Engine

Make	Kohler
Type	OHV, vertical shaft, 4 cycle
Model	CV493T
Aspiration	Natural
Cylinder	One
Compression Ratio	8.5:1
Speed, Fast Idle	3600 ± 25 rpm
Speed, Slow Idle	1550 ± 25 rpm
Operating Range	1500 - 3600 rpm
Displacement	490 cc (29.9 cu. in.)
Bore	90 mm (3.60 in.)
Stroke	77 mm (3.03 in.)
Cycle	Four
Ignition	Solid state ignition
Spark Plug Type	M78543 (RC12YC)
Cooling System	Air cooled
Oil Filter	Standard single element
Air Cleaner	Dual-stage, dry, replaceable
Governor	Mechanical
Weight (Approx.)	41.9 kg (90 lb)

Capacities

Crankcase Capacity with Oil Filter	1.9 L (2.0 qt)
Crankcase Capacity without Oil Filter	1.6 L (1.7 qt)
Fuel Tank Capacity	19 L (5.0 gal)

Dimensions

Overall Height	1.04 m (41 in.)
Overall Length	2.01 m (79.2 in.)
Overall Width (Chute Up)	1.3 m (51 in.)
Overall Width (Chute Down)	1.6 m (62 in.)
Machine Weight (with Deck)	245 Kg (540 lb)

Drive Train

Transmission	Dana, 5-speed with reverse
Forward Gears	Five
Reverse Gears	One
Shift Mechanism	Enclosed gear with keys

Fuel System

Fuel	**Regular Unleaded Gasoline (minimum 87 octane)**
Fuel Filter	**Single stage, 60 micron**
Fuel Pump	**Vacuum operated diaphragm**

Mower Decks

Cutting Width	**1.22 m (48 in.)**
Blades	**Three**
Blade Drive	**V-belt and timed cogged belt**
Cutting Heights	**25.4 to 114.3 mm (1.0 to 4.5 in.)**
Deck Material	**7-Gauge steel**

Tires

Air Pressure (Front)	**124.1 kPa (18 psi)**
Air Pressure (Rear)	**90-117 kPa (17-15 psi)**
Caster Wheels (Front)	**228 x 89 mm (9 x 3.5 in.)**
Drive Wheels (Rear)	**406 x 165 mm (16 x 6.5 in.)**

Travel Speeds

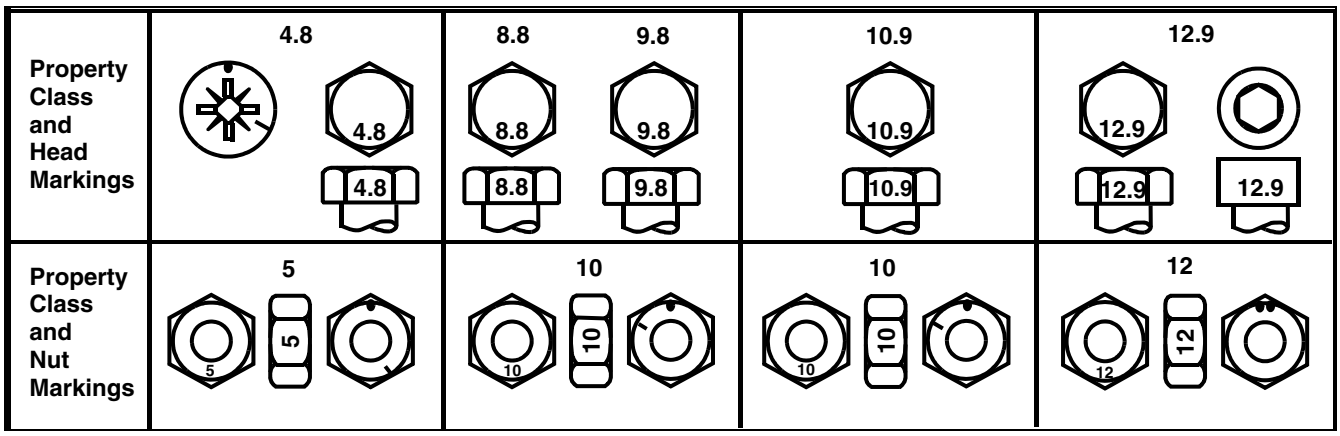
Forward Speed Range	**3.2 to 11.9 km/h (2.0 to 7.4mph)**
Reverse Speed Range	**5.1 km/h (3.2 mph)**

General

Axle	**Solid**
Brakes	**Band**

Fastener Torques

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.

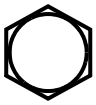
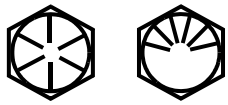
When bolt and nut combination fasteners are used, torque values should be applied to the NUT instead of the bolt head.

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

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

General Information

Using Proper Fuel

Use regular grade unleaded fuel with an octane rating of 87 octane or higher. Fuel blends containing up to 10% ethanol or up to 15% MTBE reformulated fuel are acceptable. Do not use fuel or additives containing methanol as engine damage can occur.

Always use fresh, clean fuel that is purchased in a quantity that can be used within approximately 30 days, or add fuel stabilizer.

Fuel is blended to give best seasonal performance. To avoid engine performance problems such as hard starting or vapor lock, use in-season fuel. Use fuel during warm weather that was purchased during that season, and use fuel during cold weather that was purchased during that season.

Fuel can become stale in machines with engines that are used seasonally or infrequently during a season. Stale fuel can produce varnish and plug carburetor or injector components which can affect engine performance.

Keep fuel storage container tightly covered and in a cool area out of direct sunlight. Fuel can break down and degrade if not sealed properly or exposed to sun and heat.

Condensation may collect in the fuel tank because of a variety of operating or environmental conditions and, over time, may affect your machine's operation. Fill fuel tank at the end of daily use and store fuel in plastic containers to reduce condensation.

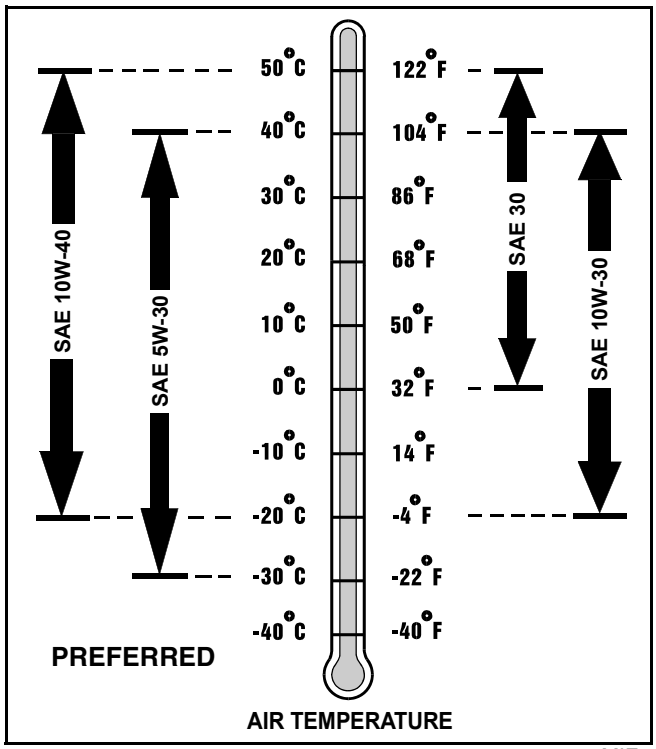
For best year-round performance and fuel-handling, add stabilizer to fuel immediately after fuel purchase. Such practice helps prevent engine performance problems and allows fuel storage in the machine all year without draining.

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 (TY25808)** or an equivalent to the gasoline. BE SURE to follow directions on container and to properly discard empty container.

4 - Cycle Gasoline Engine Oil



MIF

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™ - SAE 10W-40
- TORQ-GARD SUPREME™ - SAE 5W-30

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

- TURF-GARD™ - SAE 10W-30
- PLUS-4™ - SAE 10W-30
- TORQ-GARD SUPREME™ - SAE 30

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

- API Service Classification SG or higher

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.

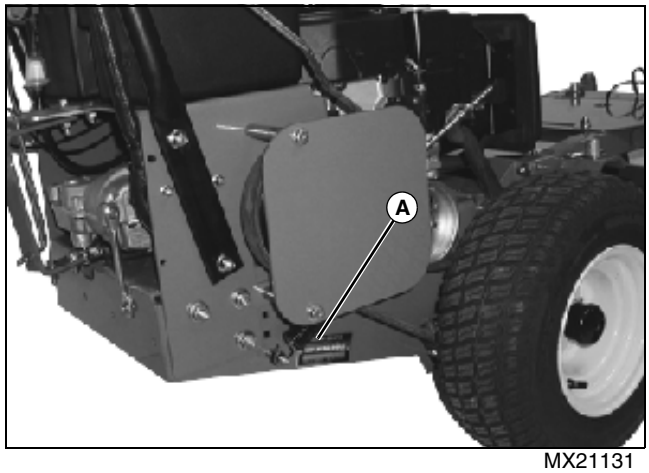
Most John Deere filters contain pressure relief and anti-drainback valves for better engine protection.

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.

Serial Number Locations

Product Serial Number

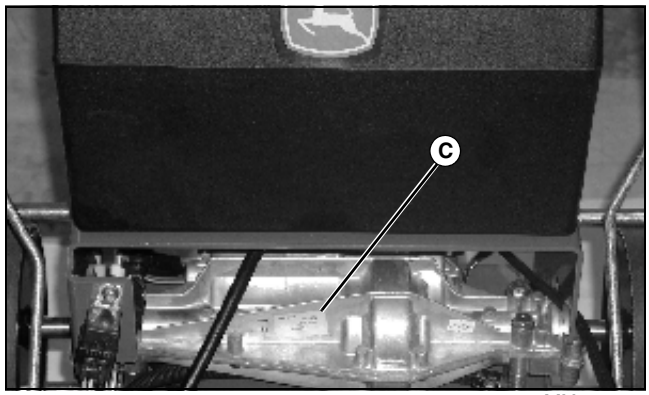


MX21131

Engine Serial Number

MX21169

Transmission Serial Number



MX21301

Table Of Contents

ENGINE SPECIFICATIONS

Specifications

General Specifications

Engine

Make	Kohler
Type	OHV, vertical shaft
Model	CV493T
Aspiration	Natural
Cylinders	One
Displacement	490 cc (29.9 cu. in.)
Stroke/Cycle	77 mm (3.03 in.) 4 cycle
Compression Ratio	(8.5:1)
Bore	90 mm (3.60 in.)
Compression Release	Automatic
Lubrication	Positive displacement pump
Cooling System	Air cooled
Air Cleaner	Dual-stage, dry, replaceable
Engine Oil Capacity	1.9 L (2.0 qt)
Oil Filter	Replaceable, full flow
Spark Plug Type	M78543 (RC12YC)
Weight, Dry (Without Muffler)	41.9 kg (90 lb)

Test and Adjustment Specifications

Engine

Crankcase Vacuum (Maximum)	102 mm (4 in.)
Fuel Pressure (Minimum) (Cranking RPM for 3-5 Seconds)	6.12 kPa (0.9 psi)
Fuel Flow/15 Seconds (Minimum)	0.30 mL (1 oz.)
Fast Idle Oil Pressure (Maximum)	260 kPa (38 psi)
Fast Idle Oil Pressure (Minimum)	193 kPa (28 psi)
Slow Idle Oil Pressure (Minimum)	137 kPa (20 psi)
Carburetor Slow Idle Mixture Screw Initial Setting	1 turn out from lightly seated
Fast Idle Speed	3600 ± 50 rpm
Slow Idle Speed	1500 ± 50 rpm
Ignition Coil Air Gap	0.20-0.30 mm (0.0080-0.012 in.)
Cylinder Compression (Minimum)	345 kPa (50 psi)
Valve Adjustment	None (hydraulic lifters)
Spark Plug Gap	1.02 mm (0.040 in.)
Coil Resistance	2.3 ± 0.2 ohms
Regulated Output Voltage @ Fast Idle	26 VAC
Unregulated Voltage @ Fast Idle	85 VAC
Primary Lead and Core Resistance (One Direction)	0.5-1000 ohms
Primary Lead and Core Resistance (Other Direction) (Min)	30 k-ohms
Spark Plug Lead and Core Resistance	7.9-18.5 k-ohms

Repair Specifications

Cylinder Head

Cylinder Head Distortion (Maximum)	0.076 mm (0.003 in.)
Push Rod Maximum Bend	0.76 mm (0.030 in.)
Cylinder Compression (Min)	345 kPa (50 psi)
Spark Plug Gap	1.02 mm (0.040 in.)

Valves and Valve Lifters

Hydraulic Lifter Clearance	0.01-0.05 mm (0.0005-0.002 in.)
Intake Valve-to-Guide Clearance	0.04-0.07 mm (0.0015-0.003 in.)
Intake Valve Stem OD	6.98-7.00 mm (0.274-0.275 in.)
Exhaust Valve Stem OD	6.97-6.98 mm (0.274-0.275 in.)
Intake Valve Guide ID (New)	7.04-7.06 mm (0.277-0.278 in.)
Intake Valve Guide ID (Maximum)	7.13 mm (0.281 in.)
Exhaust Valve Guide ID (New)	7.04-7.06 mm (0.277-0.278 in.)
Exhaust Valve Guide ID (Maximum)	7.16 mm (0.282 in.)
Valve Guide Reamer (Standard)	7.05 mm (0.277 in.)
Valve Guide Reamer (0.25 mm Oversize)	7.30 mm (0.287 in.)
Intake Valve Lift (Minimum - Engine Cold)	8.96 mm (0.353 in.)
Exhaust Valve Lift (Minimum - Engine Cold)	9.14 mm (0.360 in.)
Valve Face Angle	45°
Valve Seat Angle	44.5
Valve Margin	1.5 mm (0.059 in.)
Valve Spring Inclination (Maximum)	2.39 mm (0.090 in.)

Crankshaft

End Play (Free)	0.0575-0.4925 mm (0.0022-0.0193 in.)
End Play (With Shims)	0.050-0.530 mm (0.0020-0.0209 in.)
Crankshaft Bore ID (In Crankcase) (New)	44.965-44.990 mm (1.7703-1.7712 in.)
Crankshaft Bore ID (In Crankcase) (Maximum)	44.975-45.001 mm (1.7707-1.7717 in.)
Crankshaft Bore ID (In Crankcase) (Running Clearance)	0.030-0.077 mm (0.0011-0.0030 in.)
Crankshaft Bore ID (In Oil Pan) (New)	41.965-42.003 mm (1.6521-1.6536 in.)
Crankshaft Bore ID (In Oil Pan) (Maximum)	41.976-42.014 mm (1.6526-1.6541 in.)
Crankshaft Bore ID (In Oil Pan) (Running Clearance)	0.0300-0.0880 mm (0.0011-0.0034 in.)
Flywheel Main Bearing Journal OD (New)	44.913-44.935 mm (1.7682-1.7691 in.)
Flywheel Main Bearing Journal OD (Maximum)	44.84 mm (1.765 in.)
Flywheel Main Bearing Journal OD (Maximum Taper)	0.022 mm (0.0009 in.)
Flywheel Main Bearing Journal OD (Maximum Out-of-Round)	0.025 mm (0.0010 in.)
Oil Pan Main Bearing Journal OD (New)	41.915-41.935 mm (1.6502-1.6510 in.)
Oil Pan Main Bearing Journal OD (Minimum)	41.86 mm (1.648 in.)
Oil Pan Main Bearing Journal OD (Maximum Taper)	0.020 mm (0.0008 in.)
Oil Pan Main Bearing Journal OD (Maximum Out-of-Round)	0.025 mm (0.0010 in.)
Crankshaft Connecting Rod Journal OD (New)	38.958-38.970 mm (1.5338-1.5343 in.)
Crankshaft Connecting Rod Journal OD (Minimum)	38.94 mm (1.5328 in.)
Crankshaft Connecting Rod Journal OD (Maximum Taper)	0.012 mm (0.0005 in.)
Crankshaft Connecting Rod Journal OD (Maximum Out-of-Round)	0.025 mm (0.0010 in.)
Crankshaft Total Indicated Run - Out (TIR) PTO End (In Engine)	0.30 mm (0.012 in.)

Crankshaft Total Indicated Run - Out (TIR) Entire Crankshaft (In Bench V-Blocks)	0.10 mm (0.004 in.)
Oil Pan Seal Depth	2.49-2.98 mm (0.098-0.117 in.)
Crankcase Seal Depth	4.0 mm (0.157 in.)

Camshaft

End Play (With Shims)	0.076-0.127 mm (0.003-0.005 in.)
Running Clearance	0.025-0.105 mm (0.0010-0.0041 in.)
Journal Bore ID (New)	20.000-20.025 mm (0.7874-0.7884 in.)
Journal Bore ID (Maximum)	20.038 mm (0.7889 in.)
Journal OD (New)	19.962-19.975 mm (0.7859-0.7864 in.)
Journal OD (Minimum)	19.959 mm (0.7858 in.)

Balance Shaft

End Play	0.0575-0.3625 mm (0.0023-0.0143 in.)
Clearance	0.025-0.152 mm (0.0009-0.0059 in.)
Bore ID (New)	20.000-20.025 mm (0.7874-0.7884 in.)
Bore ID (Maximum)	20.038 mm (0.7889 in.)
Bearing OD (New)	19.962-19.975 mm (0.7859-0.7864 in.)
Bearing OD (Minimum)	19.959 mm (0.7858 in.)

Cylinder Bore, Piston and Rings

Cylinder Bore ID (New)	90.00-90.03 mm (3.543-3.544 in.)
Cylinder Bore ID (Wear Limit)	90.06 mm (3.545 in.)
Cylinder Bore ID (Maximum Out-of-Round)	0.12 mm (0.005 in.)
Cylinder Bore ID (Maximum Taper)	0.05 mm (0.002 in.)
Piston-to-Pin Clearance	0.006-0.017 mm (0.0002-0.0007 in.)
Piston Pin Bore ID (New)	19.006-19.012 mm (0.7483-0.7485 in.)
Piston Pin Bore ID (Wear Limit)	19.025 mm (0.749 in.)
Piston Pin OD (New)	18.995-19.000 mm (0.7478-0.7480 in.)
Piston Pin OD (Wear Limit)	18.994 mm (0.74779 in.)
Top Compression Ring Groove (Side Clearance)	0.060-0.105 mm (0.0023-0.0041 in.)
Center Compression Ring Groove (Side Clearance)	0.0381-0.083 mm (0.0015-0.0033 in.)
Oil Control Ring Groove (Side Clearance)	0.036-0.186 mm (0.0014-0.072 in.)
Top and Center Compression Ring End Gap (New Bore)	0.22-0.48 mm (0.008-0.018 in.)
Top and Center Compression Ring End Gap (Wear Limit)	0.76 mm (0.030 in.)
Oil Ring End Gap (Wear Limit)	0.250-0.760 mm (0.0098-0.0299 in.)
Piston Thrust Face to Cylinder Bore Clearance (New)	0.031-0.044 mm (0.0012-0.0016 in.)
Piston Thrust Face to Cylinder Bore Clearance (Wear Limit)	0.021 mm (0.008 in.)
Piston Thrust Face OD (New)	89.951-89.969 mm (3.5413-3.5420 in.)
Piston Thrust Face OD (Wear Limit)	89.824 mm (3.5363 in.)

Connecting Rod

Crankpin Running Clearance (New)	0.03-0.05 mm (0.001-0.002 in.)
Crankpin Running Clearance (Maximum)	0.07 mm (0.003 in.)
Connecting Rod Side-to-Crankshaft Side Clearance	0.18-0.41 mm (0.007-0.016 in.)
Piston Pin Clearance	0.01-0.03 mm (0.0003-0.0011 in.)
Piston Pin End ID (New)	19.01-19.02 mm (0.748-0.749 in.)
Piston Pin End ID (Maximum)	19.04 mm (0.750 in.)

Governor

Governor Control Arm Bore ID (New)	6.025-6.050 mm (0.2372-0.2382 in.)
Governor Control Arm Bore ID (Maximum)	6.06 mm (0.239 in.)
Governor Control Arm OD (New)	5.97-6.00 mm (0.235-0.236 in.)
Governor Control Arm OD (Minimum)	5.96 mm (0.233 in.)
Governor Control Arm-to-Crankcase Running Clearance	0.02-0.07 mm (0.001-0.003 in.)
Governor Gear Shaft OD (New)	5.99-6.00 mm (0.235-0.236 in.)
Governor Gear Shaft OD (Minimum)	5.98 mm (0.235 in.)
Governor Gear Shaft-to-Governor Gear Running Clearance	0.050-0.160 mm (0.0019-0.0063 in.)

Torque Specifications

Engine

Engine Mounting Cap Screw Torque	57 N•m (42 lb-ft)
Air Cleaner Base Flange Nut	9.9 N•m (88 lb-in.)
Cylinder Head Cap Screw (Torque in Two Increments)	First 20.41 N•m (15 lb-ft)
Cylinder Head Cap Screw (Torque in Two Increments)	Final Torque 41 N•m (30 lb-ft)
Connecting Rod Cap Screw (6 mm Straight Shank Bolt)	11.3 N•m (100 lb-in.)
Connecting Rod Cap Screw (8 mm Step Down Bolt)	14.7 N•m (130 lb-in.)
Connecting Rod Cap Screw (8 mm Straight Shank Bolt)	22.6 N•m (200 lb-in.)
Fan Cap Screw	9.9 N•m (88 lb-in.)
Flywheel Cap Screw	68 N•m (50 lb-ft)
Fuel Pump/Cover Screw	7.3-9.0 N•m (65-85 lb-in.)
Fuel Pump Cap Screw (New Installation)	9 N•m (80 lb-in.)
Fuel Pump Cap Screw (Installation of Existing Fuel Pump)	4.2-5.01 N•m (37-45 lb-in.)
Float Bowl Retaining Cap Screw	5.1-6.2 N•m (45-55 lb-in.)
Fast Idle Screw	9.9 N•m (88 lb-in.)
Ignition Coil Screw	4.0-6.2 N•m (35-55 lb-in.)
Muffler Cap Screws	10.4-12.7 N•m (90-110 lb-in.)
Oil Filter	5.7-9.0 N•m (50-80 lb-in.)
Oil Filter Drain Plug	7.3-9.0 N•m (65-80 lb-in.)
Oil Pan Cap Screw	24.4 N•m (216 lb-in.)
Oil Pump Cover Screw	4.0-6.2 N•m (35-55 lb-in.)
Rocker Arm Pivot Cap Screw	11.3 N•m (100 lb-in.)
Spark Plug	24.4-29.8 N•m (216-264 lb-in.)
Stator Cap Screw	6.2 N•m (55 lb-in.)
Valve Cover Cap Screw (New Cylinder Head)	10.7 N•m (95 lb-in.)
Valve Cover Cap Screw (Existing Cylinder Head)	7.4 N•m (65 lb-in.)

Special or Essential Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

Special or Required Tools

Tool Name	Tool No.	Tool Use
Valve Spring Compressor	JDM70	Compress valve springs.
Camshaft End Play Checking Tool	JDG1157	Checking camshaft end play.
Pressure Gauge	JDG356	Test fuel pump pressure.
Digital Pulse Tachometer	JT07270	Used to check/ adjust engine slow and fast idle rpm.
Digital Multimeter	JT05791	Electrical tests.
Cylinder Leakdown Test Kit	JT03502	Verify cylinder pressure
Ignition Test Plug	JT07285	Prevents damage to electronic ignition
Dial Indicator with Magnetic Base	N/A	To measure valve ACR movement.
U-Tube Manometer Kit	JT05697	Used to measure crankcase vacuum.
Fitting	JT05487	Measure oil pressure.
Hose	JT03017	Measure oil pressure.
Coupler	JT03262	Measure oil pressure.
Gauge	JT07034	Measure oil pressure.
Compression Gauge	JDM-59	Used to check engine compression.
Standard Valve Guide Reamer	D20020WI	To ream the valve guides.
Oversize Valve Guide Reamer	JDG705	To ream the valve guides.
Spark Tester	D-05351ST	Used to check overall condition of ignition system.

Special or Required Tools

Tool Name	Tool No.	Tool Use
Adaptor - 1/8 BSPT x 7/16-20 M 37°	JT03349	Connect to engine oil pressure switch port.
Hose with Quick Connect	JT03017	Connect between adapter and gauge.
Pressure Gauge - 0-414 kPa (0-60 psi)	JT03092	Used to measure engine oil pressure.
200/300 Grit Stone	N/A	Deglaze/hone cylinders

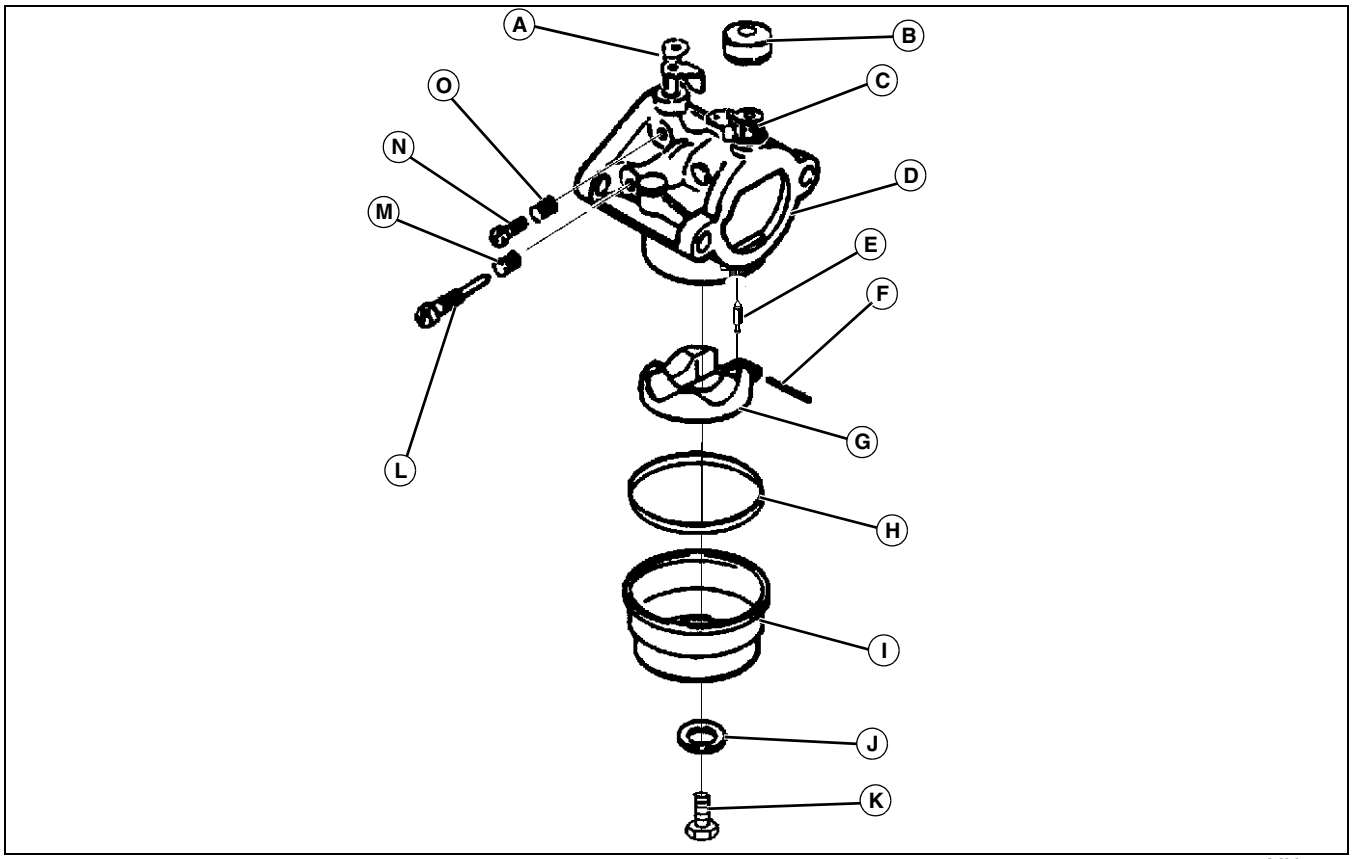
Other Materials

Other Material

Part No.	Part Name	Part Use
M79292	MPG-2 Polymer Multipurpose Grease	Prevents parts from seizing. Apply to engine crankshaft.
NA	Abrasive Sheet/Pad	Clean cylinder head.
NA	Prussian Blue Compound	Check valve seat contact.
NA	Lapping Compound	Lap valves into valve seats.
NA	Lithium Base Grease	Pack oil seals.
NA	Zinc Oxide/Wood Alcohol	Check block for cracks.

Component Location

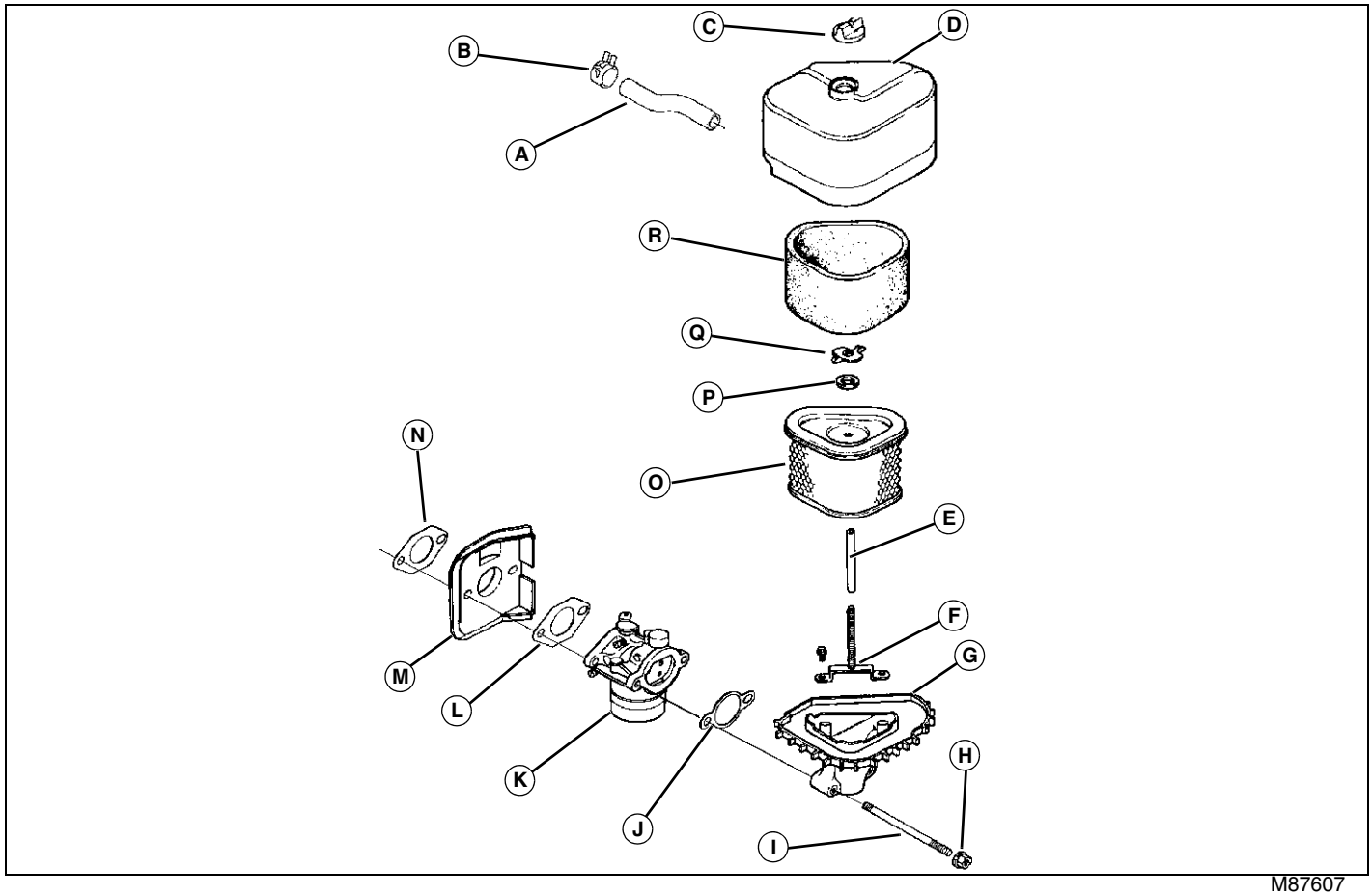
Carburetor



MX21587

A - Throttle Shaft
B - Cap
C - Choke Shaft
D - Body
E - Float Valve
F - Pin
G - Float
H - Gasket
I - Bowl
J - Gasket
K - Screw
L - Idle Fuel Needle
M - Spring
N - Idle Screw
O - Spring

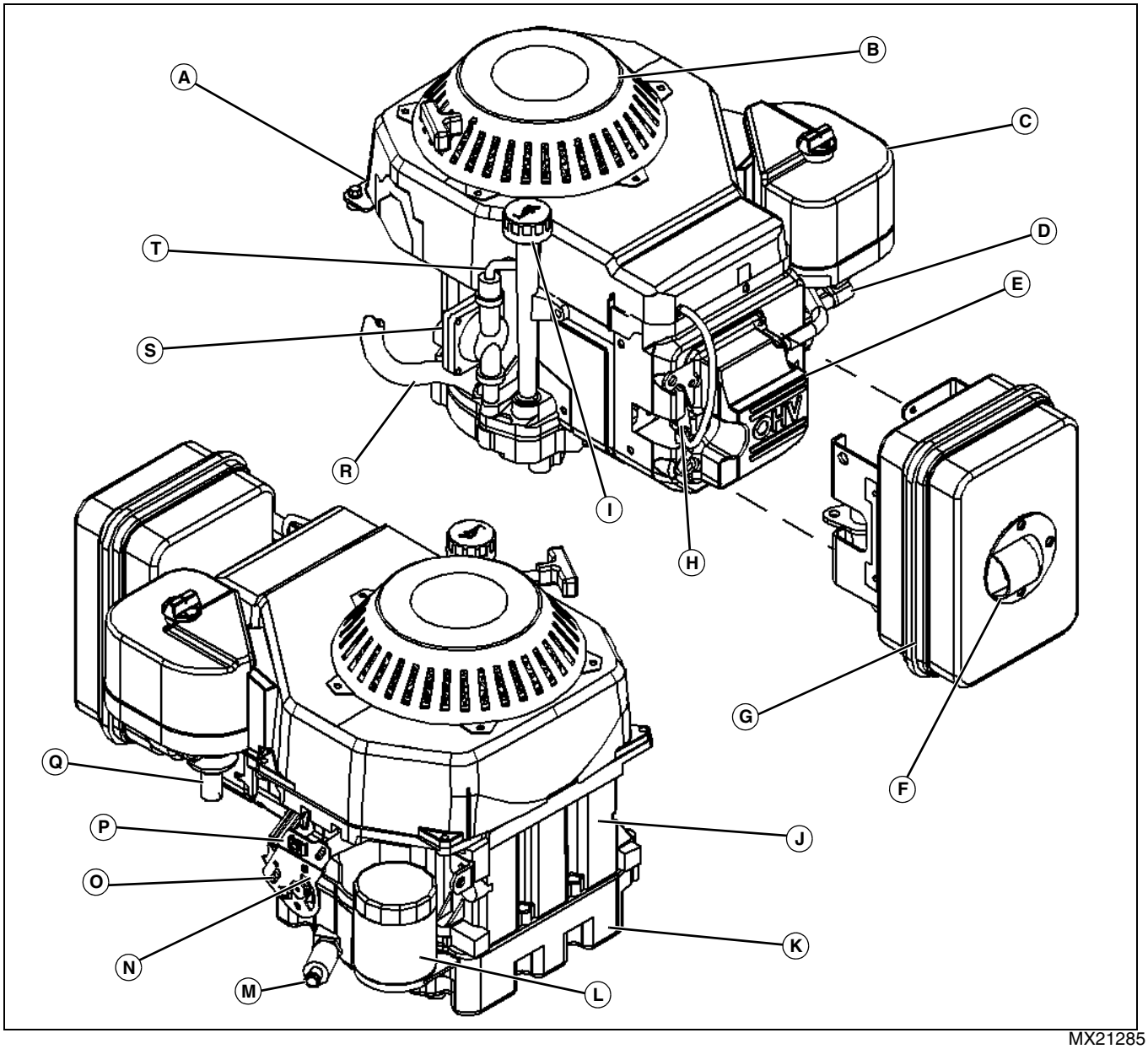
Intake System



M87607

A - Breather Hose
B - Hose Clamp
C - Wing Nut
D - Housing
E - Tube
F - Bracket
G - Lower Housing
H - Nut
I - Stud
J - Gasket
K - Carburetor
L - Gasket
M - Heat Shield
N - Gasket
O - Paper Filter Element
P - Washer
Q - Wing Nut
R - Foam Filter Element

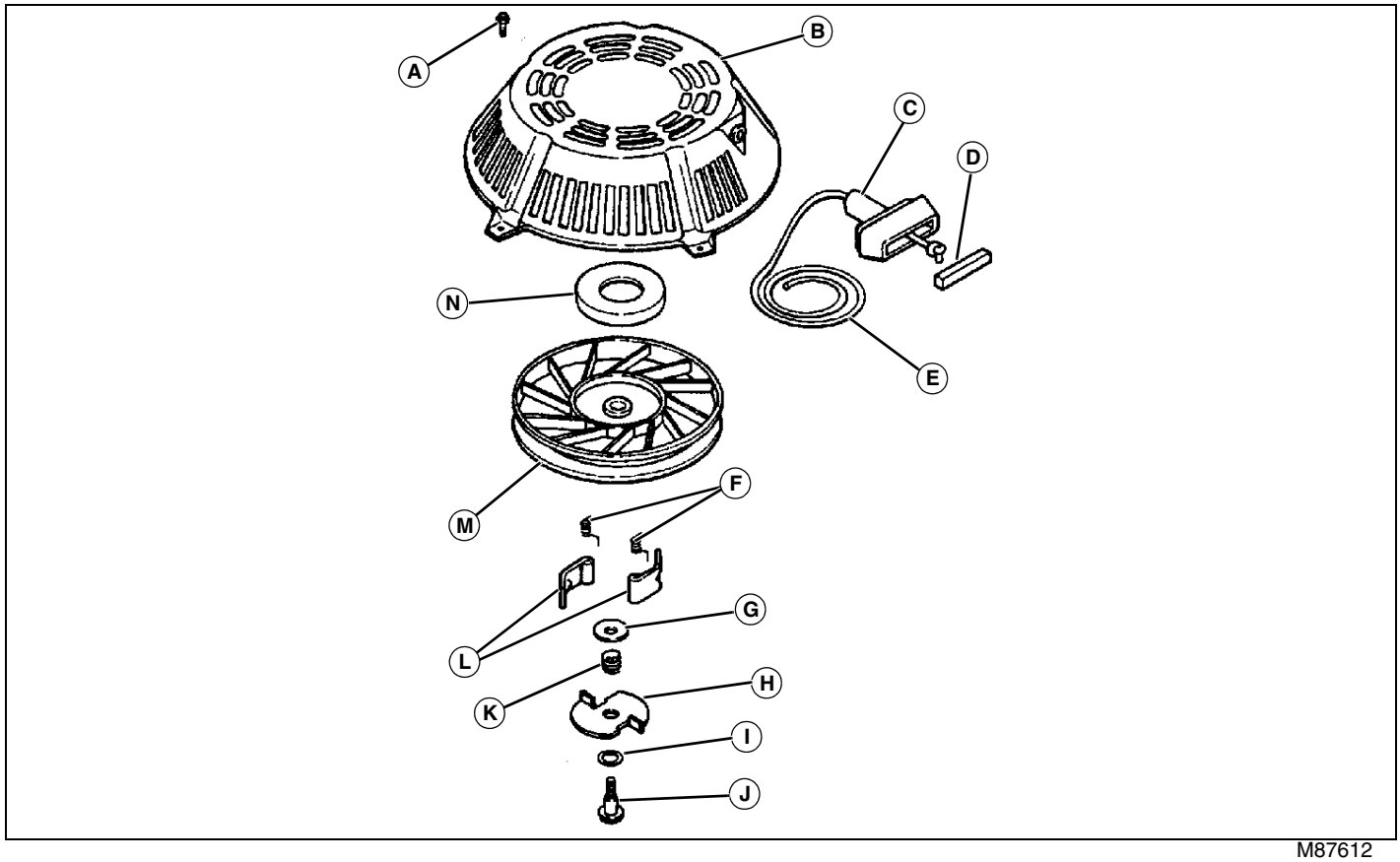
External Components



MX21285

A - Blower Housing
B - Recoil Starter Housing
C - Air Cleaner Housing
D - Carburetor
E - Rocker Arm Cover
F - Muffler Deflector
G - Muffler
H - Spark Plug
I - Dipstick
J - Crankcase
K - Oil Pan
L - Oil Filter
M - Oil Drain
N - Throttle Linkage
O - Choke Linkage
P - Control Plate
Q - Carburetor
R - Fuel Pump Intake
S - Fuel Pump
T - Fuel Delivery Hose

Recoil Starter

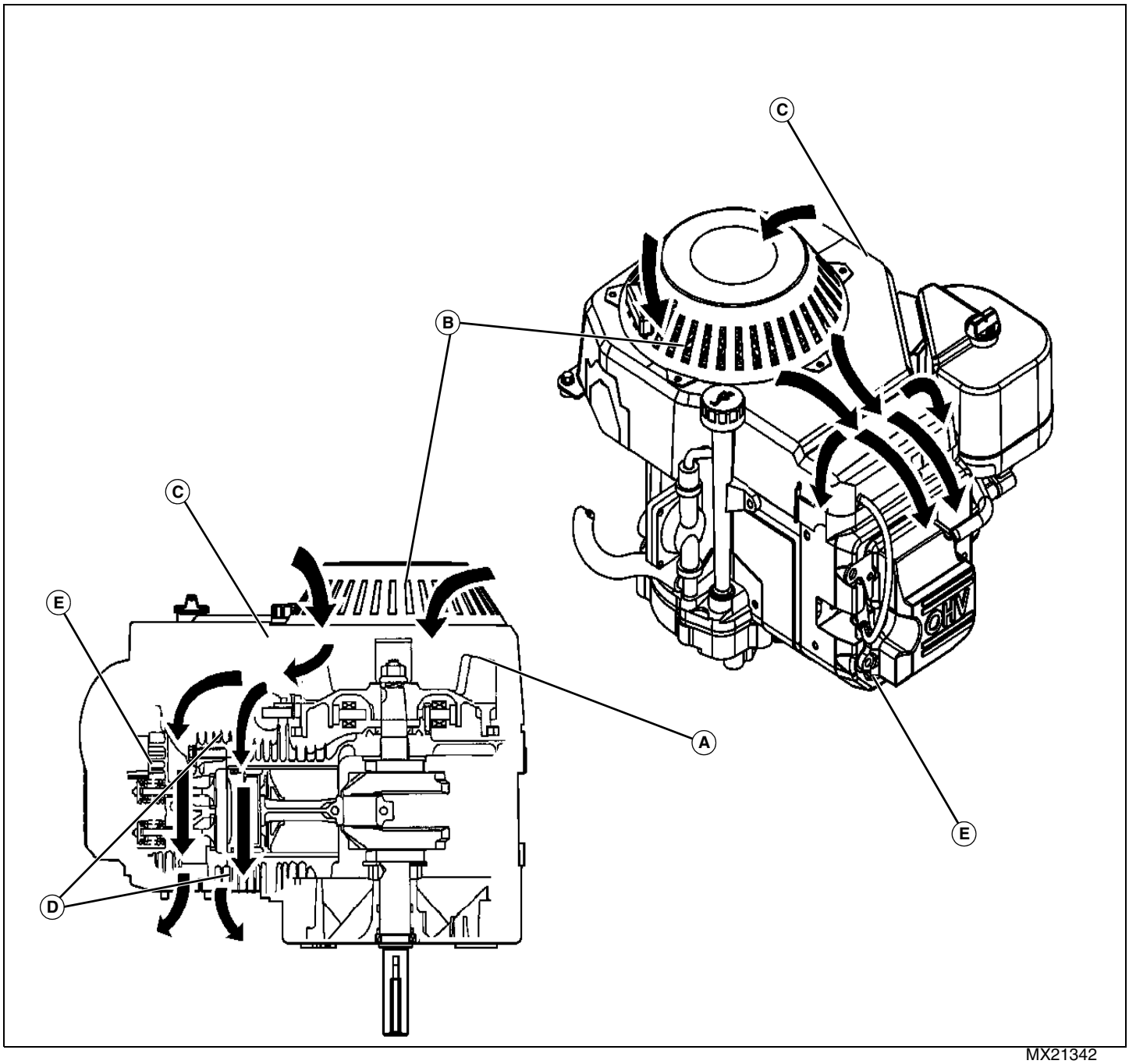


M87612

A - Screw
B - Housing
C - Handle
D - Handle Plug
E - Rope
F - Springs
G - Brake Washer
H - Pawl Retainer
I - Washer
J - Screw
K - Brake Spring
L - Pawls
M - Reel
N - Spring and Keeper

Theory of Operation

Cooling System Operation



MX21342

The engine is air cooled with air flow provided by a fan (A) that is mounted on the flywheel. During operation the fan draws air in through the intake screen (B) and delivers it, through the blower housing (C), to the cooling fins (D) surrounding the cylinder and head (E).

The intake screen rotates with the fan and cuts debris into fine pieces, helping to keep the cooling fins clear.

It is important that the intake screen remains open for proper air flow. The engine shroud should never be altered or removed, as cooling capacity will be affected. Cylinder block and cylinder head cooling fins must remain clean and open to properly dissipate heat.