

**12PB/12PC/12SB
14PB/14PT/14PZ
14SB/14SC/14SX
14SE/14ST/14SZ**
Walk-Behind Mowers
(S.N. GX-010001-)



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John Deere Horicon Works
TM1471 (16JUL96)

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ENGLISH

Introduction

FOREWORD

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.



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

Technical manuals are divided in two parts: repair and diagnostics. Repair sections tell how to repair the components. Diagnostic sections help you identify the majority of routine failures quickly.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job and service parts kits.

Section 10, Group 15—Specifications consist of all applicable specifications, near tolerances and specific torque values for various components on each individual engine.

Binders, binder labels, and tab sets can be ordered by John Deere dealers direct from the John Deere Distribution Service Center.

This manual is part of a total product support program.

FOS MANUALS—REFERENCE

TECHNICAL MANUALS—MACHINE SERVICE

COMPONENT MANUALS—COMPONENT SERVICE

Fundamentals of Service (FOS) Manuals cover basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

Technical Manuals are concise guides for specific machines. Technical manuals are on-the-job guides containing only the vital information needed for diagnosis, analysis, testing, and repair.

Component Technical Manuals are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

JOHN DEERE DEALERS

This is a complete revision for TM1471, 21-Inch Rear-Discharge Walk-Behind Rotary Mowers (S.N. 010,001-).

Discard old TM1471 dated O1 Oct 92 and replace it with this manual.

New information added to this manual includes:

1. Repair and diagnosis information for the new 14SX mower.
2. Repair information for Kawasaki (FC150V) 4-cycle engine.
3. This book has been divided into two parts; Repair Sections, Sections 10 through 80 (providing remove and install procedures), and Operation and Tests Sections, Sections 210 through 255 (providing theory

of operation, test and adjustment procedures, and diagnostic information).

4. Model designation is broken down as follows:

- 1 = Derived from 21-inch cutting width
- 2 = 2-Cycle Engine Design
- 4 = 4-Cycle Engine Design
- B = Blade Brake Clutch (BBC)
- C = Commercial Mower
- E = Electric Start
- P = Push Mower
- S = Self-Propelled Mower (2 or 5 speed transaxle)
- T = Tri-Cycler Mower
- Z = Zone Start (from Operator's station or ZONE) with flywheel band brake

5. The new 1995 K-Series and B-Series 4-Cycle Engines are classified as 5.5-HP engines.

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All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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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.



DX,FLAME -19-04JUN90

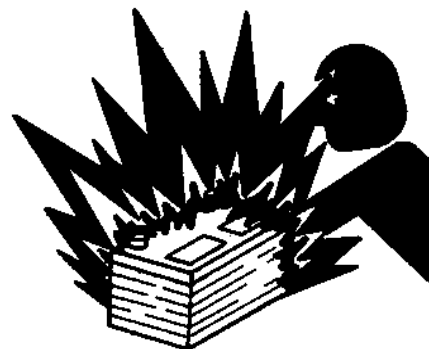
10-05-1
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TS227

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).



DX,SPARKS -19-03MAR93

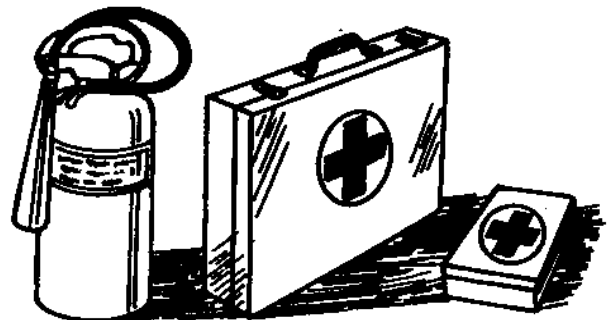
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TS204

PREPARE FOR EMERGENCIES

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.



DX,FIRE2 -19-03MAR93

-UN-23AUG88
TS291

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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 the hazard by:

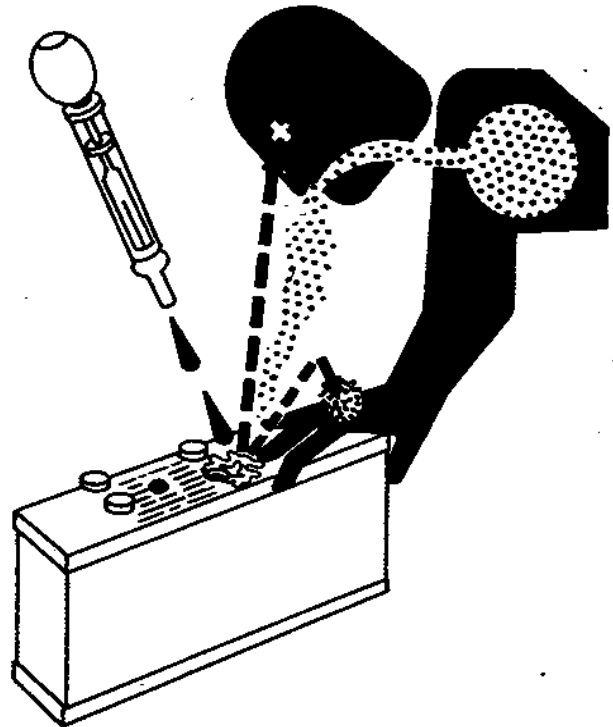
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TSS203 -UN-23AUG88

DX,POISON -19-21APR93

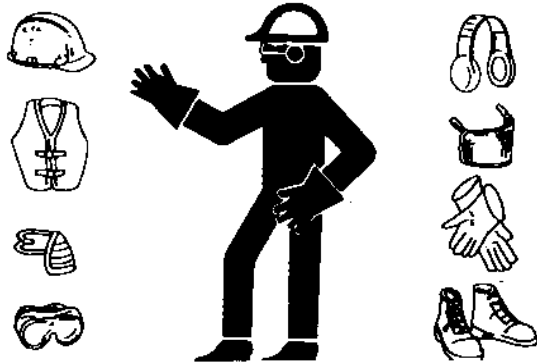
WEAR PROTECTIVE CLOTHING

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.



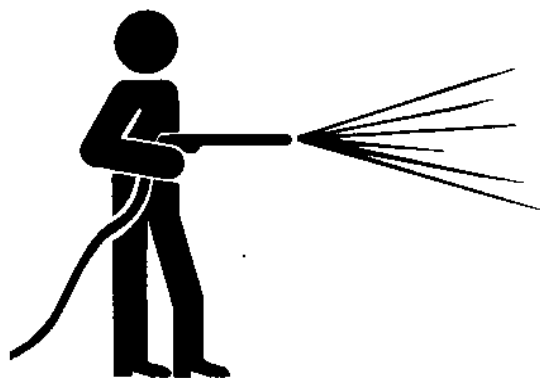
TSS206 -UN-23AUG88

DX,WEAR -19-10SEP90

WORK IN CLEAN AREA

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



DX,CLEAN -19-04JUN90

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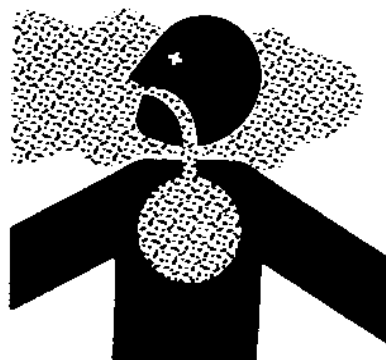
WORK IN VENTILATED AREA

WARNING

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

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.



MX,AIR -19-16JUL96

T5220 -UN-23AUG88

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.



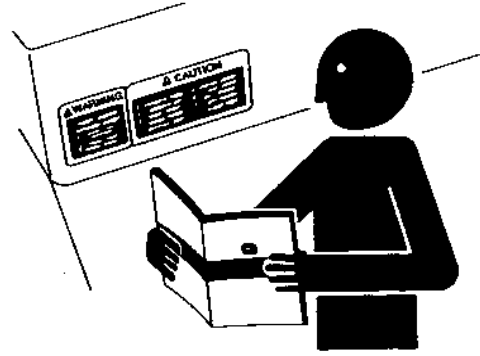
DX,LIGHT -19-04JUN90

T5223 -UN-23AUG88

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REPLACE SAFETY SIGNS

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



DX,SIGNS1 -19-04JUN90

TS201 -UN-23AUG88

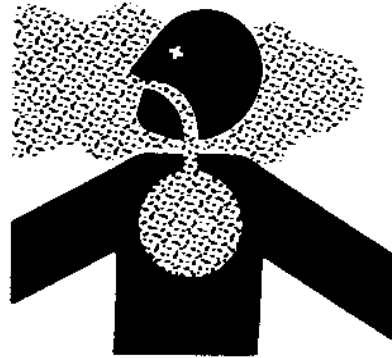
AVOID HARMFUL ASBESTOS DUST

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.



DX,DUST -19-15MAR91

TS220 -UN-23AUG88

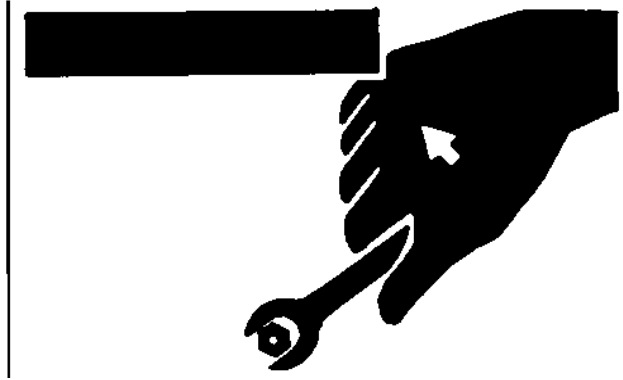
USE PROPER TOOLS

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.



DX,REPAIR -19-04JUN90

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TS779

DISPOSE OF WASTE PROPERLY

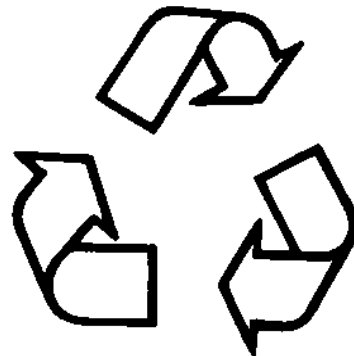
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



DX,DRAIN -19-03MAR93

-UN-26NOV90
TS1133

LIVE WITH SAFETY

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



DX,LIVE -19-25SEP92

TS231 -19-07OCT88

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MACHINE SPECIFICATIONS—12PB, 12PC, AND 12SB

MODEL	12PB	12PC	12SB
Engine:			
Type	Briggs & Stratton 2-Cycle Design	Briggs & Stratton 2-Cycle Design	Briggs & Stratton 2-Cycle Design
Series	96722 I/C	96722 I/C	96722 I/C
Horsepower—			
Early Models	3.0 kW (4 hp)	3.0 kW (4 hp)	3.0 kW (4 hp)
1991 Models	N/A	3.7 kW (5 hp)	3.7 kW (5 hp)
Displacement	141 cm ³ (8.60 cu. in.)	141 cm ³ (8.60 cu. in.)	141 cm ³ (8.60 cu. in.)
Bore x Stroke	60 x 50 mm (2.34 x 1.95 in.)	60 x 50 mm (2.34 x 1.95 in.)	60 x 50 mm (2.34 x 1.95 in.)
Idle Speed	1750 ±200 rpm	1750 ±200 rpm	1750 ±200 rpm
Operation Range	3100 ±100 rpm	3100 ±100 rpm	3100 ±200 rpm
Starting	Recoil	Recoil	Recoil
Ignition	MAGNETRON®	MAGNETRON®	MAGNETRON®
Governor	Mechanical Flyweight	Mechanical Flyweight	Mechanical Flyweight
Carburetor	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet
Air Cleaner	Dual Stage	Dual Stage	Dual Stage
Lubrication	50:1 Fuel/Oil Mix	50:1 Fuel/Oil Mix	50:1 Fuel/Oil Mix
Power Train:			
Type	Push	Push	5-Speed Transaxle
Travel Speeds	N/A	N/A	1st.—1.9 kph (1.2 mph) 2nd.—2.9 kph (1.8 mph) 3rd.—3.9 kph (2.4 mph) 4th.—4.8 kph (3.0 mph) 5th.—6.6 kph (4.1 mph)
Capacities:			
Fuel/Oil Tank	1.9 L (2 qt)	1.9 L (2 qt)	1.9 L (2 qt)
Transaxle	N/A	N/A	70 g (2.5 oz) John Deere Non-Clay, High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLG1 Grade 2 (Europe)

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MACHINE SPECIFICATIONS—14PB, 14PT, 14PZ AND 14SB

MODEL	14PB	14PT	14PZ	14SB
Engine:				
Type	Kawasaki 4-Cycle Design	Kawasaki 4-Cycle Design	Briggs & Stratton 4-Cycle Design	Kawasaki 4-Cycle Design
Series	FC150V	FC150V	122700	FC150V
Horsepower—				
Early Models	3.4 kW (4.5 hp)	N/A	3.0 kW (4.0 hp)	3.4 kW (4.5 hp)
1991 Models	3.7 kW (5.0 hp)	N/A	3.7 kW (5.0 hp)	3.7 kW (5.0 hp)
1993 Models	N/A	3.7 kW (5.0 hp)	N/A	N/A
1995 Models	4.1 kW (5.5 hp)	4.1 kW (5.5 hp)	3.7 kW (5.0 hp)	4.1 kW (5.5 hp)
Displacement	153 cm ³ (9.34 cu. in.)	153 cm ³ (9.34 cu. in.)	190 cm ³ (11.57 cu. in.)	153 cm ³ (9.34 cu. in.)
Bore x Stroke	65 x 46 mm (2.56 x 1.81 in.)	65 x 46 mm (2.56 x 1.81 in.)	68 x 51.8 mm (2.64 x 2.04 in.)	65 x 46 mm (2.56 x 1.81 in.)
Idle Speed	1500 ±200 rpm	1500 ±200 rpm	1750 ±200 rpm	1500 ±200 rpm
Operation Range	3075 ±75 rpm	3075 ±75 rpm	3000 ±100 rpm	3075 ±75 rpm
Starting	Recoil	Recoil (Zone Start)	Recoil (Zone Start)	Recoil
Ignition	Flywheel Magneto	Flywheel Magneto	MAGNETRON®	Flywheel Magneto
Governor	Mechanical Flyweight	Mechanical Flyweight	Mechanical Flyweight	Mechanical Flyweight
Carburetor	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet
Air Cleaner	Dual Stage w/ Mechanical Pre-Cleaner	Dual Stage w/ Mechanical Pre-Cleaner	Dual Stage	Dual Stage w/ Mechanical Pre-Cleaner
Lubrication	Pressure (Optional Oil Filter Kit)	Splash Lube	Splash Lube	Pressure (Optional Oil Filter Kit)
Power Train:				
Type	Push	Push	Push	5-Speed Transaxle
Travel Speeds	N/A	N/A	N/A	1st.—1.9 kph (1.2 mph) 2nd.—2.9 kph (1.8 mph) 3rd.—3.9 kph (2.4 mph) 4th.—4.8 kph (3.0 mph) 5th.—6.6 kph (4.1 mph)
Capacities:				
Fuel Tank	1.3 L (1.4 qt)	1.3 L (1.4 qt)	1.4 L (1.5 qt)	1.3 L (1.4 qt)
Crankcase	0.60 L (1.25 pt) (without filter)	0.60 L (1.25 pt)	0.60 L (1.25 pt)	0.60 L (1.25 pt) (without filter)
Transaxle	N/A	N/A	N/A	70 g (2.5 oz) John Deere Non-Clay, High-Temperature EP Grease®— JDM J13E4, NLGI Grade 2 (North America) or Grease-Gard™— JDM J13E4, NLGI Grade 2 (Europe)

MX,1010BV,2 -19-16JUL96

**MACHINE SPECIFICATIONS—14SC/14SX,
14SE, AND 14ST**

MODEL	14SC/14SX	14SE	14ST
Engine:			
Type	Kawasaki 4-Cycle Design	Kawasaki 4-Cycle Design	Kawasaki 4-Cycle Design
Series	FC150V	FC150V	FC150V
Horsepower—			
Early Models . . .	3.4 kW (4.5 hp)	3.4 kW (4.5 hp)	N/A
1991 Models . . .	3.7 kW (5.0 hp)	3.7 kW (5.0 hp)	N/A
1993 Models . . .	N/A	N/A	3.7 kW (5.0 hp)
1995 Models . . .	4.1 kW (5.5 hp)	4.1 kW (5.5 hp)	4.1 kW (5.5 hp)
Displacement	153 cm ³ (9.34 cu. in.)	153 cm ³ (9.34 cu. in.)	153 cm ³ (9.34 cu. in.)
Bore x Stroke	65 x 46 mm (2.56 x 1.81 in.)	65 x 46 mm (2.56 x 1.81 in.)	65 x 46 mm (2.56 x 1.81 in.)
Idle Speed	1500 ±200 rpm	1500 ±200 rpm	1500 ±200 rpm
Operation Range . .	3075 ±75 rpm	3075 ±75 rpm	3075 ±75 rpm
Starting	Recoil (Zone Start)	Electric (Key Start)	Recoil (Zone Start)
Ignition	Flywheel Magneto	Flywheel Magneto	Flywheel Magneto
Governor	Mechanical Flyweight	Mechanical Flyweight	Mechanical Flyweight
Carburetor	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet
Air Cleaner	Dual Stage w/Mechanical Pre-Cleaner	Dual Stage w/Mechanical Pre-Cleaner	Dual Stage w/Mechanical Pre-Cleaner
Lubrication	Pressure (Optional Oil Filter Kit)	Pressure (Optional Oil Filter Kit)	Splash Lube
Power Train:			
Type	5-Speed Transaxle	5-Speed Transaxle	2-Speed Transaxle
Travel Speeds	1st.—1.9 kph (1.2 mph) 2nd.—2.9 kph (1.8 mph) 3rd.—3.9 kph (2.4 mph) 4th.—4.8 kph (3.0 mph) 5th.—6.6 kph (4.1 mph)	1st.—1.9 kph (1.2 mph) 2nd.—2.9 kph (1.8 mph) 3rd.—3.9 kph (2.4 mph) 4th.—4.8 kph (3.0 mph) 5th.—6.6 kph (4.1 mph)	1st.—3.2 kph (2.0 mph) 2nd.—5.3 kph (3.3 mph)
Capacities:			
Fuel Tank	1.3 L (1.4 qt.)	1.3 L (1.4 qt.)	1.3 L (1.4 qt.)
Crankcase	0.6 L (1.25 pt) (Without Filter)	0.6 L (1.25 pt) (Without Filter)	0.6 L (1.25 pt)
Transaxle	70 g (2.5 oz.) John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLGI Grade 2 (Europe)	70 g (2.5 oz.) John Deere Non-Clay High-Temperature EP Grease®—JDM J12E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLGI Grade 2 (Europe)	70 g (2.5 oz.) John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLGI Grade 2 (Europe)

MACHINE SPECIFICATIONS—14SZ

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MODEL	14SZ	14SZ
Engine:		
Type	Briggs & Stratton 4-Cycle Design	Briggs & Stratton 4-Cycle Design
Series	122700	124700
Horsepower—		
Early Models . . .	3.0 kW (4 hp)	N/A
1991 Models . . .	3.7 kW (5.0 hp)	N/A
1993 Models . . .	N/A	N/A
1995 Models . . .	3.7 kW (5.0 hp)	3.7 kW (5.0 hp)
Displacement	183 cm ³ (11.17 cu. in.)	189 cm ³ (11.59 cu. in.)
Bore x Stroke	68.0 x 51.8 mm (2.64 x 2.04 in.)	68.3 x 51.8 mm (2.69 x 2.04 in.)
Idle Speed	1750 ±200 rpm	1750 ±200 rpm
Operation Range . .	3000 ±100 rpm	3000 ±100 rpm
Starting	Recoil (Zone Start)	Recoil (Zone Start)
Ignition	MAGNETRON®	MAGNETRON®
Governor	Mechanical Flyweight	Mechanical Flyweight
Carburetor	Float Type With Fixed Main Jet	Float Type With Fixed Main Jet
Air Cleaner	Dual Stage	Dual Stage
Lubrication	Splash Lube	Splash Lube
Power Train:		
Type	2-Speed Transaxle	2-Speed Transaxle
Travel Speeds	1st.—3.2 kph (2.0 mph) 2nd.—5.3 kph (3.3 mph)	1st.—3.2 kph (2.0 mph) 2nd.—5.3 kph (3.3 mph)
Capacities:		
Fuel Tank	1.4 L (1.5 qt.)	1.4 L (1.5 qt.)
Crankcase	0.6 L (1.25 pt)	0.6 L (1.25 pt)
Transaxle	70 g (2.5 oz.) John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLGI Grade 2 (Europe)	70 g (2.5 oz.) John Deere Non-Clay High-Temperature EP Grease®—JDM J12E4, NLGI Grade 2 (North America) or GREASE-GARD™— JDM J13E4, NLGI Grade 2 (Europe)

MX,1010BV,2B -19-16JUL96

General Specifications/Mower deck specifications

MOWER DECK SPECIFICATIONS

Cutting Width	533 mm (21 in.)
Cutting Height Range	13 to 90 mm (1/2 to 3-1/2 in.)
Number of Cutting Heights in 13 mm (1/2 in.) increments	7
Wheel Diameter	200 mm (8 in.)
Bagger Capacity	3.1 cu ft (2.5 bu)

(Specifications and design subject to change without notice.)

MX,1010BV,5 -19-16JUL96

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**REPAIR SPECIFICATIONS—BRIGGS &
STRATTON 2-CYCLE ENGINE
(12PB/12PC/12SB)**

Item	Specification
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Inspection Specifications:

Piston Rings Inspection Depth (In Cylinder Bore)	32 mm (1.26 in.)
Maximum Piston Rings End Gap	1.01 mm (0.039 in.)
Minimum Piston Skirt O.D.	59.85 mm (2.357 in.)
Minimum Piston Pin O.D.	13.98 mm (0.551 in.)
Maximum Piston Pin Bore I.D.	14.04 mm (0.552 in.)
Maximum Cylinder Bore I.D.	60.17 mm (2.368 in.)
Minimum Crankshaft Main Bearing Journals O.D.	24.97 mm (0.983 in.)
Maximum Crankshaft Journals Out-Of-Round	0.0127 mm (0.0005 in.)
Maximum Connecting Rod End Bore I.D.	18.05 mm (0.710 in.)
Minimum BBC Brake Pad Thickness	0.76 mm (0.030 in.)
Ignition Coil Air Gap	0.20—0.40 mm (0.008—0.016 in.)
Spark Plug Gap	0.762 mm (0.030 in.)
Engine Drive Sheave Installation (From End Of Crankshaft To Bottom Of Sheave)	38 mm (1.5 in.)

Torque Specifications:

Crankcase Cap Screws	7 N·m (62 lb-in.)
Cylinder Head Socket Cap Screws [In Increments of 4 N·m (35 lb-in.)]	12 N·m (110 lb-in.)
Flywheel Nut	41 N·m (30 lb-ft)
Muffler Cap Screws	10 N·m (87 lb-in.)
Engine Drive Sheave Set Screw	5 N·m (44 lb-in.)
Engine Mount Cap Screws	27 N·m (20 lb-ft)
Blade Mount Cap Screw(s)	41 N·m (30 lb-ft)
BBC Socket Head Cap Screw	54 N·m (40 lb-ft)
Spark Plug	18 N·m (160 lb-in.)
Recoil Start Retainer Cap Screw	3 N·m (27 lb-in.)
Recoil Start Assembly Cap Screws	7 N·m (62 lb-in.)
Recoil Start Cup To Flywheel Screen Cap Screws	7 N·m (62 lb-in.)
Recoil Start Cover Cap Screws	3 N·m (27 lb-in.)
Ignition Coil Cap Screws	4 N·m (35 lb-in.)
Governor Lever Cap Screw and Nut	3 N·m (27 lb-in.)
Carburetor Spacer Mounting Cap Screws	6 N·m (50 lb-in.)
Carburetor/Air Filter Nuts	4 N·m (35 lb-in.)
Engine Shroud Cap Screws	4 N·m (35 lb-in.)
Fuel Tank/Engine Cover Cap Screws	3 N·m (27 lb-in.)

MX,1015BV,1 -19-01OCT92

REPAIR SPECIFICATIONS—BRIGGS & STRATTON 4-CYCLE ENGINE (14PZ/14SZ)

10-15-2

Item	Specification
Inspection Specifications:	
Piston Rings Inspection Depth (In Cylinder Bore)	25 mm (1.0 in.)
Maximum Piston Compression Rings End Gap	0.89 mm (0.035 in.)
Maximum Piston Oil Ring End Gap	1.14 mm (0.045 in.)
Maximum Piston Rings Side Clearance	0.178 mm (0.007 in.)
Minimum Piston Skirt O.D.	59.85 mm (2.357 in.)
Minimum Piston Pin O.D.	12.42 mm (0.489 in.)
Maximum Piston Pin Bore I.D.	12.47 mm (0.491 in.)
Maximum Piston Pin Bearing I.D.	12.50 mm (0.492 in.)
Maximum Standard Cylinder Bore I.D.	68.288 mm (2.6885 in.)
Maximum Cylinder Bore Out-Of-Round	0.0635 mm (0.0025 in.)
Maximum Cylinder Bore Allowable Wear	Oversized—0.076 mm (0.003 in.)
Minimum Crankshaft Main Bearing Journal O.D. (Flywheel End)	22.17 mm (0.873 in.)
Minimum Crankshaft Main Bearing Journal O.D. (Output End)	26.92 mm (1.060 in.)
Minimum Crankshaft Connecting Rod Journal O.D.	25.30 mm (0.996 in.)
Maximum Crankshaft Main Bearings I.D.	25.43 mm (1.001 in.)
Maximum Crankshaft Runout (TIR)	0.05 mm (0.002 in.)
Allowable Crankshaft End Play	0.051—0.762 mm (0.002—0.030 in.)
Minimum Camshaft Journals O.D.	12.65 mm (0.498 in.)
Maximum Camshaft Bearings O.D.	12.78 mm (0.503 in.)
Maximum Crankcase Bearing I.D. (Cylinder Half)	22.30 mm (0.878 in.)
Maximum Crankcase Bearing I.D. (Cover Half)	26.92 mm (1.060 in.)
Crankcase Gasket Thickness (New)	0.38 mm (0.015 in.)
Intake Valve Clearance	0.127—0.179 mm (0.005—0.007 in.)
Exhaust Valve Clearance	0.179—0.229 mm (0.007—0.009 in.)
Maximum Valve Guide I.D.	7.94 mm (0.310 in.)
Minimum Intake Valve Face Margin	0.40 mm (0.016 in.)
Minimum Exhaust Valve Face Margin	0.40 mm (0.016 in.)
Valve Seats Surface	1.19—1.59 mm (0.047—0.063 in.)
Intake Valve Seat Angle	30° or 45°
Exhaust Valve Seat Angle	45° Only
Intake Valve Face Angle	30°
Exhaust Valve Face Angle	45°
Valves Narrowing Angle	30°
Maximum Breather Disc Valve Clearance	1.14 mm (0.045 in.)
Ignition Coil Air Gap	0.15—0.25 mm (0.007—0.010 in.)
Spark Plug Gap	0.762 mm (0.030 in.)
Engine Drive Sheave Installation (From End Of Crankshaft To Bottom Of Sheave)	38 mm (1.5 in.)

MX,1015BV,2 -19-01OCT92

REPAIR SPECIFICATIONS—BRIGGS & STRATTON 4-CYCLE ENGINE (14PZ/14SZ)—(CONTINUED)

Item	Specification
Torque Specifications:	
Connecting Rod Cap Screws	11 N·m (95 lb-in.)
Crankcase Cap Screws	10 N·m (89 lb-in.)
Cylinder Head Socket Cap Screws [In Increments of 4 N·m (35 lb-in.)]	16 N·m (140 lb-in.)
Breather Assembly Cap Screws	5 N·m (44 lb-in.)
Breather Passageway Cover Cap Screws	3 N·m (27 lb-in.)
Flywheel Nut	75 N·m (55 lb-ft)
Muffler Cap Screws	10 N·m (87 lb-in.)
Engine Drive Sheave Set Screw	5 N·m (44 lb-in.)
Engine Mount Cap Screws	27 N·m (20 lb-ft)
Blade Mount Cap Screw(s)	41 N·m (30 lb-ft)
BBC Socket Head Cap Screw	54 N·m (40 lb-ft)
Spark Plug	18 N·m (160 lb-in.)
Recoil Start Cover Cap Screws	3 N·m (27 lb-in.)
Ignition Coil Cap Screws	4 N·m (35 lb-in.)
Governor Lever Cap Screw and Nut	3 N·m (27 lb-in.)
Carburetor Cap Screws	10 N·m (89 lb-in.)
Engine Shroud Cap Screws	4 N·m (35 lb-in.)
Fuel Tank/Engine Cover Cap Screws	3 N·m (27 lb-in.)

MX,1015BV,2A -19-01OCT92

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**REPAIR SPECIFICATIONS—KAWASAKI
4-CYCLE ENGINE
(14PB/14PT/14SB/14SC/14SX/14SE/14ST)**

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Item	Specification
Inspection Specifications:	
Piston Rings Inspection Depth (In Cylinder Bore)	25 mm (1.0 in.)
Minimum Piston Ring End Gap	0.18 mm (0.007 in.)
Maximum Piston Compression Rings End Gap	1.00 mm (0.039 in.)
Maximum Piston Oil Ring End Gap	1.50 mm (0.059 in.)
Maximum Piston Rings Side Clearance	0.10 mm (0.004 in.)
Minimum Piston Skirt O.D.	64.90 mm (2.555 in.)
Minimum Piston Pin O.D.	14.98 mm (0.590 in.)
Maximum Piston Pin Bore I.D.	15.05 mm (0.593 in.)
Maximum Piston-to-Piston Pin Clearance.	0.07 mm (0.003 in.)
Piston-to-Bore Clearance (Standard).	0.06—0.10 mm (0.0024—0.0039 in.)
Piston-to-Bore Clearance (Wear Limit).	0.1375 mm (0.0054 in.)
Standard Cylinder Bore I.D.	64.90—65.00 mm (2.557—2.561 in.)
Standard Cylinder Bore I.D. (Wear Limit)	65.06 mm (2.563 in.)
0.25 mm Rebored Cylinder Bore I.D.	65.21—65.23 mm (2.567—2.568 in.)
0.50 mm Rebored Cylinder Bore I.D.	65.46—65.48 mm (2.577—2.578 in.)
0.75 mm Rebored Cylinder Bore I.D.	65.71—65.73 mm (2.587—2.588 in.)
Connecting Rod—Maximum Crankshaft Bearing I.D.	28.07 mm (1.105 in.)
Connecting Rod—Maximum Piston Pin Bearing I.D.	15.05 mm (0.593 in.)
Maximum Connecting Rod-to-Piston Clearance.	0.07 mm (0.003 in.)
Maximum Connecting Rod-to-Crankpin Clearance.	0.15 mm (0.006 in.)
Minimum Crankshaft PTO Side Journal O.D.	24.92 mm (0.981 in.)
Minimum Crankshaft Connecting Rod Journal O.D.	27.92 mm (1.099 in.)
Maximum Crankshaft Cover Plain Bearing I.D.	25.10 mm (0.988 in.)
Maximum Crankshaft T.I.R.	0.20 mm (0.008 in.)
Maximum Crankshaft End Play.	0—0.050 mm (0—0.020 in.)
Minimum Camshaft End Journals O.D.	13.92 mm (0.548 in.)
Minimum Camshaft Lobe Height.	22.80 mm (0.898 in.)
Maximum Crankcase Cover Camshaft Bearing I.D.	14.07 mm (0.554 in.)
Maximum Crankcase Camshaft Bearing I.D.	14.07 mm (0.554 in.)
Valve Clearance	0.12 mm (0.008 in.)
Maximum Push Rod Bend	0.60 mm (0.024 in.)
Minimum Valve Spring Free Length	31.50 mm (1.240 in.)
Minimum Intake Valve Guide I.D.	5.55 mm (0.218 in.)
Minimum Exhaust Valve Guide I.D.	5.56 mm (0.219 in.)
Minimum Intake Valve Stem I.D.	5.44 mm (0.214 in.)
Minimum Exhaust Valve Stem I.D.	5.42 mm (0.213 in.)
Maximum Valve Stem Bend	0.03 mm (0.001 in.)
Minimum Valve Stem End Length	3.80 mm (0.150 in.)
Valve Seating Surface	0.50—1.10 mm (0.020—0.043 in.)
Valve Seat and Face Angle	45°
Minimum Valve Margin	0.50 mm (0.020 in.)
Valve Narrowing Angle	30°
Cylinder Head Flatness	0.07 mm (0.003 in.)

**REPAIR SPECIFICATIONS—KAWASAKI
4-CYCLE ENGINE
(14PB/14PT/14SB/14SC/14SX/14SE/14ST)—(CONTINUED)**

Item	Specification
Inspection Specifications:	
Maximum Breather Air Gap	0.20 mm (0.008 in.)
Minimum Flywheel Screen Gap	1.50 mm (0.059 in.)
Minimum Oil Pump Rotor Shaft O.D.	9.01 mm (0.355 in.)
Maximum Oil Pump Rotor Shaft Bearing I.D.	9.14 mm (0.360 in.)
Minimum Oil Pump Outer Rotor Thickness	11.95 mm (0.471 in.)
Maximum Oil Pump Outer Rotor Bore Depth	12.10 mm (0.476 in.)
Minimum Oil Pump Outer Rotor O.D.	22.93 mm (0.903 in.)
Maximum Oil Pump Outer Rotor Bearing I.D.	23.17 mm (0.912 in.)
Minimum Oil Pump Valve Spring Free Length (Engine S.N. 047346—072217)	17.00 mm (0.669 in.)
(Engine S.N. 072218—)	19.00 mm (0.748 in.)
Ignition Coil Air Gap	0.30 mm (0.012 in.)
Torque Specifications:	
Crankcase Cover Cap Screw Torque	7 N·m (62 lb-in.)
Crankcase Cover Drain Plug Torque	21 N·m (186 lb-in.)
Connecting Rod End-Cap Screw Torque	12 N·m (106 lb-in.)
Flywheel Nut Torque	45 N·m (33 lb-ft)
Rocker Arm Stud and Nut Torque	7 N·m (62 lb-in.)
Cylinder Head Cap Screw Torque (In Sequence)	
Initial Torque	18 N·m (159 lb-in.)
Final Torque	24 N·m (212 lb-in.)
Spark Torque	20 N·m (177 lb-in.)
Governor Arm Nut Torque	7 N·m (62 lb-in.)

MX,1015BV,7 -19-16JUL96

**REPAIR SPECIFICATIONS—KANSAKI 2-
AND 5-SPEED TRANSAXLES**

Item	Specification
Transaxle Drive Sheave Lock Nut	34 N·m (25 lb-ft)
Transaxle Case Cap Screws	10 N·m (89 lb-in.)
Internal Bearing Anchor Cap Screw	10 N·m (89 lb-in.)

MX,1015BV,4 -19-01OCT92

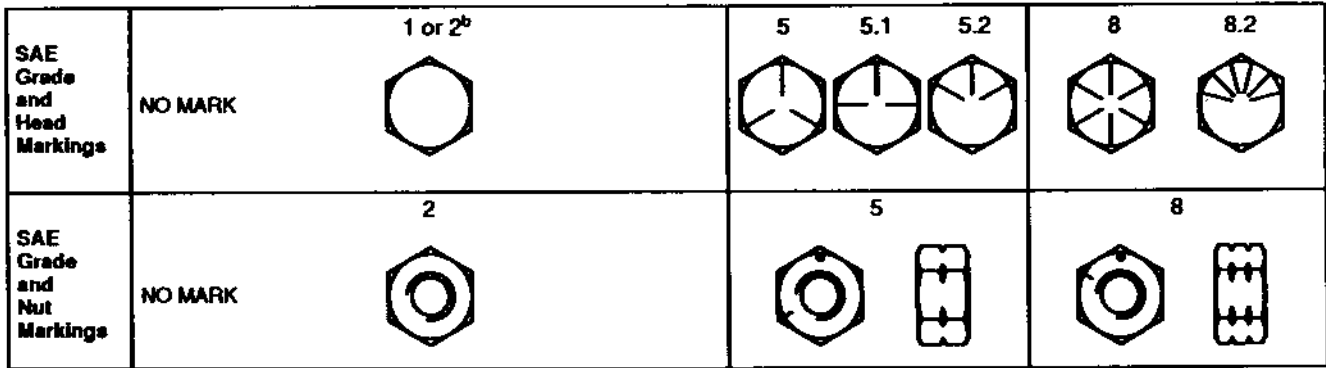
**REPAIR SPECIFICATIONS—WHEEL CAP
SCREWS**

Item	Specification
Wheel Cap Screws	25 N·m (222 lb-in.)

MX,1015BV,5 -19-01OCT92

10-15-6

UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



Size	Grade 1				Grade 2 ^b				Grade 5, 5.1, or 5.2				Grade 8 or 8.2			
	Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a	
	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	240	175	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	400	300	510	375	400	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 values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

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

^a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated 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.

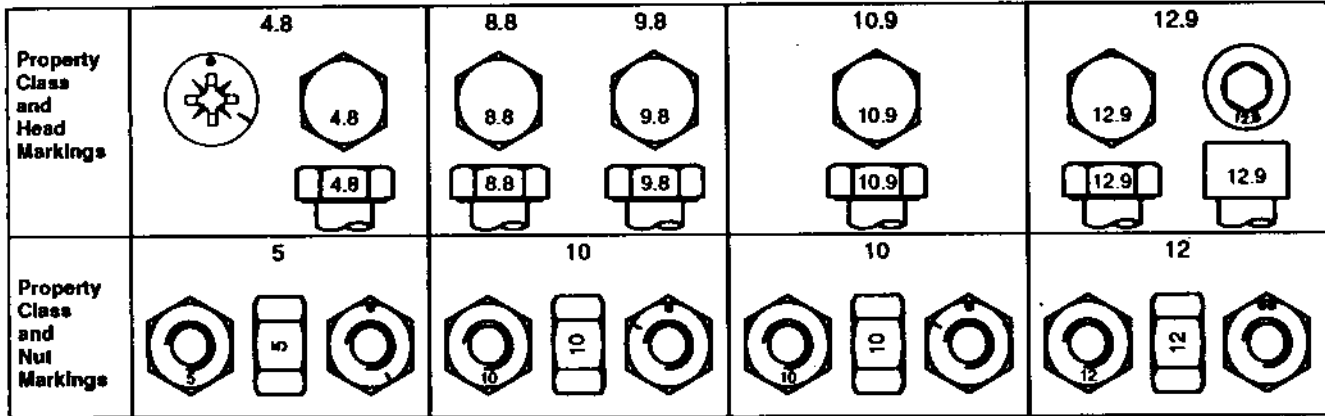
Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

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

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

METRIC BOLT AND CAP SCREW TORQUE VALUES

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15
8



TS1163 -19-04MAR91

Size	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	
	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	190
M16	100	73	125	92	190	140	240	175	275	200	350	255	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 values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

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

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

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

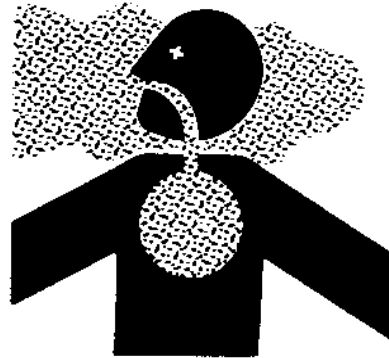
Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

^a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.

GASOLINE—4-CYCLE ENGINES



TS227 -UN-23AUG88



TS220 -UN-23AUG88

CAUTION: Gasoline is **HIGHLY FLAMMABLE**, handle it with care.

DO NOT refuel machine while:

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

Help prevent fires:

- fill gas tank to 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.

WARNING

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

To avoid engine damage:

- **DO NOT** mix oil with gasoline;
- **ONLY** use fresh, clean 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.

GASOLINE SPECIFICATIONS:

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

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

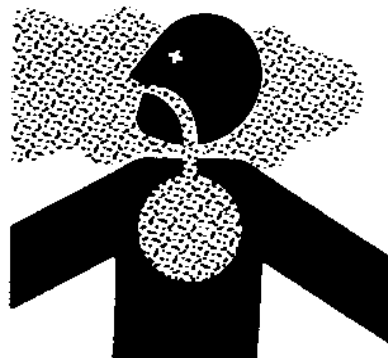
IMPORTANT: **DO NOT** use **METHANOL** gasolines because **METHANOL** is harmful to the environment and to your health.

MX,1020CL,1A -19-16JUL96

GASOLINE—2-CYCLE ENGINES



TS227 -UN-23AUG88



TS220 -UN-23AUG88

⚠ CAUTION: Gasoline is HIGHLY FLAMMABLE, handle it with care.

DO NOT refuel machine while:

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

Help prevent fires:

- fill gas tank to 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.

WARNING

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

To avoid engine damage:

- **ONLY** use fresh, clean unleaded gasoline with an octane rating (anti-knock index) of **87 or higher**;
- mix in John Deere 2-cycle Engine Oil or its equivalent (see 2-cycle Gasoline Engine oil in this section) using a 50:1 fuel/oil mixture;
- if John Deere 2-cycle Engine Oil or its equivalent IS NOT being used, mix alternative 2-cycle oil to a 32:1 fuel/oil mixture.

GASOLINE SPECIFICATIONS:

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

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

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

GASOLINE STORAGE

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

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

MX,1020CL,2 -19-16JUL96

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BREAK-IN OIL—4-CYCLE GASOLINE ENGINES (NORTH AMERICA)

IMPORTANT: 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.**

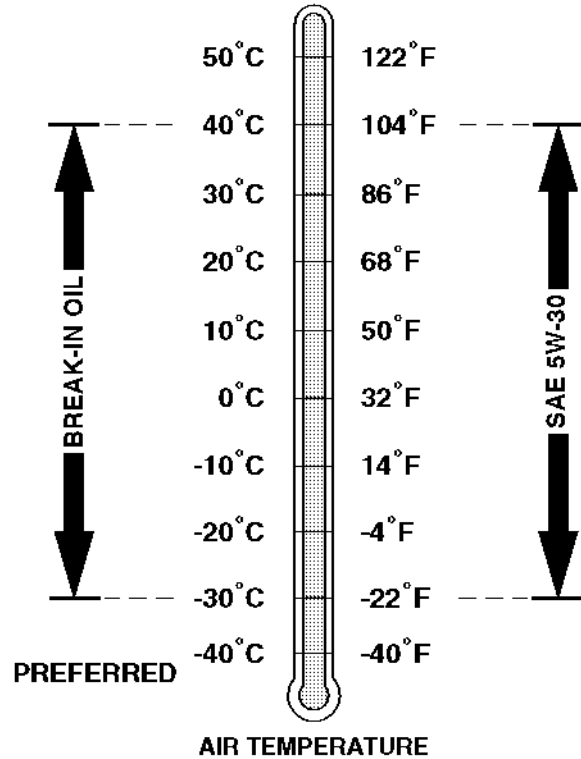
If the above recommended John Deere oils are not available, use a break-in engine oil meeting one of the following specifications during the first 5 hours (maximum) of operation:

- **SAE 5W-30—API Service Classification SE or higher.**

IMPORTANT: After the break-in period, use the John Deere oil that is recommended for this engine.

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

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



M83053 -19-07NOV95

BREAK-IN OIL—4-CYCLE GASOLINE ENGINES (EUROPE)

IMPORTANT: 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 CCMC Specifications G5—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.**

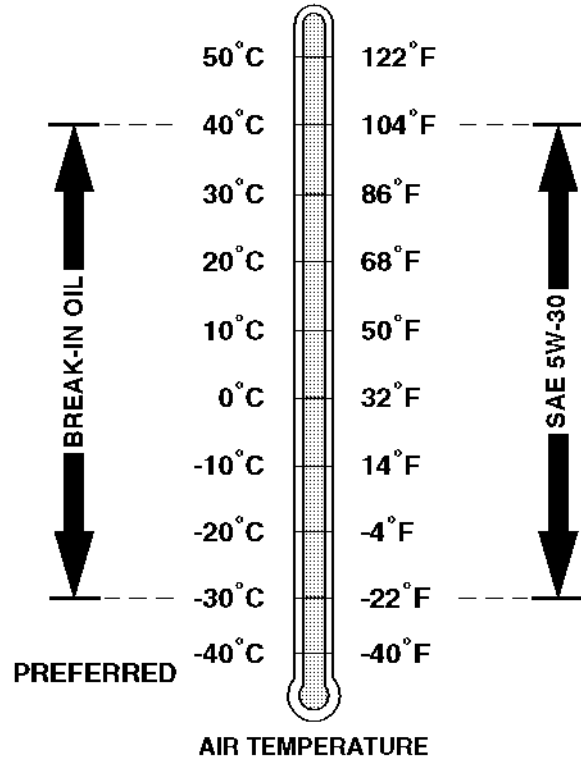
If above recommended John Deere oils are not available, use a break-in engine oil meeting the following specifications during the first 5 hours (maximum) of operation:

- **SAE 5W-30—CCMC Specification G4 or higher.**

IMPORTANT: After the break-in period, use the John Deere oil that is recommended for this engine.

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

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



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KAWASAKI 4-CYCLE GASOLINE ENGINE OIL (NORTH AMERICA)

Use 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:

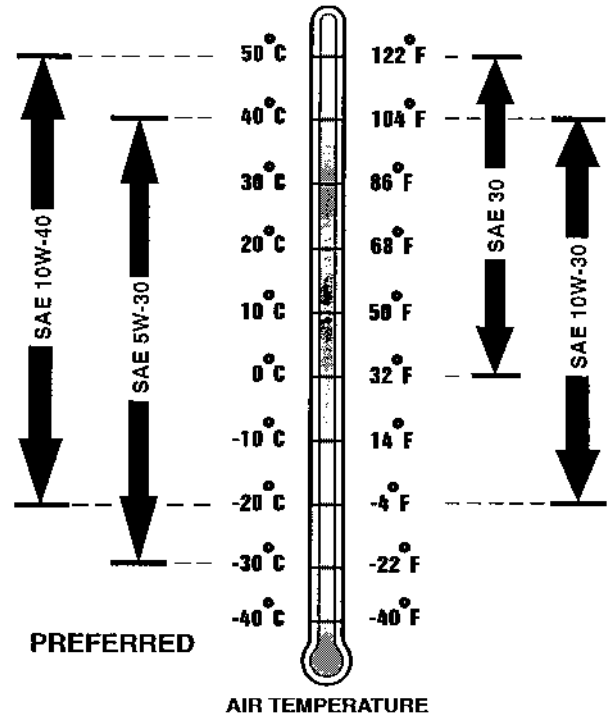
- **TURF-GARD®—SAE 10W-30;**
- **PLUS-4®—SAE 10W-30;**
- **TORQ-GARD SUPREME®—SAE 30.**

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

- SAE 10W-40—API Service Classification SG or higher;
- SAE 5W-30—API Service Classification SG or higher;
- SAE 10W-30—API Service Classification SG or higher;
- SAE 30—API Service Classification SC or higher.

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

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



M81657 -19-12MAR96

MX_1020BV_1 -19-16JUL96

KAWASAKI 4-CYCLE GASOLINE ENGINE OIL (EUROPE)

Use 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®—SAE 10W-40;
- UNI-GARD™—SAE 10W-40;
- TORQ-GARD SUPREME®—SAE 5W-30;
- UNI-GARD™—SAE 5W-30.

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

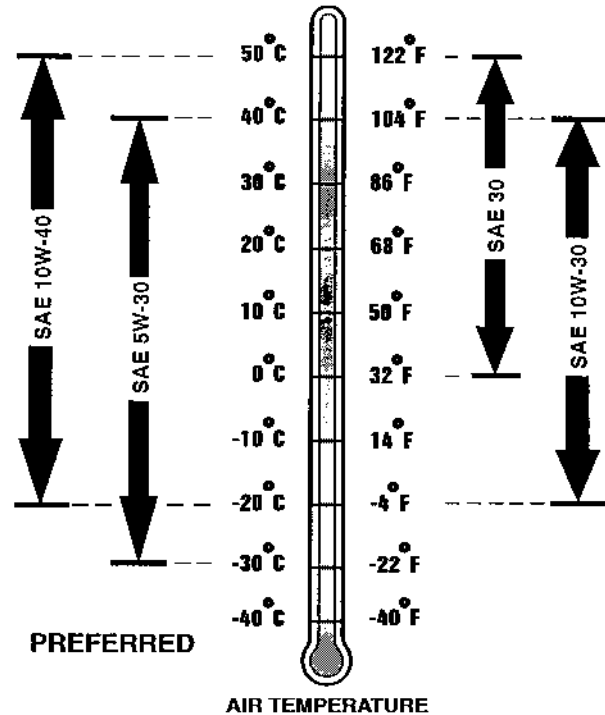
- TORQ-GARD SUPREME®—SAE 10W-30;
- UNI-GARD™—SAE 10W-30;
- TORQ-GARD SUPREME®—SAE 30;
- UNI-GARD™—SAE 30.

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

- **CCMC Specifications G4 or higher.**

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

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



BRIGGS & STRATTON 4-CYCLE GASOLINE ENGINE OIL (NORTH AMERICA)

Use 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®—SAE 30.**
- **TORQ-GARD SUPREME®—SAE 5W-30;**

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

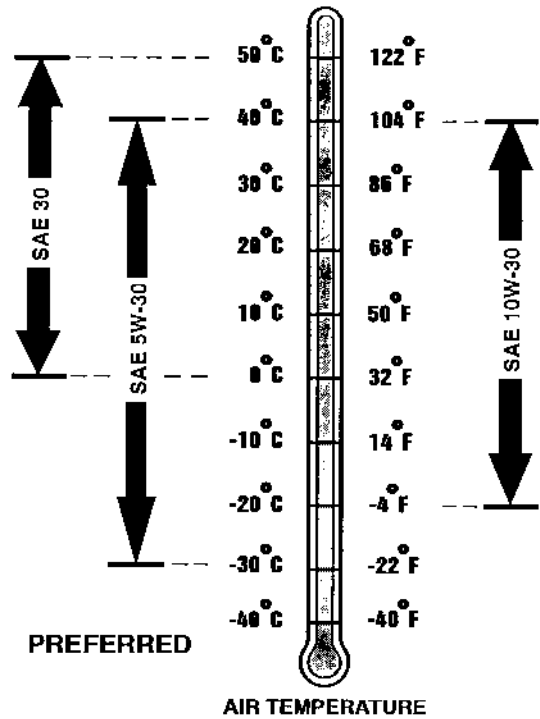
- **TURF-GARD®—SAE 10W-30.**
- **PLUS-4™—SAE 10W-30;**

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

- **SAE 30—API Service Classifications SC or higher.**
- **SAE 5W-30—API Service Classifications SG or higher.**
- **SAE 10W-30—API Service Classifications SG or higher.**

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

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



M81661 -19-12MAR96

MX.1020BV.2 -19-16JUL96

BRIGGS & STRATTON 4-CYCLE GASOLINE ENGINE OIL (EUROPE)

Use 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®—SAE 30;
- UNI-GARD™—SAE 30;
- TORQ-GARD SUPREME®—SAE 5W-30;
- UNI-GARD™—SAE 5W-30.

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

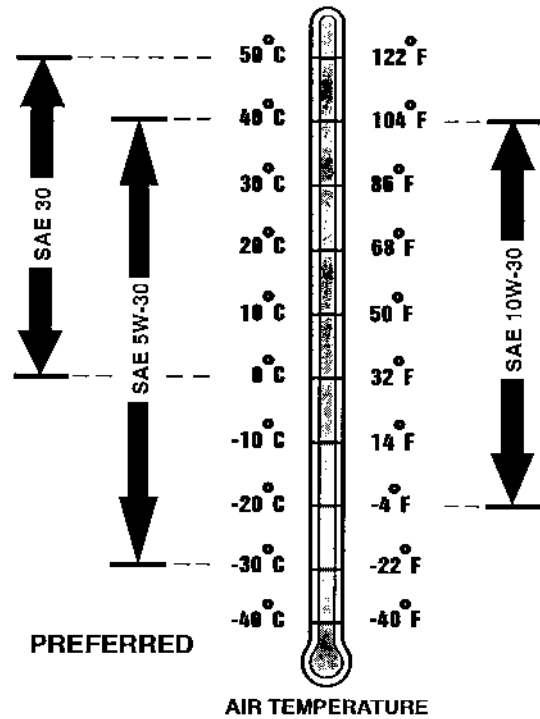
- TORQ-GARD SUPREME®—SAE 10W-30;
- UNI-GARD™—SAE 10W-30.

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

- **CCMC Specifications G4 or higher.**

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

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



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M81661 -19-12MAR96

2-CYCLE GASOLINE ENGINE OIL (NORTH AMERICA)

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IMPORTANT: Mix unleaded gasoline (87 octane or higher) and John Deere 2-cycle Engine Oil to a 50:1 ratio (3.8 L [1 U.S. gal] gasoline to 76 ml (2.6 oz.) oil or 4.5 L [1 Imperial gal] gasoline to 90 ml [3.0 oz.] oil).

If John Deere 2-Cycle Engine Oil or its equivalent IS NOT being used, mix unleaded gasoline and alternative 2-cycle engine oil to a 32:1 ratio (3.8 L [1 U.S. gal] gasoline to 119 ml [4.0 oz.] oil or 4.5 L [1 Imperial gal] gasoline to 141 ml [4.8 oz.] oil).

The following John Deere oil is **PREFERRED**:

- **2-CYCLE ENGINE OIL.**

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

- **SAE CLASSIFICATION J2116 or Classifications TA, TB, TC, or TD;**
- **API Classification TC or higher;**
- **NMMA Classifications TC-W or TC-WII or higher;**
- **JASO Classifications FA, FB, or FC or higher.**

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

- Module DX,GAS2 in JDS-G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual P17032.

MX_1020BV,3 -19-16JUL96

2-CYCLE GASOLINE ENGINE OIL (EUROPE)

IMPORTANT: Mix unleaded gasoline (87 octane or higher) and John Deere 2-cycle Engine Oil to a 50:1 ratio (3.8 L [1 U.S. gal] gasoline to 76 ml (2.6 oz.) oil or 4.5 L [1 Imperial gal] gasoline to 90 ml [3.0 oz.] oil).

If John Deere 2-Cycle Engine Oil or its equivalent IS NOT being used, mix unleaded gasoline and alternative 2-cycle engine oil to a 32:1 ratio (3.8 L [1 U.S. gal] gasoline to 119 ml [4.0 oz.] oil or 4.5 L [1 Imperial gal] gasoline to 141 ml [4.8 oz.] oil).

The following John Deere oil is **PREFERRED**:

- **2-CYCLE ENGINE OIL.**

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

- **SAE CLASSIFICATION J2116 or Classifications TA, TB, TC, or TD;**
- **API Classification TC or higher;**
- **NMMA Classifications TC-W or TC-WII or higher;**
- **JASO Classifications FA, FB, or FC or higher;**
- **CEC Standard L-19-T-77.**

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

- Module DX,GAS2 in JDS-G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;

MX,1020BV,3A -19-16JUL96

GEAR TRANSMISSION GREASE (NORTH AMERICA)

Use the following gear grease based on the air temperature range. Operating outside the recommended grease air temperature range may cause premature gear transmission failure.

IMPORTANT: ONLY use the specified greases in this transmission. DO NOT mix any other greases in this application. DO NOT use any BIO-GREASE in this transmission.

The following John Deere gear grease is **PREFERRED**:

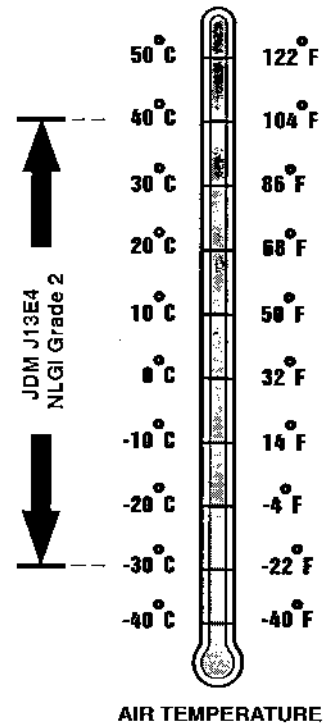
- NON-CLAY HIGH-TEMPERATURE EP GREASE®—JDM J13E4, NLGI Grade 2.

Other gear greases may be used if above recommended John Deere gear grease is not available, provided they meet the following specifications:

- **John Deere Standard JDM J13E4, NLGI Grade 2.**

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

- Module DX,GREA1 in JDS-G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.



M81658 -19-12MAR96

GEAR TRANSMISSION GREASE (EUROPE)

Use the following gear grease based on the air temperature range. Operating outside the recommended grease air temperature range may cause premature gear transmission failure.

IMPORTANT: ONLY use the specified greases in this transmission. DO NOT mix any other greases in this application. DO NOT use any BIO-GREASE in this transmission.

The following John Deere gear grease is **PREFERRED**:

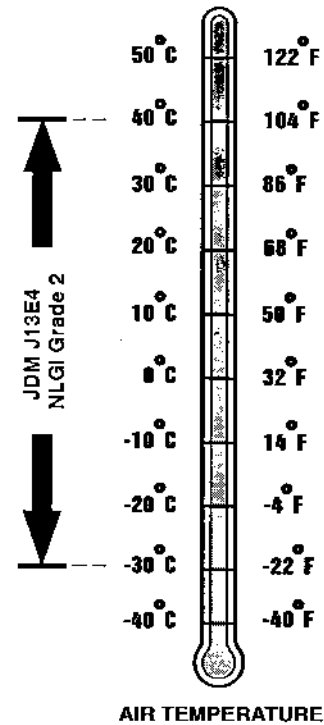
- **GREASE-GARD™—JDM J13E4, NLGI Grade 2.**

Other gear greases may be used if above recommended John Deere gear grease is not available, provided they meet the following specification:

- **John Deere Standard JDM J13E4, NLGI Grade 2.**

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

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



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GREASE, GENERAL USE (NORTH AMERICA)

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

IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO-GREASE in this application.

The following John Deere gear greases are **PREFERRED**:

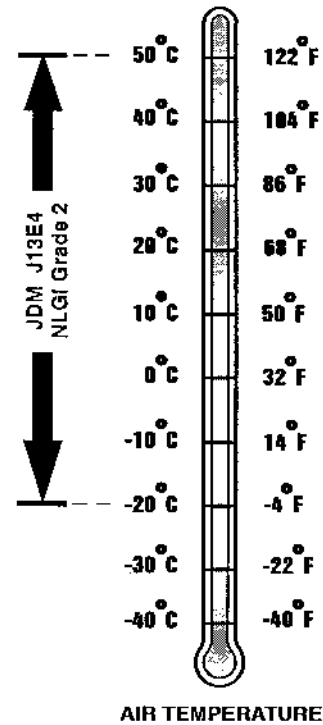
- NON-CLAY HIGH-TEMPERATURE EP GREASE®—JDM J13E4, Grade 2.

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

- **John Deere Standard JDM J13E4, NLGI Grade 2.**

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

- Module DX,GREA1 in JDS-G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.
- the Lubrication Sales Manual PI7032.



M81659 -19-12MAR96

GREASE, GENERAL USE (EUROPE)

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

IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO-GREASE in this application.

The following John Deere gear grease is **PREFERRED**:

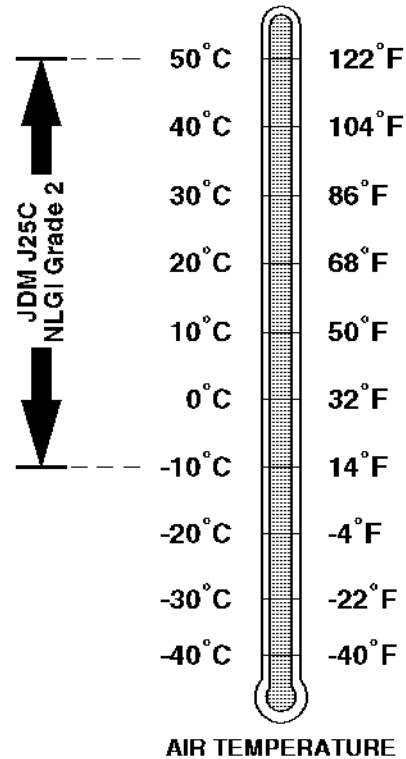
- **GREASE-GARD™—JDM J25C, NLGI Grade 2.**

Other gear greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

- **John Deere Standard JDM J25C, NLGI Grade 2;**

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

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



MX,1020BV,6 -19-16JUL96

ALTERNATIVE LUBRICANTS

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

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

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

MX,1020CL,9 -19-16JUL96

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 temperature limits and service or lubricant change intervals should be maintained as shown in the operator's manual.

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

MX,1020CL,10 -19-16JUL96

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.

MX,1020CL,11 -19-16JUL96

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.

MX,1020CL,12 -19-16JUL96

OIL FILTERS

IMPORTANT: Filtration of oils is critical to proper lubrication performance. Always change filters regularly.

The following John Deere oil filters are **PREFERRED**:

- **AUTOMOTIVE AND LIGHT TRUCK ENGINE OIL FILTERS.**

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

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

- **ASTB Tested In Accordance With SAE J806.**

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

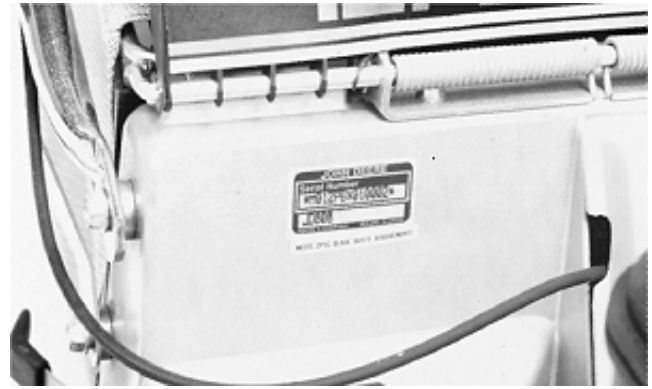
- Module DX,FILT in JDS-G135;
- Section 540, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lawn & Grounds Care Tune-Up Guide PI672.

MX,1020CL,13 -19-16JUL96

PRODUCT IDENTIFICATION NUMBER

The product identification number is located on the rear of the mower deck.

When writing about or filling out warranty claims, USE ALL NUMBERS AND LETTERS on mower serial number plate.

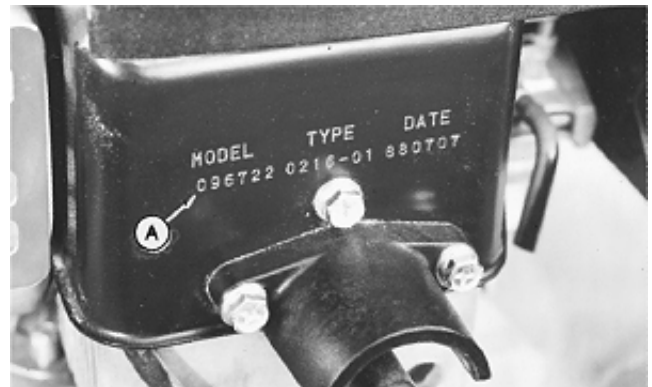


MX,1010BV,8 -19-01OCT92

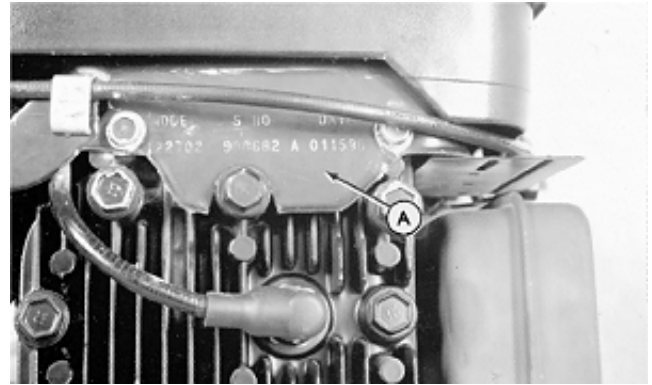
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M52384
-UN-06DEC88

ENGINE SERIAL NUMBER

The Briggs & Stratton engine serial number (A) is located on the front side of engine shroud, near the spark plug.



Briggs & Stratton 2-Cycle



Briggs & Stratton 4-Cycle

The Kawasaki 4-cycle engine serial number is located on crankcase base plate.

When writing about or filling out warranty claims, USE ALL NUMBERS AND LETTERS of engine serial number.



Kawasaki 4-Cycle

MX,1010BV,9 -19-01OCT92

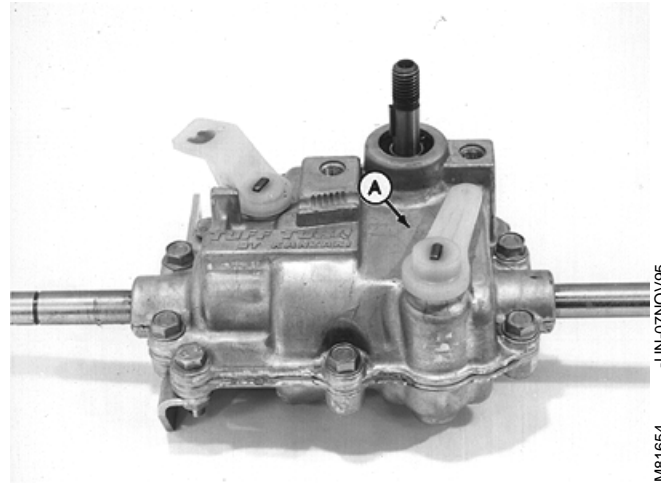
M52385
-UN-06DEC88
M54341
-UN-06AUG90

M52390
-UN-06DEC88

TRANSAXLE DATE CODE

The Kansaki production date code is located on the upper case near the input shaft.

When writing about or filling out warranty claims, USE ALL NUMBERS AND LETTERS of transmission date code.



Kansaki 5-Speed Transaxle

M81654
-UN-07NOV95

MX,1010BV,10 -19-16JUL96

Section 20

ENGINE REPAIR—BRIGGS & STRATTON 2-CYCLE ENGINE (12PB/12PC/12SB)

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Remove and Install B&S 2-Cycle Engine (12PB/12PC/12SB)

OTHER MATERIAL

Number	Name	Use
T43512	John Deere Thread Lock and Sealer (Medium Strength)	Self-propelled units: Apply to threads of engine drive sheave set screw.
M79292	MPG-2® DuBois Multi-Purpose Polymer Grease, NLGI Grade 1	Apply to any mating surfaces that might seize to each other over long periods of time.

MPG-2® is a registered trademark of DuBois, a division of Chemed Corp.

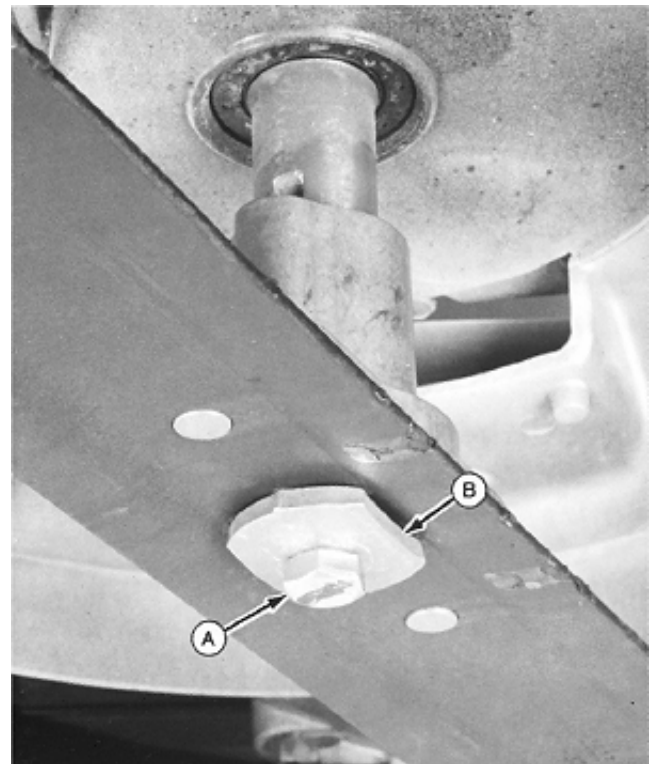
MX,2005BV,1 -19-16JUL96

REMOVE AND INSTALL BLADE—ALL MODELS

MOWERS WITHOUT BLADE BRAKE CLUTCH (BBC)

⚠ CAUTION: Blade is sharp. Wear gloves when working with blade to avoid injury. Use a block of wood wedged between end of blade and mower deck.

1. Remove cap screw (A) and compression washer (B) to remove blade, adapter, and key.

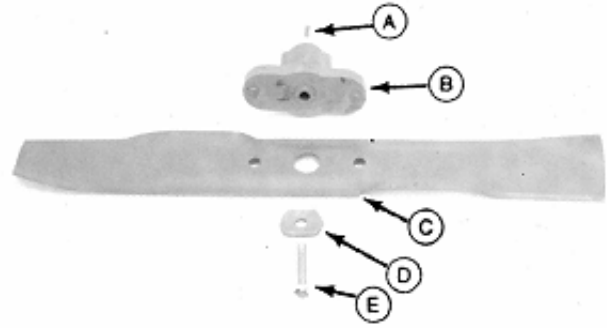


M42857 -UN-03AUG92

MX,2005BV,2A -19-16JUL96

2. Inspect cap screw (E), compression washer (D), blade (C), adapter (B), and key (A). Replace as necessary.

- A—Key
- B—Blade Adapter
- C—Blade
- D—Compression Washer
- E—Cap Screw



MX,2005BV,2B -19-01OCT92

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NOTE: Key may require filing to fit keyway.

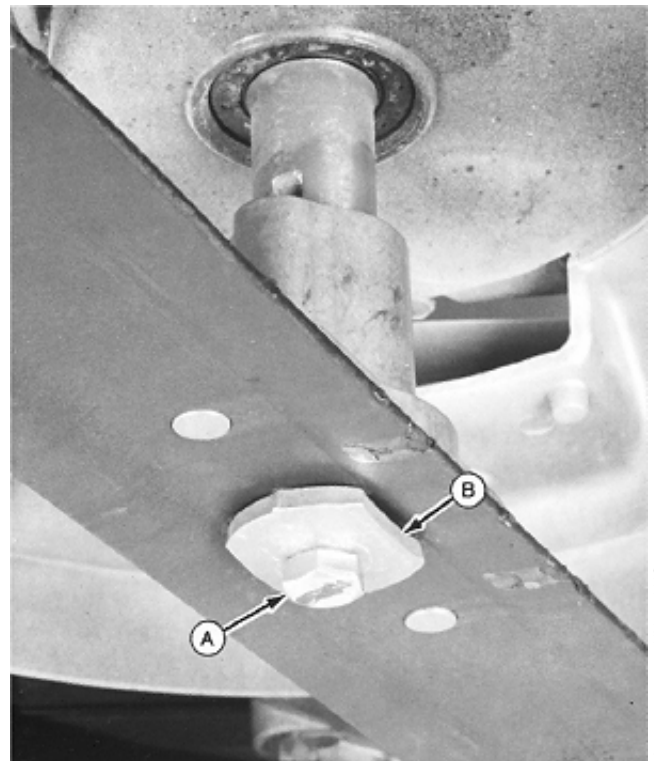
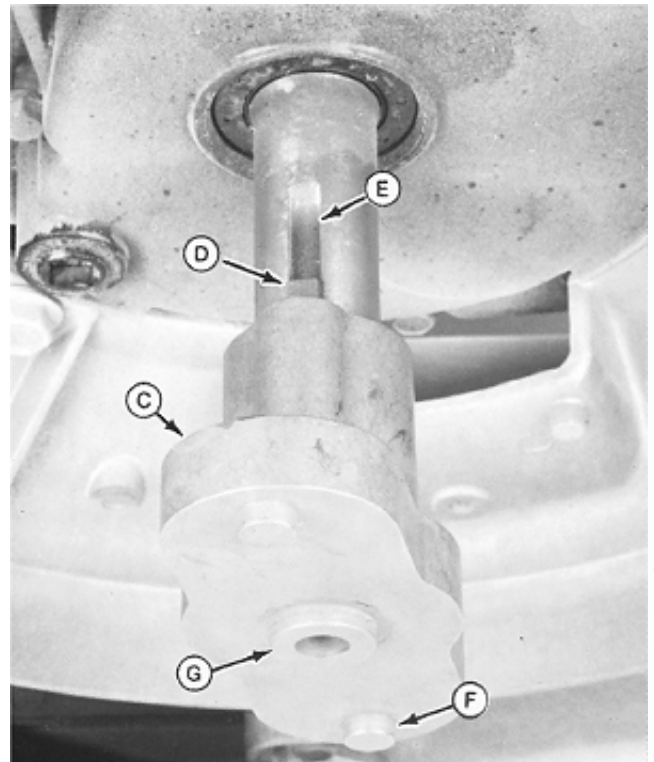
3. Coat crankshaft, key, and inside of blade adapter with MPG-2® DuBois Multi-Purpose Polymer Grease (M79292) to keep components from seizing to each other.

4. Install key (D) in crankshaft keyway (E) and install adapter (C).

5. Install blade over stabilizer pins (F) and embossment (G).

6. Fasten blade with compression washer (B) and cap screw (A). Tighten cap screw to **74.5 N·m (55 lb-ft)**.

- A—Cap Screw
- B—Compression Washer
- C—Blade Adapter
- D—Key
- E—Keyway
- F—Stabilizer Pins
- G—Embossment



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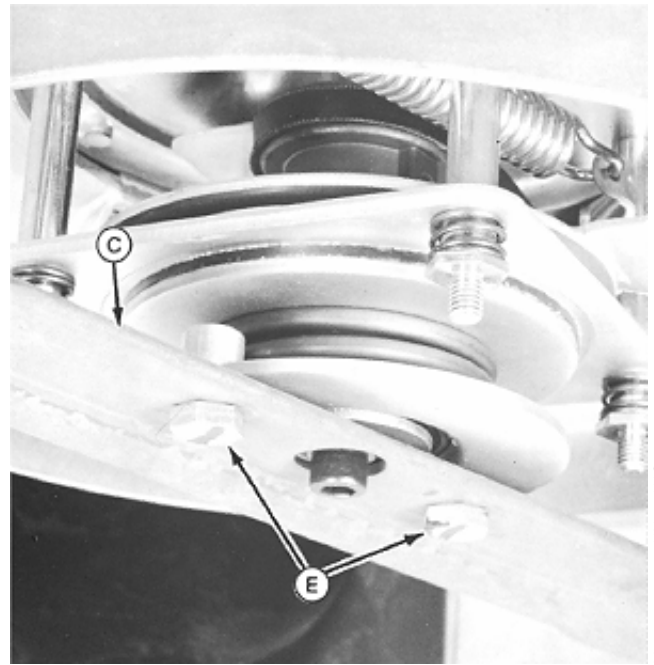
M42856 -UN-03AUG92

M42857 -UN-03AUG92

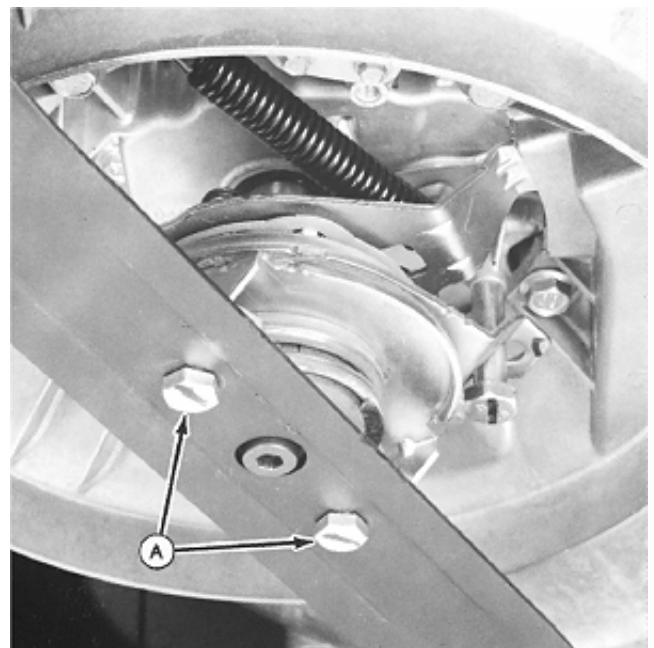
MOWERS WITH BLADE BRAKE CLUTCH (BBC): (12PB AND 12SB)

CAUTION: Blade (C) is sharp. Wear gloves when working with blade to avoid injury. Use a block of wood wedged between end of blade and mower deck.

1. Remove cap screws (A) for Warner BBC and (E) for Ogura BBC to remove blade.
2. Inspect blade and cap screws. Replace as necessary.
3. Install blade center hole over BBC socket head screw and fasten with cap screws (A) or (E). Tighten cap screws to **47 N-m (35 lb-ft)**.



Early Models With Ogura BBC



Late Models With Warner BBC

MX,2005BV,2D -19-16JUL96

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-UN-21AUG92
M42858

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M42783

REMOVE AND INSTALL ENGINE—PUSH MOWERS (12PB AND 12PC)

1. Disconnect spark plug lead.

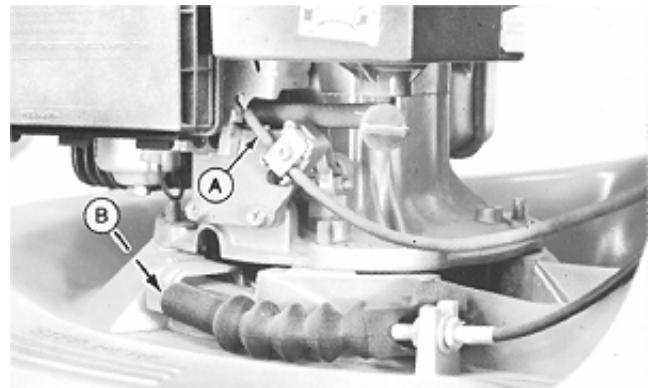
CAUTION: Gasoline is dangerous. Avoid fires due to smoking or careless maintenance. Move mower to a well ventilated area, free of sparks or flame.

2. Drain fuel into a safe container.

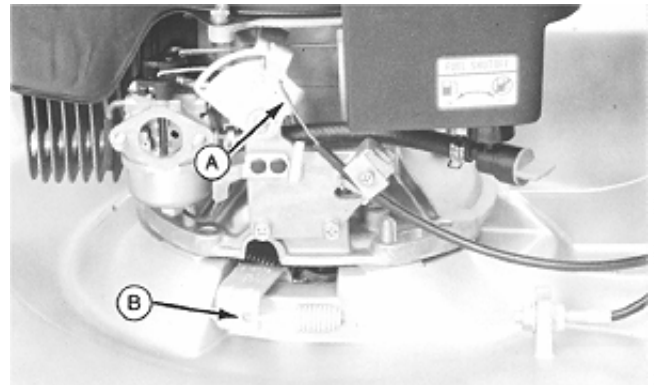
NOTE: On the 12PC Model there is no BBC unit, so disregard any instructions pertaining to the BBC unit.

3. Disconnect throttle control cable (A) and, if equipped, BBC control cable (B).

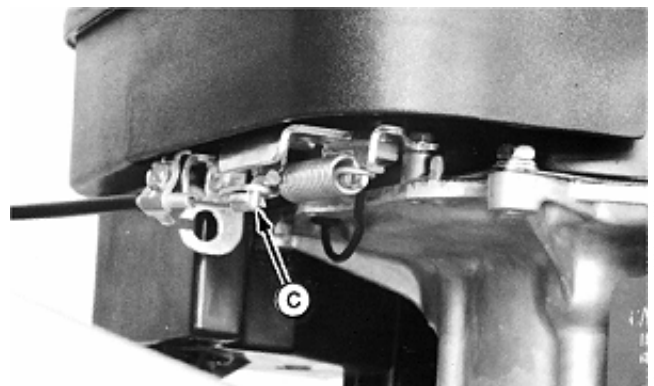
4. On 12PC Model only, loosen safety bail cable clamp and disconnect cable (C) from flywheel band brake assembly (located at the rear of the engine, just below the fuel tank).



Early Models



Late Models



Model 12PC Only

MX,2005BV,3A -19-16JUL96

M52391 -UN-30JUL92

M42814 -UN-30JUL92

M42784 -UN-30JUL92

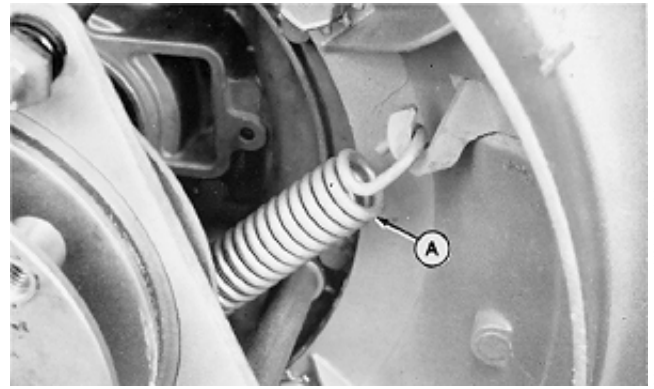
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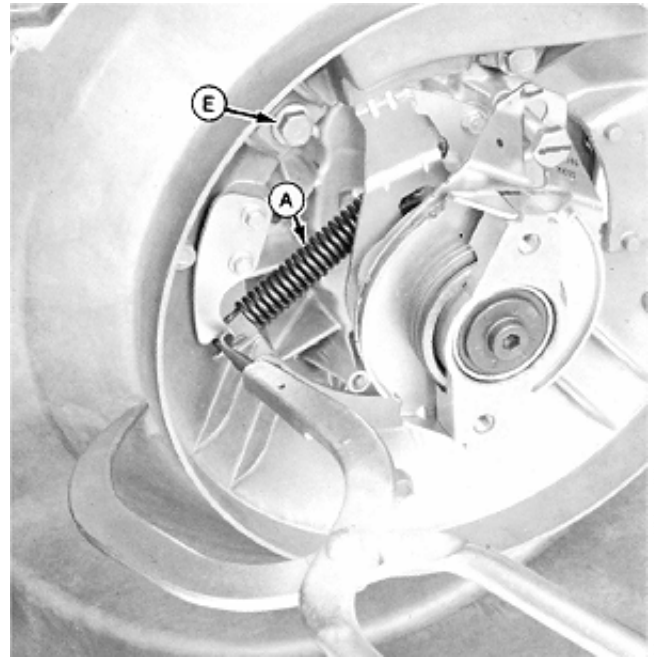
5. Remove blade.
6. If equipped with a BBC unit, disconnect spring (A) using special spring removal tool JDG717.
7. Remove four engine mounting cap screws (E) and remove engine to workbench.
8. Remove BBC unit, if equipped.
9. Make engine repairs as necessary.
10. Install BBC (if equipped), engine, BBC spring and blade. Tighten cap screws to specifications.
11. Connect throttle control cable and adjust.
12. Connect BBC (if equipped) control cable and adjust.
13. Fill fuel tank with proper fuel. (See Section 10, Group 20.)

TORQUE SPECIFICATIONS

BBC Socket Head Cap Screw	54 N·m (40 lb-ft)
Engine Mount Cap Screws	27 N·m (20 lb-ft)
Blade Mount Cap Screws	47 N·m (35 lb-ft)



Early Model BBC Units



Late Model BBC Units

M52559 -UN-11JAN89

M42785 -UN-30JUL92

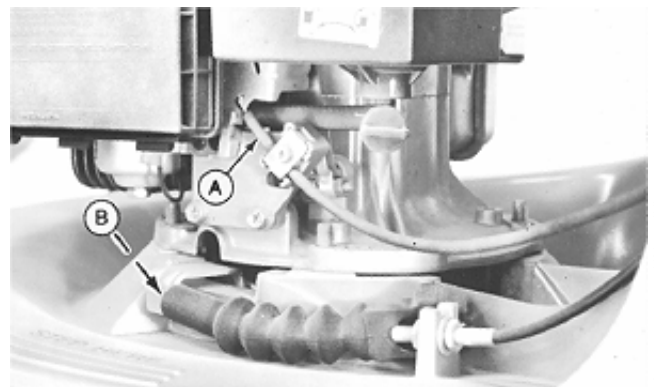
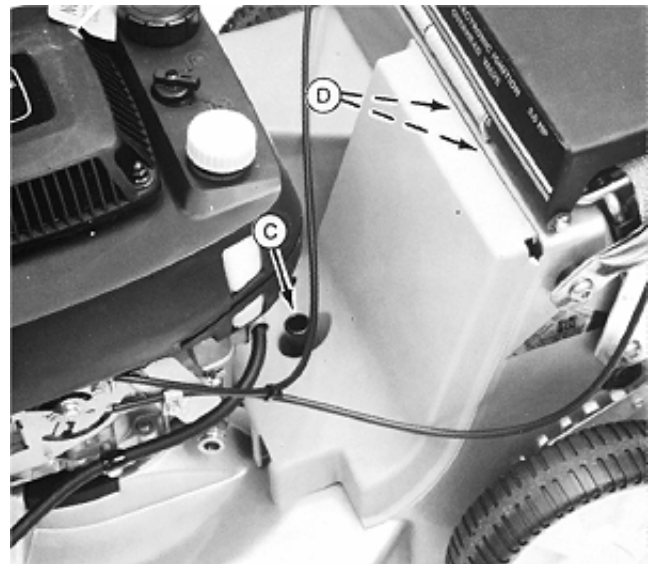
REMOVE AND INSTALL ENGINE—SELF PROPELLED MOWER (12SB ONLY)

1. Disconnect spark plug lead.

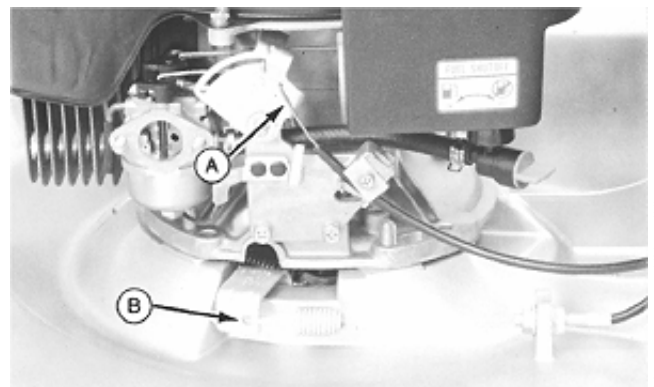
CAUTION: Gasoline is dangerous. Avoid fires due to smoking or careless maintenance. Move mower to a well ventilated area, free of sparks or flame.

2. Drain fuel into a safe container.
3. Remove plastic mower deck cover by unscrewing black knob (C) and pushing down on top to disengage two hidden mounting tabs (D).
4. Disconnect throttle cable (A) and BBC control cable assembly (B).

A—Throttle Control Cable
B—BBC Control Cable
C—Black Knob
D—Mounting Tabs



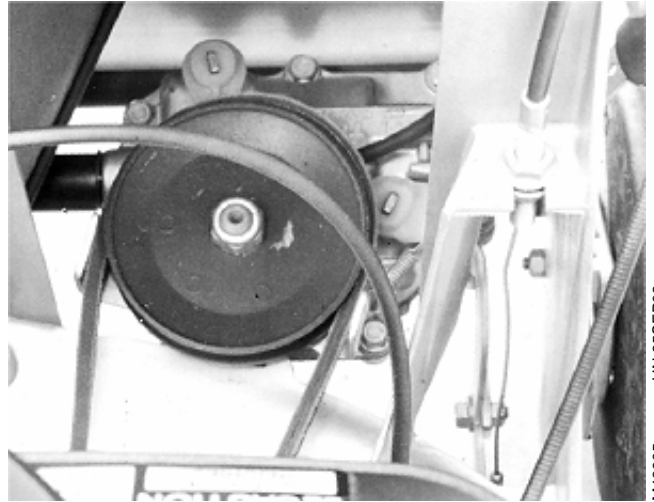
Early Models



Late Models

MX,2005BV,4A -19-16JUL96

5. Remove transaxle drive sheave to disengage belt.
6. Remove blade.

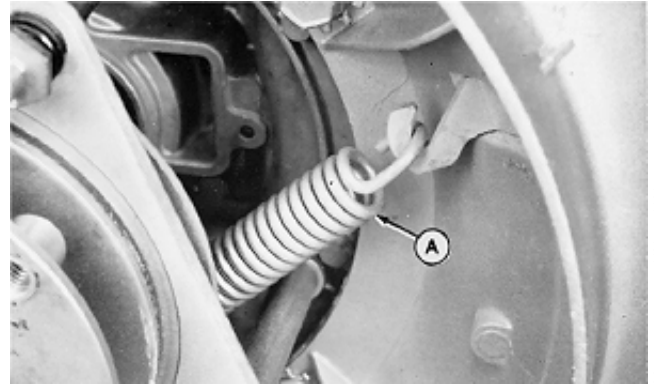


M42995 -UN-25SEP92

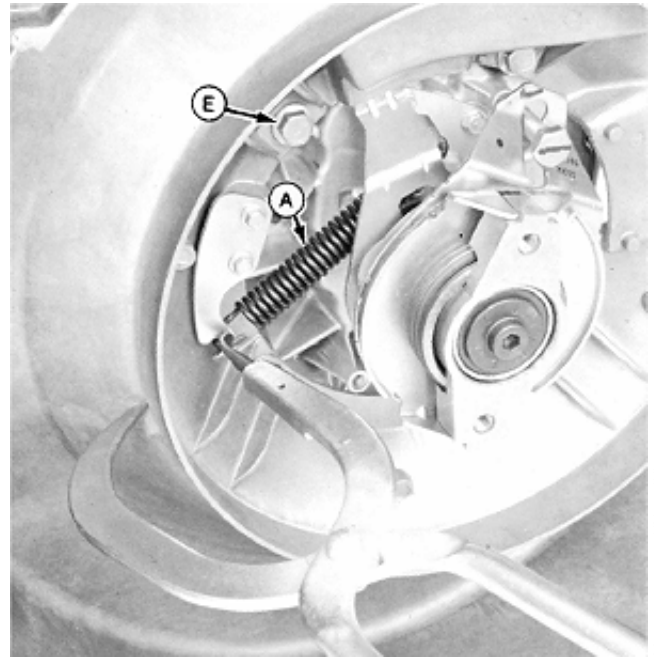
MX,2005BV,4B -19-01OCT92

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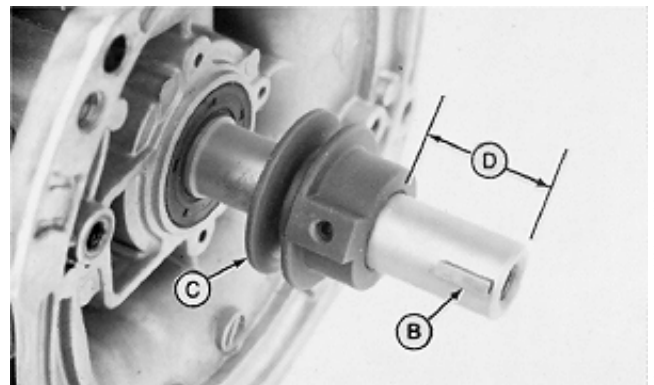
7. Disconnect spring (A) using special spring removal tool JDG717.
8. Remove four engine mounting cap screws (E) and remove engine to workbench.
9. Remove BBC unit.
10. Remove drive belt, key (B) and sheave (C).
11. Make engine repairs as necessary.
12. Apply John Deere Thread Lock and Sealer (medium strength) T43512 to threads of sheave set screw.
13. Install sheave **38 mm (1.50 in.)** (D) from end of crankshaft.
14. Install key and belt (feed belt through the mower deck hole as you install engine).
15. Install BBC.
16. Install engine, BBC spring and blade. Tighten cap screws to specifications.
17. Install sheave and drive belt. Tighten lock nut to specification.
18. Connect throttle control cable and adjust.
19. Connect BBC control cable and adjust.
20. Fill fuel tank with proper fuel. (See Section 10, Group 20.)



Early Models



Late Models



INSPECTION SPECIFICATIONS

Engine Drive Sheave Installation 38 mm (1.50 in.)

TORQUE SPECIFICATIONS

BBC Socket Head Cap Screw 74.5 N·m (55 lb-ft)
 Transaxle Drive Sheave Lock Nut 34 N·m (25 lb-ft)
 Engine Drive Sheave Set Screw 5 N·m (44 lb-in)
 Engine Mount Cap Screws 27 N·m (20 lb-ft)
 Blade Mount Cap Screws 47 N·m (35 lb-ft)

- A—Spring
- B—Key
- C—Sheave
- D—38 mm (1.5 in.)
- E—Cap Screws (4 used)

M52559 -UN-11JAN89

M42785 -UN-30JUL92

M52560 -UN-11JAN89

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ESSENTIAL TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

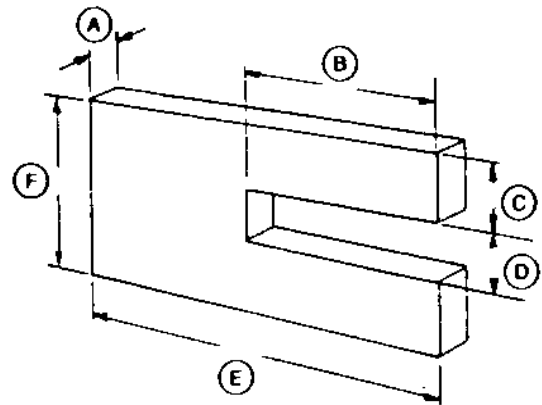
Number	Name	Use
JDG49	Piston Ring Expander Tool	Remove piston rings.
D01204AA	2-Jaw Puller	Remove flywheel and crankcase halves.

MX,2010BV,1A -19-16JUL96

FABRICATED TOOLS

Piston Support Tool—Make from a piece of wood according to the dimensions given. Use to stop crankshaft rotation during disassembly procedures.

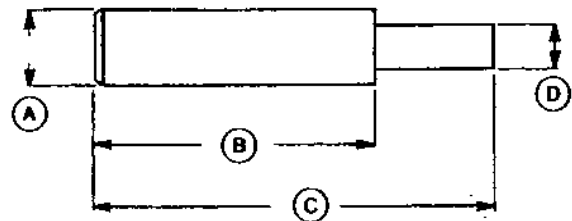
- A—25 mm (1 in.)
- B—76 mm (3 in.)
- C—28 mm (1-1/8 in.)
- D—22 mm (7/8 in.)
- E—152 mm (6 in.)
- F—76 mm (3 in.)



MX,2010BV,1B -19-16JUL96

Piston Pin Tool—Make from a piece of wooden dowel according to the dimensions given. Use to drive piston pin from piston and connecting rod.

- A—13 mm (1/2 in.)
- B—60 mm (2-23/64 in.)
- C—85 mm (3-11/32 in.)
- D—9 mm (11/32 in.)



MX,2010BV,1C -19-01OCT92

OTHER MATERIAL

Number	Name	Use
PT507	John Deere Multi-Purpose (Lithium Based) Grease	Pack oil seals.

MX,2010BV,1D -19-01OCT92

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Engine Gasket Kit

MX,2010BV,2 -19-01OCT92

EXPLODED VIEW—BRIGGS & STRATTON 2-CYCLE ENGINE (12PB, 12PC AND 12SB)

- | | | | |
|--|--------------------------|---------------------------------------|--------------------------|
| 1—Cap Screw (3 used) | 11—Ball Bearing | 21—Spark Plug | 29—Screw (2 used) |
| 2—Flat Washer (3 used) | 12—Thrust Washer | 22—Socket Head Cap Screws
(4 used) | 30—Governor Plate |
| 3—Lock Washer (3 used) | 13—Flywheel Woodruff Key | 23—Intake Gasket | 31—Governor Shaft |
| 4—Flanged Nut | 14—Piston Pin | 24—Blade Adapter Woodruff
Key | 32—Ball Bearing |
| 5—Flywheel Screen/Recoil
Start Hub Assembly | 15—Spring Clips (2 used) | 25—Needle Bearing | 33—Output Crankcase Half |
| 6—Flywheel | 16—Piston | 26—Connecting Rod | 34—Governor Shaft Seal |
| 7—Seal | 17—Piston Rings (2 used) | 27—Crankshaft | 35—Seal |
| 8—Flywheel Crankcase Half | 18—Head Gasket | 28—Governor Flyweight
Assembly | 36—Lock Washer (4 used) |
| 9—Crankcase Gasket | 19—Exhaust Gasket | | 37—Cap Screw (4 used) |
| 10—Snap Ring | 20—Cylinder Head | | |

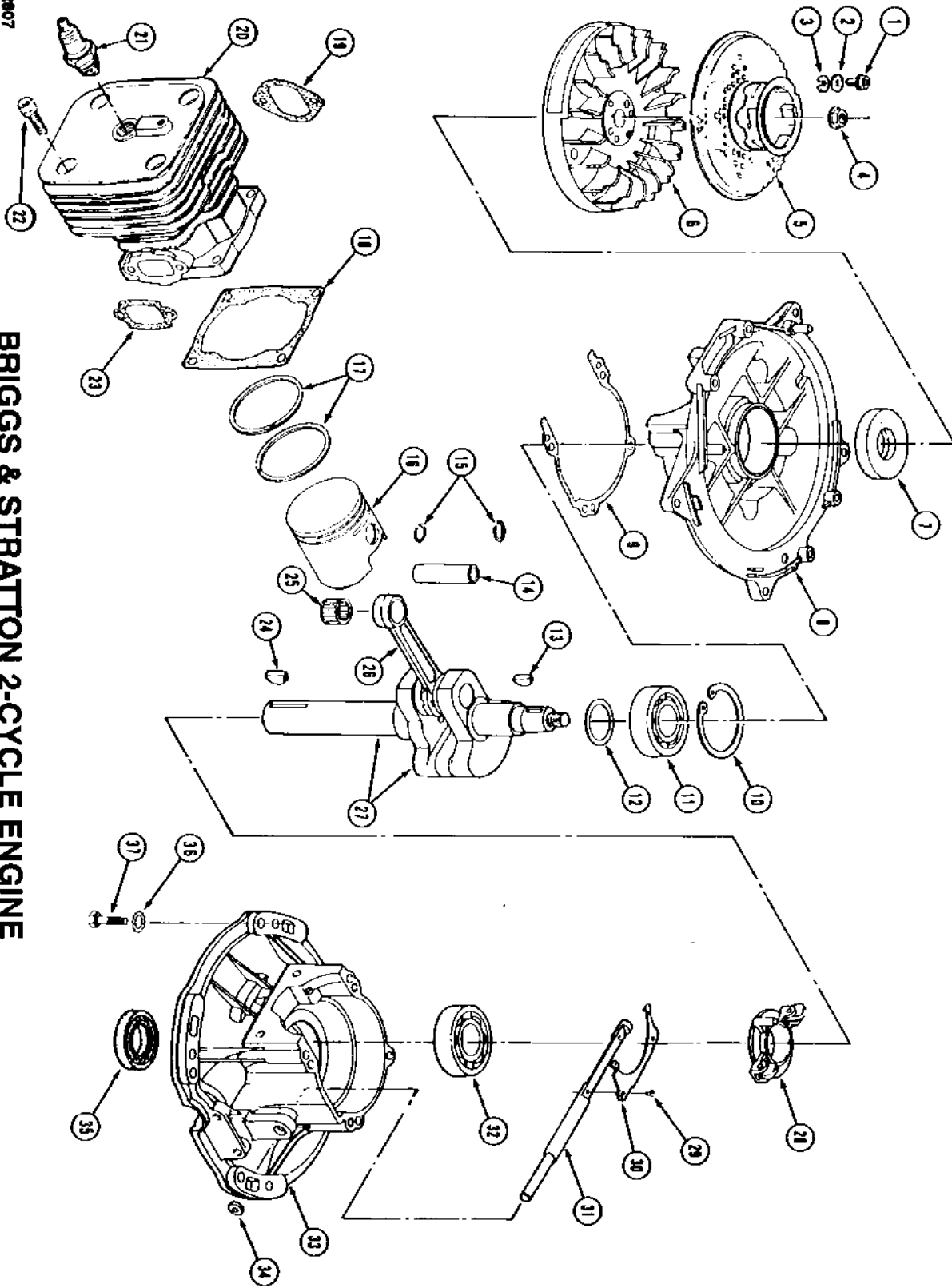
This exploded view is provided to you as a reference for disassembly and assembly of the Briggs & Stratton 2-Cycle Engine.

Design and specifications subject to change without notice.

MX,2010BV,19A -19-16JUL96

MA2807

BRIGGS & STRATTON 2-CYCLE ENGINE

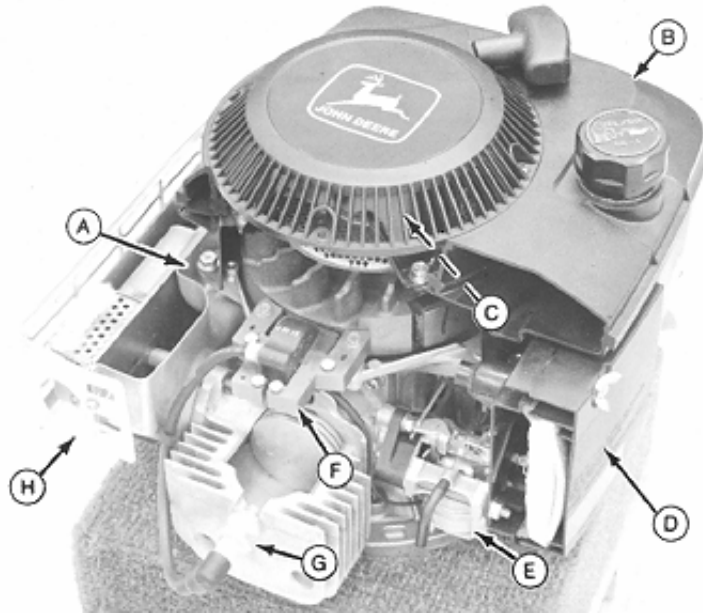


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MX,2010BV,19B -19-16JUL96

DISASSEMBLE ENGINE (12PB, 12PC AND 12SB)



M42815
-UN-30JUL92

A—Engine Shroud
B—Fuel Tank/Engine Cover
Assembly

C—Recoil Start Cover and
Assembly
D—Air Filter Assembly

E—Carburetor Assembly and
Linkage
F—Ignition Coil

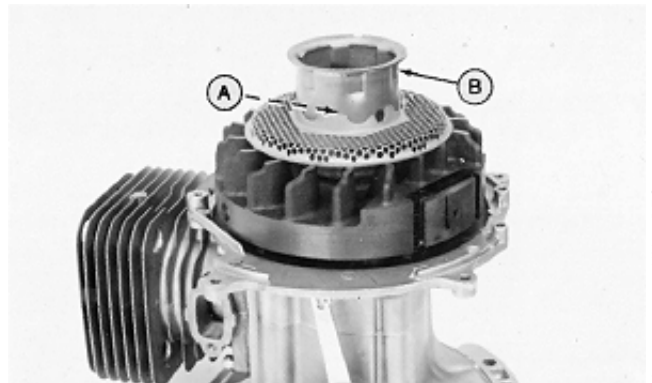
G—Spark Plug
H—Exhaust Muffler Assembly

Training Aid Cutaway View

1. Remove spark plug (G).
2. Remove recoil start cover and assembly (C).
3. Remove air filter assembly (D).
4. Remove carburetor assembly and linkage (E).
5. Remove ignition coil (F).
6. Remove muffler assembly (H).
7. Remove fuel tank/engine cover assembly (B).
8. Remove engine shroud (A), partially cutaway.

MX,2010BV,3A -19-16JUL96

9. Remove flywheel nut and three cap screws (A) from inside recoil start cup (B) to remove cup.

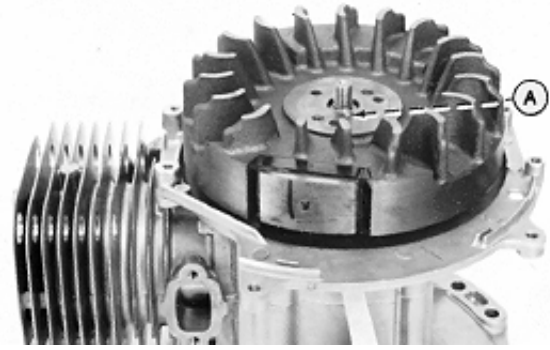


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-UN-06DEC88

MX,2010BV,3B -19-01OCT92

10. Use a puller to remove flywheel.

11. Remove flywheel key (A).

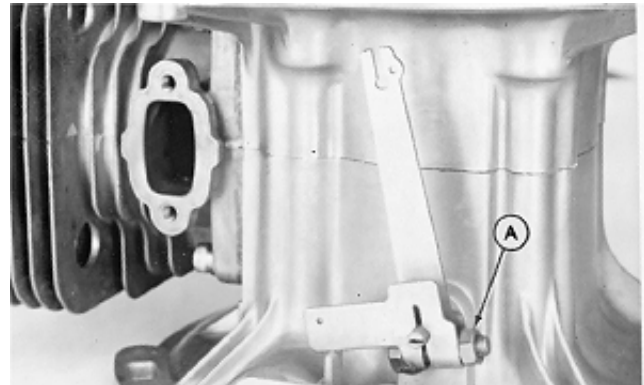


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M52362 -UN-06DEC88

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12. Loosen nut (A) to remove governor lever from shaft.

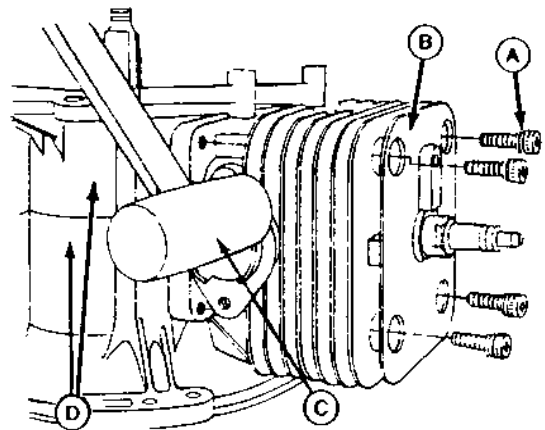


MX,2010BV,5 -19-01OCT92

M52363 -UN-06DEC88

13. Remove four socket head cap screws (A) and separate cylinder head (B) from crankcase halves (D) with a soft head mallet (C). Remove cylinder head from piston and clean off any residual gasket material from all machined mating surfaces.

- A—Socket Head Cap Screws (4 used)
- B—Cylinder Head
- C—Soft Head Mallet
- D—Crankcase Halves

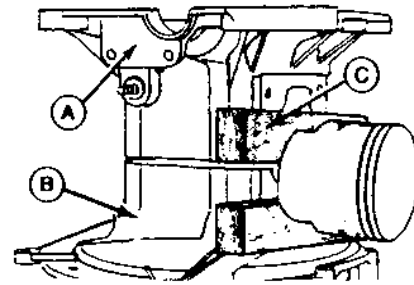


MX,2010BV,6 -19-01OCT92

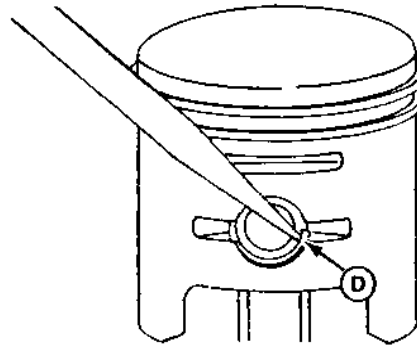
M42816 -UN-30JUL92

IMPORTANT: To prevent piston skirt damage during disassembly, install fabricated piston support tool (see Fabricated Tools module at the beginning of this section) or wrap a shop towel around connecting rod where piston skirt would make contact.

14. Install fabricated piston support tool (C) between piston, output crankcase half (A), and flywheel crankcase half (B) or wrap a clean shop cloth around connecting rod.

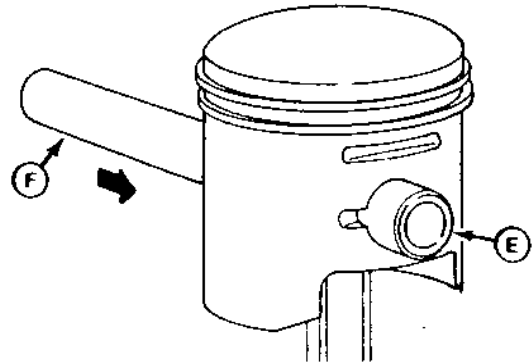


15. Use a sharp pointed tool to remove spring clip (D) from each end of piston pin bore.



IMPORTANT: DO NOT use a hammer to drive out the piston pin, you may damage the connecting rod.

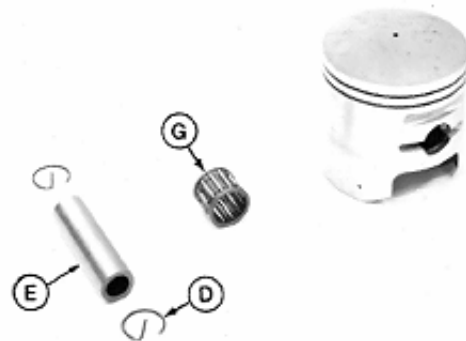
16. Use wooden fabricated piston pin tool (F) by hand to push pin (E) out of piston.



17. Remove piston from connecting rod.

18. Push needle bearing (G) from end of connecting rod.

- A—Output Crankcase Half
- B—Flywheel Crankcase Half
- C—Fabricated Piston Support Tool
- D—Spring Clip (2 used)
- E—Piston Pin
- F—Fabricated Piston Pin Tool
- G—Needle Bearing



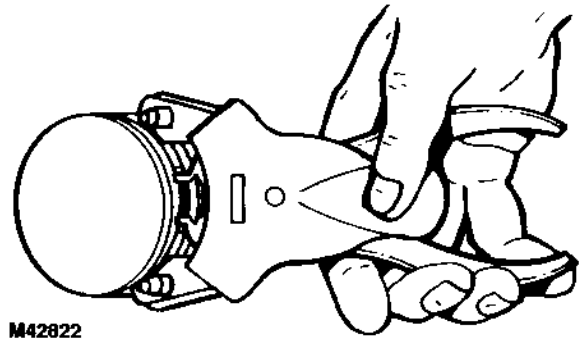
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M52365

19. Remove piston rings using the piston ring expander tool—JDM49.

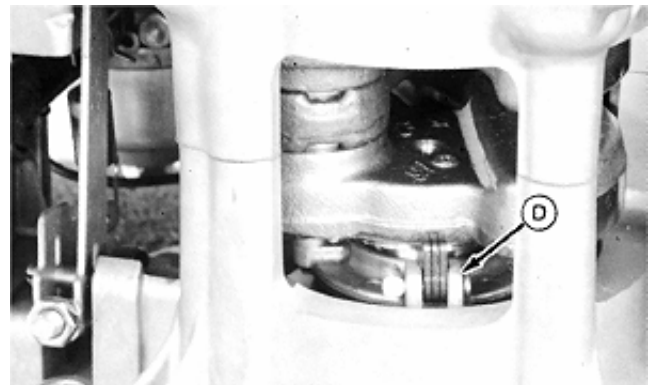


20. Remove four cap screws (A).

21. Separate output crankcase half (B) from flywheel crankcase half (C) using a soft head mallet. Remove output crankcase half and gasket. Remove any residual gasket materials from the machined mating surfaces of the crankcase halves.

22. Remove governor assembly (D).

- A—Cap Screws (4 used)
- B—Output Crankcase Half
- C—Flywheel Crankcase Half
- D—Governor Assembly



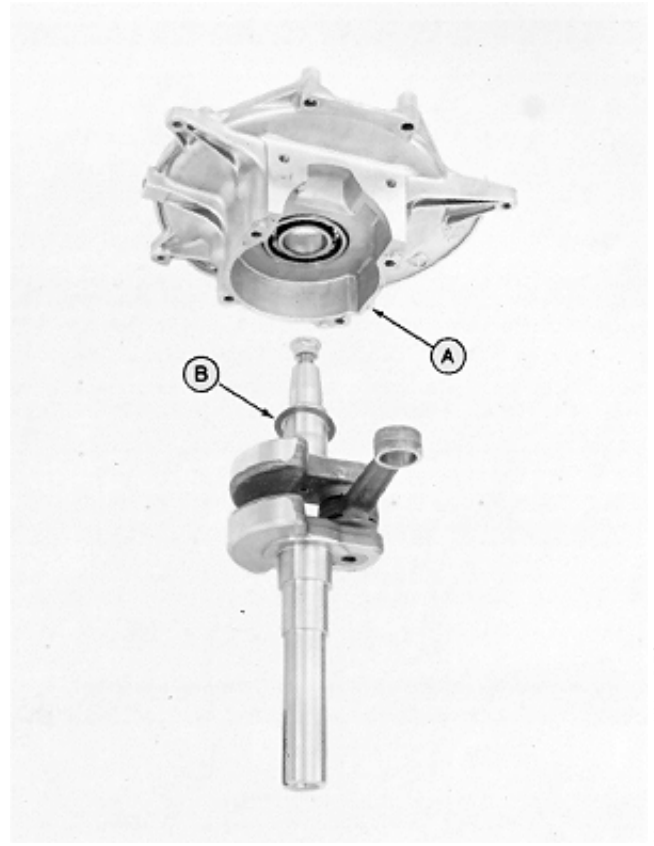
Training Aid Cutaway View

23. Position engine with flywheel end of crankshaft facing up.

NOTE: To avoid damaging crankshaft threads while using press, install flywheel nut on end of threads.

24. Remove crankshaft from flywheel crankcase half (A) using a press.

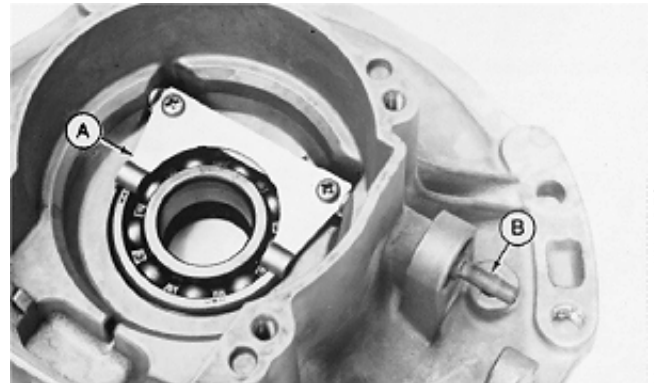
25. Remove thrust washer (B), if equipped.



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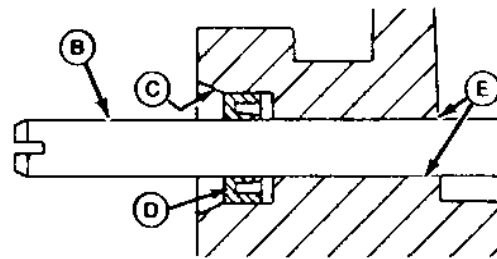
26. Remove two screws and governor plate (A).



27. Pull governor shaft (B) outward to remove. Shaft seal (D) may or may not come out with the shaft, it might remain lodged below the chamfer (C).

If lodged, use an O-ring extractor tool to remove it. Be careful not to score any of the casting surfaces.

- A—Governor Plate
- B—Governor Shaft
- C—Chamfer
- D—Shaft Seal



MX,2010BV,10 -19-16JUL96

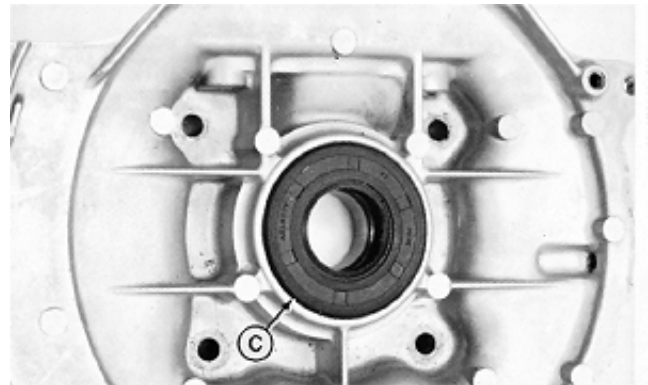
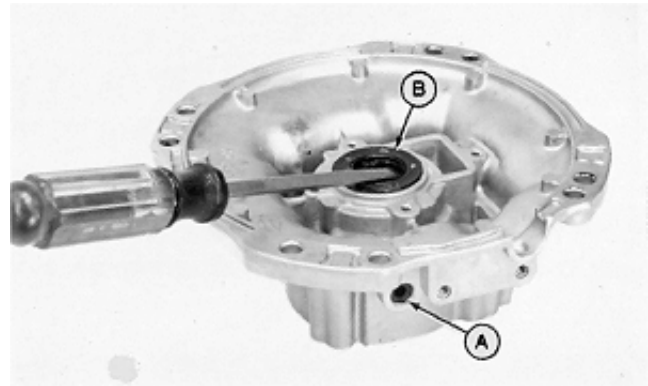
M52368 -UN-15DEC88

M42826 -UN-03AUG92

REMOVE AND INSTALL CRANKCASE OIL SEALS (12PB, 12PC AND 12SB)

IMPORTANT: DO NOT re-use oil seals after they have been removed.

1. Remove and discard oil seals (A, B and C) from both crankcase halves.
2. Apply PT507 multi-purpose, lithium base grease to inside lip of new seals.
3. Install new seals with lip to inside of crankcase. Press oil seal (A) flush with bore chamfer. Press oil seals (B and C) flush with hub.



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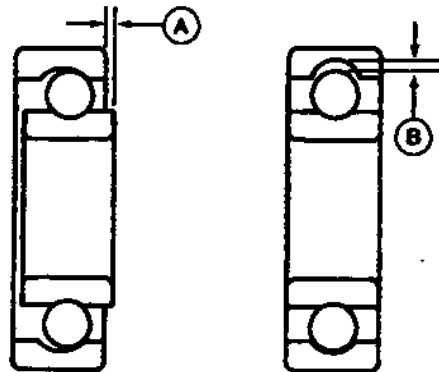
M52370 -UN-06DEC88

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INSPECT CRANKSHAFT BALL BEARINGS (12PB, 12PC AND 12SB)

NOTE: DO NOT remove crankshaft ball bearings unless they are damaged. Ball bearings cannot be re-used once they are removed. Carefully inspect them while in their crankcase halves.

1. Clean crankshaft bearings in solvent. Blow dry. Apply light weight oil to bearings.
2. Spin each bearing by hand and check for axial (A) and radial (B) free play.
3. Replace bearing if it is noisy or has too much play.



MX,2010BV,12 -19-16JUL96

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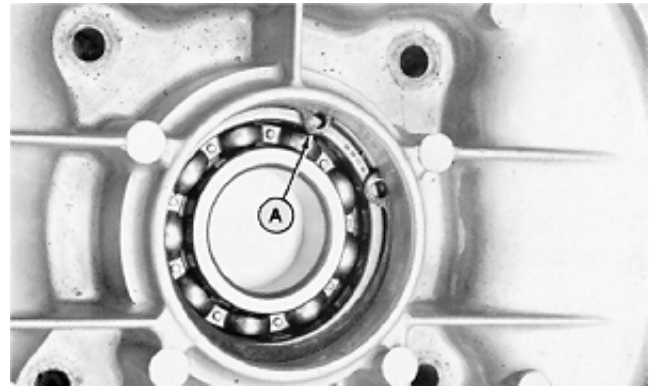
REMOVE AND INSTALL CRANKSHAFT BEARINGS (12PB, 12PC AND 12SB)

IMPORTANT: DO NOT re-use crankshaft ball bearings after they have been removed.

1. Remove crankcase oil seals.
2. Remove snap ring (A) from flywheel crankcase half.
3. Remove bearing from each crankcase half using the proper size disk and driver.
4. Install snap ring in flywheel crankcase half.

IMPORTANT: Press against outer bearing race only.

5. Lubricate new bearings with 2-cycle engine oil and install in crankcase using proper size disk and driver.
6. Install new seals.



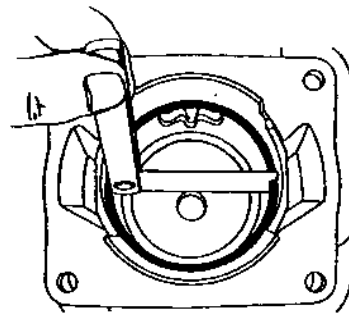
M52371 -UN-06DEC88

MX,2010BV,13 -19-16JUL96

INSPECT PISTON AND RINGS (12PB, 12PC AND 12SB)

IMPORTANT: DO NOT clean piston using any caustic cleaning solutions, wire brush or metal scraper.

1. Soak piston and rings in approved solvent to remove all deposits.
2. Clean piston ring grooves using a thin wooden stick.
3. Place each piston ring in cylinder bore approximately **32 mm (1.250 in.)** deep, just beyond bevel surface so piston ring is fully compressed inside the cylinder.
4. Measure piston ring end gap. Replace ring if end gap is **greater than 1.01 mm (0.039 in.)**.

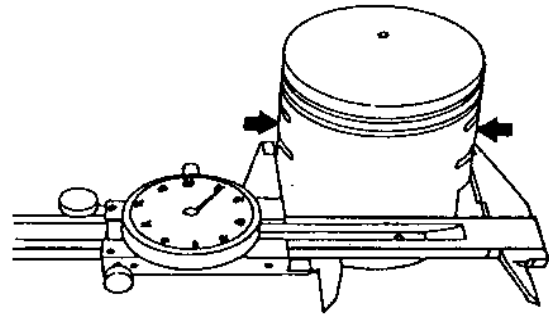
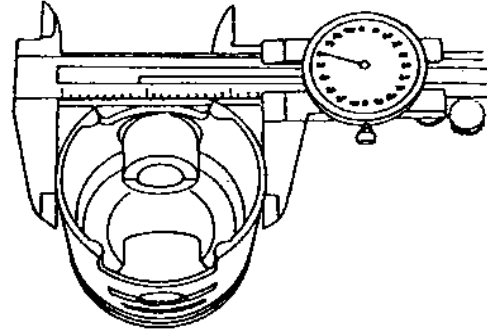


M52372 -UN-06DEC88

MX,2010BV,14 -19-16JUL96

5. Measure piston skirt outside diameter. Replace piston if skirt diameter is **less than 59.85 mm (2.357 in.)**.

6. Inspect piston for scoring and fractures. Replace if damaged.



MX,2010BV,15 -19-16JUL96

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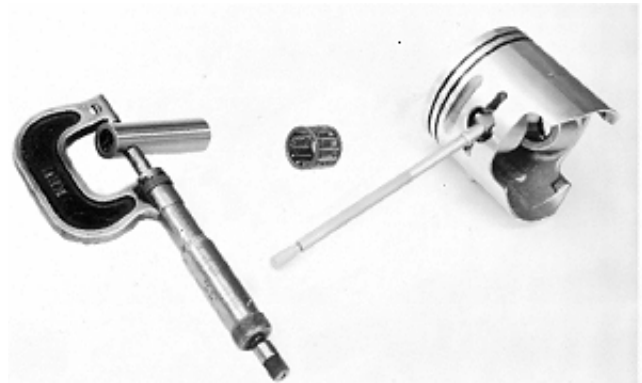
M52374 -UN-06DEC88

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7. Measure piston pin outside diameter. Replace if **less than 13.98 mm (0.551 in.)**.

8. Measure piston pin bore. Replace piston if bore is **greater than 14.04 mm (0.552 in.)**.

9. Inspect piston pin needle bearing. Replace if damaged.

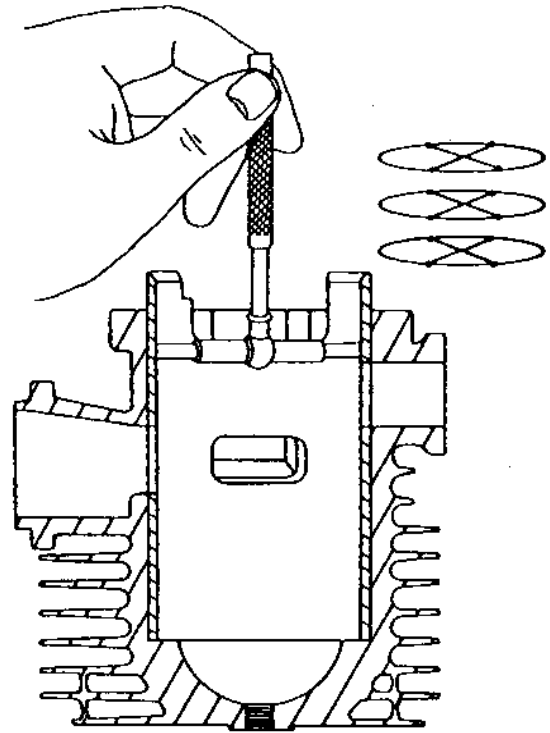


MX,2010BV,16 -19-16JUL96

M52375 -UN-06DEC88

INSPECT CYLINDER (12PB, 12PC AND 12SB)

Measure cylinder bore at top, center and bottom of ring travel. BE SURE you stay beyond the bevel surface for compressing the piston rings. Take two measurements at each level to determine out-of-round wear of cylinder bore. Replace cylinder if worn more than **60.17 mm (2.368 in.)**

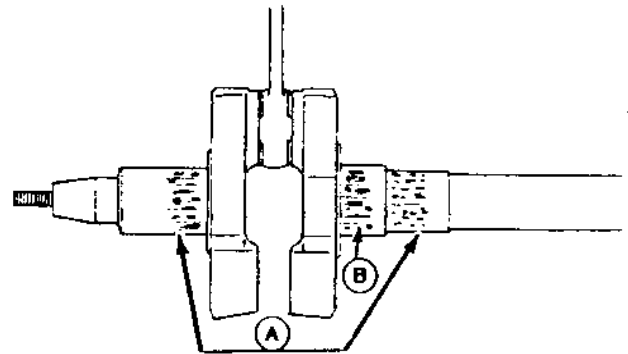


MX,2010BV,17 -19-16JUL96

M52376 -JUN-06DEC88

INSPECT CRANKSHAFT ASSEMBLY (12PB, 12PC AND 12SB)

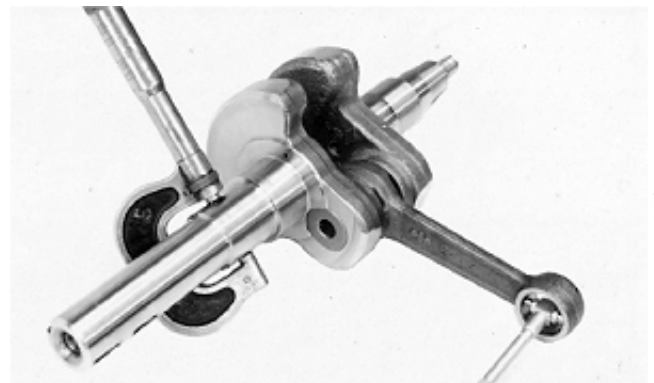
1. Clean and inspect crankshaft. Replace if main bearing journals (A) and governor flyweight assembly journal (B) are scratched or damaged.
2. Measure crankshaft main bearing journals (A). Replace crankshaft assembly if O.D. and/or out-of-round measurements are not to specifications.
3. Inspect connecting rod crankshaft bearing. Replace crankshaft assembly if bearing is damaged or loose.
4. Measure connecting rod piston end bore. Replace crankshaft assembly if bore is scored, pitted or worn out-of-round. Replace crankshaft assembly if bore is greater than specification.



M42825 -JUN-30JUL92

INSPECTION SPECIFICATIONS

Main Bearing Journals O.D.(Min.) 24.97 mm (0.983 in.)
 Journals Out-of-Round (Max.) 0.0127 mm (0.0005 in.)
 Connect'g Rod End Bore I.D.(Max.) 18.05 mm (0.710 in.)



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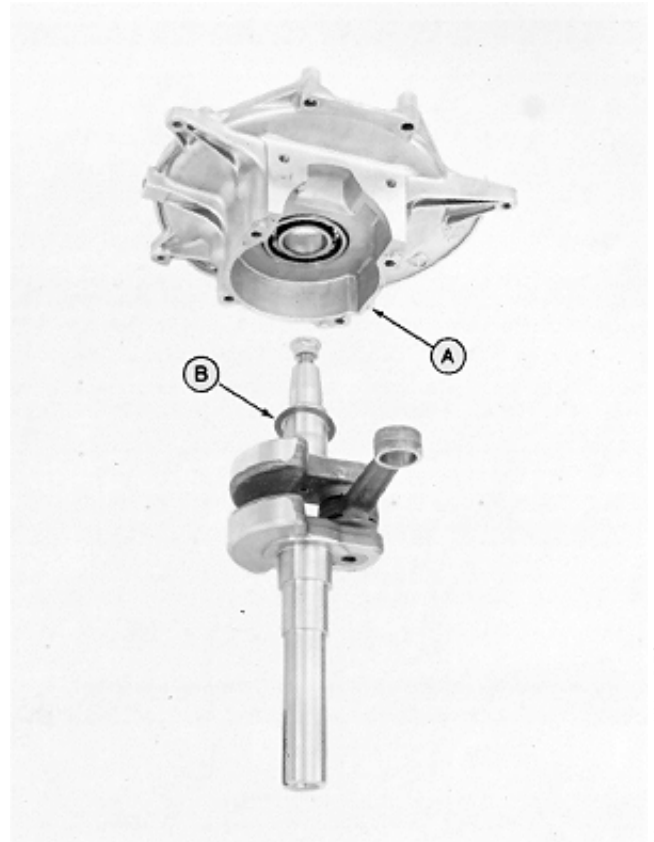
ASSEMBLE ENGINE (12PB, 12PC AND 12SB)

IMPORTANT: Coat all necessary parts with 2-cycle oil before assembly.

1. Install thrust washer (B), if equipped, to threaded flywheel end of crankshaft.

IMPORTANT: DO NOT damage crankcase oil seals when installing crankshaft.

2. Install flywheel crankcase half (A) over flywheel end of crankshaft using a soft head mallet or hydraulic press.



MX,2010BV,20 -19-16JUL96

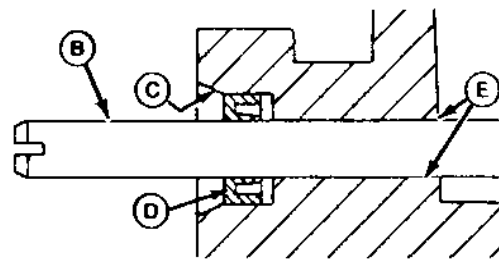
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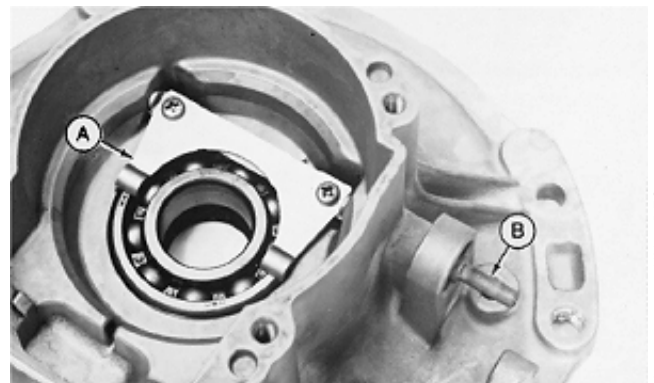
3. Install shaft seal (D) so the end is flush with the bottom of chamfer (C).

4. Install governor shaft (B) with governor plate cutout facing up. Be careful not to damage seal or shaft bearing surface (E) as you install the shaft. The opposite end of the shaft must rest in the internal recessed anchor hole of the crankcase casting.

5. Fasten governor plate (A) to shaft (B) with two screws.



A—Governor Plate
B—Governor Shaft
C—Chamfer
D—Shaft Seal
E—Shaft Bearing Surface



MX,2010BV,21A -19-16JUL96

M42826 -UN-03AUG92

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6. Position engine with output end of crankshaft facing up.

IMPORTANT: When installing governor flyweight assembly, position flyweights with wide end (B) pointing down and narrow end (A) contacting crankshaft machined surface.

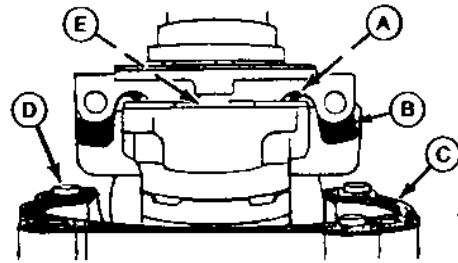
7. Install governor flyweight assembly over output end of crankshaft and onto its crankshaft journal. Align anchor pin (E) with crankshaft hole.

8. Install gasket (C) correctly over three guide pins (D) and four mounting holes of flywheel crankcase half.

9. Align output crankcase half with flywheel crankcase half guide pins (D).

10. Install four cap screws and tighten to **7 N-m (62 lb-in.)** in a crossing pattern.

IMPORTANT: Static adjustment of the governor assembly must be done whenever the engine is disassembled and re-assembled. It must also be adjusted whenever the governor plate or governor shaft are replaced (which also requires engine disassembly), or anytime the governor lever is removed or replaced.



A—Narrow End of Flyweights
B—Wide End of Flyweights
C—Gasket
D—Guide Pins (3 used)
E—Governor Assembly Anchor Pin

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MX,2010BV,21B -19-16JUL96

11. Install needle bearing (C) into end of connecting rod (D).

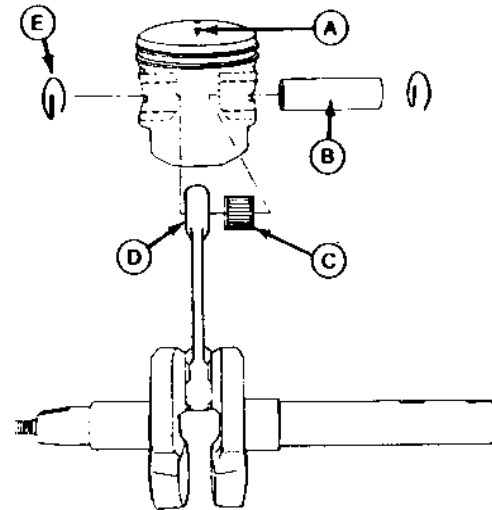
IMPORTANT: Pay close attention to the correct orientation of the piston to the connecting rod; otherwise, the piston rings may break when cylinder head is installed.

12. Orientate piston onto connecting rod with arrow (A) pointing toward exhaust port side of the engine.

NOTE: Position open end of spring clips (E) straight up or straight down in piston pin bore.

13. Fasten piston to connecting rod with piston pin (B) and spring clips (E).

- A—Arrow
- B—Piston Pin
- C—Needle Bearing
- D—Connecting Rod End
- E—Spring Clips (2 used)



MX,2010BV,22 -19-01OCT92

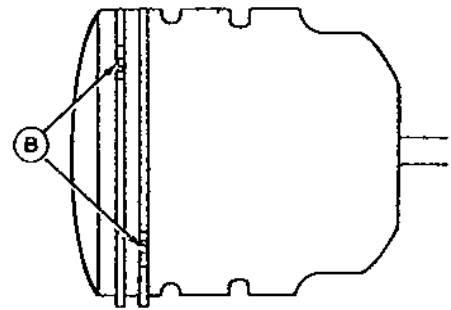
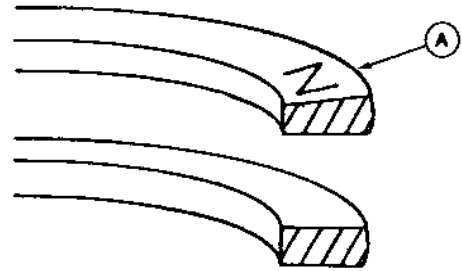
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M42828 -UN-30JUL92

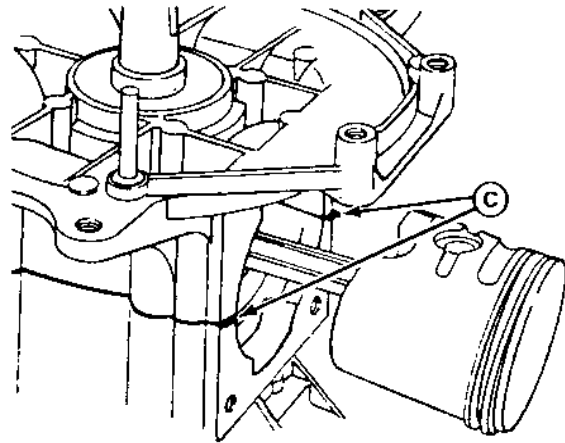
IMPORTANT: Install the piston ring (A) with stamped letter “N” in the top groove of the piston.

Lubricate piston and rings with the same 2-cycle engine oil used in the fuel/oil mixture for the engine.

14. Carefully install piston rings with JDM49 piston ring expander tool. Center each piston ring end-gap over each piston groove locator pin (B); if this isn't done, the piston ring will break and/or damage the piston and cylinder wall.



15. Trim off any excess material of the crankcase gasket (C) flush with the machined surfaces, if you haven't already done so.



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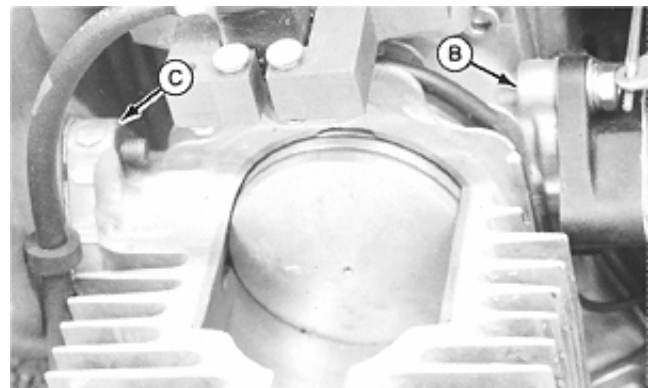
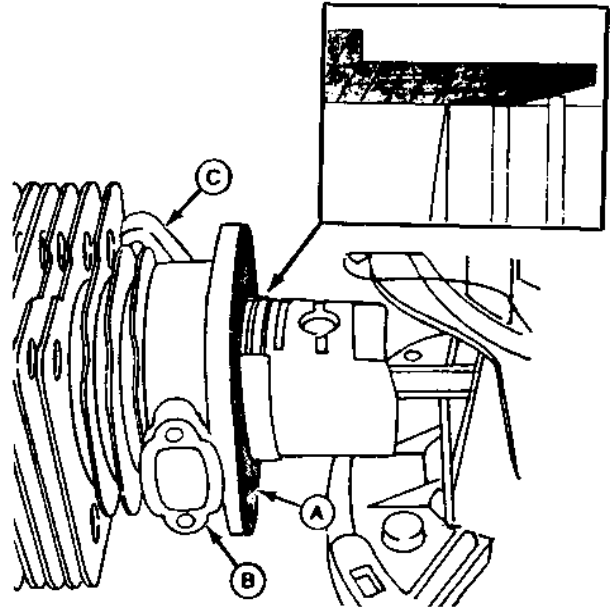
M42829

16. Install a new gasket (A) onto the cylinder head.

IMPORTANT: Pay close attention to the correct orientation of the piston to the cylinder head; otherwise, the piston rings may break when cylinder head is installed.

NOTE: The cylinder head has an internal beveled lip at its base which serves as a piston ring compressor (see inset of upper drawing).

17. Carefully install the cylinder head so the arrow on the crown of the piston is pointing towards the exhaust port (C). DO NOT install the cylinder head so arrow points towards the intake port (B).



Training Aid Cutaway View

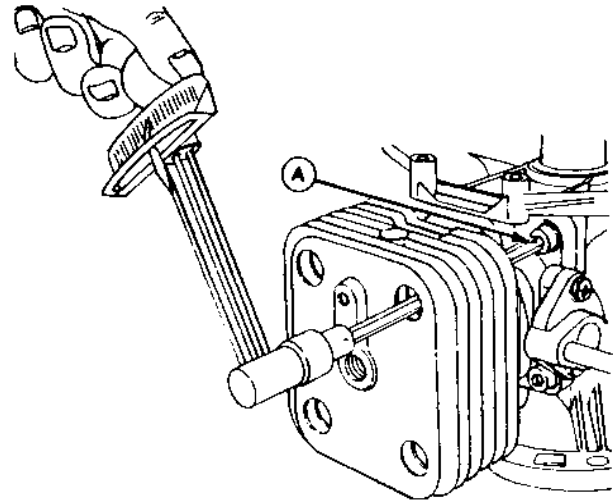
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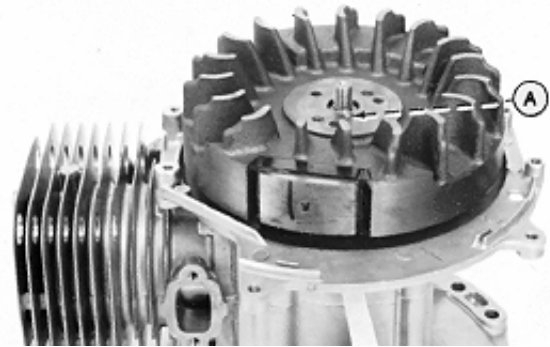
18. Install four socket head cap screws (A). Tighten to **12 N·m (110 lb-in.)** in a criss-cross pattern.



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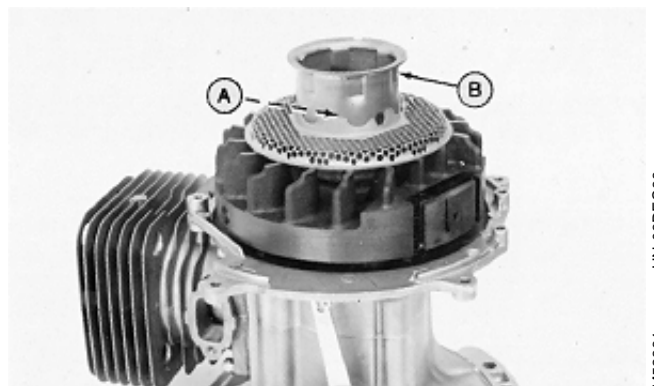
19. Install flywheel key (A) and flywheel. **DO NOT** drive flywheel on with a hammer.



MX,2010BV,25A -19-01OCT92

M52362 -UN-06DEC88

20. Install recoil start cup/screen assembly (B) with three cap screws and flywheel nut (A). Tighten cap screws to **7 N·m (62 lb-in.)** and flywheel nut to **41 N·m (30 lb-ft.)**.



MX,2010BV,25B -19-16JUL96

M52361 -UN-06DEC88

IMPORTANT: Static adjustment of the governor assembly must be done whenever the engine is disassembled and re-assembled. It must also be adjusted whenever the governor plate or governor shaft are replaced (which also requires engine disassembly), or anytime the governor lever is removed or replaced.

21. Install and adjust governor lever. Tighten cap screw and nut (A) to **3.3 N·m (30 lb-in.)**.



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MX,2010BV,26 -19-16JUL96

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22. Install new muffler gasket and muffler assembly (H). Tighten to specifications.

23. Install carburetor gaskets (new), carburetor (E), and linkage.

24. Install and adjust ignition coil (F).

25. Install engine shroud (A), front half has been cutaway. Tighten cap screws to specification.

26. Install fuel tank/engine cover assembly (B). Tighten cap screws to specification.

27. Install recoil start assembly and cover (C). Tighten cap screws to specification.

28. Install air filter assembly (D). Tighten hardware to specifications.

29. Install spark plug (G). Tighten to specification.

30. Install engine in mower.

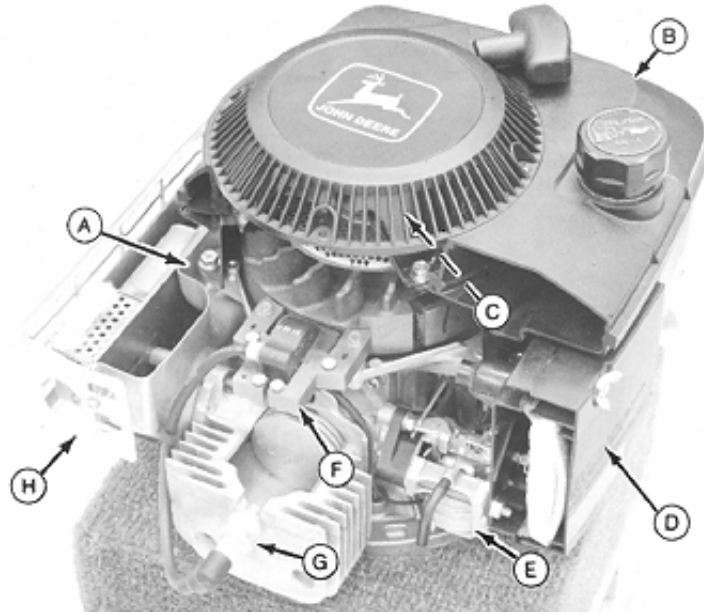
INSPECTION SPECIFICATION

Ignition Coil Air Gap 0.20-0.40 mm (0.008-0.016 in.)

TORQUE SPECIFICATIONS

Fuel Tank Cap Screws 3 N·m (27 lb-in.)
Ignition Coil Screws 4 N·m (35 lb-in.)
Cylinder Cap Screws 12 N·m (106 lb-in.)
Flywheel Nut 41 N·m (30 lb-ft.)
Spark Plug 18 N·m (160 lb-in.)
Carburetor/Air Filter Nuts 4 N·m (35 lb-in.)
Muffler Cap Screws 10 N·m (87 lb-in.)
Engine Shroud Cap Screws 4 N·m (35 lb-in.)
Recoil Start Cup/Screen Screws 7 N·m (62 lb-in.)
Recoil Start Cover Screws 3 N·m (27 lb-in.)
Engine Mount Cap Screw 27 N·m (20 lb-ft.)

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A—Engine Shroud
B—Fuel Tank/Engine Cover
Assembly

C—Recoil Start Cover and
Assembly
D—Air Filter Assembly

E—Carburetor Assembly and
Linkage
F—Ignition Coil

G—Spark Plug
H—Exhaust Muffler Assembly

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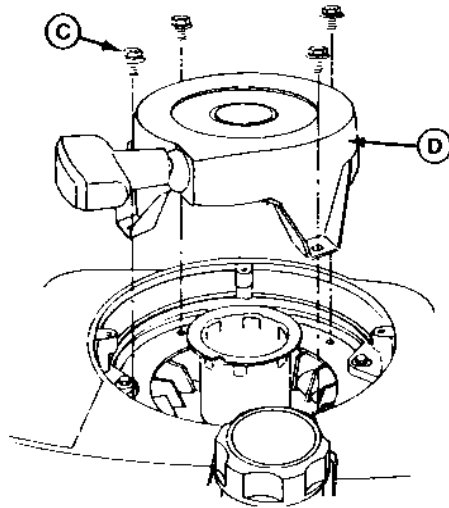
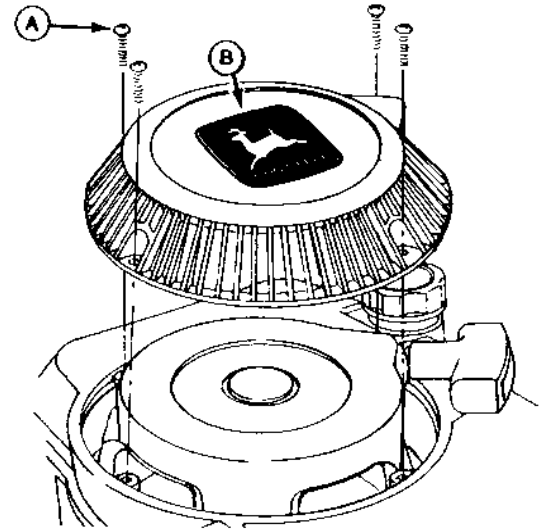
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Recoil Start Repair—B&S 2-Cycle Engine (12PB, 12PC and 12SB)

DISASSEMBLE RECOIL START (12PB, 12PC AND 12SB)

1. Remove four screws (A) to remove recoil start cover (B); then, remove four cap screws (C) to remove recoil start assembly (D).

- A—Screws (4 used)
- B—Cover
- C—Cap Screws (4 used)
- D—Recoil Start Assembly



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2. Pull handle out about 30 cm (1 ft) and tie knot (A) to prevent rope from winding back onto reel.

3. Remove insert (B) and untie knot. You may have to use two pairs of needle nose pliers to accomplish this.

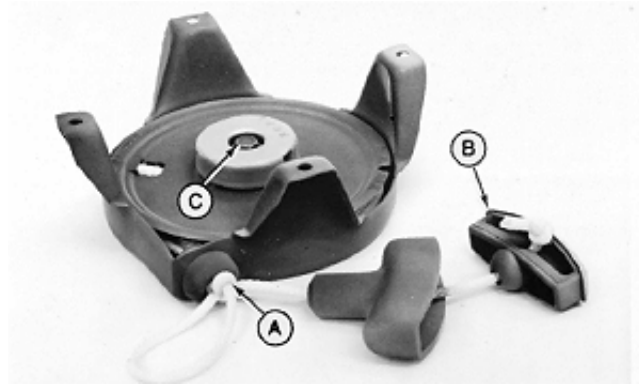
4. Remove insert and handle from rope.

NOTE: DO NOT let reel recoil freely or rope may get wedged between reel and housing.

5. While holding reel with thumb, untie knot (A); then, slowly release reel spring tension until it is completely relaxed.

CAUTION: Wear gloves and protective goggles for remaining steps.

6. Turn cap screw (C) counterclockwise (right-hand threads) to remove it and the retainer.



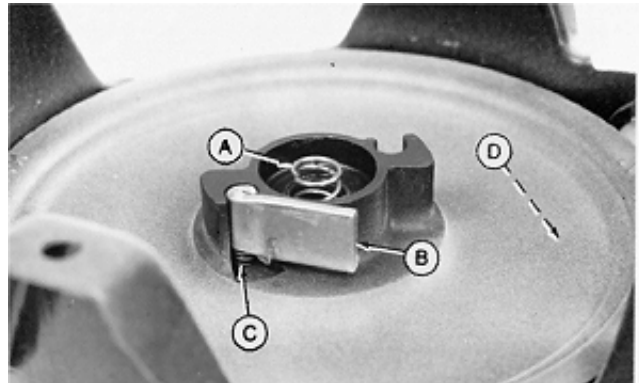
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7. Remove spring (A), pawl (B) and spring (C).

CAUTION: The preloaded recoil spring (D) operates under spring tension and it must be completely released before removing reel.

- A—Retainer Spring
- B—Pawl
- C—Pawl Spring
- D—Reel Spring



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MX,2015BV,2 -19-01OCT92

8. Remove reel while holding spring.

9. Remove rope from reel.



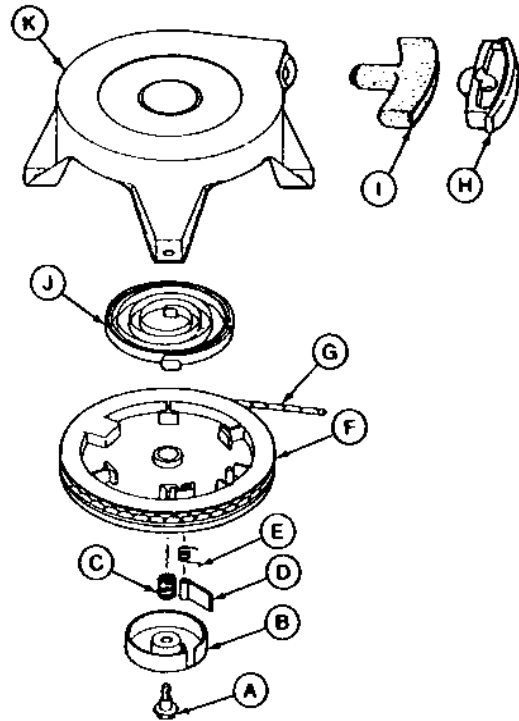
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EXPLODED VIEW—RECOIL START ASSEMBLY (12PB, 12PC AND 12SB)

1. Inspect for damaged or worn parts and replace as necessary.

- A—Cap Screw
- B—Retainer
- C—Retainer Spring
- D—Pawl
- E—Pawl Spring
- F—Reel
- G—Rope
- H—Handle Insert
- I—Handle
- J—Recoil Spring
- K—Housing

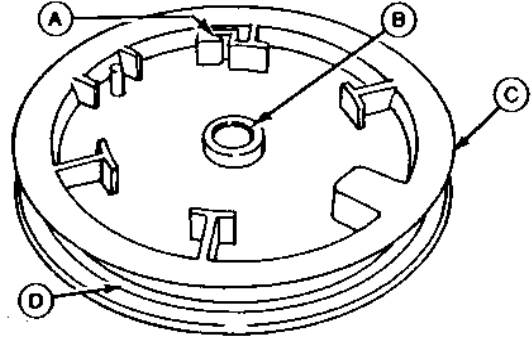


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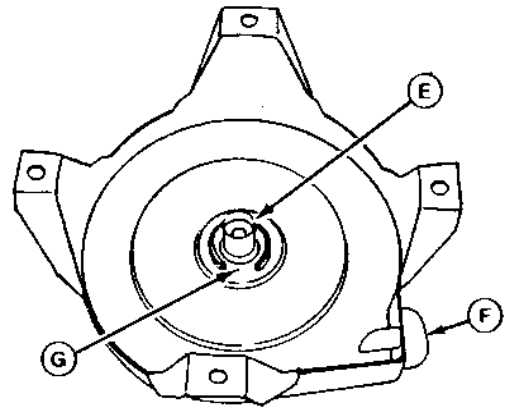
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2. Inspect reel outside anchor (A), center hole (B), edges (C) and groove (D) for burrs, nicks, cuts, and the like. Replace as necessary.



3. Inspect recoil housing center pivot post (E), rope guide (F) and inner spring anchor (G) for damaged or worn areas. Replace as necessary.

- A—Reel Outside Anchor
- B—Center Hole
- C—Edges
- D—Reel Groove
- E—Pivot Post
- F—Rope Guide
- G—Reel Inner Anchor



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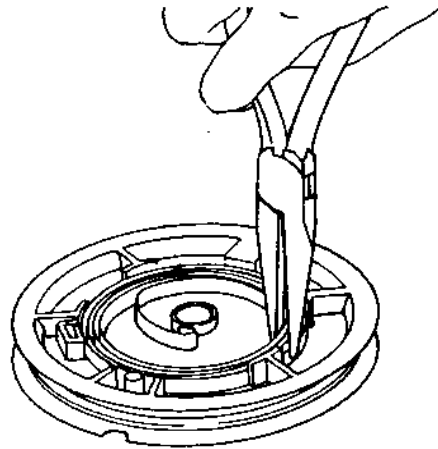
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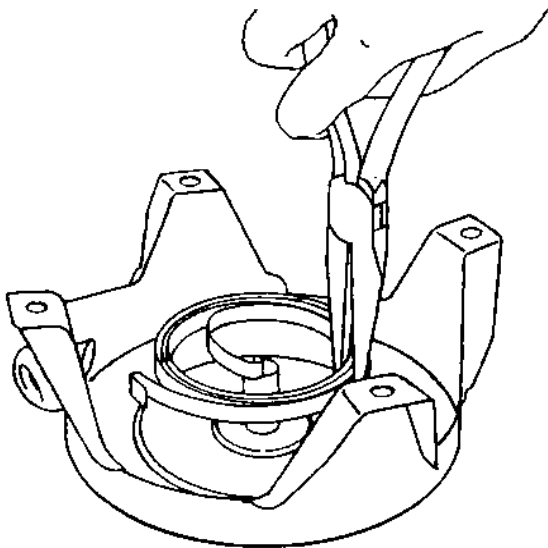
REPLACE RECOIL START SPRING (12PB, 12PC AND 12SB)



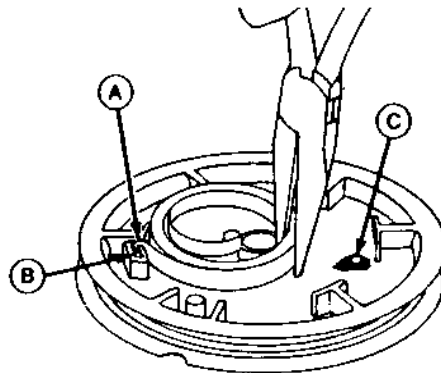
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M42832 -JUN-30JUL92



M42833 -JUN-30JUL92



M42834 -JUN-30JUL92

CAUTION: Spring is wound under tension. DO NOT let spring fly loose. Hold spring firmly in place while replacing. Wear safety glasses and gloves to protect yourself from possible injury.

1. Working from the center to the outside, carefully unwind spring from the reel by hand or use needle nose pliers to remove and set inside metal housing to safely let spring unwind.

2. Clean and inspect spring for damage or kinked areas. Replace as necessary.

3. Apply a small amount of multi-purpose grease (C) to spring area of reel.

4. By hand or with pliers, hook spring outside tang (A) into reel anchor slot (B). Working toward center, carefully install spring into reel or release pliers while holding in place with your other hand.

ASSEMBLE RECOIL START (12PB, 12PC AND 12SB)

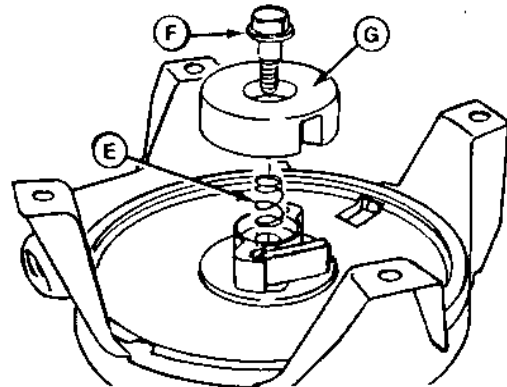
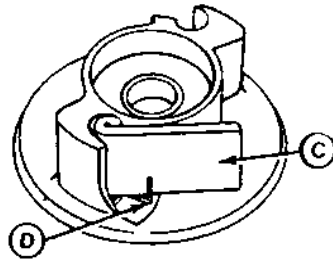
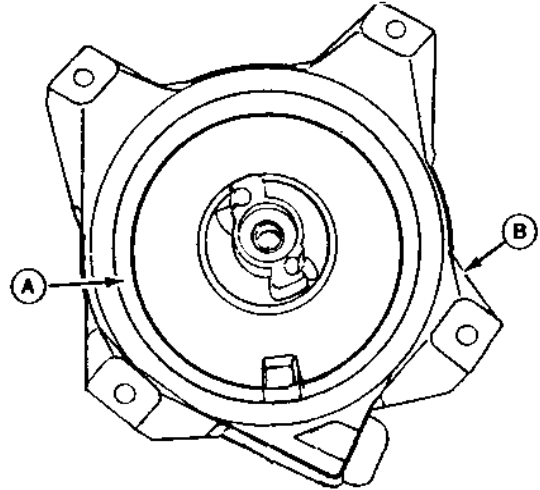
1. Carefully turn reel and recoil spring assembly (A) over and install inside recoil housing (B). Be sure reel and spring are properly seated before continuing; otherwise, you may damage the spring.

2. Turn reel counterclockwise until you feel the spring's inside tang catch on the housing inner anchor (spring tension will be noticed).

3. Install straight end of pawl spring down inside reel recess; then, install pawl (C) on top of pawl spring and behind bent anchor end (D) of pawl spring.

4. Install retainer spring (E), retainer (G), and cap screw (F). DO NOT tighten at this time.

- A—Reel and Recoil Spring Assembly
- B—Recoil Housing
- C—Pawl
- D—Pawl Spring Bent Anchor End
- E—Retainer Spring
- F—Cap Screw
- G—Retainer



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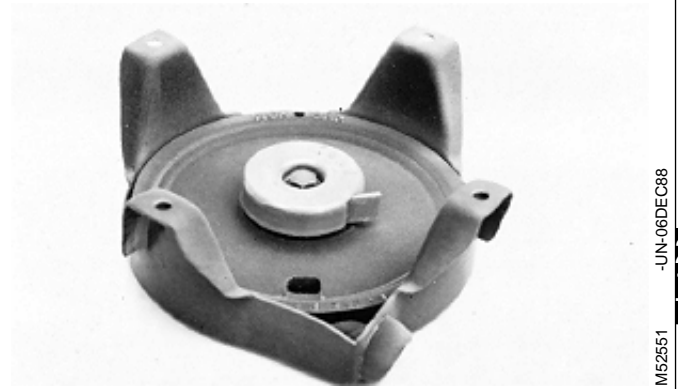
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5. Rotate retainer clockwise until pawl extends through retainer slot. Hold retainer in this position as you tighten cap screw to **3 N·m (27 lb-in.)**.



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6. Tie a figure eight knot in end of the rope.

7. Turn reel counterclockwise to preload spring and align hole in reel with rope guide (A). Hold reel in this position.

8. With your other hand, feed the untied end of the rope through holes in reel and rope guide (A).

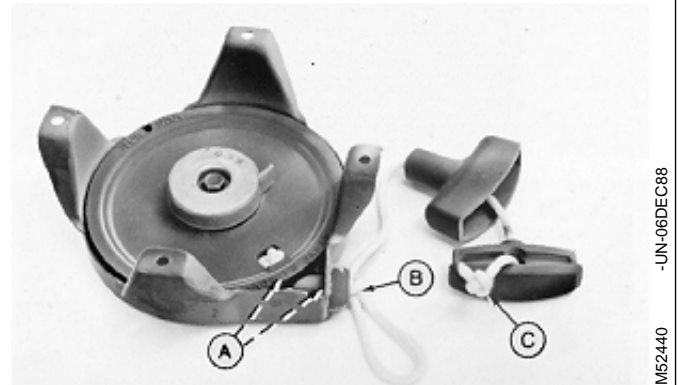
9. Tie knot (B) about 30 cm (1 ft) from end of rope. Allow rope to slowly retract into reel until it stops at the knot.

10. Feed untied end of rope through handle and insert. Tie knot (C).

11. Put insert inside handle.

12. Untie knot (B) and slowly allow to recoil.

13. Pull rope several times to check for proper operation.



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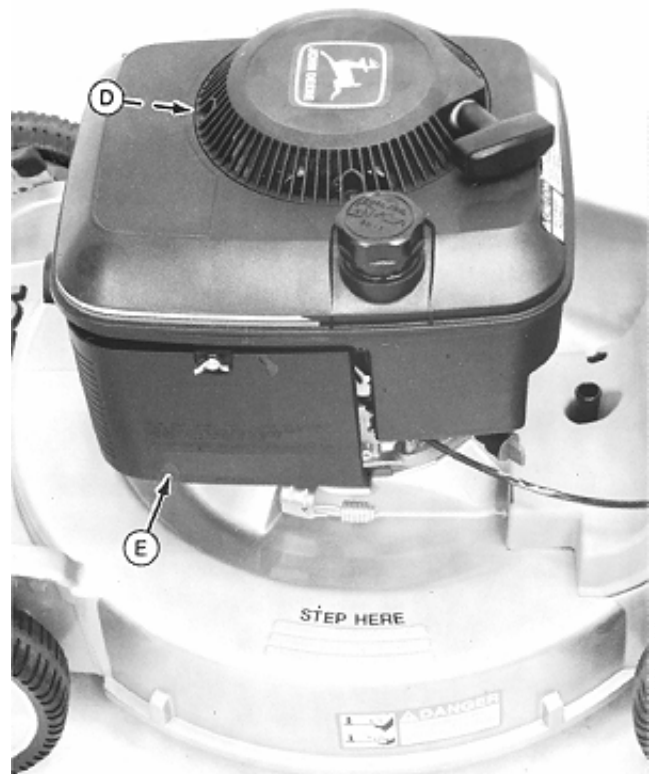
INSTALL RECOIL START ASSEMBLY (12PB, 12PC AND 12SB)

1. Orientate recoil start assembly so handle is pointing to the left side of the mower where the operator can utilize the step ribs of the deck to help start the engine.
2. Align the four mounting legs of the recoil start assembly with the engine shroud mounting holes.
3. Fasten with four cap screws (A). Tighten screws to **7 N-m (62 lb-in.)**.
4. Install fuel tank/engine cover assembly (B) and fasten with screws and washers (C). Tighten screws to **3 N-m (27 lb-in.)**.
5. Orientate recoil start cover cutout over T-handle and four mounting holes with engine mounting holes.
6. Fasten with four screws (D). Tighten screws to **3 N-m (27 lb-in.)**.
7. Install air cleaner assembly (E).
8. Disconnect spark plug lead and pull recoil start T-handle several times to check for smooth operation and complete retractability. Connect spark plug lead.

- A—Screws (4 used)
- B—Fuel Tank/Engine Cover Assembly
- C—Cap Screws and Washers (3 used)
- D—Recoil Start Cover Screws (4 used)
- E—Air Cleaner Assembly



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-UN-30JUL92

MX,2015BV,8A -19-16JUL96

Section 21

ENGINE REPAIR—BRIGGS & STRATTON 4-CYCLE ENGINE (14PZ/14SZ)

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Remove and Install Engine Fan Shroud	21-10-7	
Remove and Install Flywheel	21-10-7	
Remove and Install Cylinder Head	21-10-10	
Remove and Install Breather	21-10-11	
Remove and Install Intake/Exhaust Valves	21-10-14	
Inspect Intake/Exhaust Valves	21-10-16	
Analyze Intake/Exhaust Valves	21-10-16	
Inspect Intake/Exhaust Valve Seats	21-10-18	
Recondition Valves and Seats	21-10-18	
Reseat Valve Seats	21-10-19	
Inspect Valve Guides	21-10-20	
Lap Valves and Seats	21-10-20	
Adjust Valve-to-Tappet Clearance	21-10-21	
Adjust Crankshaft End Play	21-10-22	
Remove and Install Crankcase Cover	21-10-24	
Remove and Install Governor Assembly	21-10-25	
Remove and Install Governor Shaft	21-10-26	
Remove and Install Camshaft Assembly	21-10-27	
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Remove and Install Crankshaft	21-10-30	
Inspect Crankshaft	21-10-30	
Inspect Crankshaft Bearings	21-10-31	
Remove and Install Oil Seals	21-10-32	
Remove and Install Piston Assembly	21-10-33	
Inspect Piston and Rings	21-10-35	
Remove and Install Piston Rings	21-10-40	
Remove and Install Connecting Rod	21-10-41	
Inspect Cylinder Block	21-10-42	
Rebore Cylinder Block	21-10-43	
Group 15—Recoil Start		
Disassemble and Assemble Recoil Start	21-15-1	
Replace Recoil Start	21-15-4	

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Group 05

Remove and Install B&S 4-Cycle Engine (14PZ/14SZ)

OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Prevents fasteners from loosening.
M79292	MPG-2® DuBois Multi-Purpose Polymer Grease, NLGI Grade 1	Apply to any mating surfaces that might seize to each other over long periods of time.

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

MX,2105BV,1 -19-16JUL96

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REMOVE AND INSTALL ENGINE—PUSH MOWER (14PZ)

1. Disconnect spark plug lead (C).
2. Remove blade.

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe up any spilled fuel IMMEDIATELY.

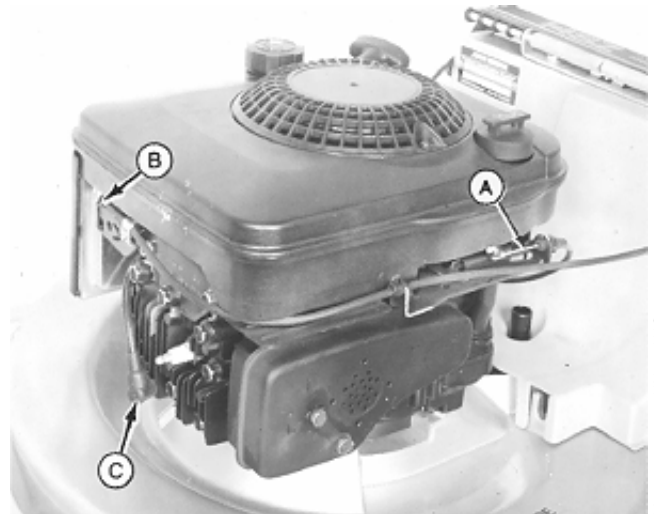
NOTE: Fuel shut-off valves have been eliminated on later models (engines marked 12F702).

3. Turn shut-off valve (D) vertically to OFF position and place a shop cloth underneath valve to catch any fuel that might run out.
4. Move hose clamp (E) away from valve to disconnect carburetor inlet hose.

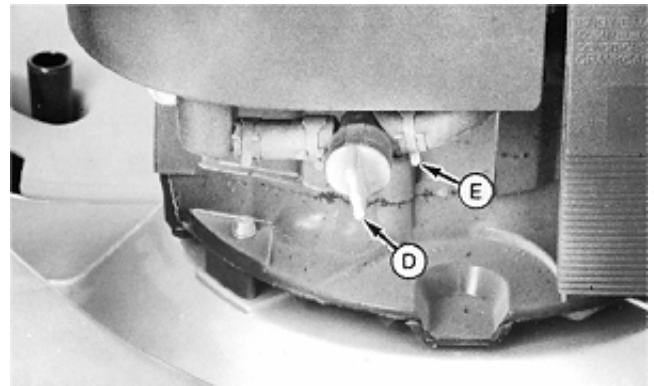
NOTE: Approximate fuel tank capacity is 1.4 L (1.5 qt).

5. Put valve into a small funnel and open valve to drain tank into a suitable and clearly marked container.
6. Loosen throttle cable clamp (F) to disconnect throttle control cable (B) from carburetor linkage.

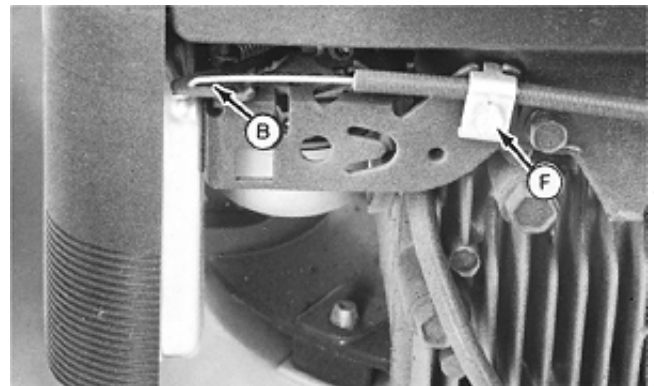
A—Brake Cable
B—Throttle Cable
C—Spark Plug Lead
D—Shut-Off Valve
E—Hose Clamp
F—Cable Clamp



M54386 -UN-03AUG92



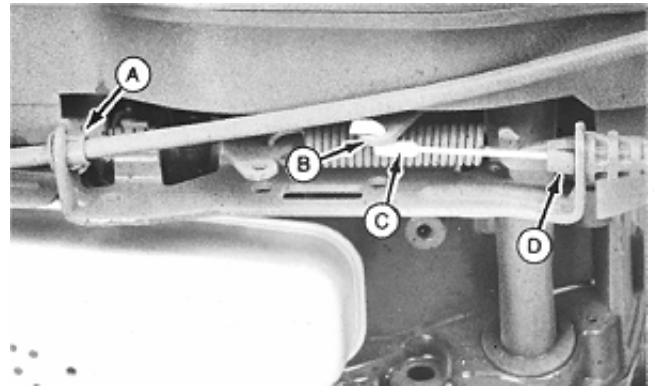
M42846 -UN-03AUG92



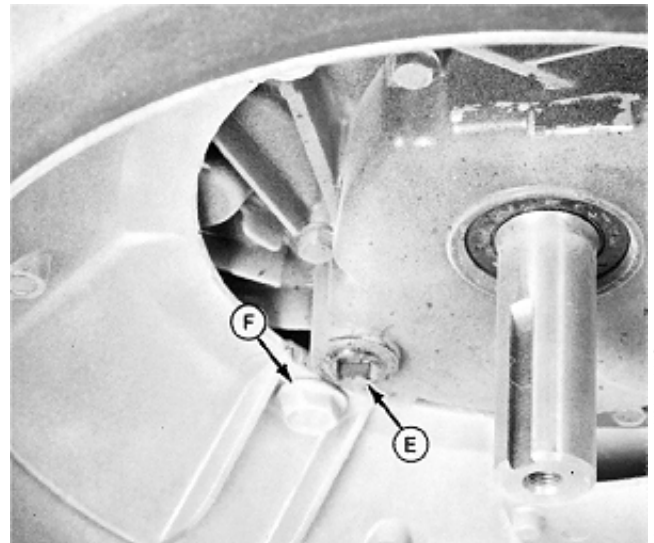
M42848 -UN-03AUG92

MX.2105BV,2 -19-16JUL96

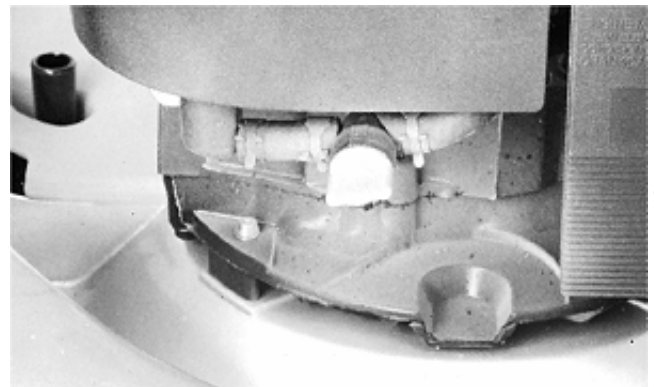
7. Remove throttle cable and grommet (A) from bracket.
8. Push brake arm (B) rearward to disconnect brake cable anchor (C).
9. Remove brake cable grommet (D) from bracket.
10. Safely put mower up on blocks or jack stands and remove plug (E) to drain engine oil into a suitable container.
11. Remove three engine mount cap screws (F).
12. Remove engine from mower deck.
13. Make engine repairs as necessary.
14. Coat threads of engine mount cap screws and oil drain plug with John Deere medium strength thread lock and sealer—T43512.
15. Install engine in mower deck and fasten with three mount cap screws (F). Tighten to **27 N·m (20 lb-ft)**.
16. Install engine oil drain plug (E). Tighten to **27 N·m (20 lb-ft)**.
17. Install blade.
18. Safely remove mower from blocks or jack stands.
19. Connect cables in reverse order of removal.
20. Adjust throttle control cable.
21. Connect fuel line to shut-off valve in reverse order of disconnection and turn valve horizontally to the OPEN position.
22. Fill engine with proper oil. (See Section 10, Group 20.)
23. Fill tank with proper gasoline. (See Section 10, Group 20.)



M42849
-UN-03AUG92



M42850
-UN-03AUG92



M42847
-UN-03AUG92

- A—Throttle Cable Grommet
- B—Brake Arm
- C—Brake Cable Anchor
- D—Brake Cable Grommet
- E—Oil Drain Plug
- F—Engine Mount Cap Screws (3 used)

REMOVE AND INSTALL ENGINE—SELF-PROPELLED MOWER (14SZ)

1. Disconnect spark plug lead (C).

⚠ CAUTION: Blade is sharp. Wear gloves when working with blade to avoid injury.

2. Remove blade.

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe up any spilled fuel IMMEDIATELY.

NOTE: Fuel shut-off valves have been eliminated on later models (engines marked 12F702).

3. Turn shut-off valve (D) vertically to OFF position and place a shop cloth underneath valve to catch any fuel that might run out.

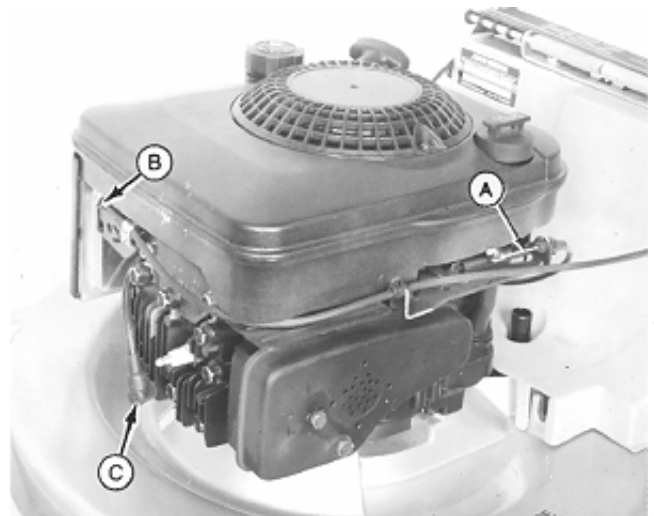
4. Move hose clamp (E) away from valve to disconnect carburetor inlet hose.

NOTE: Approximate fuel tank capacity is 1.4 L (1.5 qt).

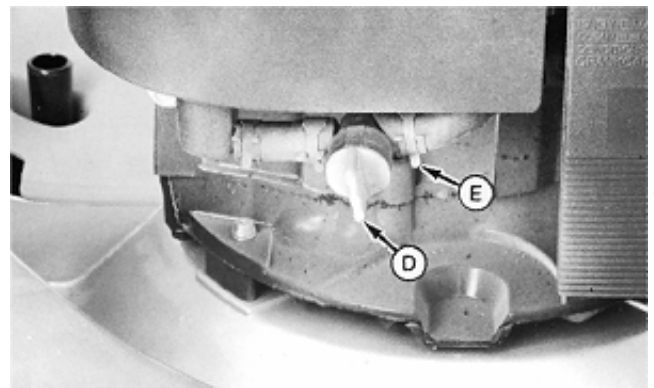
5. Put valve into a small funnel and open valve to drain tank into a suitable and clearly marked container.

6. Loosen throttle cable clamp (F) to disconnect throttle control cable (B) from carburetor linkage.

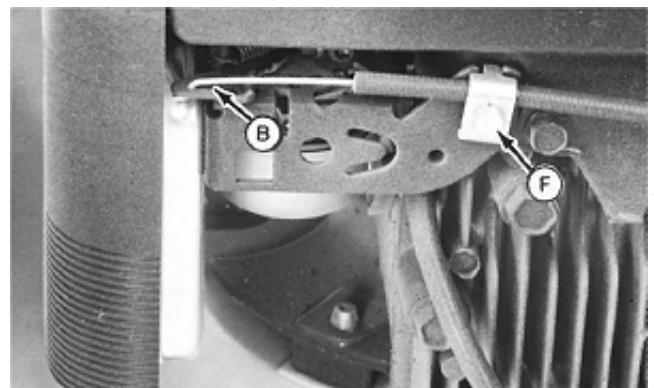
A—Brake Cable
B—Throttle Cable
C—Spark Plug Lead
D—Shut-Off Valve
E—Hose Clamp
F—Cable Clamp



M54386 -UN-03AUG92



M42846 -UN-03AUG92

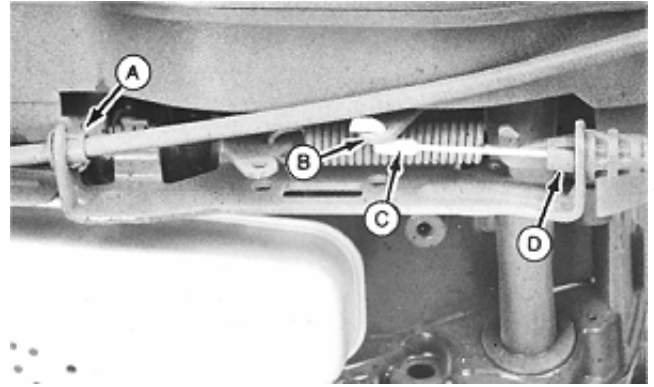


M42848 -UN-03AUG92

MX.2105BV,4 -19-16JUL96

7. Remove throttle cable and grommet (A) from bracket.
8. Push brake arm (B) to the rear to disconnect brake cable anchor (C).
9. Remove brake cable grommet (D) from bracket.

A—Throttle Cable Grommet
B—Brake Arm
C—Brake Cable Anchor
D—Brake Cable Grommet



MX,2105BV,7 -19-16JUL96

M42849 -JUN-03AUG92

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10. Safely put mower up on blocks or jack stands and remove oil drain plug (C) to drain oil.

11. Remove three engine mounting cap screws (D).

12. Slide engine rearward until belt drive sheave (B) clears belt guide fingers (A) and drive belt.

13. Remove engine from mower deck and loosen set screw (E) to remove belt drive sheave and woodruff key (F).

14. Make engine repairs as necessary.

15. Coat crankshaft, key, and inside of sheave with MPG-2® DuBois Multi-Purpose Polymer Grease, NLGI Grade 1 (M79292). Install key (F) into upper output shaft keyway and slide on belt drive sheave (B) to **38 mm (1.5 in.) (G)**. Tighten set screw (E) to **5 N·m (44 lb-in.)**.

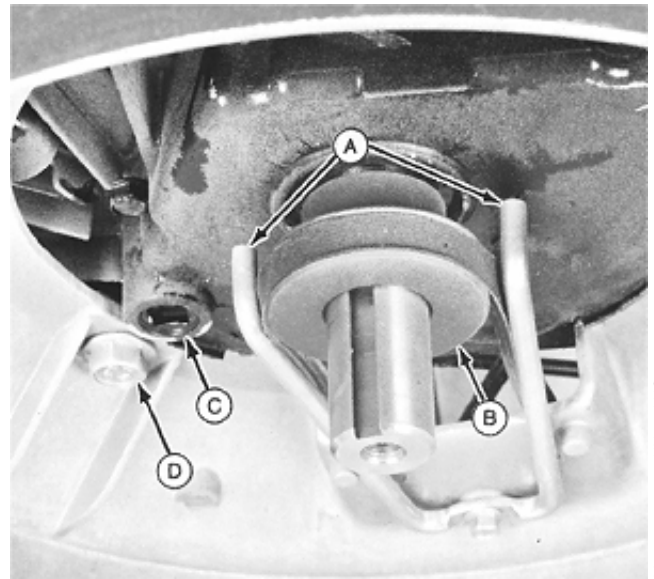
16. Align engine drive sheave (B) with drive belt and center it between belt guide fingers (A).

NOTE: Coat threads of three engine mount cap screws with John Deere medium strength thread lock and sealer—T43512.

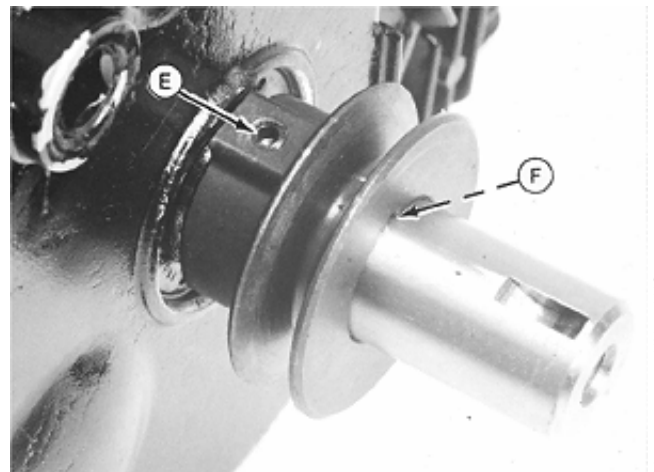
17. Fasten engine to mower deck with three mounting cap screws (D). Tighten to **27 N·m (20 lb-ft.)**.

18. Install and tighten engine oil drain plug (C) to **27 N·m (20 lb-ft.)**.

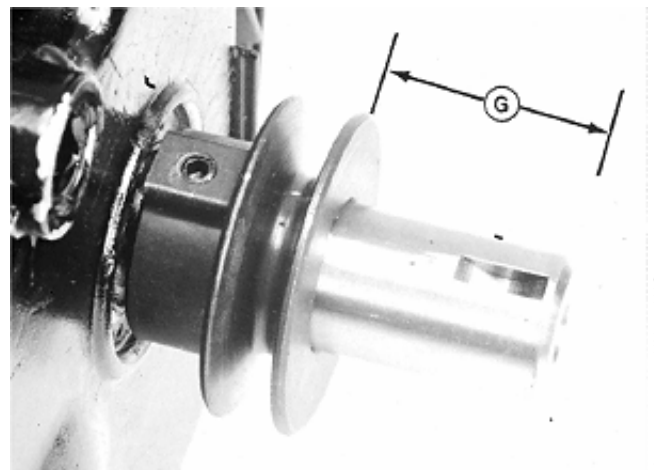
- A—Belt Guide Fingers
- B—Belt Drive Sheave
- C—Oil Drain Plug
- D—Engine Mount Cap Screws (3 used)
- E—Set Screw
- F—Woodruff Key
- G—38 mm (1.5 in.)



-UN-03AUG92
M42851

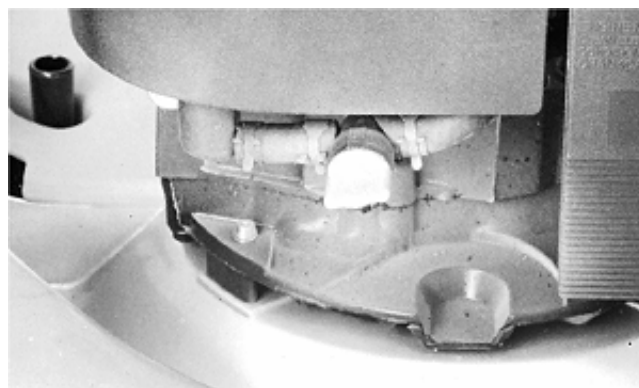
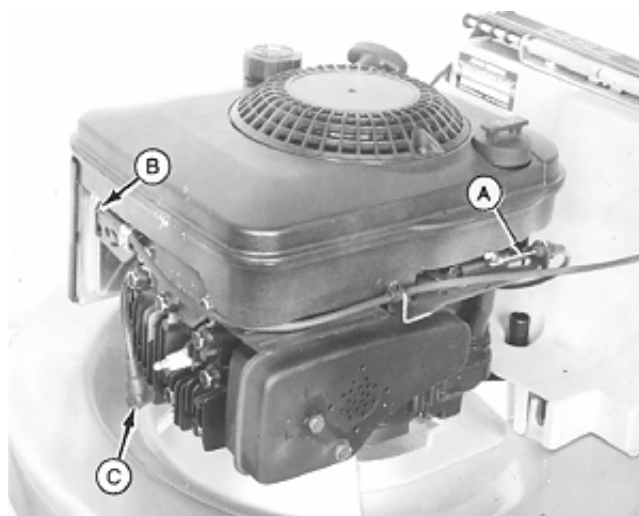


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M42852



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M42853

19. Install blade.
20. Safely remove mower from blocks or jack stands.
21. Connect brake (A) and throttle (B) control cables in reverse order of removal and connect spark plug lead (C).
22. Adjust throttle control cable.
23. Connect fuel line to shut-off valve in reverse order of disconnection and turn valve horizontally to the OPEN position.
24. Fill engine with proper oil. (See Section 10, Group 20.)
25. Fill tank with proper gasoline. (See Section 10, Group 20.)



M54386 -JUN-03AUG92

M42847 -JUN-03AUG92

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MX,2105BV,9 -19-16JUL96

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Disassemble Engine—B&S 4-Cycle Engine (14PZ and 14SZ)

ESSENTIAL TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

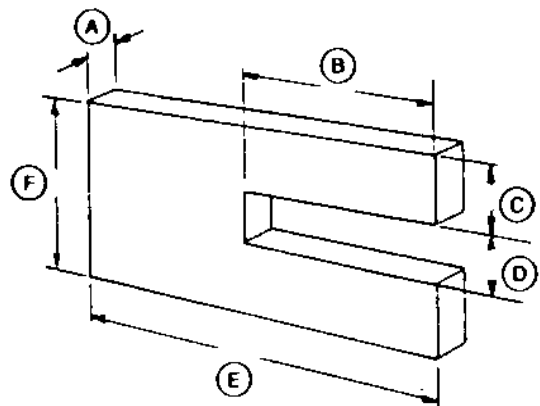
Number	Name	Use
JDG49	Piston Ring Expander Tool	Remove piston rings.
D01204AA	2-Jaw Puller	Remove flywheel and crankcase halves.
JDM46-2	Valve Guide Reject Gauge (Go-No Go Type)	Test for valve guide wear.
JDM46-14 or JDM70	Valve Spring Compressor	Compress valve springs.
JDM52A	Valve Seat Service Kit	Recondition valve seats.
JDG432 (Part of JDG430 Valve Seat Repair Kit)	Valve Seat Driver	Install valve seats.
JDG554 (Use with JDG433 Puller Kit of JDG430 Valve Seat Repair Kit)	Valve Seat Installer Pilot	Install valve seats.

MX,2110BV,A -19-16JUL96

FABRICATED TOOLS

Piston Support Tool—Make from a piece of wood according the dimensions given. Use to stop crankshaft rotation during disassembly procedures.

- A—25 mm (1 in.)
- B—76 mm (3 in.)
- C—28 mm (1-1/8 in.)
- D—22 mm (7/8 in.)
- E—152 mm (6 in.)
- F—76 mm (3 in.)

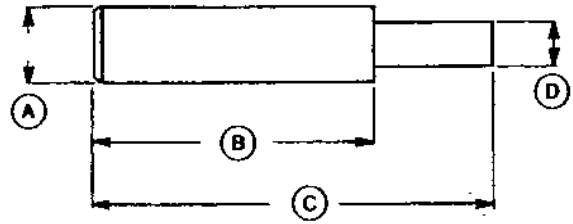


M42817 -UN-03AUG92

MX,2110BV,1B -19-16JUL96

Piston Pin Tool—Make from a piece of wooden dowel according to the dimensions given. Use to drive piston pin from piston and connecting rod.

- A—13 mm (1/2 in.)
- B—60 mm (2-23/64 in.)
- C—85 mm (3-11/32 in.)
- D—9 mm (11/32 in.)



MX,2110BV,1C -19-01OCT92

M42B18 -UN-03AUG92

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OTHER MATERIAL

Number	Name	Use
T43512	John Deere Thread Lock and Sealer (Medium Strength)	Apply to threads of cylinder cap screws.

MX,2205BV,1E -19-16JUL96

SERVICE PARTS KITS

The following kit is available through your parts catalog:

Engine Gasket Kit.

MX,2110BV,2A -19-01OCT92

EXPLODED VIEW—BRIGGS & STRATTON 4-CYCLE ENGINE (14PZ AND 14SZ)

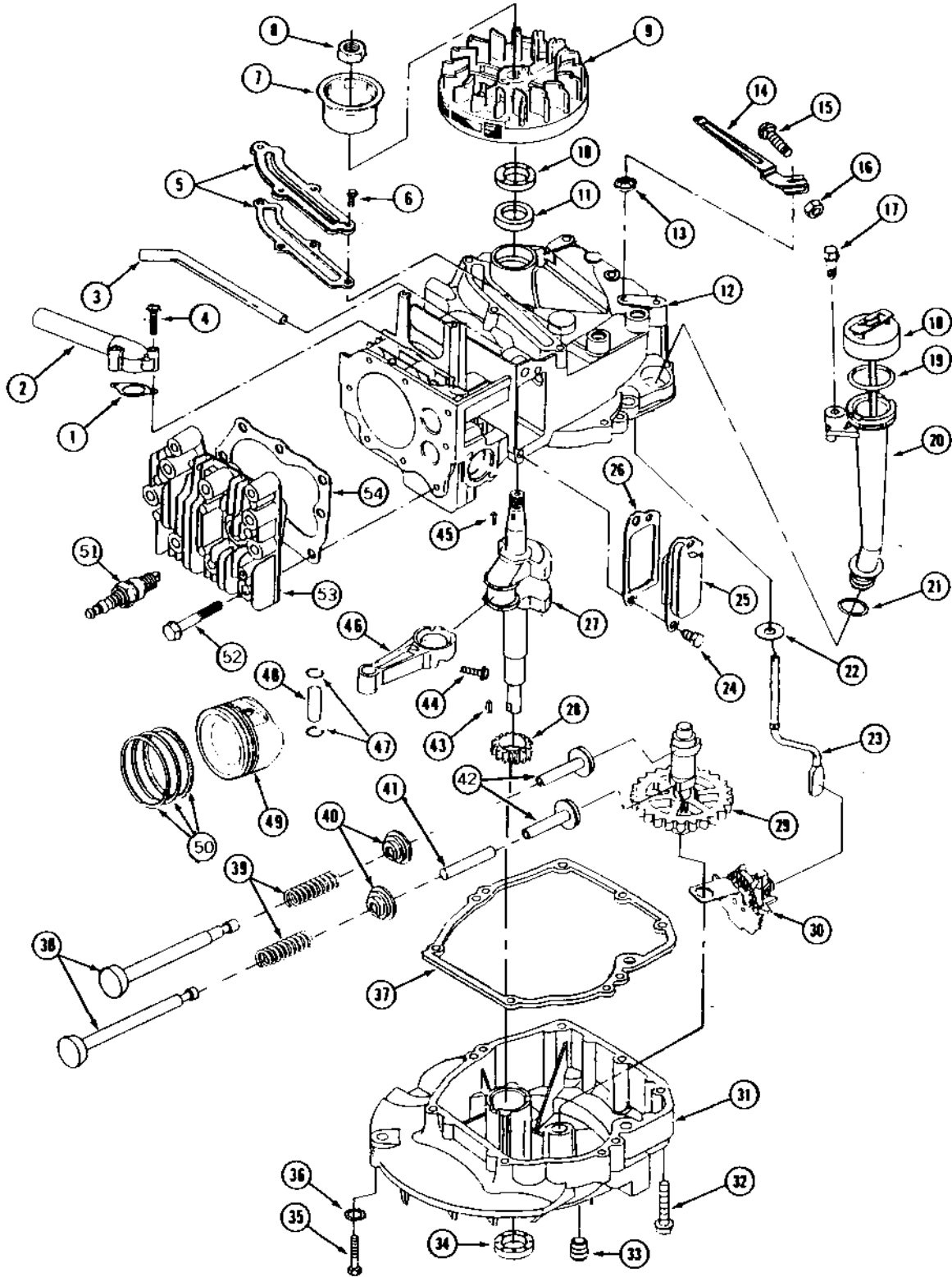
1—Intake Gasket	14—Governor Lever	29—Camshaft Assembly	43—Lower Crankshaft
2—Intake Tube	15—Cap Screw	30—Governor Assembly	Woodruff Key
3—Breather Tube	16—Nut	31—Lower Crankcase Half	44—Cap Screws (2 used)
4—Cap Screws (2 used)	17—Cap Screw	32—Cap Screws (7 used)	45—Upper Crankshaft
5—Breather Channel Cover	18—Dip Stick	33—Drain Plug	Woodruff Key
Halves	19—O-Ring	34—Seal	46—Connecting Rod
6—Cap Screws (4 used)	20—Fill Tube	35—Cap Screws (3 used)	47—Spring Clips (2 used)
7—Flywheel Recoil Start Cup	21—O-Ring	36—Lock Washer (3 used)	48—Piston Pin
8—Flywheel Nut	22—Washer	37—Crankcase Gasket	49—Piston
9—Flywheel	23—Governor Shaft	38—Intake/Exhaust Valves	50—Piston Rings (3 used)
10—Seal	24—Cap Screws (2 used)	39—Valve Springs	51—Spark Plug
11—Bushing	25—Breather Assembly	40—Spring Retainers	52—Cap Screws (8 used)
12—Upper Crankcase	26—Breather Gasket	41—Exhaust Valve Guide	53—Cylinder Head
Housing	27—Crankshaft	42—Tappets	54—Gasket
13—Governor Shaft Pushnut	28—Crankshaft Gear		

This exploded view is provided to you as a reference for disassembly and assembly of the Briggs & Stratton 4-Cycle Engine.

NOTE: Coat all appropriate parts with specified engine oil before assembly.

Design and specifications subject to change without notice.

MX,2110BV,2B -19-16JUL96



BRIGGS & STRATTON 4-CYCLE ENGINE

M42810

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M42810 -JUN-21AUG92

REMOVE AND INSTALL AIR FILTER ASSEMBLY (14PZ AND 14SZ)

See Fuel and Air System—B&S 4-Cycle Engine, in Section 31, Group 05 for removal and installation procedures.

MX,2110BV,3 -19-16JUL96

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REMOVE AND INSTALL CARBURETOR ASSEMBLY (14PZ AND 14SZ)

See Fuel and Air System—B&S 4-Cycle Engine, in Section 31, Group 10 for removal and installation procedures.

MX,2110BV,4 -19-16JUL96

REMOVE AND INSTALL FUEL TANK ASSEMBLY (14PZ AND 14SZ)

See Fuel and Air System—B&S 4-Cycle Engine, in Section 31, Group 15 for removal and installation procedures.

MX,2110BV,5 -19-16JUL96

REMOVE AND INSTALL EXHAUST ASSEMBLY (14PZ AND 14SZ)

See Fuel and Air System—B&S 4-Cycle Engine, in Section 31, Group 20 for removal and installation procedures.

MX,2110BV,6 -19-16JUL96

REMOVE AND INSTALL ENGINE FAN SHROUD (14PZ AND 14SZ)

See Fuel and Air System—B&S 4-Cycle Engine, in Section 31 for removal and installation procedures.

MX,2110BV,7 -19-16JUL96

REMOVE AND INSTALL FLYWHEEL (14PZ AND 14SZ)

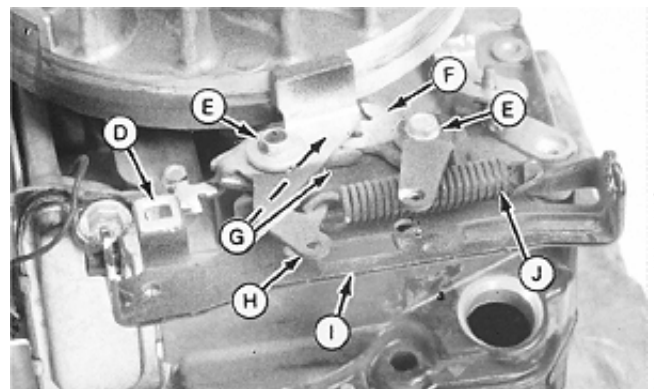
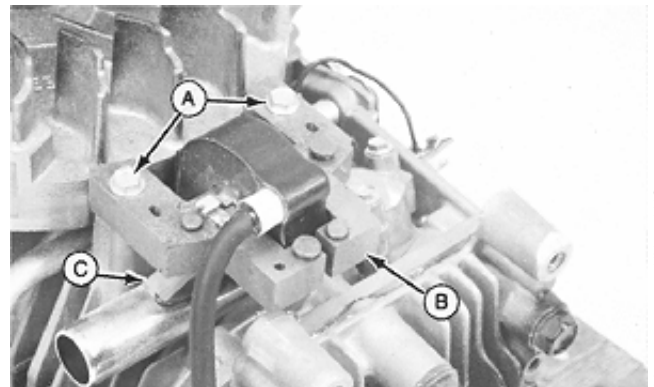
1. Disconnect safety switch lead (C) and remove two ignition coil cap screws (A) to remove ignition coil (B).

NOTE: BE SURE to remember the orientation of the actuating lever teeth (F) and the engaging teeth (G) of the brake lever. When it comes time to install this brake assembly it must be orientated correctly or linkage will not work.

2. Remove safety switch from brake assembly mounting hole (D).

3. Disconnect brake spring (J) from mounting bracket to relieve pressure of brake against flywheel. Remove two cap screws and washers (E) to remove flywheel brake assembly (I).

- A—Cap Screws
- B—Ignition Coil
- C—Safety Switch Lead
- D—Safety Switch Mounting Hole
- E—Cap Screws and Washers
- F—Actuating Lever Teeth
- G—Brake Lever Teeth
- H—Brake Lever
- I—Flywheel Brake Assembly
- J—Brake Spring



MX,2110BV,8 -19-16JUL96

4. Hold flywheel from turning while you remove nut and recoil start cup (A).

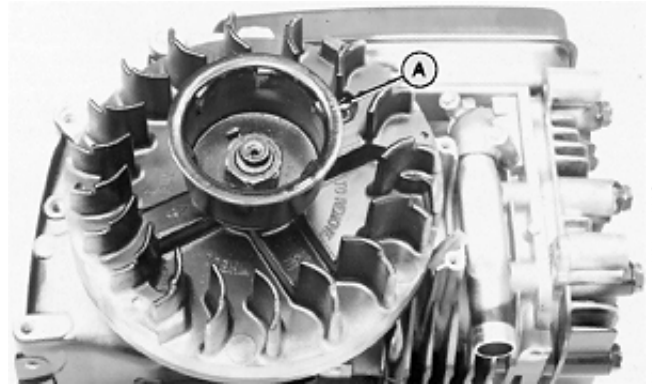
5. Remove flywheel using two-jaw flywheel puller—D01204AA.

6. Inspect flywheel for chipped or cracked cooling fins. Inspect flywheel key and keyway for damage or partially sheared condition. Replace damaged parts.

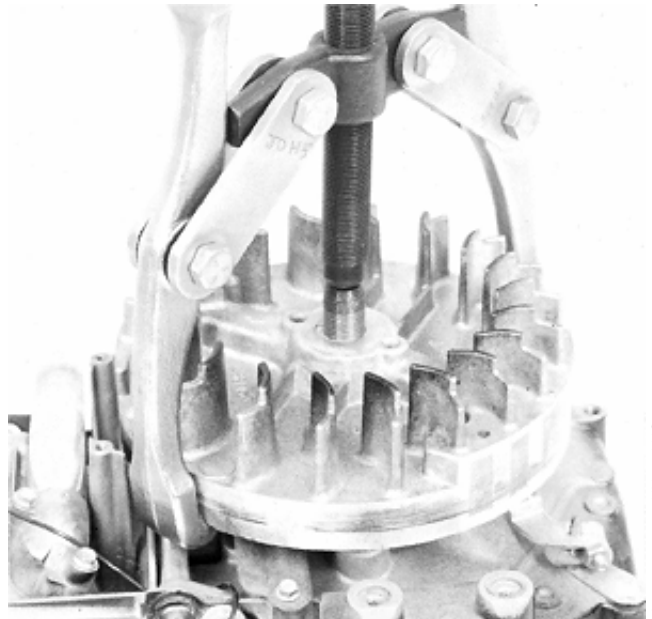
IMPORTANT: DO NOT substitute aluminum flywheel key with steel key. Machine damage or personal injury can result.

7. Install key in crankshaft keyway, align flywheel keyway with key as you install flywheel.

8. Install recoil start cup (A) and flywheel nut. Tighten nut to **75 N·m (55 lb-ft)**.

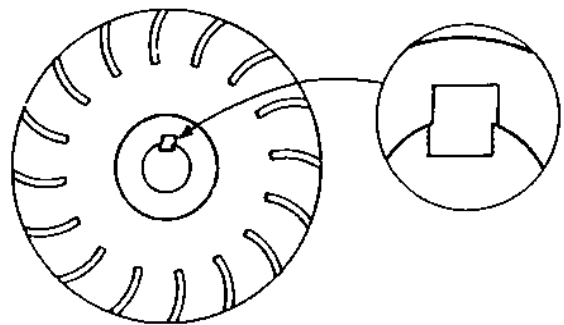


M54359 -UN-06AUG90



M42863 -UN-21AUG92

Two-Jaw Puller—D01204AA



M42862 -UN-21AUG92

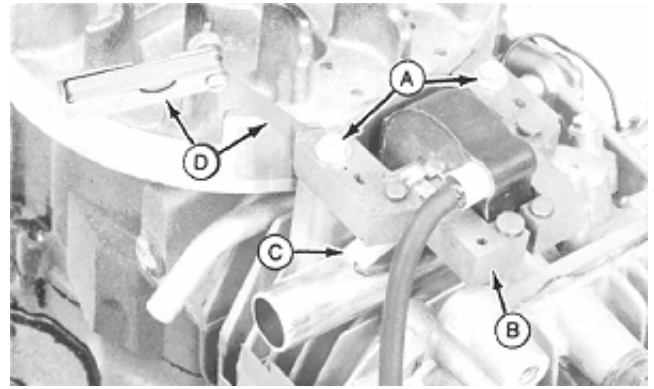
MX.2110BV,9 -19-16JUL96

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9. Install ignition coil (B) to an air gap **0.15—0.25 mm (0.007—0.010 in.)** with feeler gauge (D) and tighten cap screws (A) to **4 N·m (35 lb-in.)**.

10. Connect safety switch lead (C).

- A—Cap Screws
- B—Ignition Coil
- C—Safety Switch
- D—Air Gap With Feeler Gauge



MX,2110BV,10 -19-16JUL96

M42860 -UN-21AUG92

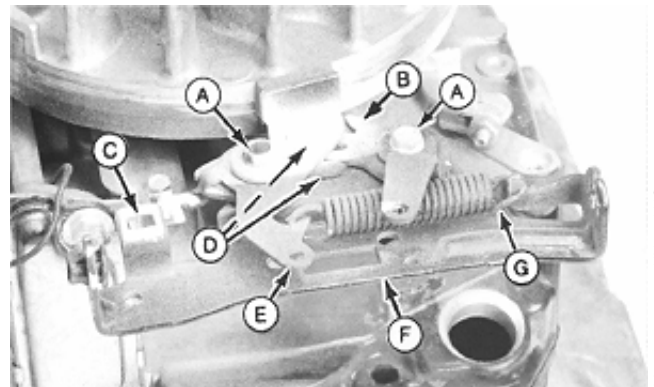
NOTE: BE SURE to correctly orientate actuating lever teeth (B) and the engaging teeth (D) of brake lever (E). They must be orientated correctly or linkage will not work.

11. Align mounting holes and install two cap screws and washers (A) to fasten flywheel brake assembly (F) to engine.

12. Connect brake spring (G) to mounting bracket to apply brake pressure against the flywheel.

13. Install safety switch to brake assembly mounting hole (C).

14. Adjust flywheel brake assembly.



- A—Cap Screws and Washers
- B—Actuating Lever Teeth
- C—Safety Switch Mounting Hole
- D—Brake Lever Teeth
- E—Brake Lever
- F—Flywheel Brake Assembly
- G—Brake Spring

MX,2110BV,11 -19-01OCT92

M42864 -UN-21AUG92

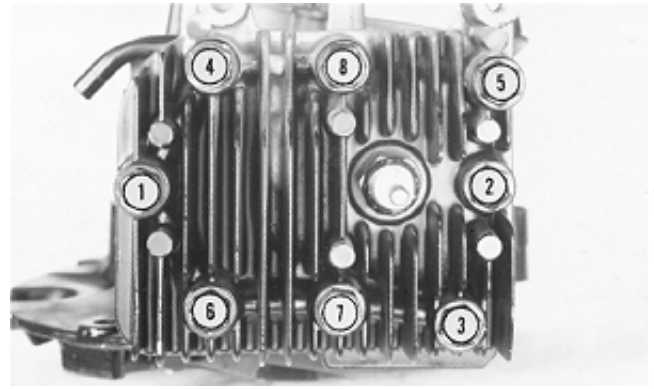
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REMOVE AND INSTALL CYLINDER HEAD (14PZ AND 14SZ)

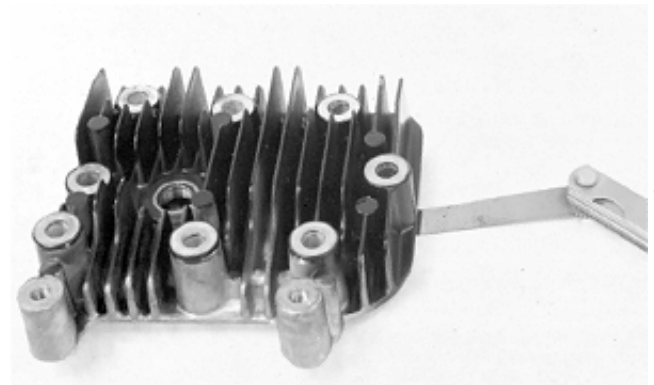
CAUTION: Allow engine to cool completely before working on engine to prevent possible injury.

IMPORTANT: Remove cylinder head **ONLY WHEN ENGINE IS COOL TO THE TOUCH** to prevent cylinder head from warping.

1. Disconnect and remove spark plug.
2. Loosen eight cap screws to remove cylinder head and gasket. Clean any residual gasket material from any machined surfaces on the head and the cylinder.
3. Remove carbon deposits from combustion chamber and gasket surface using SCOTCH-BRITE® abrasive pads or an equivalent.
4. Clean head with approved solvent.
5. Inspect for cracks or broken cooling fins.
6. Inspect gasket surface for burrs and nicks.
7. Inspect head gasket for burns and traces of gas leakage.
8. Put cylinder head on a flat surface plate. Check for distortion at several points around the head using a feeler gauge. Replace head if distortion is **greater than 0.07 mm (0.003 in.)**.
9. Install a new gasket and the original cylinder head, if not damaged.
10. Apply light coat of T43512—John Deere Thread Lock and Sealer (medium strength) to cylinder head cap screws. Tighten cap screws, in four increments of 4 N·m (35 lb-in.) each, in the sequence shown. Tighten to **16 N·m (140 lb-in.)**.
11. Install spark plug and tighten to **18 N·m (160 lb-in.)**.



M54353 -JUN-06AUG90

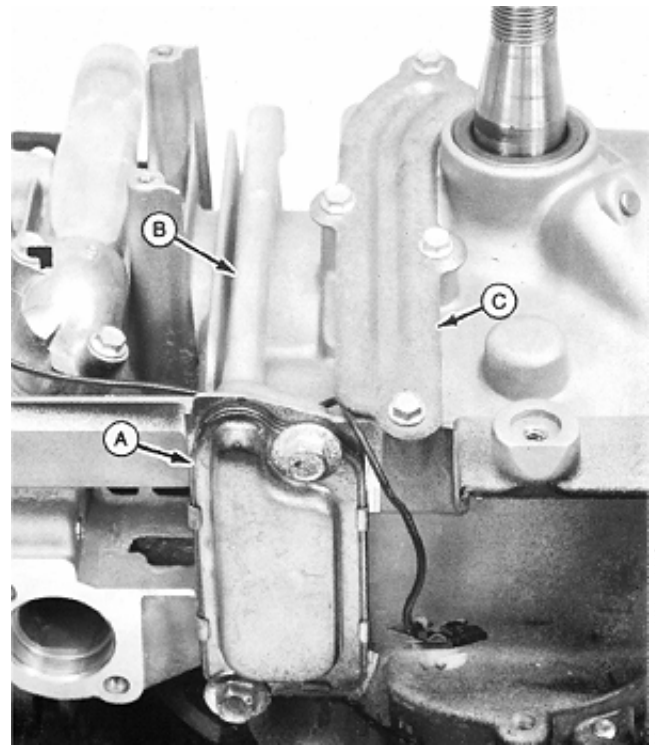


M54354 -JUN-06AUG90

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REMOVE AND INSTALL BREATHER (14PZ AND 14SZ)

1. Remove muffler.
2. Remove breather and gasket (A) and passageway cover and gasket (C). DO NOT remove breather tube (B) unless damaged.



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-UN-21AUG92
M42865

MX,2110BV,14 -19-16JUL96

A—Inlet Passageway
B—Disc Valve
C—Drain Holes
D—Breather Assembly Gasket

E—Breather Passageway Crankcase Port
F—Breather Assembly-to-Passageway Port

G—Breather Passageway Gasket

H—Breather Tube
I—Wire Feeler Gauge

IMPORTANT: The fiber disc valve (B) is attached to an easily damaged bracket. DO NOT apply excessive pressure when using wire gauge (I).

3. Use a 1.14 mm (0.045 in.) wire gauge to check clearance between the fiber disc valve (B) and the breather body. This is a "GO-NO GO" type measurement; if the gauge fits, replace breather assembly. Press ever-so-lightly on disc valve to see if it sticks or binds. Replace breather assembly as necessary.

4. Inspect breather assembly inlet passageway (A) and drain holes (C) for blockage or damage. Replace breather assembly as necessary.

5. Always install a new gasket (D) whenever assembly is removed.

INSPECTION SPECIFICATIONS

Breather Disc Valve Clearance
(Maximum) 1.14 mm (0.045 in.)

6. Shine a flashlight into one end of breather tube (H) while looking through the opposite end to see if there is any blockage. Also check for holes anywhere along the tube. Replace tube as necessary.

7. Inspect and clean breather passageway ports (E and F) for blockage or damage.

8. Install passageway cover and new gasket (G). Tighten cap screws to **3 N·m (27 lb-in.)**.

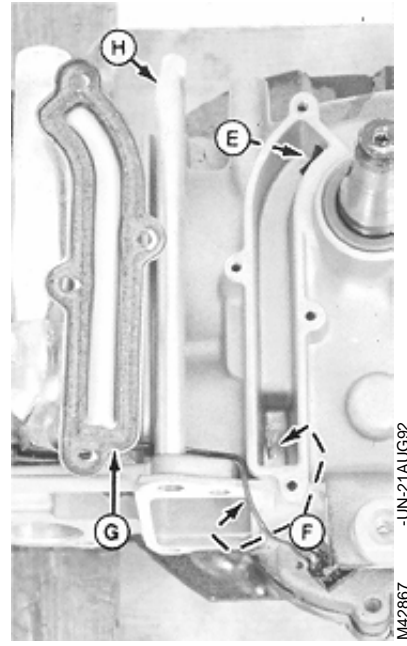
9. Install breather assembly and new gasket. Tighten cap screws to **5 N·m (44 lb-in.)**.

10. Install muffler.

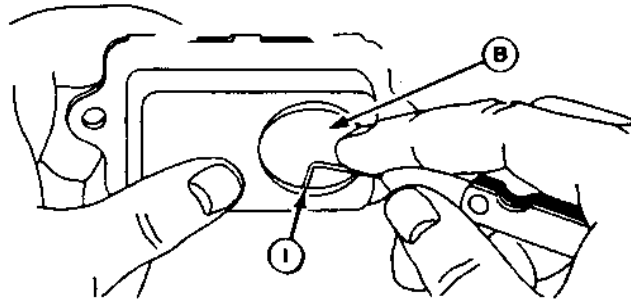
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M42866 -UN-21AUG92



M42867 -UN-21AUG92



M42868 -UN-21AUG92

MX,2110BV,15 -19-01OCT92

REMOVE AND INSTALL INTAKE/EXHAUST VALVES (14PZ AND 14SZ)

1. Remove cylinder head.
2. Remove breather assembly.

NOTE: Intake valve (wider diameter faced valve) is removed in photo.

3. Turn crankshaft until both valves are closed. Turn retainer so notch (C) on edge of retainer faces out.

4. Compress spring (B) using JDM46-14 or JDM-70 Valve Spring Compressor.

5. Pull retainer outward until larger portion of hole (D) fits over valve stem anchor (E) to remove retainer. Remove valve (A) from valve guide and pull spring (B) from breather chamber. Repeat procedure for other valve.

6. Inspect springs, valves, guides and seats.

7. Install spring (B) and retainer into breather chamber (with notch (C) facing out—be sure raised portion of retainer faces towards center of spring).

8. Install valve in engine block so stem is centered inside spring.

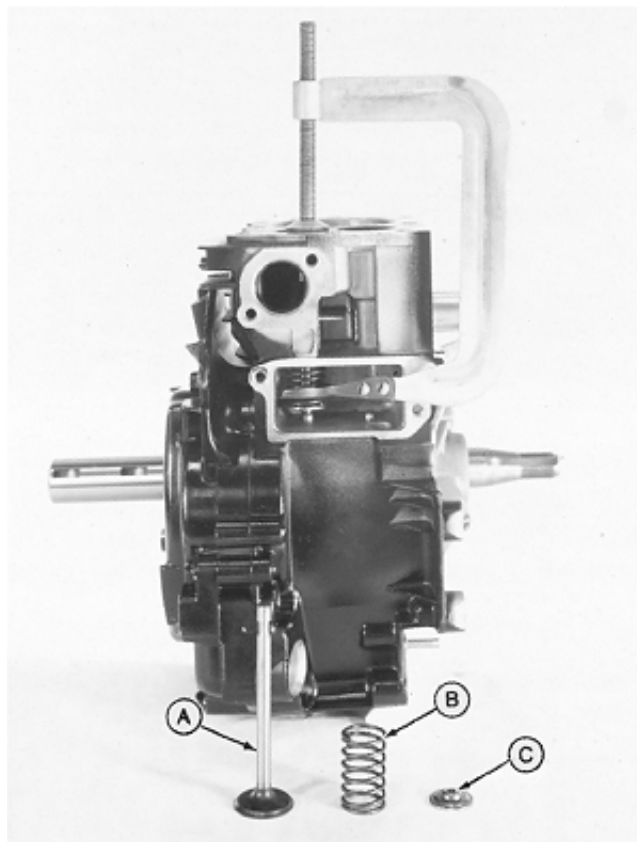
9. Compress spring with JDM46-14 or JDM70 Valve Spring Compressor and fit large hole (D) of retainer over valve stem anchor (E). Lock retainer onto valve stem as you decompress valve spring (B). Repeat procedure for other valve.

10. Install breather assembly.

11. Install cylinder head.

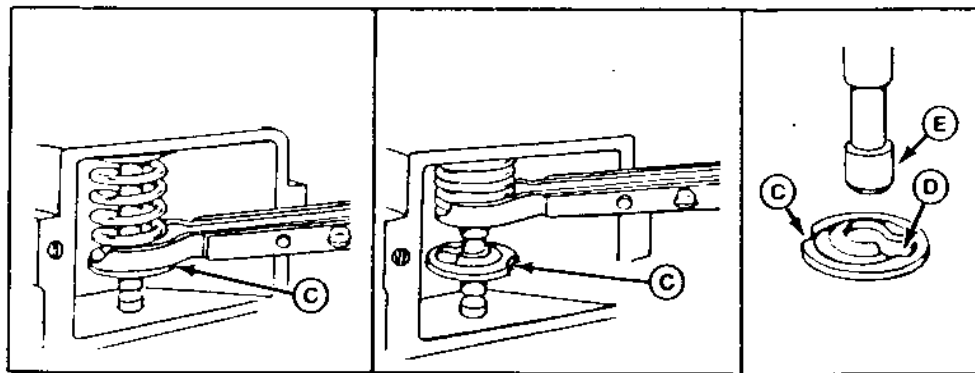
12. Adjust valve clearance.

MX,2110BV,16A -19-16JUL96



M54355 -JUN-06AUG90

JDM70 Spring Compressor Shown



M42870 -JUN-21AUG92

A—Exhaust Valve
B—Spring

C—Retainer Notch

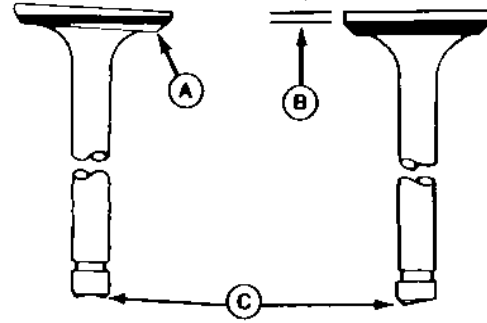
D—Large Hole

E—Valve Stem Anchor

MX,2110BV,16 -19-01OCT92

INSPECT INTAKE/EXHAUST VALVES (14PZ AND 14SZ)

1. Remove carbon from valve head, face and stem with a power-operated wire brush. Be sure carbon is removed, not merely burnished.
2. Check valve faces, heads and stems for defects.
3. Replace warped valves (A) or valves with less than specified face margin (B). Valve stem ends (C) should be ground square before you check valve-to-tappet clearance.



INSPECTION SPECIFICATIONS

Intake/Exhaust Valve	
Face Margin (Min.)	0.40 mm (0.016 in.)

MX,2110BV,17 -19-16JUL96

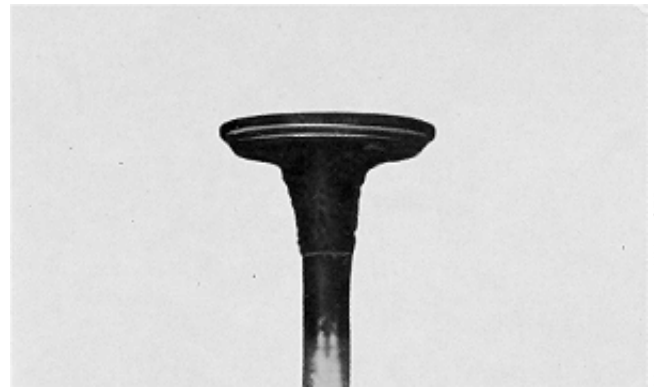
M38087 -UN-21AUG92

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ANALYZE INTAKE/EXHAUST VALVES (14PZ AND 14SZ)

Deposits on the intake valve are a natural by-product of the internal combustion process of the 4-cycle engine. Grind the valves and reface their seats to remove these deposits.

NOTE: Be sure to recheck valve-to-tappet clearance after grinding valves and valve seats.



MX,2110BV,18 -19-16JUL96

M29934 -UN-06SEP88

Valve stem corrosion is caused by moisture in the engine. Moisture in the fuel-air mixture can condense inside the engine when the engine is stopped and cools down.

Valve corrosion can also occur during storage. Fogging or pouring oil in the combustion chamber before storing helps prevent valve corrosion.

Corroded or pitted valves collect deposits and may cause sticking valves. Replace badly corroded or pitted valves.



MX,2110BV,19 -19-16JUL96

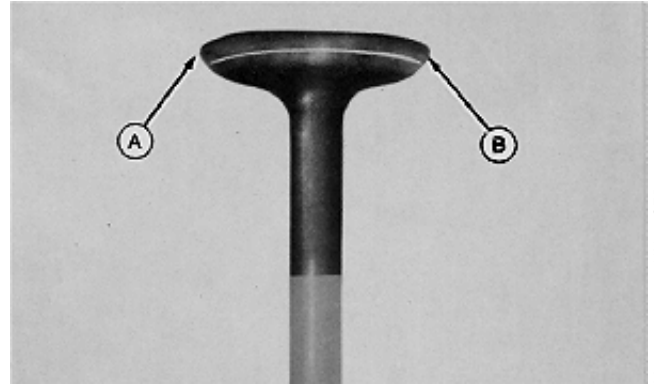
M5563 -UN-31AUG88

Exhaust valves are designed to function in temperatures exceeding 1093°C (2000°F). However, when operating at high temperatures for long periods of time, valve burning may occur. Valves running too hot will show a dark discoloration of the valve stem into the area protected by the valve guide. Another indication is distortion of the valve margin (A) and valve face (B). Intake valve guide bore and exhaust valve guide insert may also begin to burn away.

IMPORTANT: DO NOT run the engine with blower housing removed.

Poor engine cooling due to dirt or obstructions is a common cause for overheating an engine and the valves. Remove blower housing and clean the engine cooling fins.

Other causes for valves running hot are worn valve guides or valve springs, incorrect valve clearance, lean fuel-air mixture and incorrect or overheated spark plug.



M30024 -UN-06SEP88

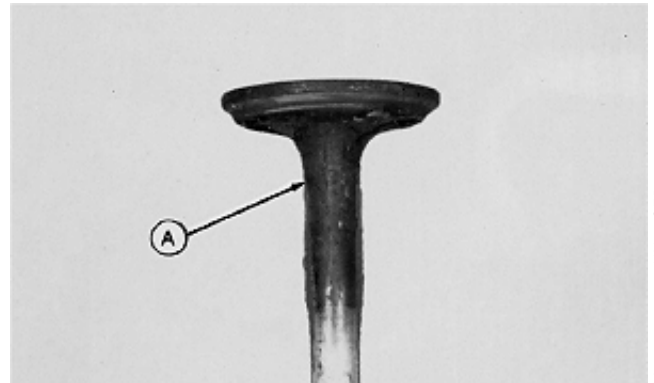
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MX,2110BV,20 -19-01OCT92

Using old or stale unleaded gasoline is a common cause for sticky valves (A).

This gummy deposit can be seen on the valve. When this condition exists, the carburetor may also contain gum deposits and will require a complete cleaning.

Always use fresh unleaded gasoline (87 octane or higher) and drain fuel tank, lines, and carburetor before storing tractor.

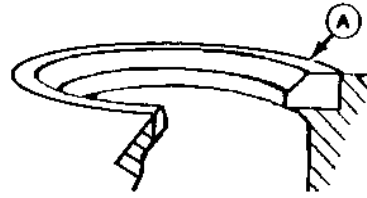


M29936 -UN-06SEP88

MX,2110BV,21 -19-01OCT92

INSPECT INTAKE/EXHAUST VALVE SEATS (14PZ AND 14SZ)

- Carefully inspect valve seats (A) for wear, cracks, pitting, distortion, or loose fit. Recondition (reface) pitted or worn seats.
- If valve seats are worn, cracked, pitted, or distorted beyond reconditioning, replace with a new cylinder/crankcase housing. Valve seats are not replaceable.
- If valve seats are loose, reseal them.



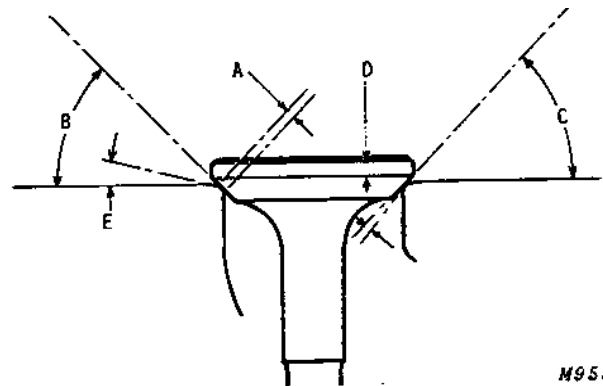
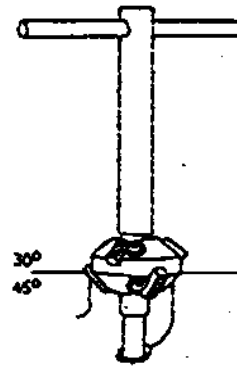
-UN-21AUG92
M42869

MX,2110BV,22 -19-16JUL96

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RECONDITION VALVES AND SEATS (14PZ AND 14SZ)

- Pitted or worn seats can be reconditioned (refaced) using Valve Seat Service Kit—JDM52A.
- To recondition (reface) valve seat, cut at 45° angle (B) to clean up seat. Cut narrowing angle (E) at 30°. Finish cut at 45° (B) to establish seating surface width (A).
- Cut valve seating surface (A) as close as possible to specifications.
- Lap valves to their seats after reconditioning (refacing) is completed.



VALVE AND SEAT RECONDITION SPECIFICATIONS

A—Valve Seat Surface	1.19—1.59 mm (0.047—0.063 in.)
B—Valve Seat Angle:	
Intake	30° or 45°
Exhaust	45°
C—Valve Face Angle:	
Intake	30°
Exhaust	45°
D—Valve Margin	0.40 mm (0.016 in.)
E—Valve Narrowing Angle	30°

M955

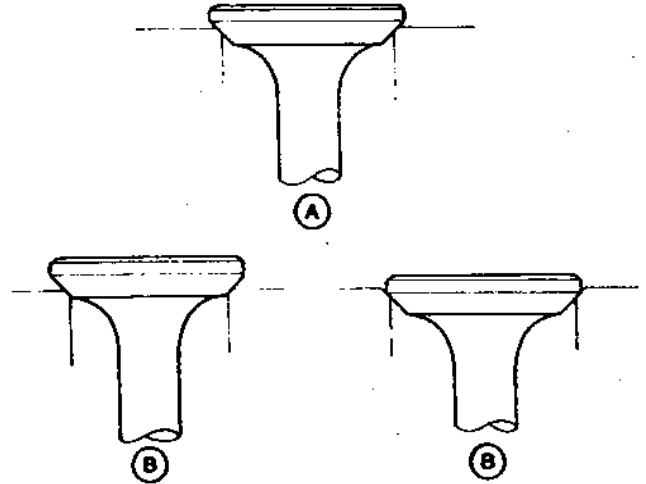
-UN-31AUG88
M51558
-UN-01SEP88
M9552

MX,2110BV,23 -19-16JUL96

5. Center valve face properly on the valve seat:

- (A) correct positioning,
- (B) incorrect positioning.

6. Check seat for good contact using Prussian blue compound.



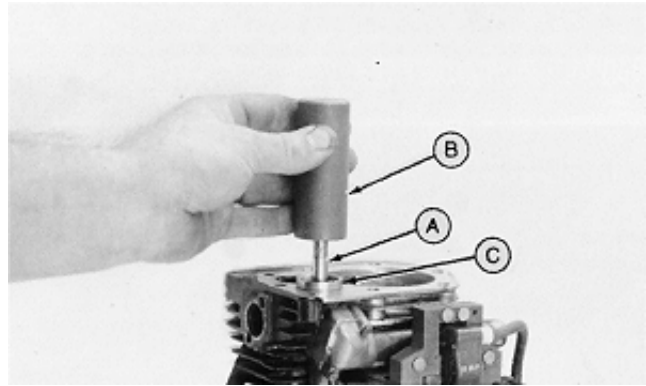
MX,2110BV,24 -19-01OCT92

M18615 -UN-07SEP88

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RESEAT VALVE SEATS (14PZ AND 14SZ)

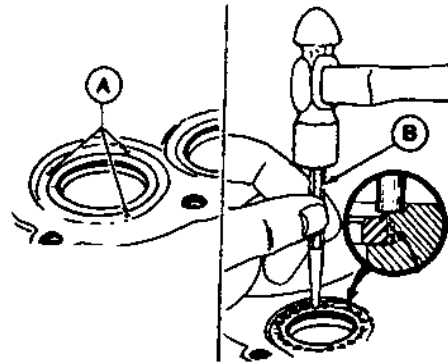
1. If during your inspection you discover that the valve seat(s) are loose, make sure outside chamfered edge of valve seat faces downward.
2. Put JDG-554 Pilot (A) into valve guide.
3. Drive in valve seat (C) until it bottoms out using JDG-432 driver (B) from JDG433 Puller Kit.



MX,2110BV,25 -19-16JUL96

M40896 -UN-30AUG88

4. Using a center punch, punch the cylinder block material around the valve seat in an equal, triangular pattern (A) to tighten seat.
5. Using a flat punch (B), peen around entire seat to lock it into position.
6. Lightly grind and lap valve seat.



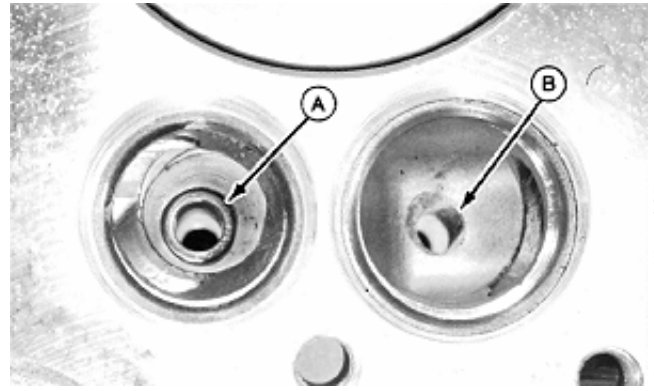
MX,2110BV,26 -19-16JUL96

TY14521 -UN-04MAY89

INSPECT VALVE GUIDES (14PZ AND 14SZ)

NOTE: The exhaust valve has a guide bushing (A) and the intake valve has its guide (B) bored into the block.

1. Clean valve guides with valve guide cleaner.
2. Check valve guides by seeing if JDM-46-2 Valve Guide Reject Gauge will fit into valve guides. If gauge fits into guides, this is a "GO-NO GO" type inspection; replace cylinder/crankcase housing with a new one. Exhaust valve guide bushing and intake valve guide bore are not serviceable.



M42997
-UN-02OCT92

INSPECTION SPECIFICATIONS

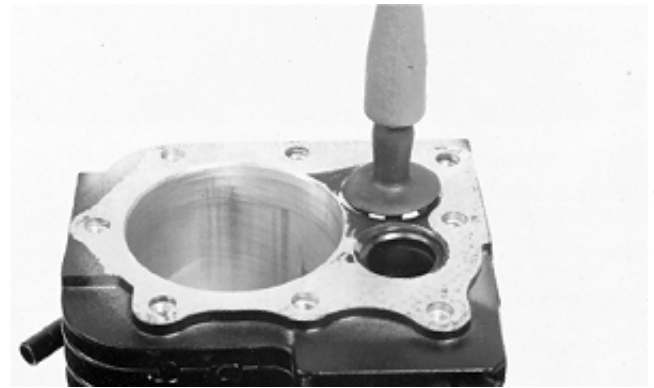
Valve Guide Diameter (Maximum) 7.94 mm (0.310 in.)

MX,2110BV,27 -19-16JUL96

LAP VALVES AND SEATS (14PZ AND 12SZ)

NOTE: Valves and seats must be lapped if they DO NOT make good contact.

1. Apply small amount of lapping compound to valve face.
2. Turn valve in seat using a vacuum cup tool.
3. Check valve every eight strokes until a uniform ring appears around surface of valve face.
4. Wash parts in solvent to remove lapping compound.
5. Check position of lap mark on face. Lap mark must be on or near center of valve face.
6. Check valve-to-tappet clearance.



M54357
-UN-06AUG90

MX,2110BV,28 -19-16JUL96

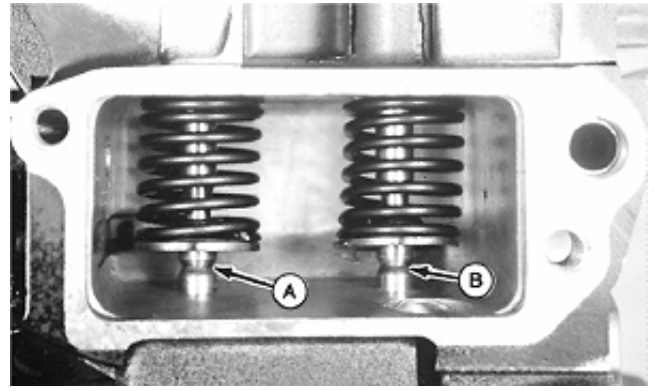
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ADJUST VALVE-TO-TAPPET CLEARANCE (14PZ AND 14SZ)

1. Position piston at top dead center (TDC) on the compression stroke. Both valves should be closed. Move past TDC (clockwise rotation from flywheel end of crankshaft) until piston is 6 mm (0.250 in.) down from top of cylinder.
2. Check clearance between bottom of exhaust valve stem (A) and its tappet using a feeler gauge. Compare to specifications. Repeat procedure for intake valve stem (B) and its tappet.
3. Grind tip of valve stem (increase clearance) or cut and lap valve seat (tighten clearance) until measurement is within specifications.

INSPECTION SPECIFICATIONS

Intake Valve Clearance—0.127—0.179 mm (0.005—0.007 in.)
Exhaust Valve Clearance—0.179—0.229 mm (0.007—0.009 in.)



M54358 -JUN-21AUG92

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MX,2110BV,29 -19-16JUL96

ADJUST CRANKSHAFT END PLAY (14PZ AND 14SZ)

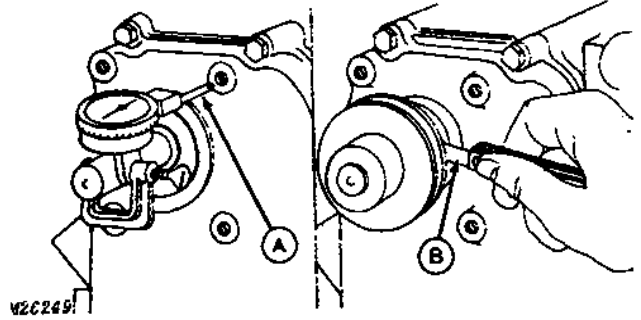
1. Measure crankshaft end play with a dial indicator (A) or a feeler gauge (B):

DIAL INDICATOR—Pull crankshaft all the way towards the crankcase cover to bottom out the crankshaft. Install dial indicator on crankshaft with pointer against crankcase cover and set dial indicator to zero. Move crankshaft in as far as it will go. The indicator will show the amount of end play. Record reading. Repeat this procedure three times to obtain a mean reading. Compare to specification.

FEELER GAUGE—Push crankshaft all the way towards the flywheel end to bottom out the crankshaft. Install a drive sheave on the crankshaft, up against crankcase cover, back off drive sheave to 0.127 mm (0.005 in.) gap, and tighten drive sheave set screw. Remeasure to ensure that sheave or crankshaft did not move while tightening set screw. Move crankshaft out as far as it will go. Measure and record the gap with a feeler gauge again. Subtract the 0.127 mm (0.005 in.) original sheave gap from end gap just measured. This is the actual crankshaft end play. Repeat this procedure three times to obtain a mean reading. Compare to specification.

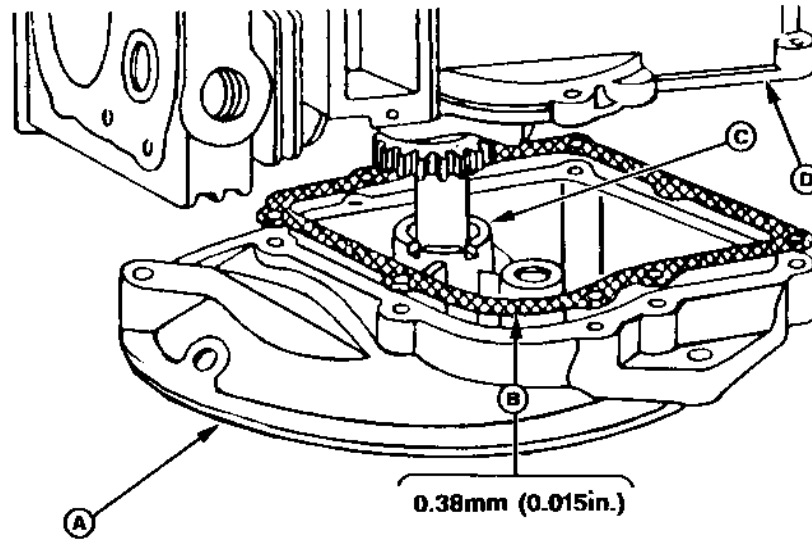
INSPECTION SPECIFICATIONS

Crankshaft End Play 0.051—0.762 mm (0.002—0.030 in.)



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M26249 -UN-25APR89



-UN-21AUG92

M42873

A—Crankcase Cover

B—Crankcase Gasket

C—Bearing Surface

D—Cylinder/Crankcase Housing

2. If crankshaft end play is LESS than specification with gasket (B) installed, add another gasket(s) to obtain specification. Never use more than three gaskets sandwiched together.

3. If crankshaft end play is MORE than specification with one gasket (B) installed, bearing surface (C) is worn to the point that a new crankcase cover (A) must be installed.

INSPECTION SPECIFICATIONS

Crankcase Gasket Thickness (New) 0.38 mm (0.015 in.)

MX,2110BV,31 -19-01OCT92

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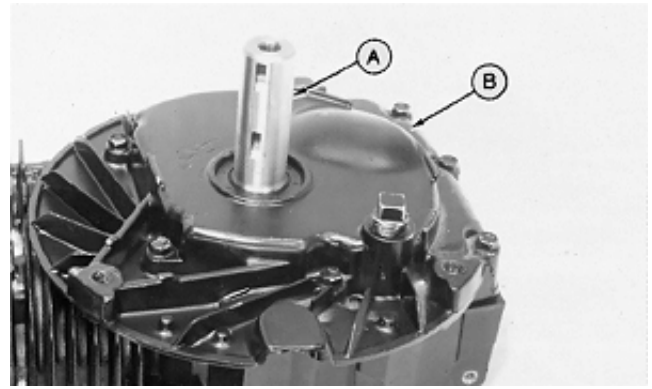
REMOVE AND INSTALL CRANKCASE COVER (14PZ AND 14SZ)

NOTE: Measure crankshaft end play before you remove crankcase cover.

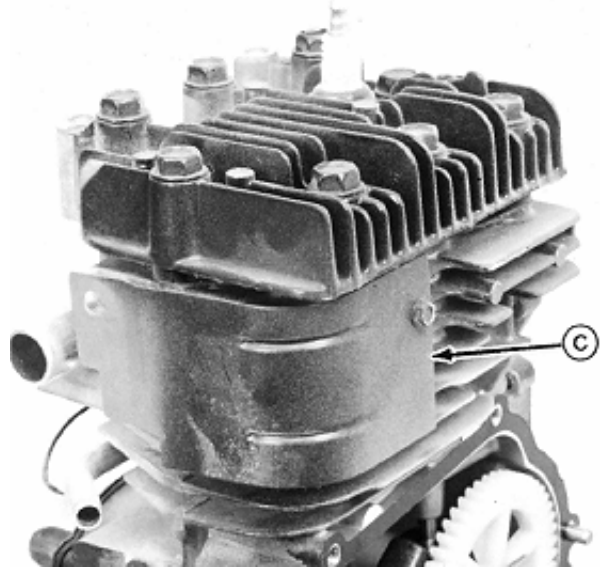
1. Remove corrosion or burrs from crankshaft (A).
2. Remove seven cap screws to remove crankcase cover (B).
3. Remove cylinder cooling fins cover (C). Clean and inspect cylinder cooling fins. Replace cylinder/crankcase housing as necessary.
4. Install cylinder cooling fins cover (C).
5. Inspect crankcase cover for broken fins, cracks, and overall condition. Replace as necessary.
6. Clean any residual gasket material from both cylinder/crankcase housing and cover gasket surfaces. Coat crankshaft seal lips with clean engine oil.

NOTE: A minimum of one 0.38 mm (0.015 in.) gasket is required for proper seal of crankcase.

7. Install new gasket(s), depending on the results of the crankshaft end play measurements. Put gasket over guide pins of cylinder/crankcase housing, and install crankcase cover onto guide pins.
8. Apply T43512 Thread Lock and Sealer (medium strength) to threads of cap screws. Tighten cap screws in a crossing pattern to **10 N·m (90 lb-in.)**.



M54362 -UN-06AUG90



M42886 -UN-31AUG92

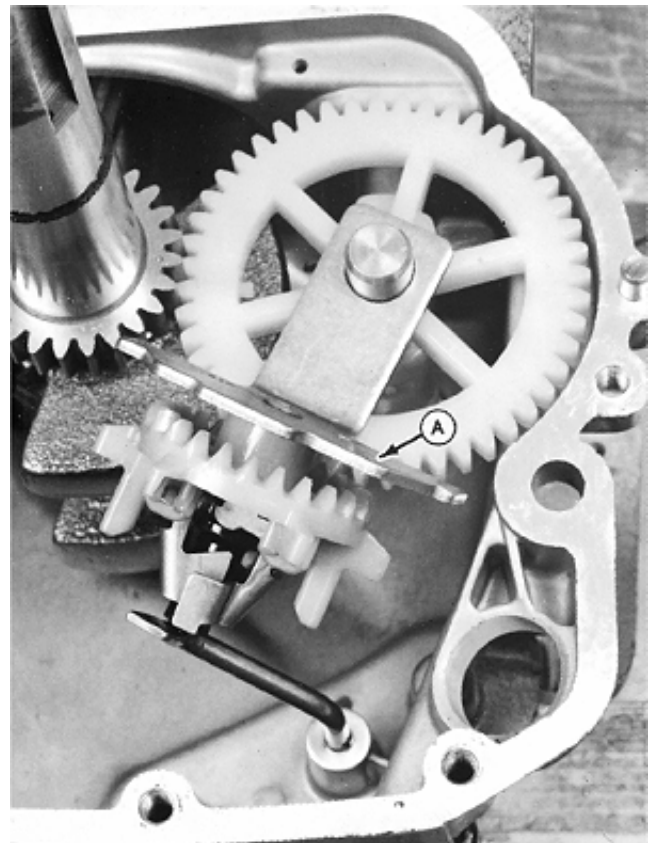
MX,2110BV,32 -19-16JUL96

REMOVE AND INSTALL GOVERNOR ASSEMBLY (14PZ AND 14SZ)

1. Remove crankcase cover.
2. Remove governor assembly (A).
3. Inspect governor for wear or damage. Replace if necessary.
4. Install governor assembly.



Early Model 4-HP Engines



Late Model 5 and 5.5-HP Engines

MX,2110BV,33 -19-16JUL96

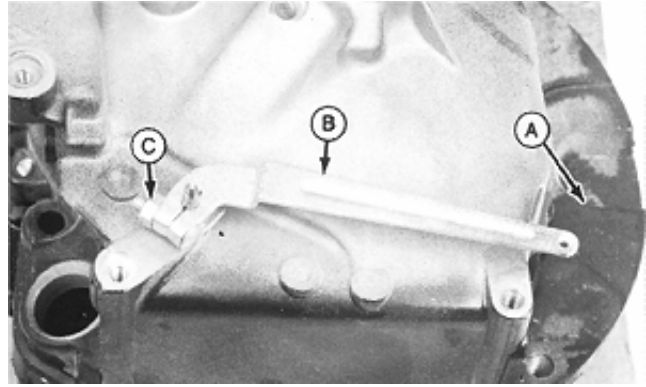
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M54364 -JUN-06AUG90

M42874 -JUN-21AUG92

REMOVE AND INSTALL GOVERNOR SHAFT (14PZ AND 14SZ)

1. Remove crankcase cover (A).
2. Loosen nut (C) to remove governor lever (B).



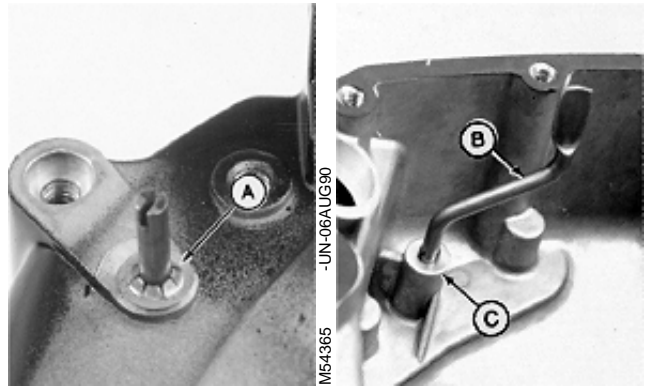
M42871 -UN-21AUG92

MX,2110BV,34 -19-16JUL96

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IMPORTANT: BE SURE to remove any burrs or scratches from end of governor shaft after you remove pushnut (A) and BEFORE you remove the shaft from the housing; otherwise, shaft bore will be damaged and crankcase housing will have to be replaced.

3. Remove pushnut (A) and immediately remove any burrs and scratches from the end of the shaft BEFORE you remove it.
4. Remove governor shaft (B) and washer (C).
5. Inspect parts for wear or damage. Replace as necessary.
6. Install washer (C) and shaft (B) internally until it hits the stops. Hold shaft against its stops while you install pushnut (A) externally.
7. Install and adjust governor lever.



External View

Internal View

M54365 -UN-06AUG90

M54366 -UN-06AUG90

MX,2110BV,35 -19-01OCT92

REMOVE AND INSTALL CAMSHAFT ASSEMBLY (14PZ AND 14SZ)

1. Remove governor assembly.

IMPORTANT: Align timing marks to prevent damage to tappets when removing camshaft.

2. Rotate crankshaft until timing marks (A) align, one dot on crankshaft gear and a U-shaped groove on camshaft gear of early model 4-hp engines or a V-shaped groove on camshaft gear of late model 5 and 5.5-hp engines.

3. Remove camshaft.

4. Inspect camshaft. Replace parts as necessary.

5. BE SURE valve tappets are installed above camshaft alignment.

6. Align timing marks (A) as you install camshaft.



Early Model 4-HP Engines



Late Model 5 and 5.5-HP Engines

MX,2110BV,36 -19-16JUL96

M54367 -UN-06AUG90

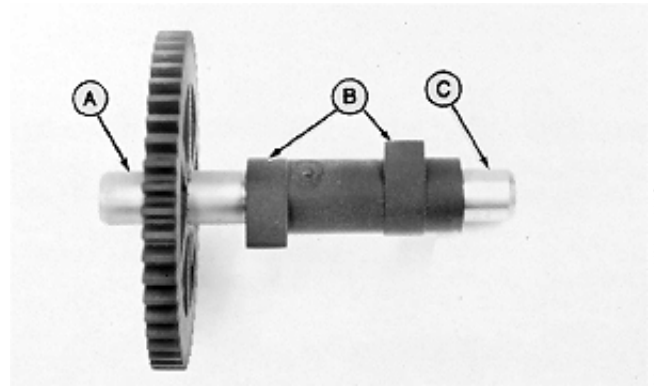
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M42875 -UN-21AUG92

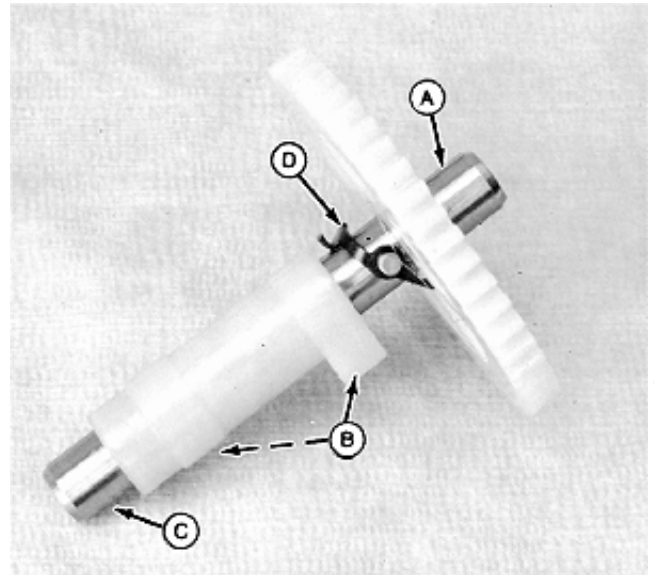
INSPECT CAMSHAFT ASSEMBLY (14PZ AND 14SZ)

1. Inspect camshaft gear for worn or broken teeth. Inspect gear spokes for any damage. Replace camshaft assembly as necessary.
2. Inspect nylon lobes (B) for pitting or wear. Replace camshaft assembly as necessary.
3. Measure camshaft journals (A and C). Replace camshaft assembly if less than **12.65 mm (0.498 in.)**.
4. Inspect compression release mechanism (D) for smooth operation and that return spring is functioning properly. Replace camshaft assembly as necessary.

A—Camshaft Journal
B—Cam Lobes
C—Camshaft Journal
D—Compression Release Mechanism



Early Model 4-HP Engines



Late Model 5 and 5.5-HP Engines

MX,2110BV,37 -19-16JUL96

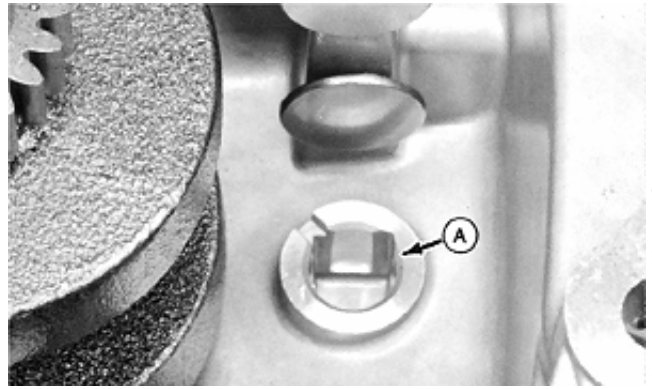
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M54369 -UN-06AUG90

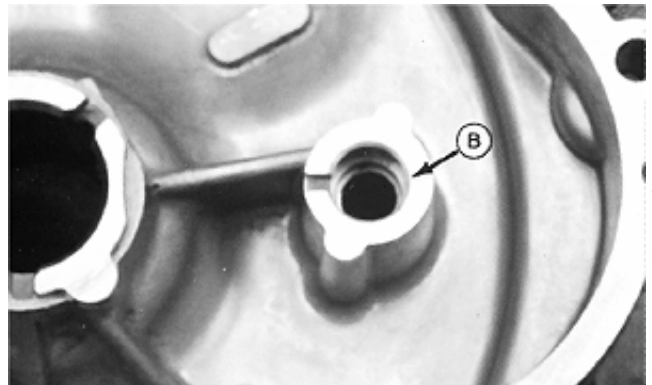
M42812 -UN-21AUG92

INSPECT CAMSHAFT BEARINGS (14PZ AND 14SZ)

1. Measure camshaft bearings (A) in cylinder/crankcase housing and crankcase cover (B).
2. Replace cylinder/crankcase housing or crankcase cover if diameter is greater than **12.78 mm (0.503 in.)**. Camshaft bearings are not serviceable.



M54370 -JUN-21AUG92



M42876 -JUN-21AUG92

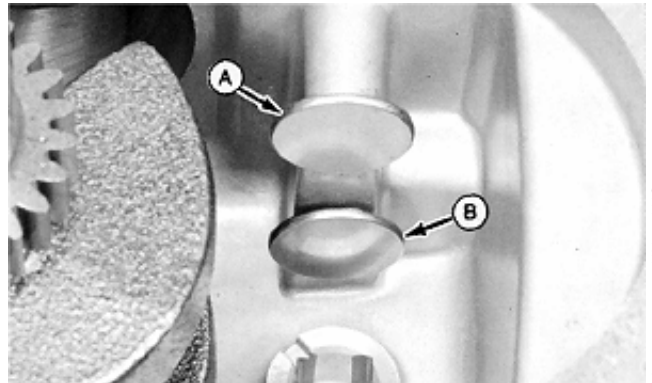
MX,2110BV,38 -19-16JUL96

REMOVE AND INSTALL TAPPETS (14PZ AND 14SZ)

1. Remove camshaft.

NOTE: Mark tappets so they can be installed in their original guides during assembly.

2. Remove intake valve tappet (A) and exhaust valve tappet (B).
3. Inspect tappets for wear or discoloration (an indicator of over-heating). Replace as necessary.
4. Install original tappets in their respective bore. Install new tappets in either bore.

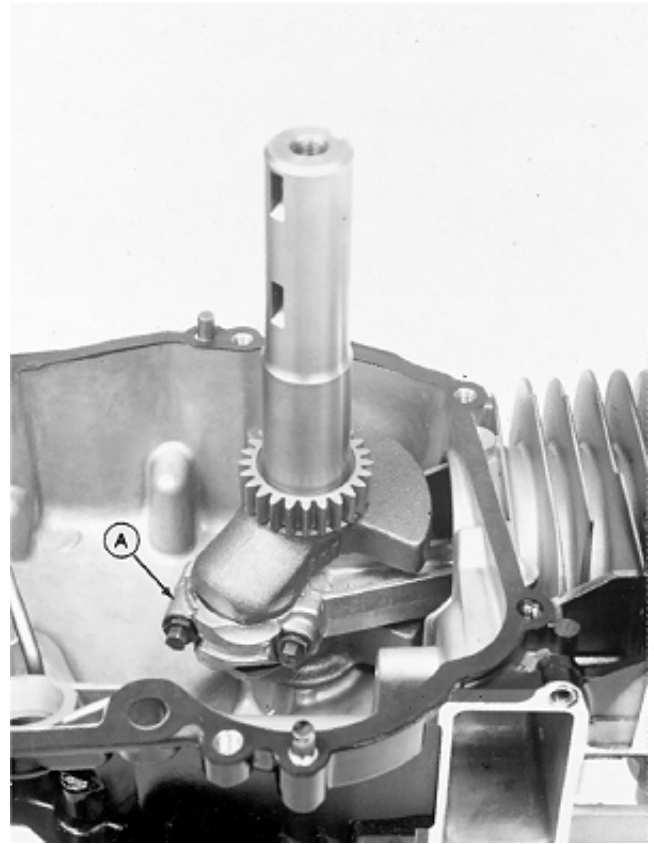


M54368 -JUN-21AUG92

MX,2110BV,39 -19-16JUL96

REMOVE AND INSTALL CRANKSHAFT (14PZ AND 14SZ)

1. Remove camshaft.
2. Remove connecting rod cap (A).
3. Move connecting rod/piston assembly high enough up inside cylinder bore to clear crankshaft.
4. Remove crankshaft.
5. Inspect crankshaft.
6. Install crankshaft.
7. Install connecting rod cap (A). Tighten cap screws to **11.3 N·m (100 lb-in.)**.



MX,2110BV,40 -19-16JUL96

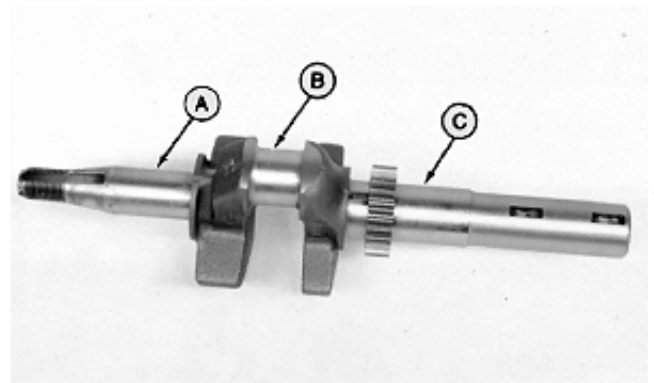
M54371 -JUN-06AUG90

INSPECT CRANKSHAFT (14PZ AND 14SZ)

1. Clean and inspect crankshaft. Replace if scored or damaged.

NOTE: Crankshaft gear must be installed with timing mark toward output end of crankshaft.

2. Inspect gear for chipped or missing teeth and discoloration (a sign of over-heating). Replace as necessary.
3. Measure main bearing journals (A and C) and connecting rod journal (B). Replace crankshaft if measurements are less than specifications.



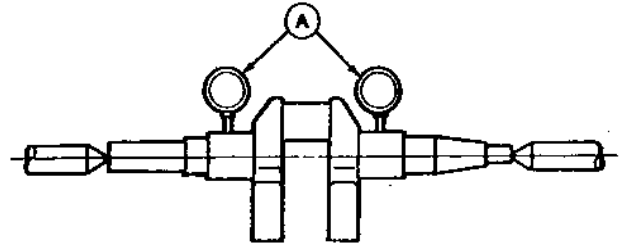
M54372 -JUN-06AUG90

INSPECTION SPECIFICATIONS

Flywheel Side Journal (Min.) (A)	22.17 mm (0.873 in.)
Connecting Rod Journal (Min.) (B)	25.30 mm (0.996 in.)
Output Side Journal (Min.) (C)	26.92 mm (1.060 in.)

MX,2110BV,41 -19-16JUL96

4. Place crankshaft into an alignment jig and rotate crankshaft slowly. Use dial indicators (A) to measure maximum total indicated runout (TIR). Replace crankshaft if runout is more than **0.05 mm (0.002 in.)**.



MX,2110BV,42 -19-16JUL96

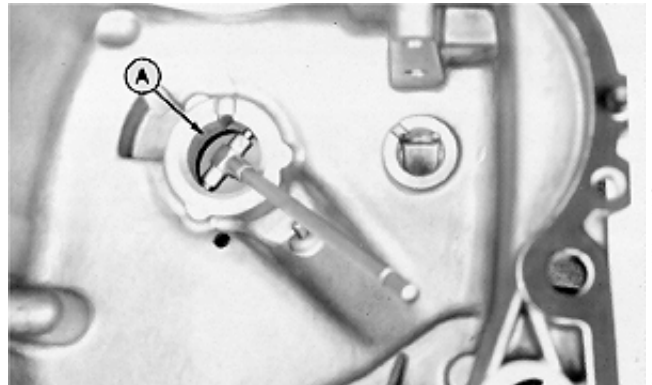
M51761 -UN-07SEP88

INSPECT CRANKSHAFT BEARINGS (14PZ AND 14SZ)

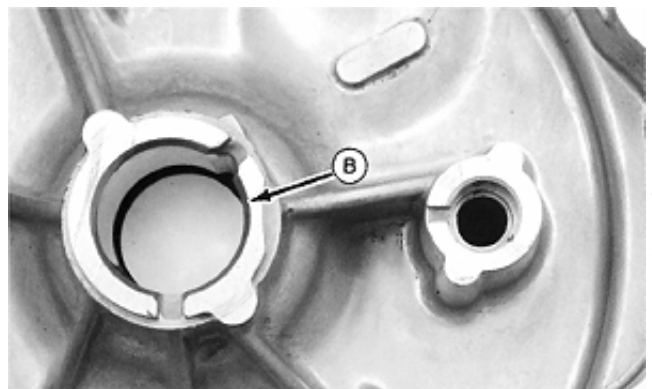
Measure inside diameter (ID) of crankshaft bearings (A) in cylinder/crankcase housing and crankcase cover (B). Replace cylinder/crankcase housing or crankcase cover if diameter is greater than specifications.

INSPECTION SPECIFICATIONS

Cylinder Bearing I.D. (Max.) (A)	22.30 mm (0.878 in.)
Cover Bearing I.D. (Max.) (B)	26.92 mm (1.060 in.)



M54373 -UN-06AUG90

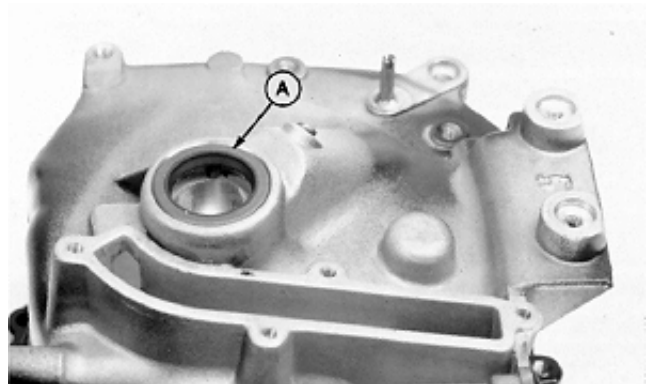


M42877 -UN-21AUG92

MX,2110BV,43 -19-16JUL96

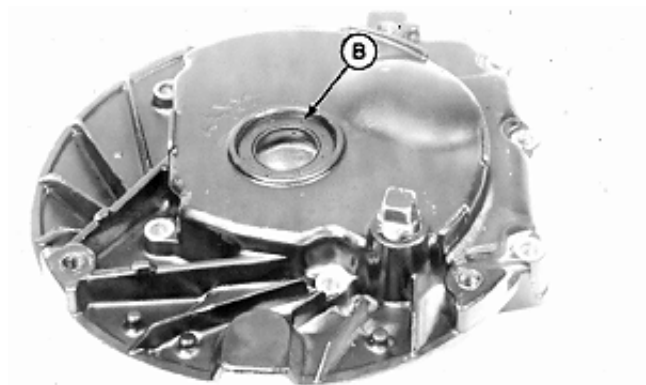
REMOVE AND INSTALL OIL SEALS (14PZ AND 14SZ)

1. Remove cylinder/crankcase housing oil seal (A) and crankcase cover oil seal (B) with a screwdriver.
2. Coat new seals with engine oil.
3. Install new seals with lip to inside of engine. Press seal into bore until flush with hub.



Flywheel End

M54374 -UN-06AUG90



Output End

M54375 -UN-21AUG92

MX,2110BV,44 -19-16JUL96

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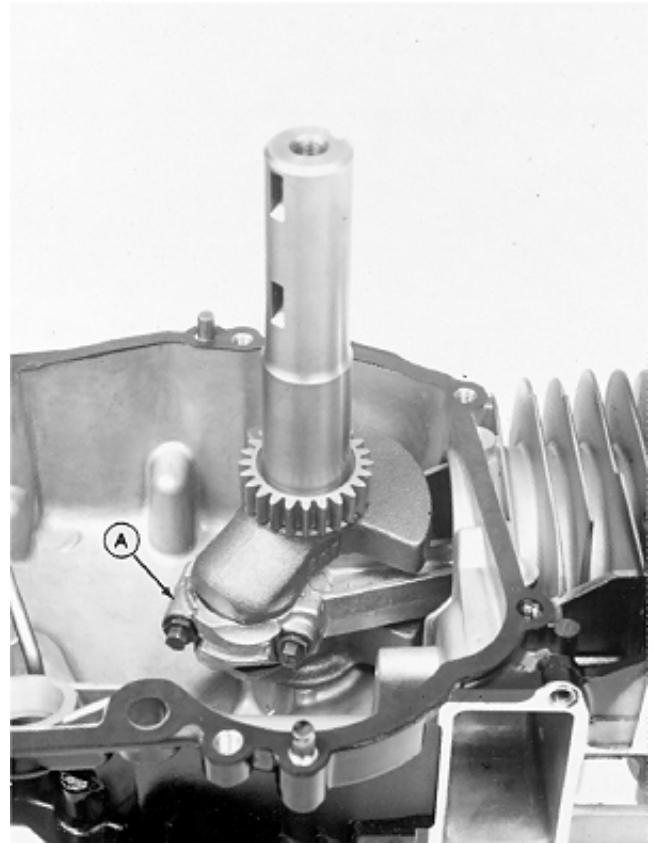
REMOVE AND INSTALL PISTON ASSEMBLY (14PZ AND 14SZ)

1. Remove cylinder head.
2. Remove camshaft.
3. Remove connecting rod cap (A).

IMPORTANT: Use only soft handle or headed instrument when removing piston assembly from cylinder.

NOTE: It is not necessary to remove cylinder ridge, if present, before removing piston from aluminum cylinder block.

4. Use your hand or a soft instrument to remove piston assembly through top of cylinder.
5. Remove piston from connecting rod.
6. Inspect piston assembly. Replace components as necessary.
7. Coat all mating surfaces with engine oil.
8. Install connecting rod inside piston.
9. Install piston rings.

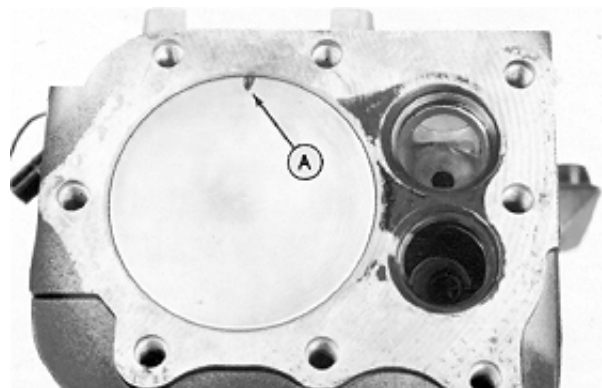


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M54371
-JUN-06AUG90

MX,2110BV,45 -19-16JUL96

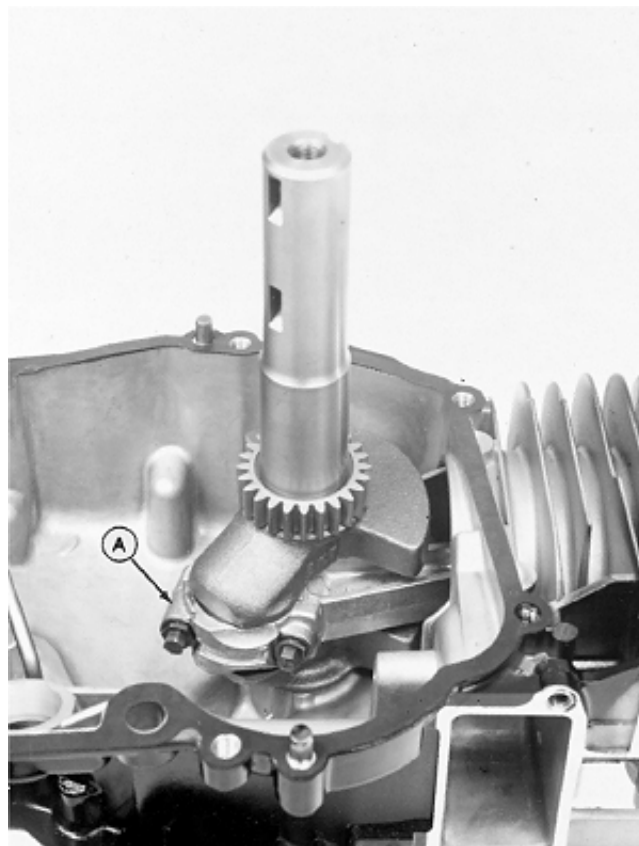
10. Stagger piston ring end gaps 180° apart.
11. Compress piston rings with a ring compressor.
12. Apply a light film of engine oil to cylinder bore.
13. Install piston assembly through top of cylinder bore with notch (A) on piston head facing flywheel side of the engine.



M54376
-JUN-06AUG90

MX,2110BV,46 -19-01OCT92

14. Apply a light film of engine oil to crankshaft machined surface and bearing race surface and cap screws. Install connecting rod cap (A). Tighten cap screws to **11.3 N·m (100 lb-in.)**.



MX,2110BV,47 -19-16JUL96

M54371 -JUN-06AUG90

21
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34

INSPECT PISTON AND RINGS (14PZ AND 14SZ)

Rings of the wrong size or rings having improper end gap will not conform to the shape of the cylinder. This results in high oil consumption and excessive blow-by.

Ring end gaps should be staggered 180° on the piston during installation. End gaps in alignment can also cause oil consumption and blow-by.

Light scuffing or scoring (A) of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of the piston material.

When this condition exists, it is due to one or more of the following probable causes:

- Dirty cooling shroud and cylinder head.
- Lack of cylinder lubrication.
- Improper combustion.
- Wrong bearing or piston clearance.
- Too much oil in crankcase causing fluid friction.



M29943 -UN-06SEP88

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MX,2110BV,48 -19-16JUL96

The engine operating at abnormally high temperatures may cause varnish, lacquer or carbon deposits (A) to form in the piston grooves making the rings stick. When this happens, excessive oil consumption and blow-by will occur.

Engine overheating and ring sticking is usually caused by one or more of the following:

- Overloading engine.
- Incorrect ignition timing.
- Lean fuel mixture.
- Dirty cooling fins.
- Incorrect oil.
- Low oil supply.
- Stale fuel.



M29944 -UN-06SEP88

MX,2110BV,49 -19-01OCT92

Vertical scratches (A) across the piston rings are due to an abrasive in the engine. Abrasives may be airborne, may have been left in the engine during overhaul or may be loose lead and carbon deposits.

When this condition exists, check for one or more of the following:

- Damaged, collapsed or improperly installed air filter.
- Loose connection or damaged gasket between air cleaner and carburetor.
- Air leak around carburetor-to-cylinder block gasket.
- Air leakage around throttle shaft.
- Failure to properly clean cylinder bore after reconditioning engine.



M29945 -UN-06SEP88

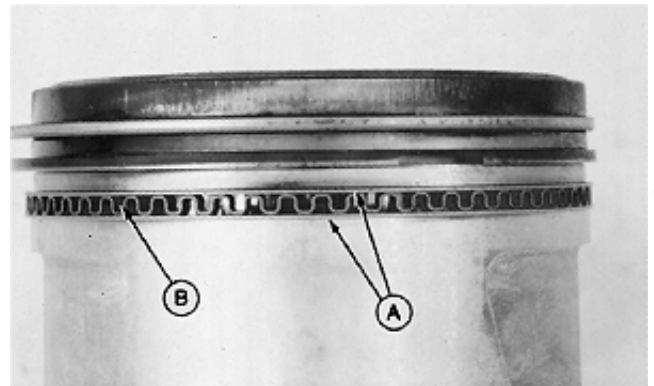
MX,2110BV,50 -19-01OCT92

Abrasive particles in engine oil cause scratches on side rails (A) of oil control ring. Inner spacer (B) wear or distortion may cause:

- High oil consumption.
- Increased deposits in combustion chamber.
- Sticking compression rings.

Increased oil consumption may be caused by:

- Worn side rails with low tension.
- Worn or distorted inner spacer.



M38101 -UN-29AUG88

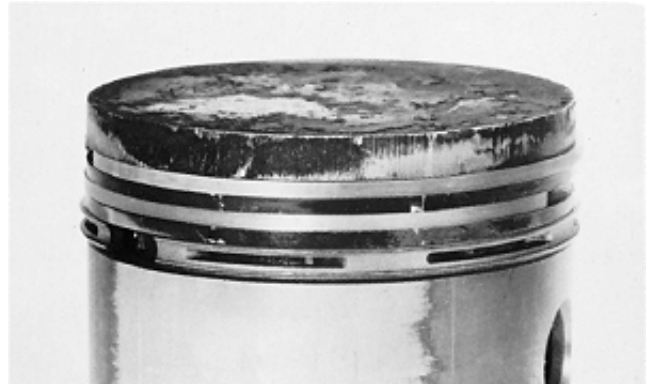
MX,2110BV,51 -19-01OCT92

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Detonation is abnormal combustion causing excessive temperature and pressure in the combustion chamber. Commonly called carbon knock, spark knock or timing knock, detonation occurs as the compressed fuel-air mixture ignites spontaneously to interrupt the normal ignition.

The following is a list of possible causes for detonation:

- Lean fuel mixture.
- Low octane fuel.
- Advanced ignition timing.
- Engine lugging.
- Build-up of carbon deposits on piston or cylinder head, causing excessive compression.
- Wrong cylinder head or milling of head increasing compression ratio.



M29947 -UN-06SEP88

MX,2110BV,52 -19-01OCT92

Pre-ignition is the igniting of the fuel-air mixture prior to regular ignition spark. Pre-ignition causes internal shock, resulting in pings, vibration, detonation and power loss. Severe damage to piston (A), rings and valves results from pre-ignition.

Check the following for causes of pre-ignition:

- Internal carbon deposits.
- Incorrect spark plug (high heat range).
- Broken ceramic in spark plug.
- Sharp edges on valves.



M30039 -UN-06SEP88

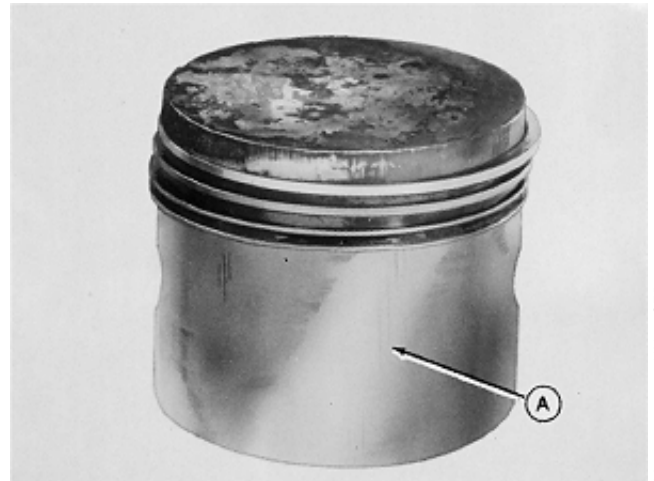
MX,2110BV,53 -19-01OCT92

Check rod and piston alignment when piston shows a diagonal wear pattern (A) extending across the skirt of the piston. Contact with the cylinder wall shows on bottom of skirt at left and ring lands on the right.

A cylinder bored at an angle to the crankshaft can also cause improper ring contact with the cylinder.

This condition causes:

- Rapid piston wear.
- Uneven piston wear.
- Excessive oil consumption.



M29948 -UN-06SEP88

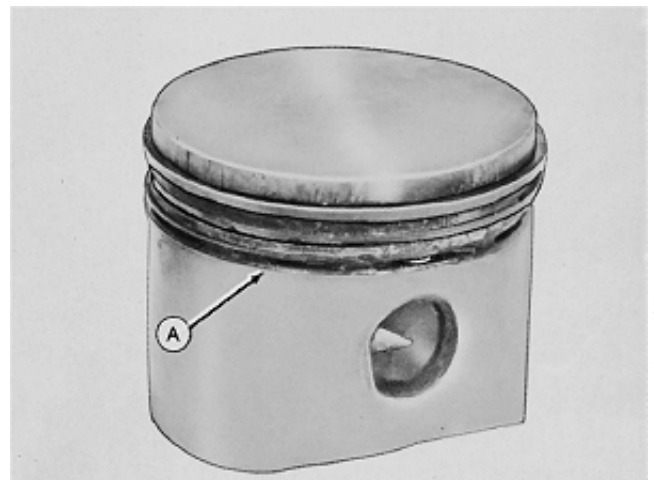
MX,2110BV,54 -19-01OCT92

A broken spring clip caused the damage (A) shown.

Spring clips loosen or break due to:

- Rod misalignment.
- Excessive crankshaft end play.
- Crankshaft journal taper.
- Weak spring clips.
- Incorrectly installed spring clips.

Inertia can cause a broken spring clip to gouge out the piston and cylinder, causing extensive damage.



M29949 -UN-06SEP88

MX,2110BV,55 -19-01OCT92

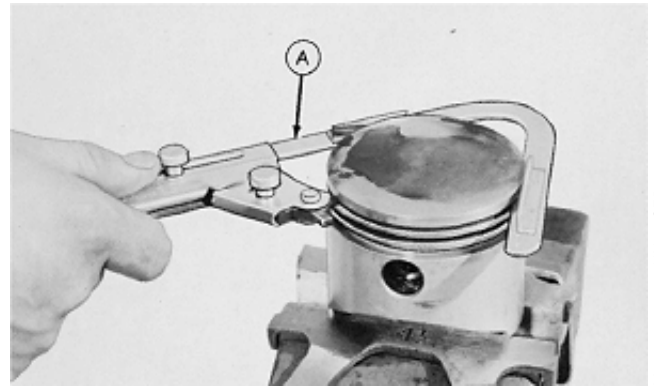
NOTE: DO NOT inspect piston if cylinder will be resized; a new oversized piston will then be used.

IMPORTANT: DO NOT use a caustic cleaning solution or wire brush to clean piston—piston will be damaged.

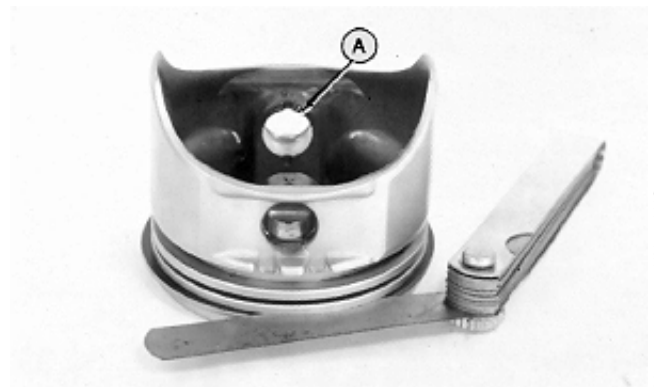
1. Remove piston rings.
2. Remove all deposits from piston, including piston ring grooves. Use a ring groove cleaner (A) or break an old ring and use it carefully to clean grooves.
3. Inspect piston for scoring or fractures. Replace piston if damaged.
4. Install a new piston ring. Check side clearance at several points. Replace piston if clearance is **greater than 0.178 mm (0.007 in.)**.

NOTE: Piston pins 0.127 mm (0.005 in.) larger than standard are available.

5. Measure inside diameter of piston pin bore (A). Replace piston pin or piston if measurement is **greater than 12.471 mm (0.491 in.)**.



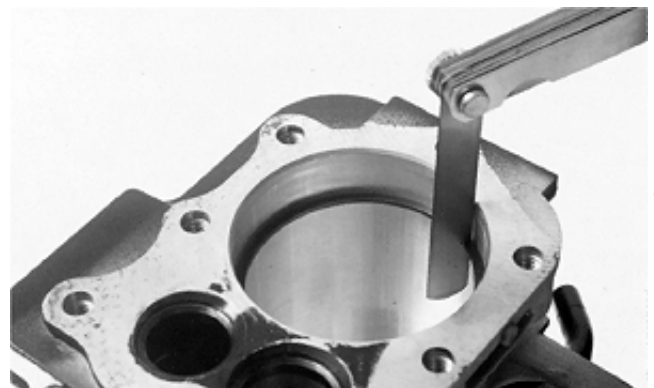
M29946 -UN-06SEP88



M54378 -UN-06AUG90

MX,2110BV,56 -19-16JUL96

6. Before installing rings (original or new) on piston, check ring end gap in cylinder bore.
7. Install separately each piston ring squarely in cylinder bore approximately 25.4 mm (1 in.) down from top of cylinder.
8. Check end gap with feeler gauge. Replace ring if end gap is greater than specifications. Should the end gap be less than specification, file ring ends off squarely until specification is obtained.



M54377 -UN-06AUG90

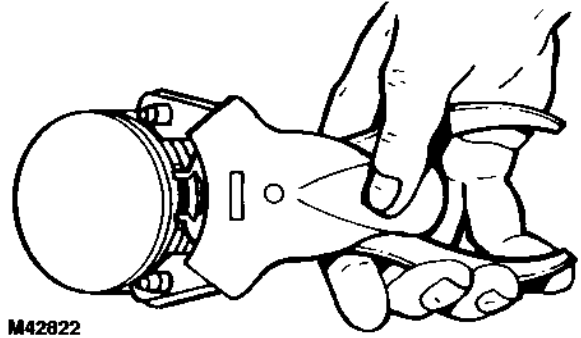
INSPECTION SPECIFICATIONS

Piston Rings Inspection Depth	25.4 mm (1.0 in.)
Compression Rings End Gap (Max.)	0.89 mm (0.035 in.)
Oil Ring End Gap (Max.)	1.14 mm (0.045 in.)

MX,2110BV,57 -19-16JUL96

REMOVE AND INSTALL PISTON RINGS (14PZ AND 14SZ)

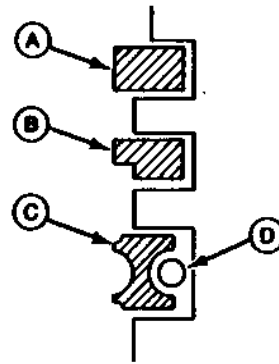
1. Remove piston rings using a piston ring expander.
2. Inspect piston and rings. Replace as necessary.



M42822

3. Use a piston ring expander to install piston rings. Install rings (A and B) as shown. Install spring (D) before installing oil ring (C).

- A—Top Compression Ring
- B—Second Compression Ring
- C—Oil Control Ring
- D—Oil Ring Expander Spring



-JUN-03SEP92

M42822

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MX,2110BV,58 -19-16JUL96

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REMOVE AND INSTALL CONNECTING ROD (14PZ AND 14SZ)

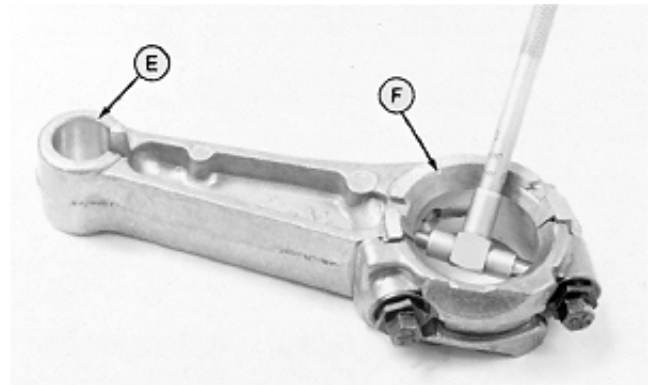
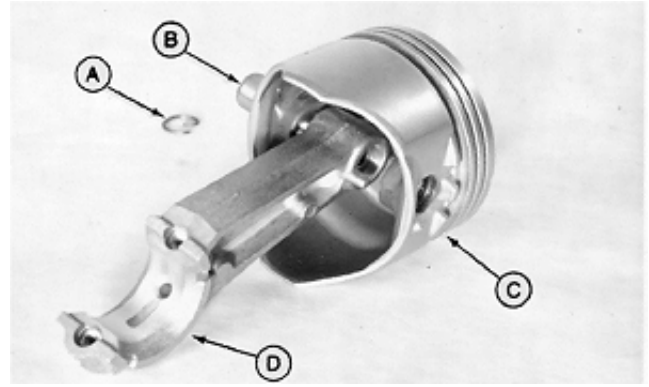
1. Remove piston assembly.
2. Remove spring clip (A) from side opposite piston notch (C).
3. Remove second spring clip from notched side (C) and use wooden fabricated tool to push piston pin (B) out through the opposite side.
4. Inspect piston assembly. Replace components as necessary.
5. Coat all mating surfaces with engine oil.
6. Install connecting rod inside piston with crankshaft race pointing up and recess end of piston pin to notch side (C) of piston. Fasten pin (B) with two spring clips (A).
7. Install piston assembly in cylinder bore.

NOTE: Piston pins 0.127 mm (0.005 in.) larger than standard are available.

8. Clean and inspect rod. Replace if scored.
9. Measure bearings (E and F). Replace connecting rod if either measurement is greater than specifications.
10. Measure outside diameter of piston pin (B). Replace if less than specifications.
11. Install spring clip (A) in notch side of pin bore.
12. Install connecting rod with offset (D) as shown.
13. Apply oil to piston pin. Push pin through piston and connecting rod from side of piston opposite notch.
14. Install spring clip (A).

INSPECTION SPECIFICATIONS

Crankshaft Bearing I.D. (Max.)	25.43 mm (1.001 in.)
Piston Pin Bearing I.D. (Max.)	12.50 mm (0.492 in.)
Piston Pin O.D. (Min.)	12.42 mm (0.489 in.)



- A—Spring Clip (2 used)
- B—Piston Pin
- C—Notch
- D—Connecting Rod Offset
- E—Piston Pin Bearing
- F—Crank Pin Bearing

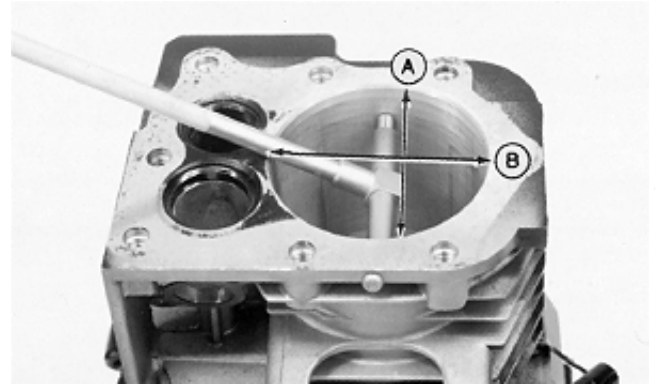
M54380 -JUN-06AUG90

M54379 -JUN-06AUG90

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INSPECT CYLINDER BLOCK (14PZ AND 14SZ)

1. Clean and check block for cracks.
2. Cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25 percent kerosene and 75 percent light engine oil.
3. Wipe area dry and immediately apply coating of zinc oxide dissolved in wood alcohol. If crack is present, coating becomes discolored at the defective area. Replace block if any cracks are found.
4. Check for broken cooling fins. Replace block if any are found.
5. Check on surface plate for warped cylinder seating surface. Replace cylinder block if seating surface is distorted more than 0.05 mm (0.002 in.)
6. Measure cylinder bore dimensions (A and B) in three places at top, middle and bottom of ring travel.
7. If cylinder bore is worn beyond specifications, it must be rebored to 0.25, 0.50 or 0.76 mm (0.010, 0.020 or 0.030 in.) oversize.



M54381 -JUN-06AUG90

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INSPECTION SPECIFICATIONS

Standard Cylinder Bore (Max.)	68.288 mm (2.6885 in.)
Cylinder Bore Out-Of-Round (Maximum)	0.0635 mm (0.0025 in.)
Cylinder Bore Allowable Wear (Maximum)	Oversized - 0.076 mm (0.003 in.)

MX,2110BV,60 -19-16JUL96

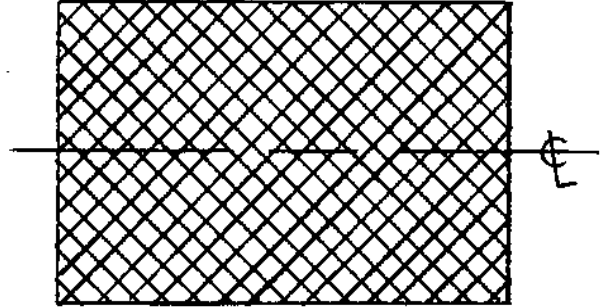
REBORE CYLINDER BLOCK (14PZ AND 14SZ)

If block is to be bored to accept 0.254, 0.508 or 0.762 mm (0.010 in., 0.020 in. or 0.030 in.) oversize pistons, clean and dry block thoroughly. Boring can be done by a reliable automotive repair shop or by using an electric drill press and JDM-63A Small Engine Hone Set. Hone pattern should be 45 degrees from centerline.

IMPORTANT: If block is jugged in a drill press for honing, be sure honing tool and block are in true alignment.

NOTE: Some hones require honing oil and some will not work with even a small amount of oil on the cylinder wall. Check manufacturer's specifications.

1. Chuck hone in a drill press that has a spindle speed of 300—700 rpm.
2. Use recommended stones and center cylinder under press spindle. Lower hone so lower end of stones contacts lowest point in cylinder bore.
3. Rotate adjusting nut so that stones touch cylinder wall and begin honing at bottom of cylinder. Move hone up and down at a rate of 50 strokes per minute to avoid cutting ridges in cylinder wall. On every fourth or fifth stroke, move hone far enough to extend the stones 25.4 mm (1 in.) beyond top and bottom of cylinder bore.
4. Check bore every 30 or 40 strokes for size and straightness. If stones collect metal, clean with a wire brush each time hone is removed.
5. Hone until bore is 0.0127 mm (0.0005 in.) larger than desired size to allow for shrinkage when cylinder cools.
6. Remove burnishing stones, and install finishing stones to polish cylinder to final size and 45° crosshatch pattern, as shown.
7. Clean cylinder with solvent and dry thoroughly. Clean cylinder bore with a brush and a detergent/water solution. Dry thoroughly.



TY13153 -UN-02MAY89

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DISASSEMBLE AND ASSEMBLE RECOIL START (14PZ AND 14SZ)

1. Remove recoil start assembly.

2. Release recoil spring tension:

- Separate T-handle (A) to untie knot and, while holding rope tight in one hand, remove T-handle from rope with the other hand.
- Slowly allow recoil spring to unwind inside housing.

3. Turn recoil start retainer (C) over onto a 25 mm (1.0 in.) diameter piece of pipe that is clamped into a bench vise. Drive flared roll pin and flat washer (B) from center of assembly.

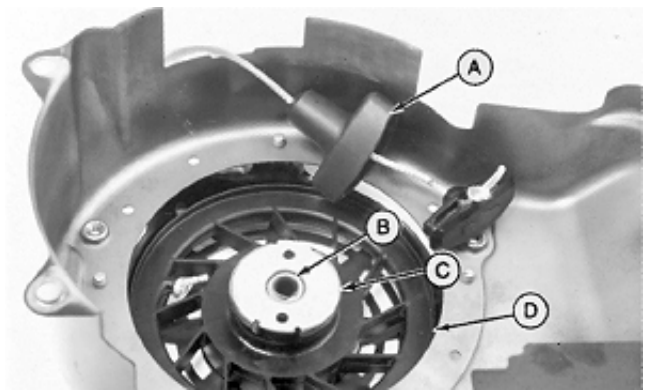
4. Turn assembly over and remove retainer (C).

5. Remove torsion spring (E), plastic washer (F), dogs (G) and dog return springs (H). Inspect all components for damage. Replace as necessary.

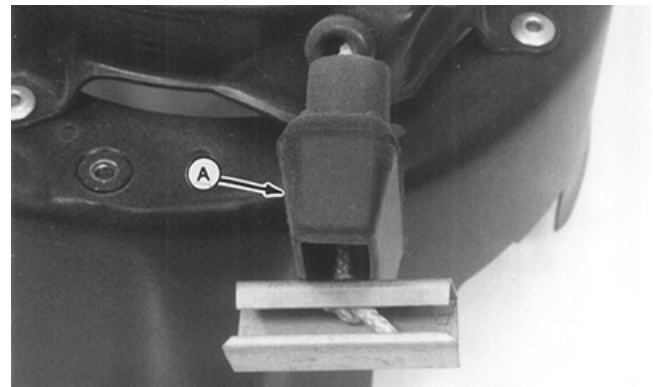
CAUTION: Sheave and recoil spring assembly (D) is replaced as a unit. DO NOT attempt to disassemble. Recoil spring is under tension and can cause personal injury if disassembled.

6. Remove sheave and recoil spring assembly (D).

- A—T-Handle
- B—Flared Roll Pin and Flat Washer
- C—Retainer
- D—Sheave and Recoil Spring Assembly
- E—Torsion Spring
- F—Plastic Washer
- G—Dog (2 used)
- H—Dog Return Spring (2 used)



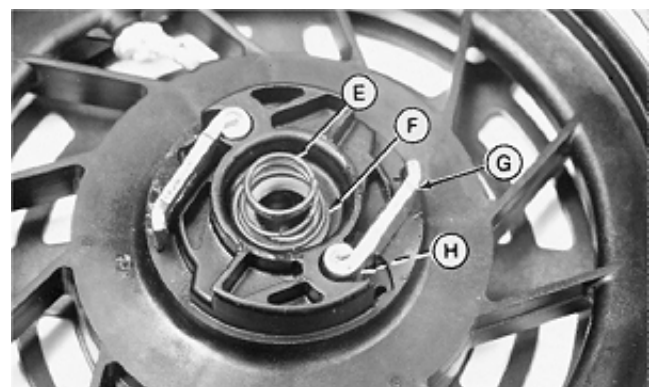
Early Model 4-HP Engine

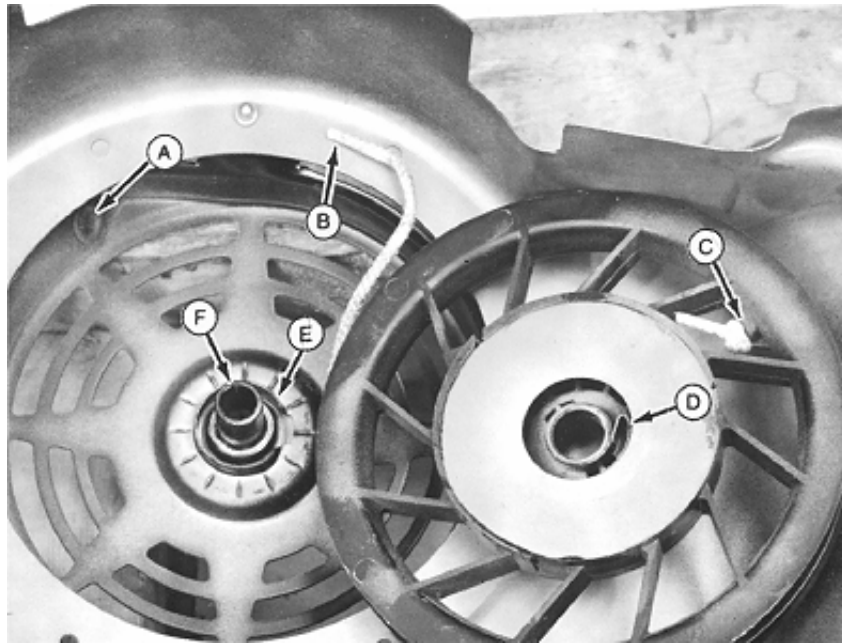


Late Model 5-HP Engine



Late Model 5.5-HP Engine





A—Housing Eyelet
B—Unknotted End of Rope

C—Sheave Hole
D—Recoil Spring Anchor

E—Housing Anchor Lip

F—Housing Hub

7. Inspect sheave and recoil spring assembly, rope, housing hub, and anchor lip for wear or damage. Replace components as necessary. Replace rope if worn or frayed with #4-1/2 or #5 braided rope, 2251 mm (88.625 in.) long.

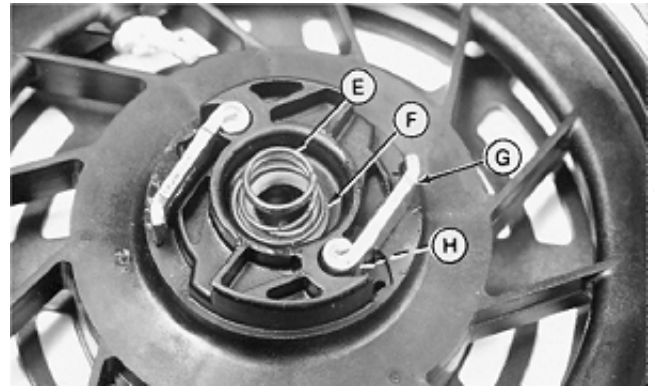
8. Knot rope on one end and feed unknotted end inside-out through sheave hole (C) until knotted end becomes seated against sheave hole (C). Tightly wind rope in a counterclockwise direction onto

sheave. BE SURE to keep rope inside sheave all-the-way around or recoil start will not function properly.

9. Feed untied end of rope (B) through housing eyelet (A) and install sheave and spring assembly over housing hub (F). Rotate sheave and recoil spring assembly in a counterclockwise direction until spring anchor (D) engages anchor lip (E). Check that tension is detected when you pull on the rope.

MX,2115BV,2 -19-01OCT92

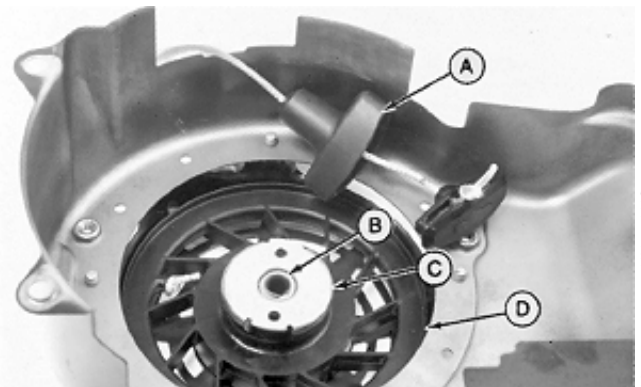
10. Install plastic washer (F), torsion spring (E), dog return springs (H), and dogs (G). BE SURE that anchors of dog return springs (H) are installed on the outsides of dogs and that they return dogs back toward hub. Also BE SURE that plastic washer and torsion spring are centered over hub hole.



M54346 -JUN-06AUG90

11. Install retainer (C) with two outside lips and two small hole lips facing the hub.

IMPORTANT: BE SURE that flared roll pin is installed straight into hub hole. DO NOT drive flared roll pin and flat washer in too far or recoil start assembly will become damaged. Plastic washer, torsion spring, retainer, housing hub, and/or sheave and recoil spring assembly will become distorted or damaged (I), rendering recoil start assembly inoperable.



M54345 -JUN-06AUG90

12. Install flat washer on flared roll pin (B) and press pin in until flare is flush with retainer (C).

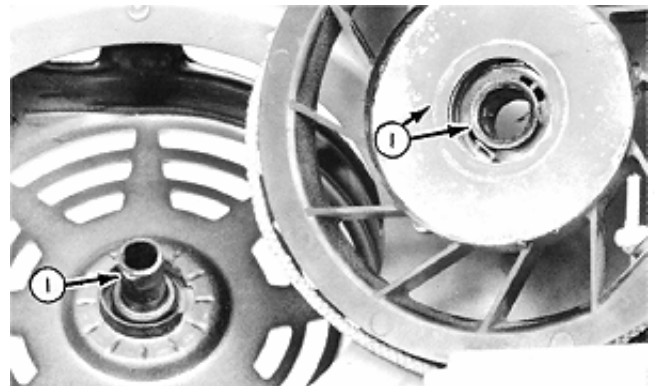
13. Feed end of rope through T-handle (A) and rope anchor. Knot rope and cauterize rope end to prevent fraying. Insert anchor into T-handle.

14. Disconnect spark plug lead and recycle recoil start assembly several times; check that recoil start assembly (D) functions smoothly and properly. Connect spark plug lead.



M42884 -JUN-31AUG92

- A—T-Handle
- B—Flared Roll Pin and Flat Washer
- C—Retainer
- D—Sheave and Recoil Spring Assembly
- E—Torsion Spring
- F—Plastic Washer
- G—Dogs (2 used)
- H—Dog Return Springs (2 used)
- I—Distortions or Damage

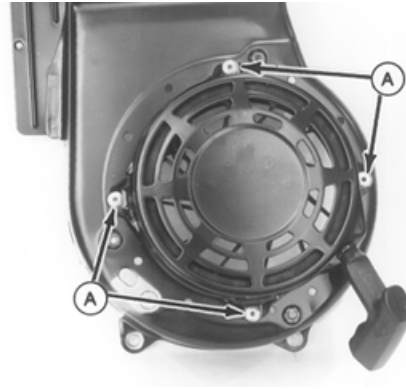


M42885 -JUN-31AUG92

REPLACE RECOIL START (14PZ AND 14SZ)

NOTE: The recoil start should only be removed from fan shroud if it is to be replaced.

1. Remove engine fan shroud. (See Section 31, Group 05.)
2. Using a 1/4-in. drill bit, drill out four rivets (A).
3. Install new recoil start assembly using screws and hex nuts.
4. Install engine fan shroud.



M81646 -UN-23MAY95

MX,2115BV,4 -19-16JUL96

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Section 22

ENGINE REPAIR—KAWASAKI 4-CYC ENG (14PB/14PT/14SB/14SC/14SX/14SE/14ST)

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Remove and Install Camshaft	22-10-17	Replace Spring	22-15-3
Inspect Camshaft	22-10-17	Assemble Recoil Starter	22-15-3
Inspect Camshaft Plain Bearings	22-10-18	Analyze Electric Starter Condition	22-15-4
Inspect Automatic Compression Release (A.C.R.)	22-10-18	Check Starter Armature Rotation	22-15-5
Remove, Inspect and Install Tappets	22-10-19	Inspect Electric Starter	22-15-6

22

OTHER MATERIAL

Number	Name	Use
T43512	John Deere Thread Lock and Sealer (Medium Strength)	Self-propelled units: Apply to threads of engine drive sheave set screw.
M79292	MPG-2 [®] DuBois Multi-Purpose Polymer Grease, NLGI Grade 1	Apply to any mating surfaces that might seize to each other over long periods of time.

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

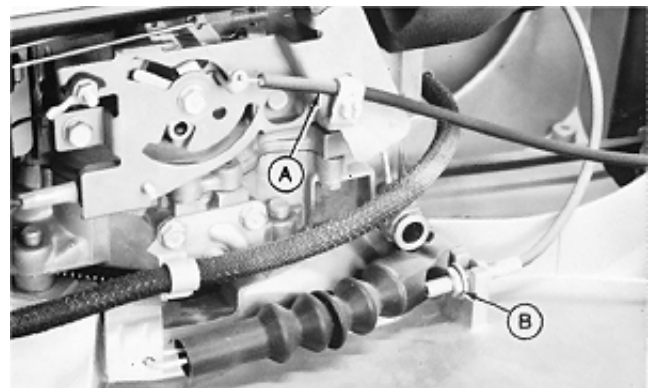
MX,2205BV,1 -19-16JUL96

REMOVE AND INSTALL ENGINE—PUSH MOWERS (14PB AND 14PT)

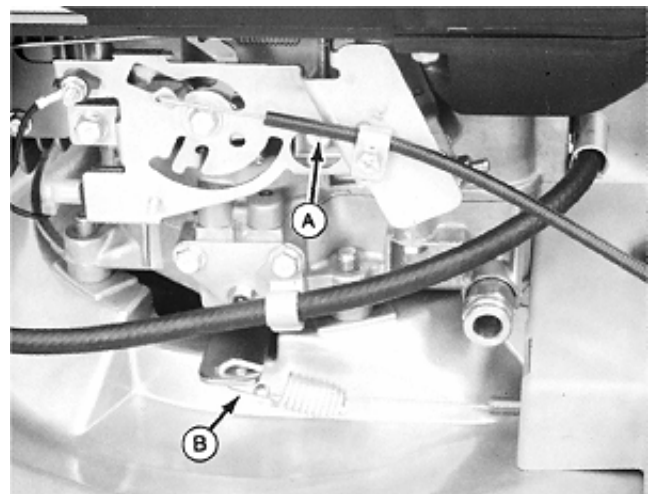
1. Disconnect spark plug lead.

⚠ CAUTION: Gasoline is dangerous. Avoid fires due to smoking or careless maintenance. In a well ventilated area free of sparks or flame, drain fuel into a safe container.

2. Drain fuel and oil.
3. Disconnect throttle control cable (A) and BBC control cable assembly (B) on 14PB mower only.
4. Remove blade.



Early Models With Ogura BBC



Late Models With Warner BBC

MX,2205BV,2A -19-16JUL96

5. Disconnect Ogura BBC return spring (C) on early model mowers and Warner BBC return spring (A) on late model mowers using special spring removal tool JDG717.

6. Have a helper hold the engine while you remove four mounting cap screws (E) to remove engine to workbench.

7. Remove blade brake clutch (BBC), if equipped.

8. Inspect engine and make repairs as necessary.

9. Inspect recoil start assembly and make repairs as necessary.

10. Coat crankshaft, key, and blade adapter with MPG-2® DuBois Multi-Purpose Polymer Grease, NLGI Grade 1 (M79292). Install key, blade adapter, and blade. Tighten blade cap screws to **47 N·m (35 lb-ft)**.

NOTE: If an Ogura BBC assembly is damaged beyond repair, a new Warner BBC will be installed in its place.

11. Install BBC (if equipped).

12. Install engine, BBC return spring (if equipped), and blade. Tighten cap screws to **27 N·m (20 lb-ft)**.

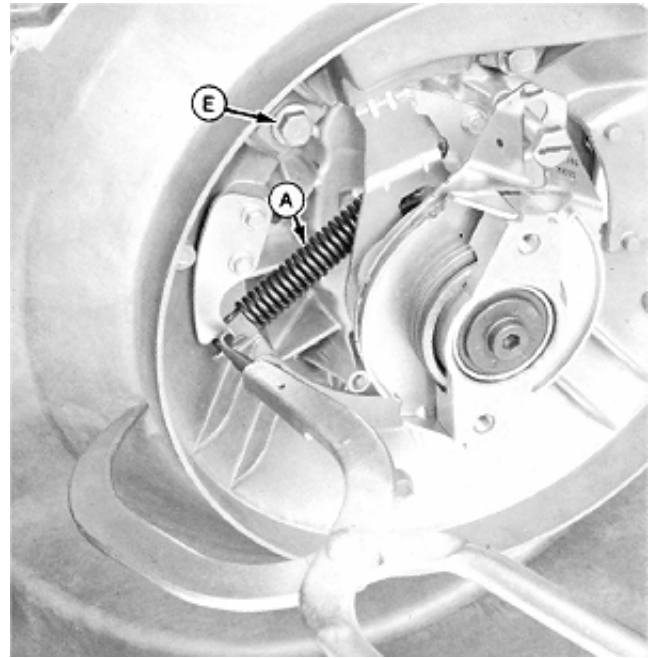
13. Connect throttle control cable and adjust.

14. Connect BBC control cable, if equipped, and adjust.

15. Fill engine with proper fuel and oil. (See Section 10, Group 20.)



Early Models With Ogura BBC



Late Models With Warner BBC

M52453 -UN-06DEC88

M42785 -UN-30JUL92

MX,2205BV,2B -19-16JUL96

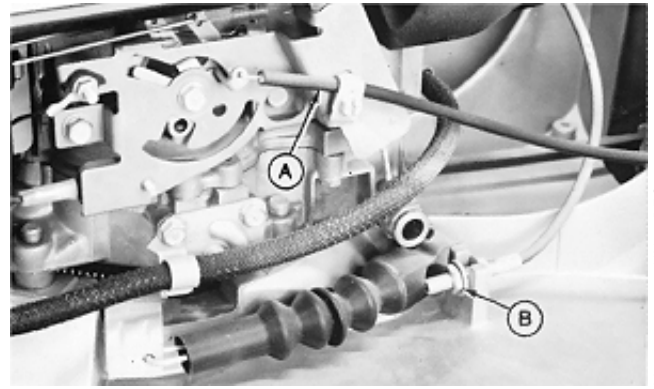
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REMOVE AND INSTALL ENGINE—SELF-PROPELLED MOWERS (14SB, 14SC/14SX, 14SE, AND 14ST)

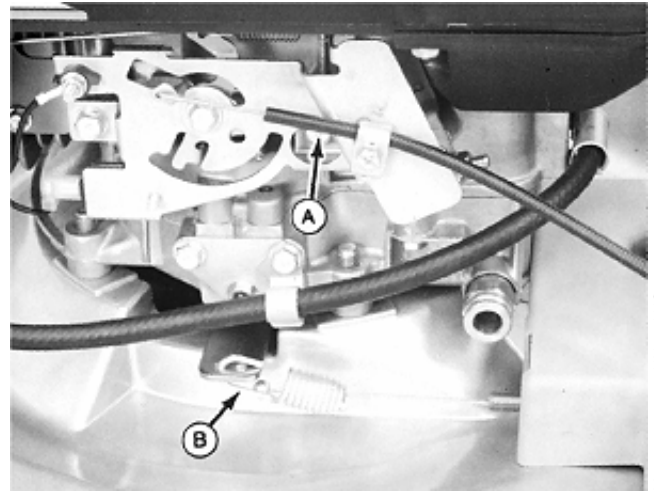
1. Disconnect spark plug lead.

CAUTION: Gasoline is dangerous. Avoid fires due to smoking or careless maintenance. In a well ventilated area free of sparks or flame, drain fuel into a safe container.

2. Drain fuel and oil.
3. Remove mower deck cover.
4. Disconnect throttle control cable (A) and BBC control cable (B), if equipped.



Early Models With Ogura BBC



Late Models With Warner BBC

MX,2205BV,3A -19-16JUL96

M52433 -JUN-06DEC88

M42782 -JUN-31AUG92

22
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3

A—Late Model Return Spring
B—Starter Connector
C—Early Model Return Spring

D—Battery Connector
E—Mounting Cap Screw

F—Battery
G—Drive Sheave

H—Drive Belt

IMPORTANT: DO NOT turn mower on its side while battery is installed. Battery acid may leak out and cause damage.

5. On 14SE electric start model only, disconnect wiring harness at connector (B) to disconnect electric start motor and connector (D) to disconnect and remove battery (F).

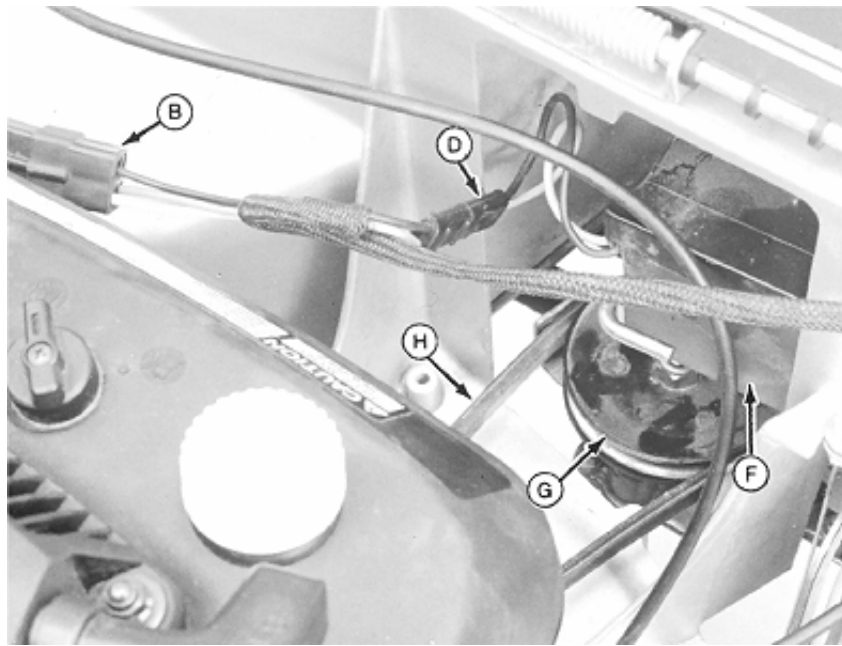
6. Remove drive sheave (G) and drive belt (H) from transaxle.

7. Remove blade.

8. Disconnect Ogura BBC return spring (C) on early model mowers and Warner BBC return spring (A) on late model mowers using special spring removal tool JDG717.

9. Have a helper hold onto the engine while you remove four mounting cap screws (E) to remove engine to workbench.

10. Remove blade brake clutch (BBC), if equipped.



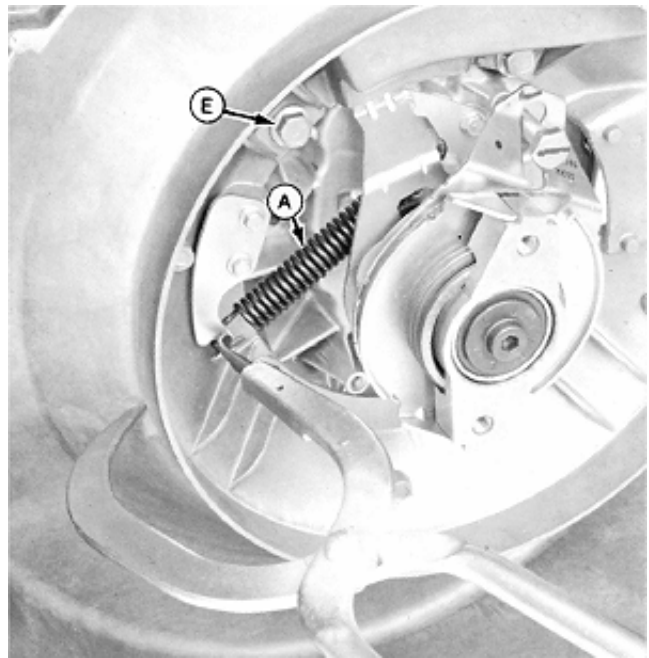
M52434 -UN-31AUG92

Model 14SE Only



M52453 -UN-06DEC88

Early Models With Ogura BBC



M42785 -UN-30JUL92

Late Models With Warner BBC

MX,2205BV,3C -19-01OCT92

11. Measure and record distance (E) for installation purposes. Remove key (A) and loosen set screw (B) to remove engine drive sheave (C) and key (D).

12. Inspect engine and make repairs as necessary.

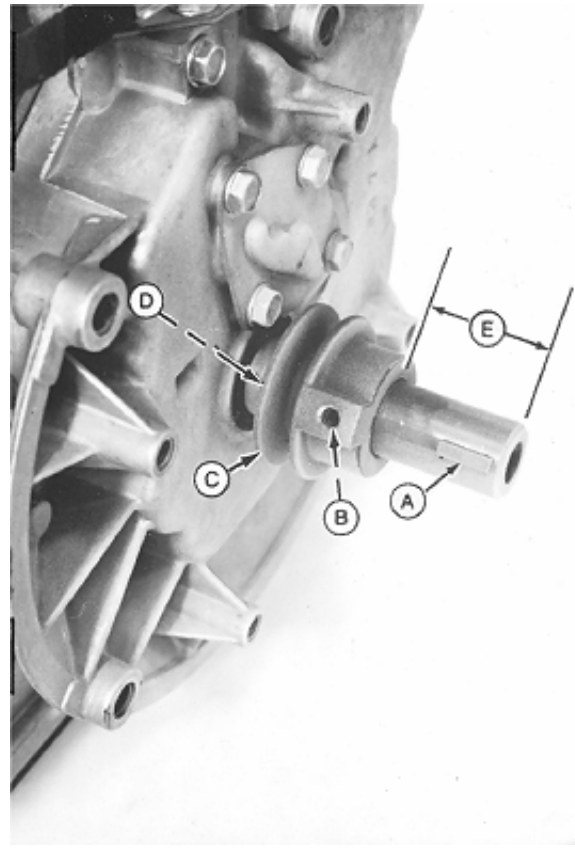
13. Inspect recoil start assembly or electric start motor (Model 14SE only) and make repairs as necessary.

14. Coat crankshaft, inside mounting surface of drive sheave (C), and key (D) with MPG-2® DuBois Multi-Purpose Polymer Grease, NLGI Grade 1 (M79292). Install sheave to assembly **38 mm (1.500 in.)** (E) from end of shaft. Apply John Deere thread lock and sealer (medium strength) TY43512 to threads of set screw (B). Install and tighten set screw to **5 N·m (44 lb-in.)**. Install key (A) before you install BBC or blade adapter.

NOTE: If an Ogura BBC assembly is damaged beyond repair, a new Warner BBC will be installed in its place.

15. Install BBC (if equipped).

- A—Key
- B—Set Screw
- C—Drive Sheave
- D—Key
- E—38 mm (1.500 in.)



M52561 -JUN-31AUG92

MX,2205BV,4 -19-16JUL96

- A—Late Model Return Spring
- B—Starter Connector
- C—Early Model Return Spring

- D—Battery Connector
- E—Mounting Cap Screw

- F—Battery
- G—Drive Sheave

- H—Drive Belt

16. Have a helper hold engine in place while you fasten it with four mounting cap screws (E). Tighten to **35 N·m (26 lb-ft)**.

17. If equipped with BBC, use JDG717 special spring removal tool to engage return spring (C) on early model mowers with Ogura BBC and return spring (A) on late model mowers with Warner BBC.

18. If not equipped with BBC, coat end of crankshaft, key, and inside of blade adapter with MPG-2® DuBois

Multi-Purpose Grease, NLGI Grade 1 (M79292). Install blade. Tighten cap screws to **47 N·m (35 lb-ft)**.

19. Install transaxle drive sheave (G) and drive belt (H). Tighten lock nut to **34 N·m (25 lb-ft)**.

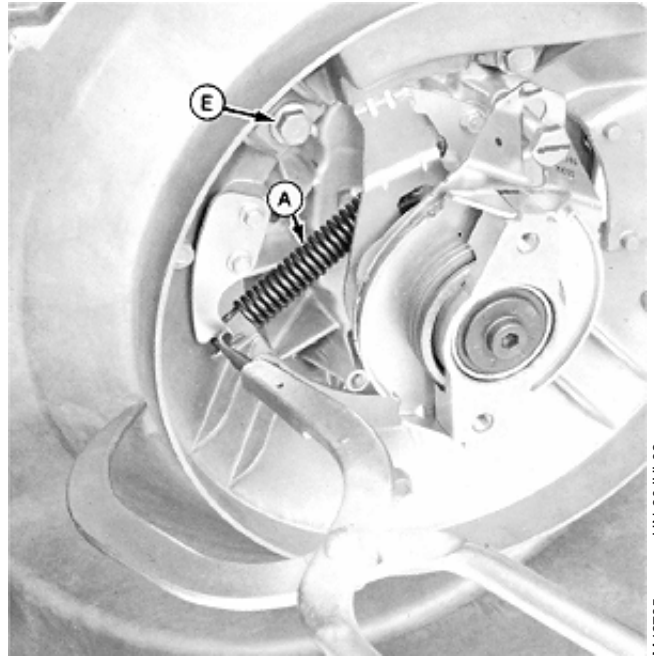
20. Install battery (F) and connect wiring harness connector (D). Connect wiring harness connector (B) to electric start motor.

MX,2205BV,5 -19-16JUL96



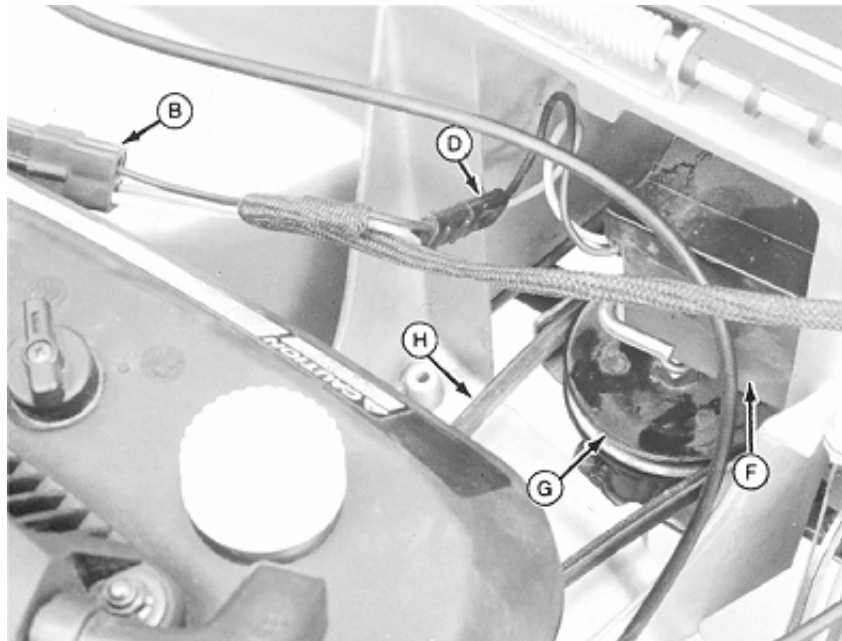
Early Model Ogura BBC

M52453 -UN-06DEC88



Late Model Warner BBC

M42785 -UN-30JUL92

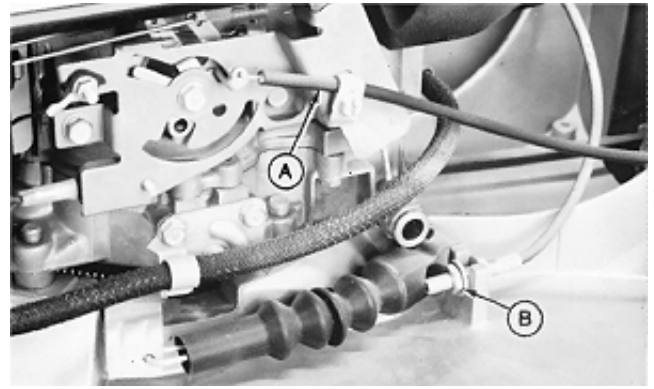


Model 14SE Only

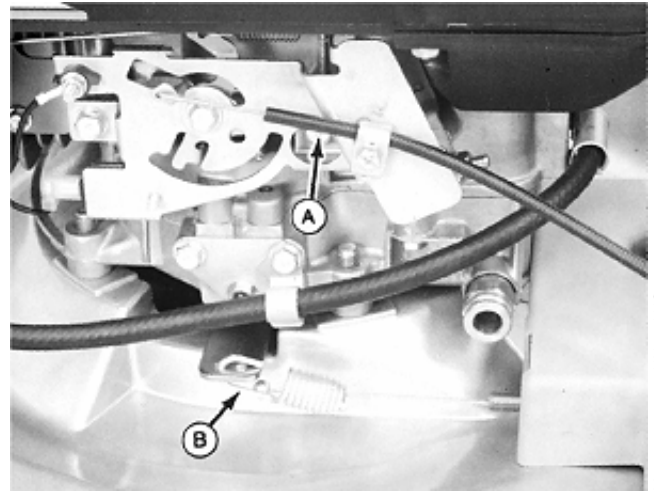
M52434 -UN-31AUG92

MX,2205BV,5A -19-01OCT92

21. Connect throttle control cable (A) and adjust.
22. If equipped with BBC, connect BBC control cable (B) and adjust.
23. Fill engine with proper oil. (See Section 10, Group 20.)
24. Fill tank with proper fuel. (See Section 10, Group 20.)



Early Model Ogura BBC



Late Model Warner BBC

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M52433 -JUN-06DEC88

M42782 -JUN-31AUG92

MX,2205BV,6 -19-16JUL96

Group 10 Engine Repair—Kawasaki FC150V 4-Cycle Engine

OTHER MATERIAL

Number	Name	Use
	SCOTCH-BRITE® Abrasive Sheets/Pads	Clean Cylinder Head
	Valve Guide Cleaner	Clean Valve Guides
	Stanisol (or Kerosene)	Finish Ream Valve Guide
	Prussian Blue Compound	Check Valve Seat Contact
	Lithium Base Grease	Pack oil seals.
	Zinc Oxide/Wood Alcohol	Check block for cracks.

SCOTCH-BRITE is a trade mark of the 3M Company.

MX,2210BV,3 -19-16JUL96

SERVICE PARTS KITS

The following kits are available through your parts catalog.

Overhaul Gasket Kit

Intake & Exhaust Valve Kit

Rocker Arm Kit

Piston Ring Kit

Oversized Pistons

Oversized Piston Rings

Undersized Connecting Rod

Cylinder Block

Short Block Kit

MX,2210BV,4 -19-16JUL96

EXPLODED VIEW—KAWASAKI FC150V 4-CYCLE ENGINE (14PB, 14PT, 14SB, 14SC/14SX, 14SE, AND 14ST)

- | | | | |
|--|---------------------------|----------------------------|----------------------------------|
| 1—Flywheel Nut | 15—Pick-Up Screen | 33—Crankshaft Gear | 51—Valve Spring Retainers |
| 2—Washer | 16—Check Ball | 34—Crankshaft Woodruff Key | 52—Valve Springs |
| 3—Flywheel Screen/Recoil Start Cup Assembly | 17—Check Spring | 35—Crankshaft | 53—Breather Valve |
| 4—Flywheel | 18—O-Ring | 36—Ball Bearing | 54—Reed Valve |
| 5—Electric Starter Assembly (14SE only) | 19—Oil Pump | 37—Cylinder Head Gasket | 55—Spark Plug |
| 6—Upper Crankcase Seal | 20—Lower Plate | 38—Connecting Rod | 56—Cylinder Head |
| 7—Electric Starter Charging Coil (14SE only) | 21—Governor Shaft | 39—Piston | 57—Reed Valve |
| 8—Upper Crankcase/Cylinder Housing | 22—Guide Pin | 40—Piston Pin | 58—Breather Valve |
| 9—Dip Stick | 23—Governor Nylon Tip | 41—Piston Rings (3 used) | 59—Gasket |
| 10—Gasket | 24—Governor Assembly | 42—Spring Clips (2 used) | 60—Cover |
| 11—Grommet | 25—Washer | 43—Camshaft Assembly | 61—Bracket |
| 12—Fill Tube | 26—Crankcase Cover | 44—Tappets | 62—Breather Tube |
| 13—O-Ring | 27—O-Ring | 45—Push Rods | 63—Intake/Exhaust Valves |
| 14—Upper Plate | 28—Drain Fitting | 46—Guide Plate | 64—Compression Release Mechanism |
| | 29—O-Ring | 47—Rocker Arm Studs | 65—Valve Cover Gasket |
| | 30—Oil Filter Cover Plate | 48—Rocker Arms | 66—Valve Cover |
| | 31—Lower Crankcase Seal | 49—Jam Nuts | |
| | 32—Crankcase Gasket | 50—Special Nuts | |

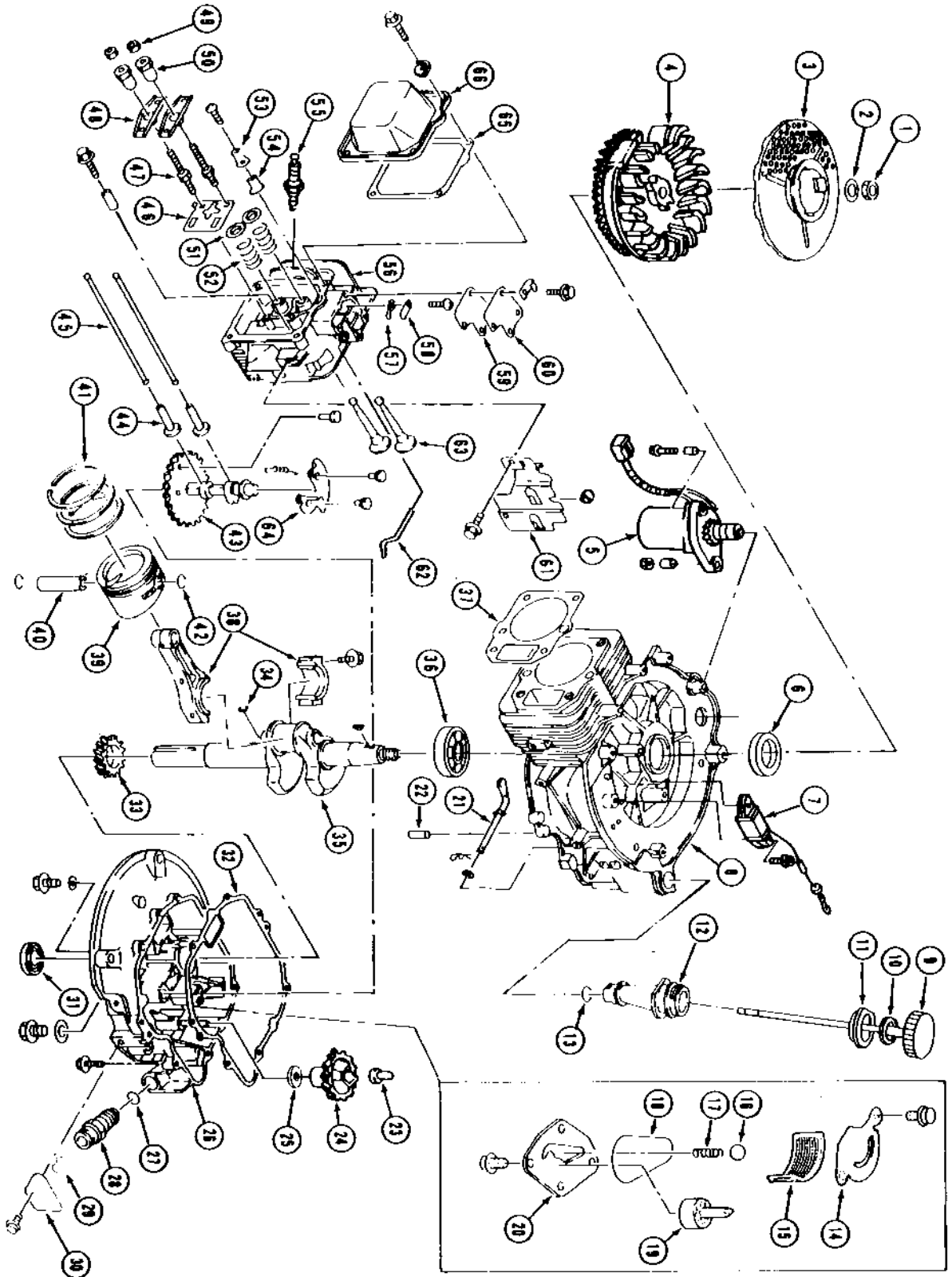
This exploded view is provided to you as a reference for disassembly and assembly of the Kawasaki FC150V 4-Cycle Engine.

Design and specifications subject to change without notice.

MX,2210BV,2A -19-16JUL96

M42872

KAWASAKI 4-CYCLE ENGINE



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M42872 -JUN-21AUG92

REMOVE AND INSTALL AIR FILTER ASSEMBLY

See Fuel and Air System—Kawasaki 4-Cycle Engine, in Section 32, Group 05 for removal and installation procedures.

MX,2210BV,5 -19-16JUL96

REMOVE AND INSTALL CARBURETOR ASSEMBLY

See Fuel and Air System—Kawasaki 4-Cycle Engine, in Section 32, Group 10 for removal and installation procedures.

MX,2210BV,6 -19-16JUL96

REMOVE AND INSTALL FUEL TANK ASSEMBLY

See Fuel and Air System—Kawasaki 4-Cycle Engine, in Section 32, Group 15 for removal and installation procedures.

MX,2210BV,7 -19-16JUL96

REMOVE AND INSTALL EXHAUST ASSEMBLY

See Fuel and Air System—Kawasaki 4-Cycle Engine, in Section 32, Group 20 for removal and installation procedures.

MX,2210BV,8 -19-16JUL96

REMOVE AND INSTALL ENGINE COVER

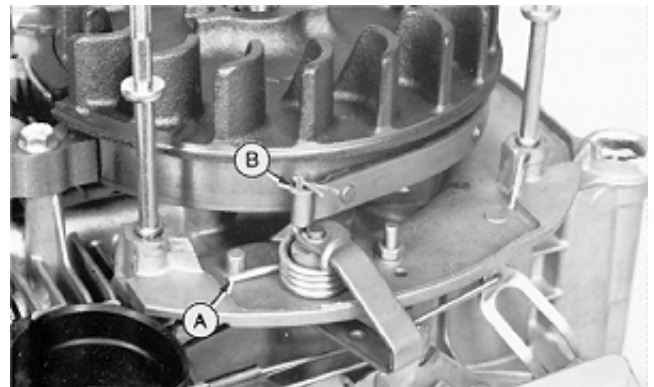
See Fuel and Air System—Kawasaki 4-Cycle Engine, in Section 32 for removal and installation procedures.

MX,2210BV,9 -19-16JUL96

REMOVE AND INSTALL BRAKE BAND—ZONE START MODELS

1. Remove engine cover. (See Section 32, Group 10.)
2. Remove oil fill tube.
3. Pry spring arm (A) over stop.
4. Remove pin and washer (B).

NOTE: Remove engine cover mount stud when replacing brake band only.

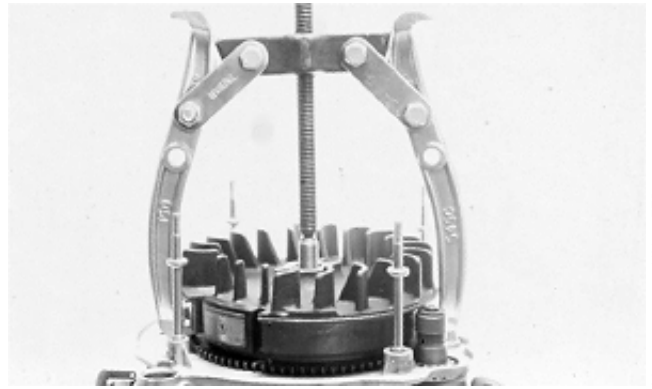


5. Inspect band for wear or damage. Replace if necessary.
 - Remove engine cover mount stud on end of band.
 - Replace brake band.
 - Apply thread lock and sealer (medium strength) on threads of engine cover mount stud.
 - Install brake band and stud.
6. Install brake band, washer and pin.
7. Install spring arm in front of stop.
8. Install oil fill tube.
9. Install engine cover.

MX,2210BV,10 -19-16JUL96

REMOVE AND INSTALL FLYWHEEL

1. Remove engine cover. (See Section 32, Group 10.)
2. Remove armature with coil. (See Section 42, Group 10.)
3. Remove brake band, if equipped. (See Remove and install Band Brake—Zone Start Models in this group.)
4. Remove flywheel using a two-jaw puller.
5. Inspect flywheel for wear or damage. Replace if necessary.
6. Install flywheel.
7. Install brake band, if equipped.
8. Install armature with coil.
9. Install engine cover.



M80166 -JUN-11FEB91

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MX,2210BV,11 -19-16JUL96

REMOVE, INSPECT AND INSTALL ROCKER ARM ASSEMBLY

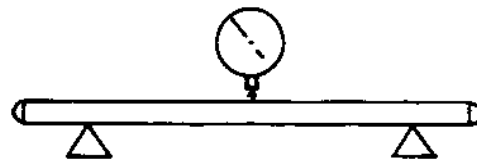
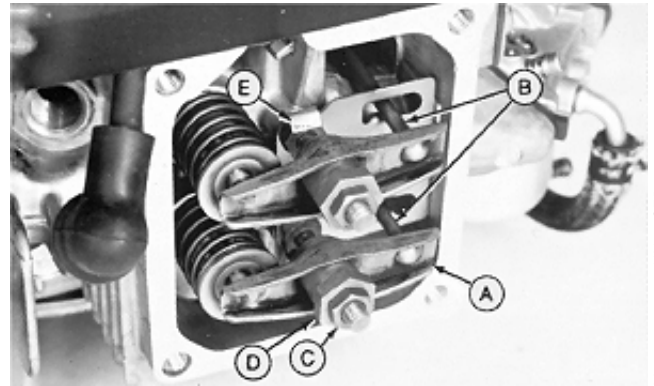
1. Remove rocker arm cover.
2. Turn crankshaft until piston is at highest position in compression stroke.
3. Remove nut (C) and pivot (D) to remove arm (A).

IMPORTANT: Mark push rods for reassembly in original locations.

4. Remove push rods (B).
5. Bend open lock tabs (E). Remove rocker arm studs and support plate.
6. Inspect parts for wear or damage. Replace as necessary.
7. Inspect push rods for bends using V-blocks and a dial indicator. Turn rod slowly and read variation on indicator. Replace if variation is greater than **0.30 mm (0.012 in.)**.
8. Install support plate and studs. Tighten studs to **7 N·m (62 lb-in.)**. Bend over lock tabs.

IMPORTANT: Align rocker arms over push rods during assembly.

9. Install push rods, rocker arms, pivots and nuts.
10. Check valve clearance. (See Check Valve Clearance in this group.)
11. Install rocker arm cover.



- A—Rocker Arm (2 used)
- B—Push Rods
- C—Nut (2 used)
- D—Pivot (2 used)
- E—Lock Tab

MX,2210BV,12 -19-16JUL96

M51747 -UN-07SEP88

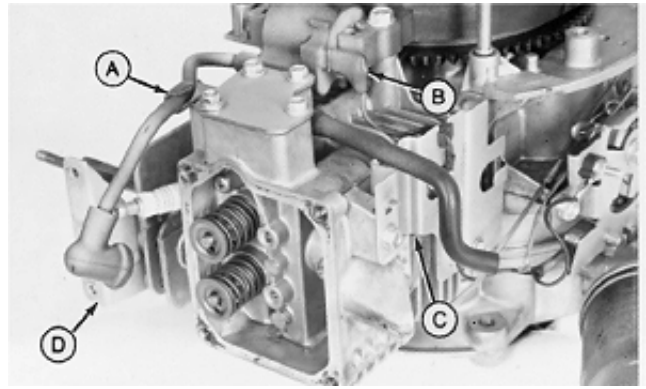
-UN-31AUG88

M50044

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REMOVE AND INSTALL CYLINDER HEAD ASSEMBLY

1. Remove engine cover. (See Section 32, Group 10.)
2. Remove carburetor. (See Section 32, Group 05.)
3. Remove rocker arm assembly. (See Remove, Inspect and Install Rocker Arm Assembly in this group.)
4. Remove muffler shield, muffler and gasket. (See Section 32, Group 20.)
5. Disconnect wiring lead (B).
6. Remove heat shields (C and D).
7. Disconnect spark plug wiring lead and remove from clamp (A).
8. Remove spark plug.
9. Remove cylinder head assembly.
10. Make repairs as necessary. (See procedures in this group.)



A—Clamp
B—Wiring Lead
C—Heat Shield
D—Heat Shield

M80167 -JUN-11FEB91

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MX,2210BV,13 -19-16JUL96

IMPORTANT: Gasket surfaces are coated with sealant. Do not damage surfaces or gasket during installation.

11. Install cylinder head assembly with new gasket. Install cap screws and tighten finger tight.

12. Tighten cap screws in sequence shown to **18 N·m (159 lb-in.)**.

13. Continue in sequence, 3 N·m (27 lb-in.) at a time, until final torque of **24 N·m (212 lb-in.)**.

14. Install spark plug and tighten to **20 N·m (177 lb-in.)**.

15. Connect spark plug wiring lead.

16. Install heat shields.

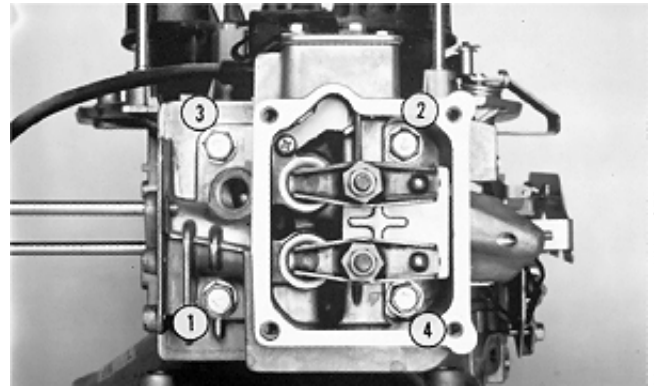
17. Connect armature wiring lead.

18. Install new gasket, muffler and muffler shield.

19. Install rocker arm assembly.

20. Install carburetor.

21. Install engine cover.



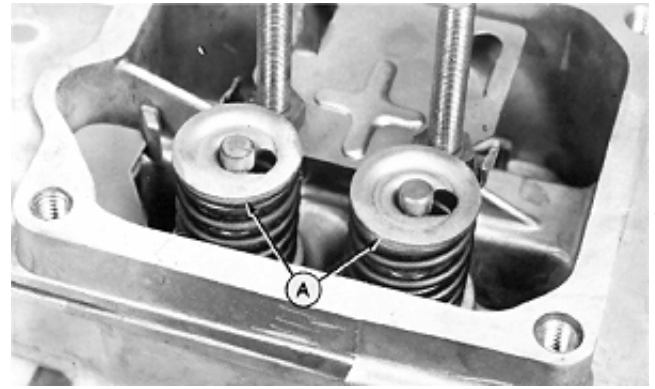
M51748 -JUN-07SEP88

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MX,2210BV,14 -19-16JUL96

REMOVE AND INSTALL VALVES AND SPRINGS

1. Remove cylinder head. (See Remove and Install Cylinder Head Assembly in this group.)
2. Support valves from below and press down on spring retainers (A).
3. Remove retainers, springs and valves.
4. Inspect and analyze valves. (See Analyze Valves in this group.)
5. Inspect springs, valves, guides and seats. (See procedures in this group.)
6. Install valves, springs, and retainers.
7. Install cylinder head.

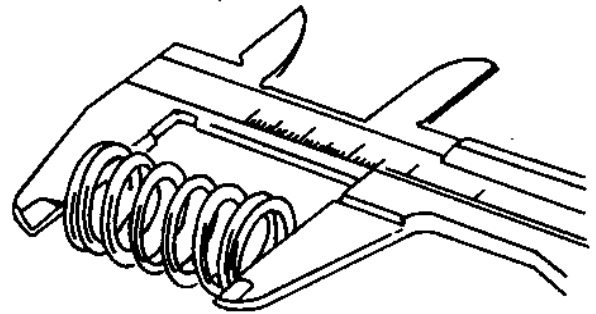


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MX,2210BV,15 -19-16JUL96

INSPECT SPRINGS

Inspect spring free length. Replace if damaged or if less than **31.50 mm (1.240 in.)**.

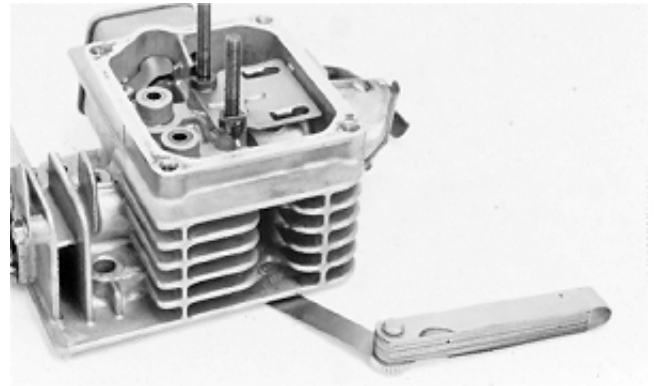


M50036 -UN-31AUG88

MX,2210BV,16 -19-16JUL96

INSPECT CYLINDER HEAD

1. Remove carbon deposits from combustion chamber and gasket surface using SCOTCH-BRITE abrasive pads or an equivalent.
2. Clean head with solvent.
3. Inspect for cracks or broken cooling fins.
4. Inspect gasket surface for burrs and nicks.
5. Inspect head gasket for burns and traces of gas leakage. Replace if necessary.
6. Check that oil drainback passages are not plugged.
7. Put cylinder head on a surface plate. Check for distortion at several points around the head using a feeler gauge. Replace head if distortion is more than **0.07 mm (0.003 in.)**.



M80168 -UN-11FEB91

MX,2210BV,17 -19-16JUL96

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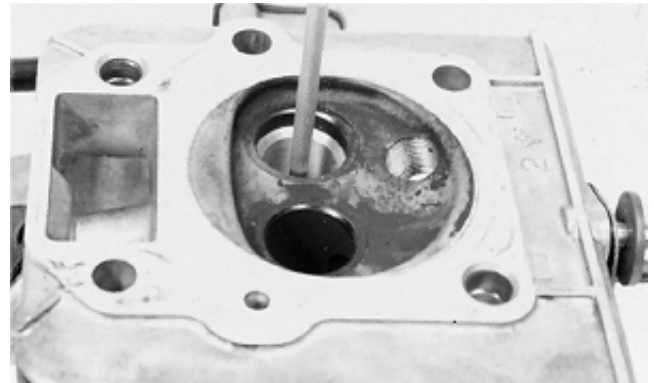
INSPECT VALVE GUIDES

Clean inside of valve guides with valve guide cleaner.

Measure inside diameter of valve guides. Replace cylinder head if inside diameter is greater than specifications.

SPECIFICATIONS (Maximum) I.D.

Intake	5.55 mm (0.218 in.)
Exhaust	5.56 mm (0.219 in.)



M80169 -UN-11FEB91

MX,2210BV,18 -19-16JUL96

RECONDITION VALVE SEATS

1. Inspect valve seats for damage. If seats are loose, warped or distorted beyond reconditioning, replace cylinder head. Pitted or worn seats can be refaced using a seat cutter.

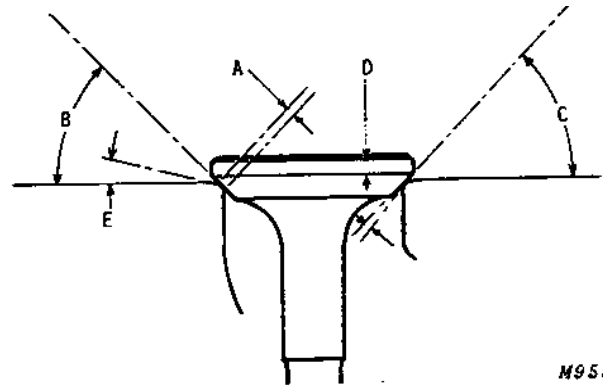
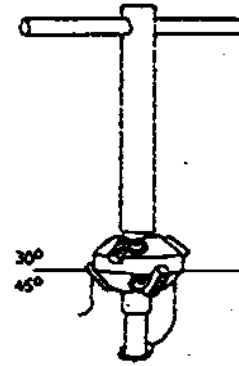
2. To recondition valve seat, cut at 45° angle (B) to clean up seat. Cut narrowing angle (E) at 30°. Finish cut at 45° (B) to establish seating surface width (A).

3. Cut valve seating surface (A) as close as possible to specifications.

4. Lap valves to seats after refacing. (See Lap Valves in this group.)

SPECIFICATIONS

A—Valve Seating Surface	0.80 mm (0.031 in.)
B—Valve Seat Angle	45°
C—Valve Face Angle	45°
D—Valve Margin	0.60 mm (0.020 in.)
E—Valve Narrowing Angle	30°



M955

MX,2210BV,19 -19-16JUL96

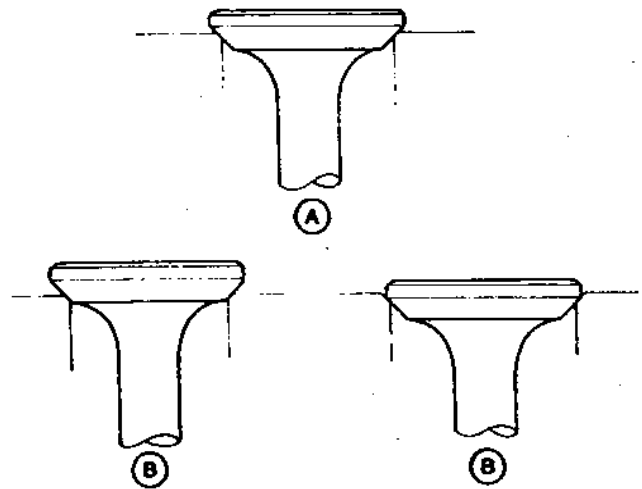
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M9552

5. Center valve seat on the valve face:
—(A) shows correct position.
—(B) shows incorrect.

6. Check seat for good contact using Prussian Blue Compound.



MX,3015A1,A9 -19-21OCT92

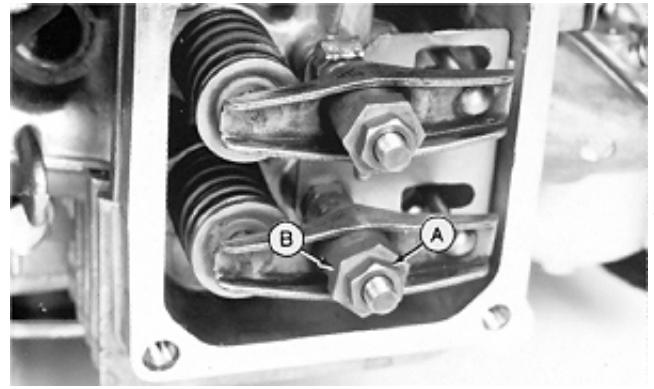
-UN-07SEP88

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CHECK VALVE CLEARANCE

NOTE: Valve repair changes valve clearance. Check valve clearance. Adjust if needed.

1. Turn crankshaft until piston is at highest position in compression stroke.
2. Measure clearance.
3. If necessary, adjust clearance to **0.12 mm (0.005 in.)**. Loosen nut (A) and turn pivot (B) in or out to adjust clearance. Tighten nut to **7 N·m (62 lb-in.)**.



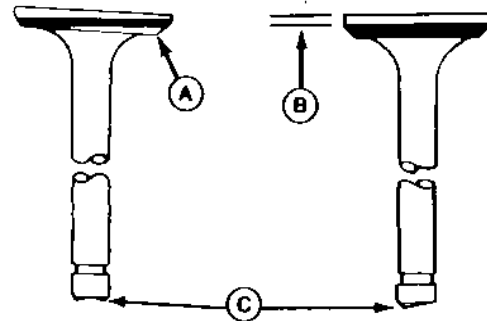
M51750 -UN-07SEP88

MX,2210BV,20 -19-16JUL96

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INSPECT VALVES

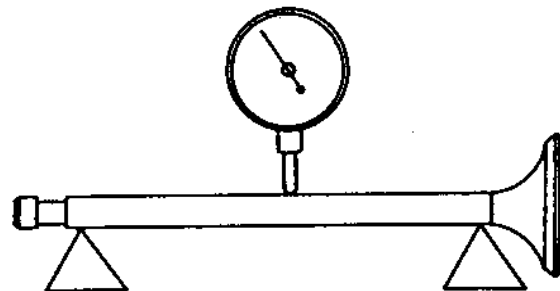
1. Remove carbon from valve head, face and stem with a power-operated wire brush. Be sure carbon is removed, not merely burnished.
2. Check valve faces, heads and stems for defects.
3. Replace warped valves (A) or valves with **less than 0.6 mm (0.02 in.)** margin (B). Valve stem ends (C) should be ground square before you check valve-to-tappet clearance.



M38087 -UN-21AUG92

MX,2210BV,21 -19-16JUL96

4. Inspect valve stem for bend using V-blocks and a dial indicator. Turn valve slowly and read variation on indicator. Replace if variation is greater than **0.03 mm (0.001 in.)**.



M51753 -UN-07SEP88

MX,2210BV,22 -19-16JUL96

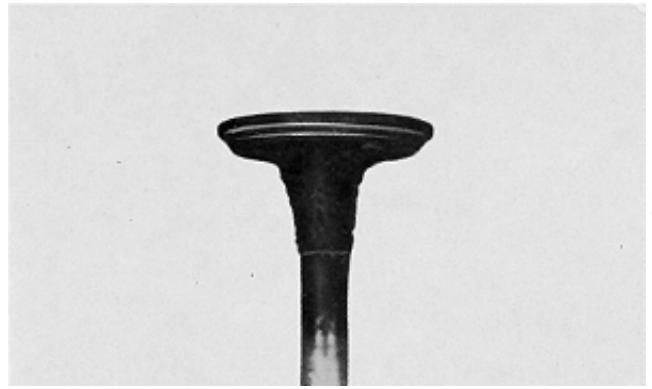
ANALYZE VALVES

Lead deposits on the intake valve are caused by exhaust gas leakage past the valve. This indicates that the valve is not seating properly.

IMPORTANT: Do not grind the exhaust valve or valve life will be shortened.

Grind intake valve and reface the seat to correct this condition.

NOTE: Be sure to reset valve-to-tappet clearance after grinding valves.



M29934 -UN-06SEP88

MX,2210BV,23 -19-16JUL96

Valve stem corrosion is caused by moisture in the engine. Moisture in the fuel-air-mixture can condense inside the engine when the engine is stopped and cools down.

Valve corrosion can also occur during storage. Fogging or pouring oil in the combustion chamber before storing helps prevent valve corrosion.

Corroded or pitted valves collect deposits and may cause sticking valves. Replace badly corroded or pitted valves.



M5563 -UN-31AUG88

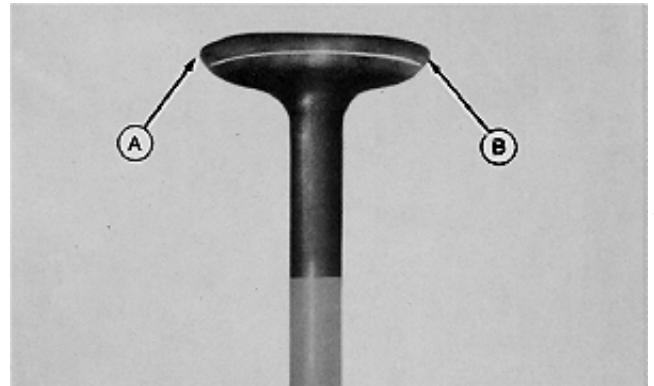
MX,2415G,37 -19-21OCT92

Exhaust valves are designed to function in temperatures exceeding (2760°C) 5000°F. However, when operating at high temperatures for long periods of time, valve burning may occur. Valves running too hot will show a dark discoloration of the valve stem into the area protected by the valve guide. Another indication is distortion of the valve margin (A) and valve face (B). Valve inserts may also begin to burn away.

IMPORTANT: Do not run the engine with blower housing removed.

Poor engine cooling due to dirt or obstructions is a common cause for overheating an engine and the valves. Remove blower housing and clean the engine cooling fins.

Other causes for valves running hot are worn valve guides or valve springs, incorrect valve clearance, lean fuel-air mixture and incorrect or overheated spark plug.



M30024 -UN-06SEP88

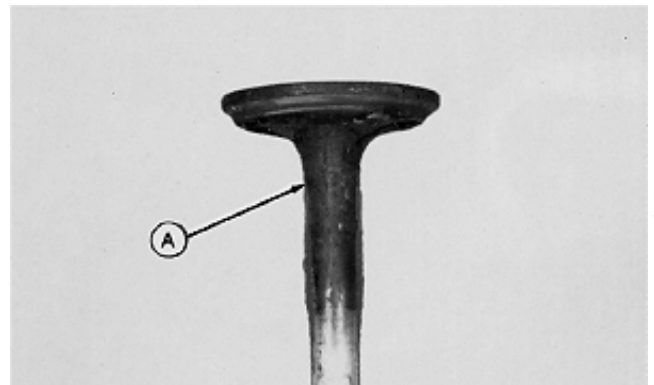
MX,2415G,38 -19-21OCT92

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Using old or stale gasoline is a common cause for sticky valves (A).

This gummy deposit can be seen on the valve. When this condition exists, the carburetor may also contain gum deposits and will require a complete cleaning.

Always use fresh gasoline and drain fuel tank, lines, and carburetor before storing machine.



M29936 -UN-06SEP88

MX,2210BV,24 -19-16JUL96

LAP VALVES

1. If seat does not make proper contact, lap the valve into the seat.
2. Apply small amount of fine lapping compound to face of valve.
3. Grip top of valve with a vacuum cup tool. Turn valve to lap valve to seat.
4. Lift valve from seat every 8 to 10 strokes. Lap until a uniform ring appears around the surface of the valve face.
5. Wash all parts in solvent to remove lapping compound. Dry parts.
6. Check position of lap mark on valve face. Lap mark must be on or near center of valve face.



M50041
-JUN-31AUG88

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MX,2210BV,25 -19-16JUL96

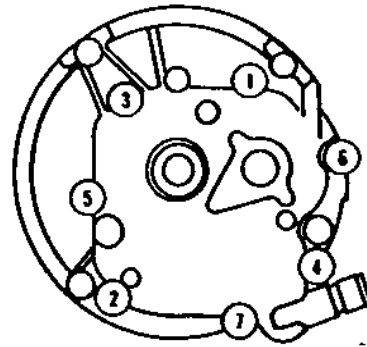
REMOVE AND INSTALL CRANKCASE COVER

NOTE: Approximate crankcase oil capacity is 0.6 L (1.27 pt).

1. Drain crankcase.
2. Remove crankcase cover and gasket.
3. Clean crankcase and crankcase cover gasket surfaces.

NOTE: Do not force cover. Gears must mesh for proper positioning.

4. Install gasket and cover. Tighten cap screws to **7 N·m (62 lb-in.)** using the sequence shown.
5. Install oil drain plug. Tighten to **21 N·m (186 lb-in.)**.



M80170
-JUN-11FEB91

MX,2210BV,26 -19-16JUL96

REMOVE AND INSTALL CAMSHAFT

1. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)

IMPORTANT: Align timing marks to prevent damage to tappets when removing camshaft.

2. Rotate crankshaft until timing marks (A) align.
3. Remove camshaft (B).
4. Inspect camshaft. (See Inspect Camshaft in this group.)
5. Apply clean engine oil to camshaft lobes and journals.
6. Align timing marks and install camshaft.
7. Install crankcase cover.



M80171 -UN-11FEB91

MX,2210BV,27 -19-16JUL96

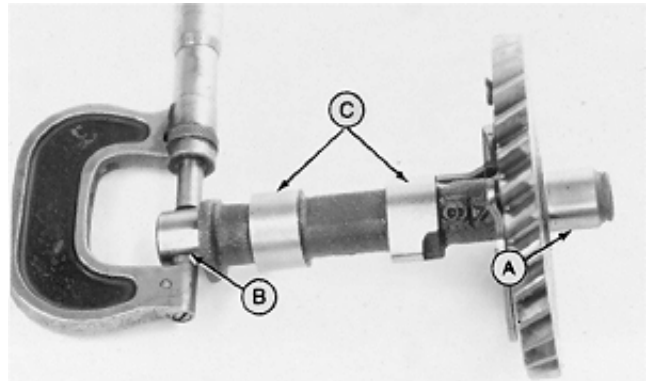
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INSPECT CAMSHAFT

Inspect camshaft for worn or broken teeth.

*NOTE: Camshaft and tappets are a matched set.
Replace both camshaft and tappets if necessary.*

Measure PTO side journal (A), flywheel side journal (B), and lobes (C). Replace camshaft and tappets if less than specifications.



M80172 -UN-11FEB91

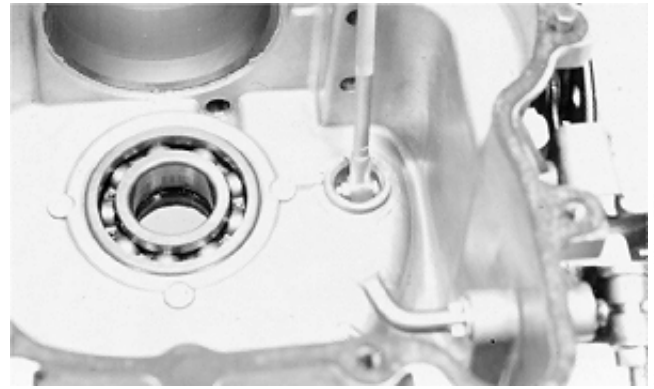
SPECIFICATIONS (Minimum)

PTO Side Journal	Flywheel Side Journal	Cam Lobes
13.92 mm (0.548 in.)	13.92 mm (0.548 in.)	22.80 mm (0.898 in.)

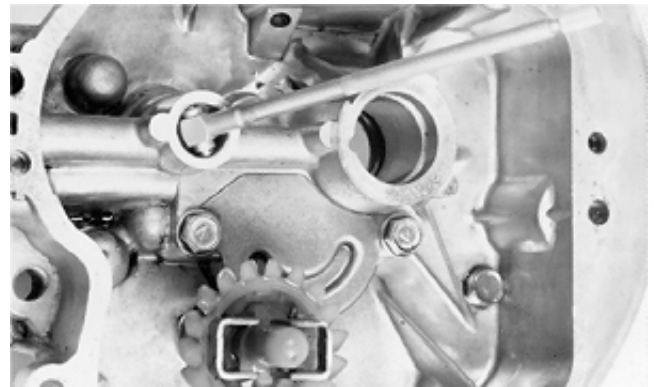
MX,2210BV,28 -19-16JUL96

INSPECT CAMSHAFT PLAIN BEARINGS

1. Remove camshaft. (See Remove and Install Camshaft in this group.)
2. Measure camshaft bearing in cylinder block. Replace block if diameter is greater than **14.07 mm (0.554 in.)**.
3. Measure camshaft bearing in crankcase cover. Replace cover if diameter is greater than **14.07 mm (0.554 in.)**.
4. Install camshaft.



Cylinder Block



Crankcase Cover

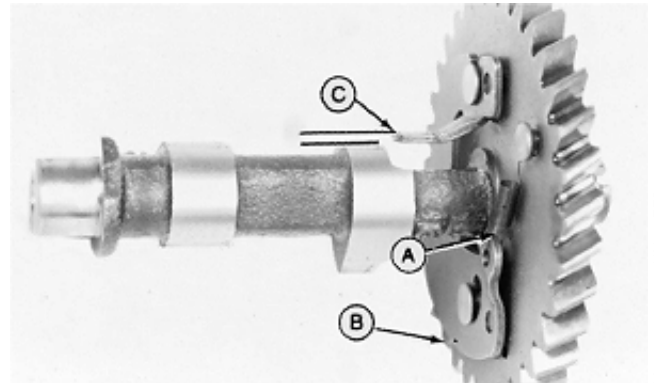
MX,2210BV,29 -19-16JUL96

M80173 -UN-11FEB91

M80174 -UN-11FEB91

INSPECT AUTOMATIC COMPRESSION RELEASE (A.C.R.)

1. Remove camshaft. (See Remove and Install Camshaft in this group.)
2. Inspect automatic compression release mechanism (A.C.R.) for damage.
3. Inspect spring (A). Replace if worn or damaged.
4. Move weight (B) by hand to check for proper operation.
5. Check that tab (C) sits slightly above cam lobe when weight is released. Tab should drop below cam when weight is operated.
6. Replace A.C.R. if it does not operate properly.
7. Install camshaft.



M80175 -UN-11FEB91

MX,2210BV,30 -19-16JUL96

REMOVE, INSPECT AND INSTALL TAPPETS

1. Remove camshaft. (See Remove and Install Camshaft in this group.)

NOTE: Mark tappets so they can be installed in their original bores during assembly.

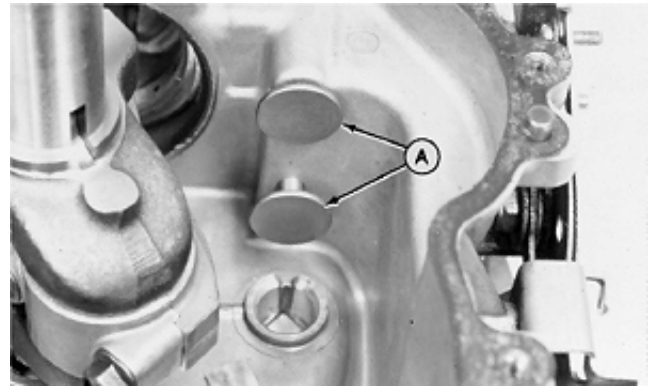
2. Remove tappets (A).

3. Inspect tappets for wear or damage. Replace if necessary.

4. Apply clean engine oil to tappets and bores.

5. Install tappets in original bores.

6. Install camshaft.



M80176
-JUN-11FEB91

MX,2210BV,31 -19-16JUL96

REMOVE AND INSTALL PISTON AND CONNECTING ROD

1. Remove cylinder head. (See Remove and Install Cylinder Head Assembly in this group.)

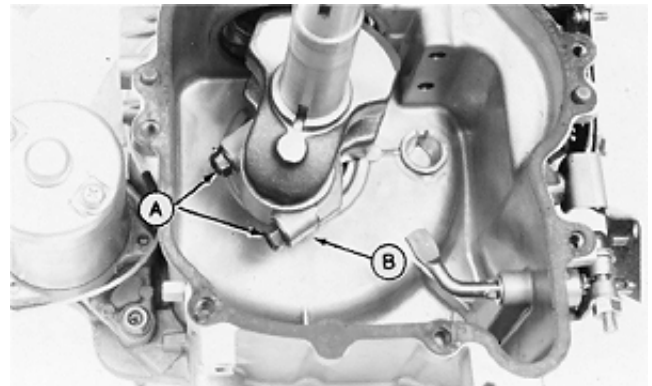
2. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)

3. Remove carbon and varnish from top of cylinder bore with a ridge reamer.

4. Remove cap screws (A) and connecting rod cap (B).

5. Push piston and connecting rod from cylinder bore.

6. Make repairs as necessary. (See procedures in this group.)



M80177
-JUN-11FEB91

MX,2210BV,32 -19-16JUL96

7. Deglaze cylinder bore. (See Deglaze Cylinder Bore in this group.)
8. Stagger piston ring end gaps 180° apart, but do not align with oil ring side rail end gaps.
9. Apply a light film of oil to piston and rings. Compress rings with a ring compressor.
10. Apply a light film of oil to cylinder bore, connecting rod bearing surface and cap screws.
11. Install piston assembly in cylinder bore with engraved match mark/arrow on piston head facing flywheel side of engine.
12. Install connecting rod cap and cap screws. Tighten cap screws to **12 N·m (106 lb-in.)**.



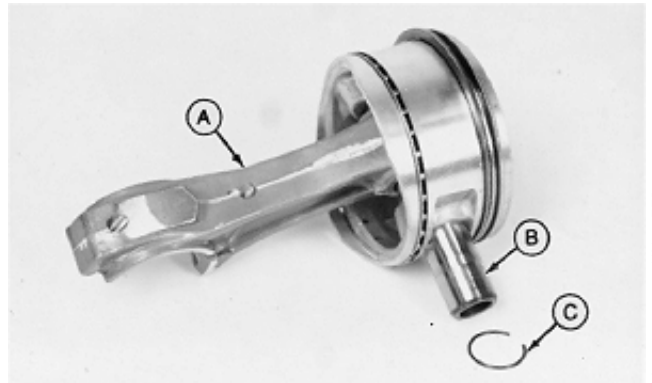
M50074 -JUN-31AUG88

MX,2210BV,33 -19-16JUL96

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DISASSEMBLE, INSPECT AND ASSEMBLE PISTON AND CONNECTING ROD

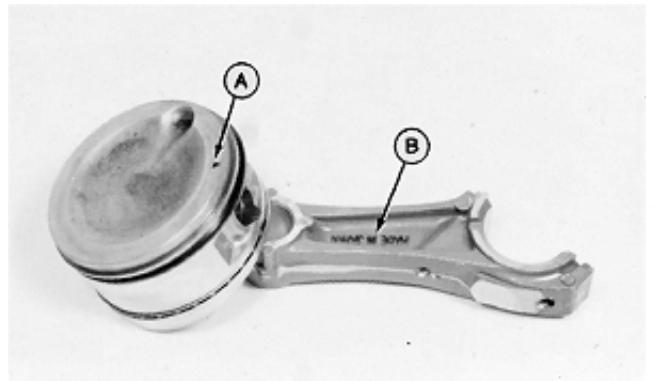
1. Remove circlip (C), piston pin (B) and connecting rod (A).
2. Inspect all parts for wear or damage. Replace as necessary. (See procedures in this group.)
3. Apply a light film of oil to piston pin and connecting rod bearing.



M80178 -JUN-11FEB91

MX,2210BV,34 -19-16JUL96

4. Align arrow match mark (A) on piston head with MADE IN JAPAN (B) on connecting rod.
5. Install piston pin and circlip.



M80179 -JUN-11FEB91

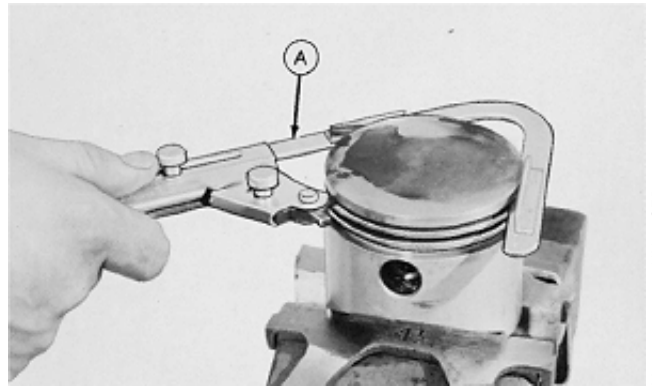
MX,3020A1,A10 -19-21OCT92

INSPECT PISTON

1. Analyze piston and piston ring wear. (See Analyze Piston Ring Wear and Analyze Piston Wear in this group.)
2. Remove piston rings. (See Remove and Install Piston Rings in this group.)

IMPORTANT: Do not use a caustic cleaning solution or a wire brush to clean piston.

3. Remove all deposits from the piston.
4. Clean carbon from piston ring grooves with a ring groove cleaner (A). If cleaning tool is not available, break an old ring and use it carefully to clean groove.
5. Check that oil return passages in grooves are open.



M29946 -UN-06SEP88

MX,2210BV,35 -19-16JUL96

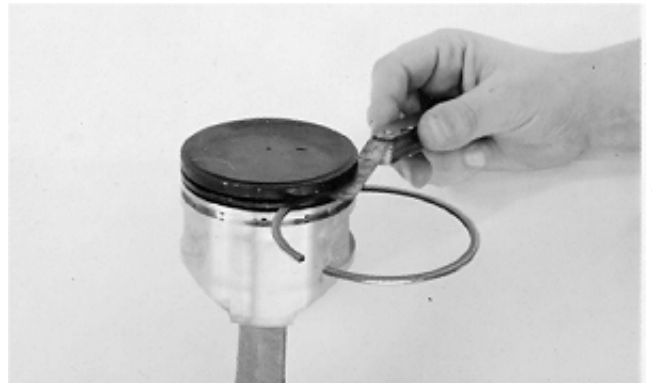
6. Inspect piston for scoring or fractures. Replace piston if damaged.

NOTE: Inspect clearance visually. Replace piston if clearance appears excessive.

7. Check ring grooves for wear at several points around piston. Replace piston if clearance is greater than specification.

CLEARANCE SPECIFICATION (Maximum)

Top Ring	Second Ring	Oil Control Ring
0.10 mm (0.004 in.)	0.10 mm (0.004 in.)	0.10 mm (0.004 in.)



M38102 -UN-29AUG88

MX,3020A1,A12 -19-16JUL96

8. Measure piston pin outer diameter. Replace pin if less than **14.98 mm (0.590 in.)**.

9. Measure piston pin bore. Replace piston if measurement is greater than **15.05 mm (0.593 in.)**.



M50064 -JUN-31AUG88



M80180 -JUN-11FEB91

MX,2210BV,36 -19-16JUL96

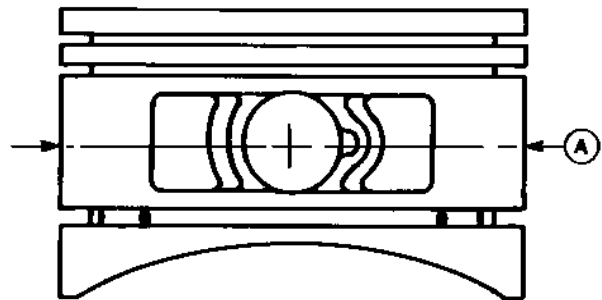
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10. Measure piston O.D. (A) perpendicular to piston pin bore.

11. Measure cylinder bore. (See Inspect Block in this group.)

12. Subtract piston O.D. measurement (A) from cylinder bore measurement to determine piston-to-cylinder bore clearance.

13. Replace piston and/or rebore cylinder block if not within specifications. (See Rebore Cylinder Block in this group.)



M80181 -JUN-11FEB91

SPECIFICATIONS

Piston O.D. (A)	64.90 mm (2.555 in.)
Piston-to-Cylinder Bore Clearance	
Standard	0.06—0.10 mm (0.0024—0.0039 in.)
Wear Limit	0.1375 mm (0.0054 i

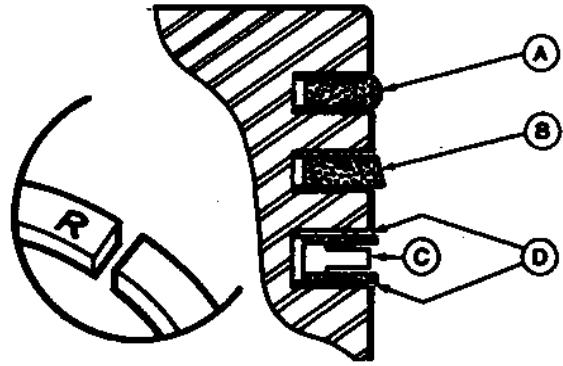
MX,2210BV,37 -19-16JUL96

REMOVE AND INSTALL PISTON RINGS

1. Remove piston rings with a piston ring expander.
2. Inspect piston. Clean piston ring grooves. (See Inspect Piston in this group.)
3. Check piston ring end gap. (See Check Piston Ring End Gap in this group.)
4. Install top ring (A) and second ring (B) with R or NPR mark facing up. Rings should turn freely in grooves.

NOTE: Oil ring assembly is located near bottom of piston.

5. Oil ring is an assembly. Install spacer (C), then side rails (D). Put side rail end gaps 180° apart.



A—Top Ring
B—Second Ring
C—Spacer
D—Side Rails

M38074 -UN-29AUG88

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MX,2210BV,39 -19-16JUL96

CHECK PISTON RING END GAP

1. Before installing rings on piston, check end gap in cylinder bore.
2. Install each ring squarely in bore approximately 25.4 mm (1.0 in.) down from top of cylinder.
3. Check end gap. Replace ring if end gap is more than specifications.

END GAP SPECIFICATIONS

Minimum End Gap	0.18 mm (0.007 in.)
Maximum End Gap	
Compression Rings	1.00 mm (0.039 in.)
Oil Ring Side Rails	1.50 mm (0.059 in.)



M80182 -UN-11FEB91

MX,2210BV,40 -19-16JUL96

ANALYZE PISTON RING WEAR

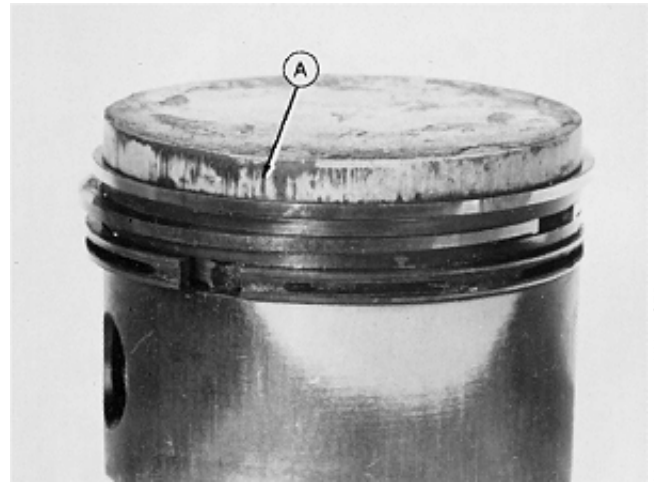
Rings of the wrong size or rings having improper end gap will not conform to the shape of the cylinder. This results in high oil consumption and excessive blow-by.

Ring end gaps should be staggered on the piston during installation. End gaps in alignment can also cause oil consumption and blow-by.

Light scuffing or scoring (A) of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of the piston material.

When this condition exists, it is due to one or more of the following probable causes:

1. Dirty cooling shroud and cylinder head.
2. Lack of cylinder lubrication.
3. Improper combustion.
4. Wrong bearing or piston clearance.
5. Too much oil in crankcase causing fluid friction.



M29943 -UN-06SEP88

MX,2210BV,38 -19-16JUL96

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The engine operating at abnormally high temperatures may cause varnish, lacquer or carbon deposits (A) to form in the piston grooves making the rings stick. When this happens, excessive oil consumption and blow-by will occur.

Engine overheating and ring sticking is usually caused by one or more of the following:

1. Overloading.
2. Incorrect ignition timing.
3. Lean fuel mixture.
4. Dirty cooling fins.
5. Incorrect oil.
6. Low oil supply.
7. Stale fuel.



M29944 -UN-06SEP88

MX,2420G,69 -19-21OCT92

Vertical scratches (A) across the piston rings are due to an abrasive in the engine. Abrasives may be airborne, may have been left in the engine during overhaul or may be loose lead and carbon deposits.

When this condition exists, check for one or more of the following:

1. Damaged, collapsed or improperly installed air filter.
2. Loose connection or damaged gasket between air cleaner and carburetor.
3. Air leak around carburetor-to-cylinder block gasket.
4. Air leakage around throttle shaft.
5. Failure to properly clean cylinder bore after reconditioning engine.



M29945 -UN-06SEP88

MX,2420G,70 -19-21OCT92

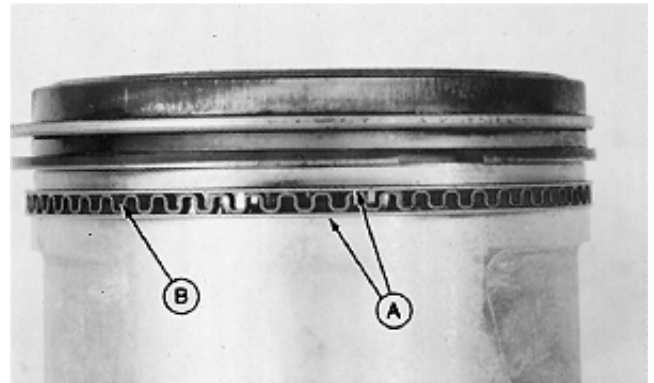
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Abrasive particles in engine oil cause scratches on side rails (A) of oil control ring. Inner spacer (B) wear or distortion may cause:

- High oil consumption.
- Increased deposits in combustion chamber.
- Sticking compression rings.

Increased oil consumption may be caused by:

- Worn side rails with low tension.
- Worn or distorted inner spacer.



M38101 -UN-29AUG88

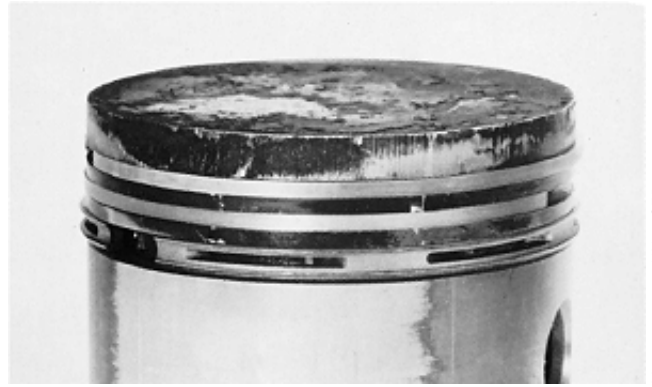
MX,2420G,24 -19-21OCT92

ANALYZE PISTON WEAR

Detonation, is abnormal combustion causing excessive temperature and pressure in the combustion chamber. Commonly called carbon knock, spark knock or timing knock, detonation occurs as the compressed fuel-air mixture ignites spontaneously to interrupt the normal ignition.

The following is a list of possible causes for detonation:

1. Lean fuel mixture.
2. Low octane fuel.
3. Advanced ignition timing.
4. Engine lugging.
5. Build-up of carbon deposits on piston or cylinder head, causing excessive compression.
6. Wrong cylinder head or milling of head increasing compression ratio.



M29947 -UN-06SEP88

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MX,2210BV,41 -19-16JUL96

Pre-ignition is the igniting of the fuel-air mixture prior to regular ignition spark. Pre-ignition causes internal shock, resulting in pings, vibration, detonation and power loss. Severe damage to piston (A), rings and valves results from pre-ignition.

Check the following for causes of pre-ignition:

1. Internal carbon deposits.
2. Incorrect spark plug (high heat range).
3. Broken ceramic in spark plug.
4. Sharp edges on valves.



M30039 -UN-06SEP88

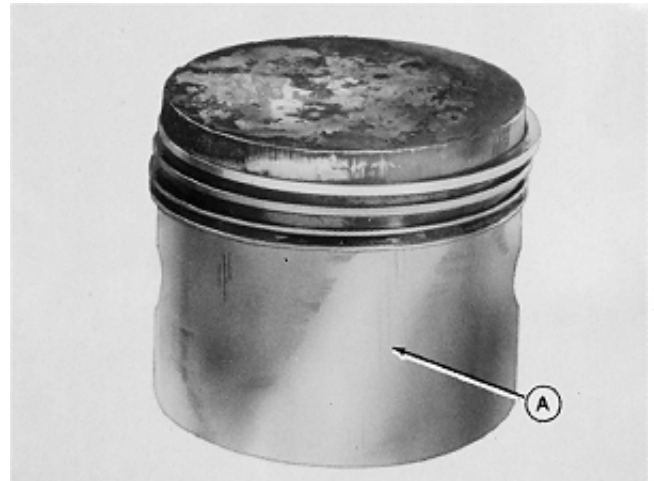
MX,2420G,72 -19-21OCT92

Check rod and piston alignment when piston shows a diagonal wear pattern (A) extending across the skirt of the piston. Contact with the cylinder wall shows on bottom of skirt at left and ring lands on the right.

A cylinder bored at an angle to the crankshaft can also cause improper ring contact with the cylinder.

This condition causes:

1. Rapid piston wear.
2. Uneven piston wear.
3. Excessive oil consumption.



M29948 -UN-06SEP88

MX,2420G.73 -19-21OCT92

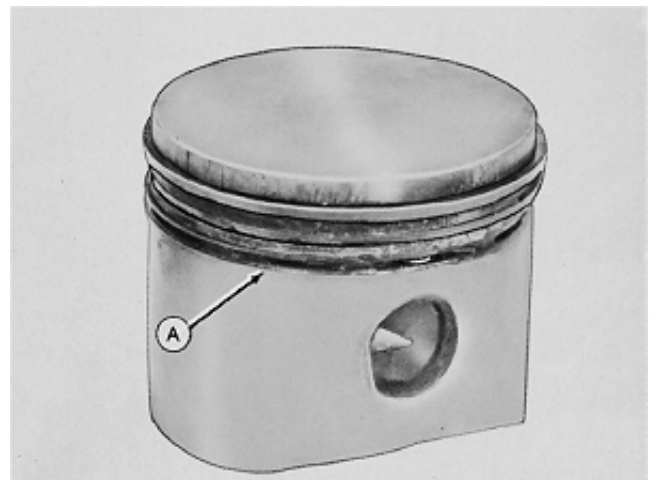
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A broken retaining ring caused the damage (A) shown.

Retaining rings loosen or break due to:

1. Rod misalignment.
2. Excessive crankshaft end play.
3. Crankshaft journal taper.
4. Weak retaining rings.
5. Incorrectly installed retaining rings.

Inertia can cause a broken retaining ring to beat out the piston and cylinder, causing extensive damage.

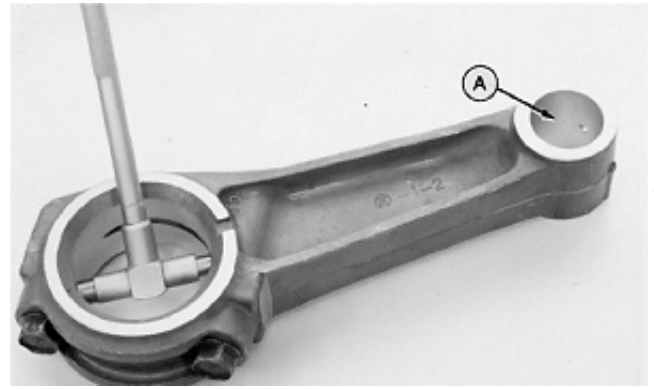


M29949 -UN-06SEP88

MX,2420G.74 -19-21OCT92

INSPECT CONNECTING ROD

1. Clean and inspect rod. Replace if scored.
2. Analyze crankshaft and connecting rod wear. (See Analyze Crankshaft and Connecting Rod Wear in this group.)
3. Install connecting rod cap. Tighten to **12 N·m (106 lb-in.)**.
4. Measure connecting rod crankshaft bearing and piston bearing (A). Replace connecting rod if either measurement is greater than specifications.



M50066 -JUN-31AUG88

BEARING I.D. SPECIFICATIONS (Maximum)

Crankshaft Bearing	Piston Bearing
28.07 mm (1.105 in.)	15.05 mm (0.593 in.)

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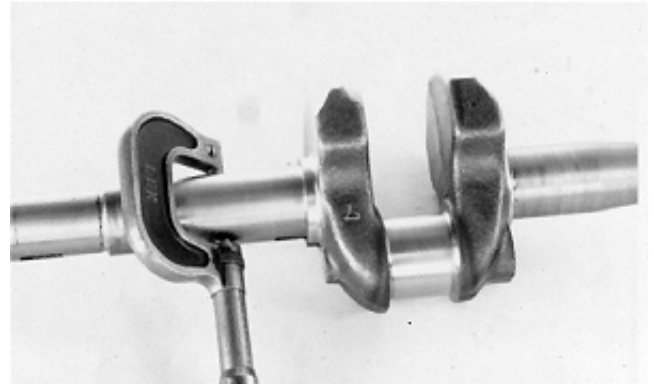
MX,2210BV,42 -19-16JUL96

REMOVE, INSPECT AND INSTALL CRANKSHAFT

1. Remove camshaft. (See Remove and Install Camshaft in this group.)
2. Remove piston and connecting rod. (See Remove and Install Piston and Connecting Rod in this group.)
3. Remove crankshaft.

IMPORTANT: A bent crankshaft must be replaced; it cannot be straightened.

4. Check crankshaft alignment (TIR). (See Check Crankshaft Alignment (TIR) in this group.)
5. Clean and inspect crankshaft. Replace if parts are scratched or damaged.
6. Analyze crankshaft and connecting rod wear. (See Analyze Crankshaft and Connecting Rod Wear in this group.)
7. Measure crankshaft main bearing journals and connecting rod journal. Replace crankshaft if measurements are less than specifications.



JOURNAL SPECIFICATIONS (Minimum)

Main Bearing PTO Side	Journal Flywheel Side	Connecting Rod Journal
24.92 mm (0.981 in.)	24.92 mm (0.981 in.)	27.92 mm (1.099 in.)

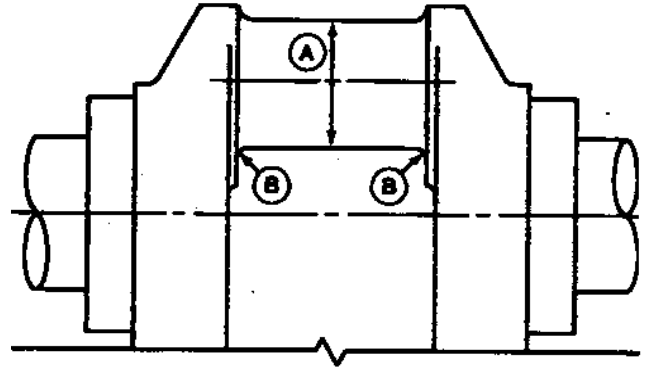
MX,2210BV,43 -19-16JUL96

M80183 -JUN-11FEB91

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NOTE: An undersized connecting rod is available through the parts catalog, if necessary.

8. Connecting rod journal (A) can be resized to accept under-sized rod. Have grinding done by a reliable repair shop. Before sending crankshaft for grinding, inspect journal radii (B) for cracks.
9. Cover keyway on flywheel end of crankshaft with tape to prevent seal damage when installing crankshaft.
10. Put a light film of oil on crankshaft bearing surfaces.
11. Pack grease in oil seals and install crankshaft.
12. Install piston and connecting rod.
13. Install camshaft.



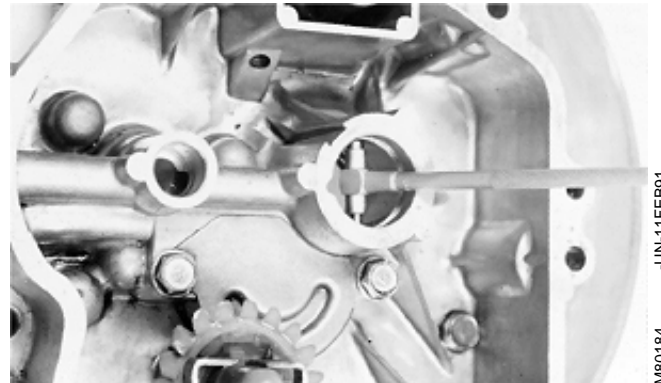
M/38036 -UN-29AUG88

MX,3020A1,A19 -19-21OCT92

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INSPECT CRANKSHAFT PLAIN BEARING

1. Remove crankshaft. (See Remove, Inspect and Install Crankshaft in this group.)
2. Measure crankshaft bearing in crankcase cover. Replace cover if diameter is greater than **25.10 mm (0.988 in.)**.
3. Install crankshaft.

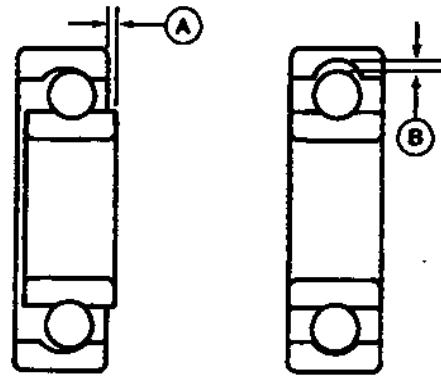


M/80184 -UN-11FEB91

MX,2210BV,44 -19-16JUL96

INSPECT CRANKSHAFT BALL BEARING

1. Remove flywheel end oil seal. (See Inspect Oil Seals in this group.)
2. Remove crankshaft bearing using a bearing, bushing and seal driver set.
3. Thoroughly clean bearing in solvent. Dip bearing in light weight oil.
4. Spin the bearing by hand and check for axial (A) and radial (B) free play.
5. Replace the bearing if it is noisy or has too much play.
6. Install bearing flush to inside of crankcase using a bearing, bushing and seal driver set.
7. Install oil seal.



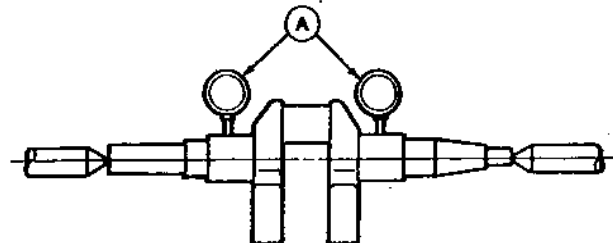
MX,2210BV,45 -19-16JUL96

M38073 -UN-29AUG88

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31

CHECK CRANKSHAFT ALIGNMENT (TIR)

Place crankshaft into an alignment jig and rotate crankshaft slowly. Use dial indicators (A) to measure maximum total indicated runout (TIR). Replace crankshaft if runout is greater than **0.20 mm (0.008 in.)**.



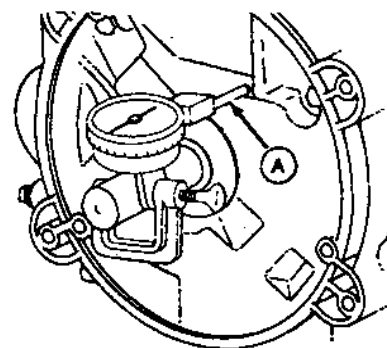
MX,2210BV,46 -19-16JUL96

-UN-07SEP88

M51761

MEASURE CRANKSHAFT END PLAY

1. Measure end play using dial indicator (A). Record this measurement.
2. Move crankshaft in and out. Replace block or crankshaft if end play is not within **0—0.50 mm (0—0.020 in.)**.



MX,2210BV,47 -19-16JUL96

-UN-06SEP88

M30048

ANALYZE CRANKSHAFT AND CONNECTING ROD WEAR

Check connecting rod and cap for damage or unusual wear patterns.

Lack of lubrication or improper lubrication can cause the connecting rod and cap to seize the crankshaft.

When the rod and cap seize to the crankshaft, the connecting rod and piston may both break causing other internal damage. Inspect block carefully before rebuilding engine.

Crankshaft and connecting rod damage can result from:

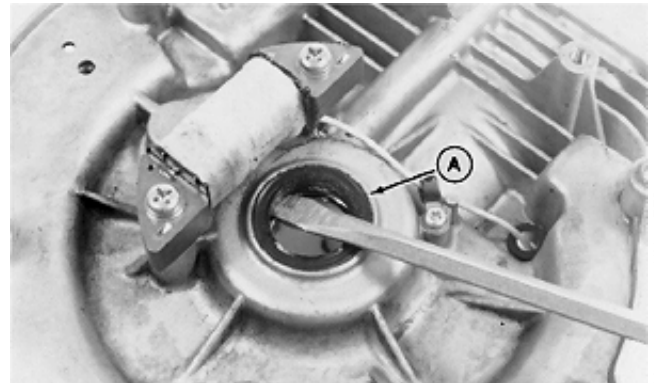
1. Engine run low on oil or without oil.
2. Oil not changed regularly.
3. Bearing cap installed incorrectly.

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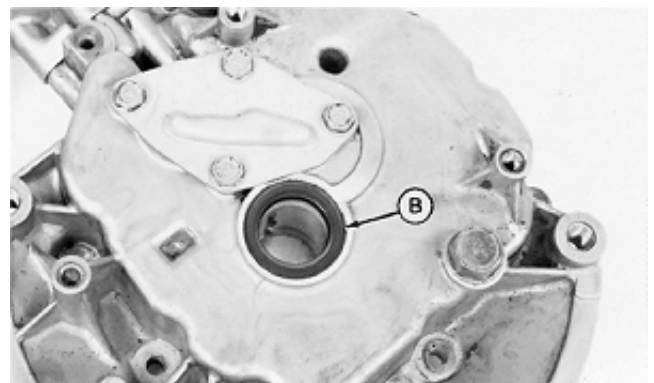
MX,2210BV,48 -19-16JUL96

INSPECT OIL SEALS

1. Remove flywheel. (See Remove and Install Flywheel in this group.)
2. Inspect oil seals (A and B) at flywheel end and PTO end for wear or damage. Replace if necessary.
3. Remove crankshaft. (See Remove, Inspect and Install Crankshaft in this group.)
4. Remove worn or damaged seals with a screwdriver.
5. Install seals with lip to inside of engine using a bearing, bushing and seal driver set. Press seals in until flush with hub.
6. Install crankshaft.
7. Install flywheel.



Flywheel End



PTO End

MX,2210BV,49 -19-16JUL96

INSPECT CYLINDER BLOCK

1. Remove crankshaft. (See Remove, Inspect and Install Crankshaft in this group.)
2. Clean and check block for cracks.
3. Cracks not visible to the eye may be detected by coating the suspected area with a mixture of 25 percent kerosene and 75 percent light engine oil.
4. Wipe area dry and immediately apply coating of zinc oxide dissolved in wood alcohol. If crack is present, coating becomes discolored at the defective area. Replace block if any cracks are found.

MX,2210BV,50 -19-16JUL96

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33

NOTE: A bare block is available for service.

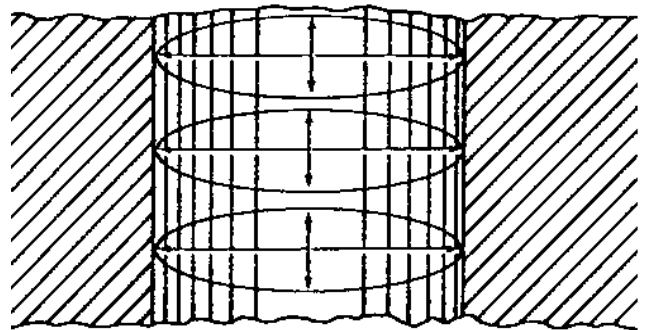
5. Measure cylinder bore parallel with crankshaft and right angles to crankshaft at top and bottom of ring travel.
6. If cylinder bore exceeds wear limit, replace cylinder block or rebore cylinder. (See Rebore Cylinder Block in this group.)

NOTE: If cylinder is rebored, oversize piston and rings must be installed.

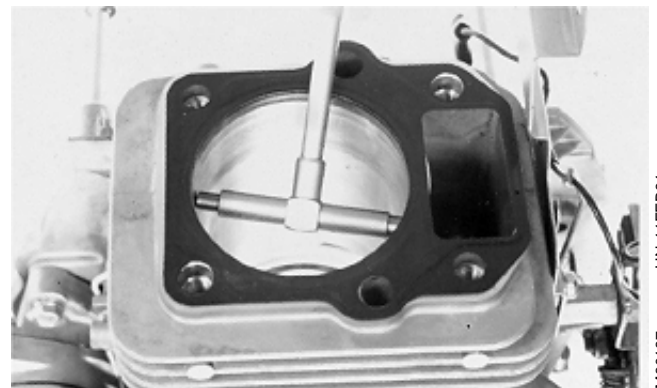
7. Install crankshaft.

CYLINDER BORE SPECIFICATIONS

Standard	Wear Limit
64.90—65.00 mm (2.557—2.561 in.)	65.06 mm (2.563 in.)



M51745 -UN-23FEB89



M80187 -UN-11FEB91

MX,2210BV,53 -19-16JUL96

DEGLAZE CYLINDER BORE

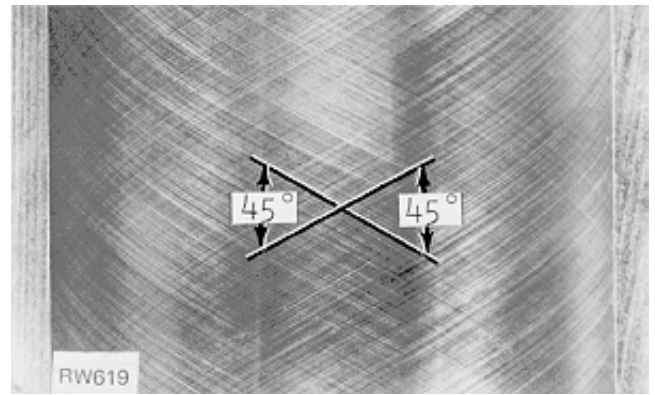
1. Deglaze cylinder bore using a rigid hone with a 220 to 300 grit stone.

NOTE: A cutaway of a cylinder bore is shown for clarity of photograph.

2. Use hone as instructed by manufacturer to obtain 45° crosshatch pattern as shown.

IMPORTANT: Do not use gasoline, kerosene, or commercial solvent to clean cylinder bores. Solvents will not remove all abrasives from cylinder walls.

3. Clean cylinder walls using clean white rags and water. Continue to clean cylinder until white rags show no discoloration.



MX,2210BV,51 -19-16JUL96

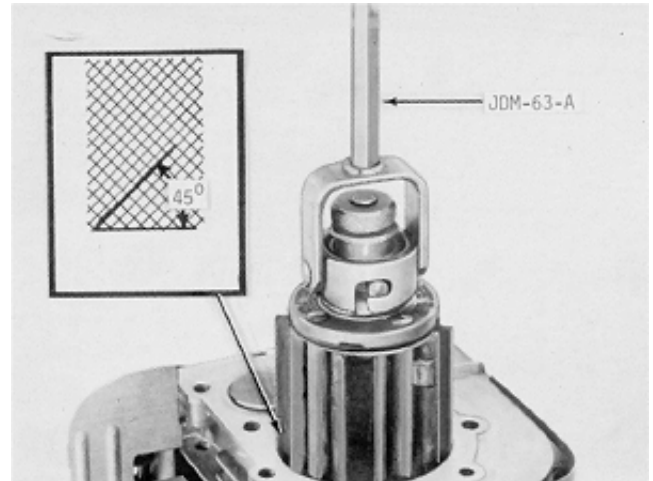
REBORE CYLINDER BLOCK

NOTE: The cylinder block can be rebored to use 0.25, 0.50 or 0.75 mm (0.010, 0.020 or 0.030 in.) oversize pistons and rings. Have a reliable repair shop rebore the block, or use the drill press and honing tool.

1. Rebore cylinder with a honing tool to initial and final bore specifications.
2. Align center of bore to press center. Set the press to operate from 200—250 rpm.
3. Lower and raise hone until ends extend 20—25 mm (0.75—1.0 in.) past ends of cylinder.
4. Turn adjusting nut on one hone until stones contact cylinder wall at narrowest point.
5. Coat inside of cylinder with honing oil. Turn hone by hand. If you cannot turn it, hone is too tight.
6. Start drill press. Move hone up and down in cylinder approximately 20 times per minute.
7. Check cylinder diameter regularly during honing. Stop press before measuring. Remove hone from cylinder.

NOTE: Finish should not be smooth, but have a 40—60° cross-hatch pattern.

IMPORTANT: Check stone for wear or damage. Use correct stone for the job.



M24711 -JUN-25AUG88

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CYLINDER INITIAL BORE SPECIFICATIONS

Piston Oversize:
0.25 mm
(0.010 in.)

65.21—65.23 mm
(2.567—2.568 in.)

Piston Oversize:
0.50 mm
(0.020 in.)

65.46—65.48 mm
(2.577—2.578 in.)

Piston Oversize:
0.75 mm
(0.030 in.)

65.71—65.73 mm
(2.587—2.588 in.)

MX,2210BV,52 -19-16JUL96

8. Hone the cylinder an additional 0.028—0.030 mm (0.0011—0.0012 in.) for final bore specifications. This allows for 0.020 mm (0.0008 in.) shrinkage when cylinder cools.

IMPORTANT: DO NOT use gasoline or commercial solvents to clean cylinder bores. Solvents will not remove metal particles produced during honing.

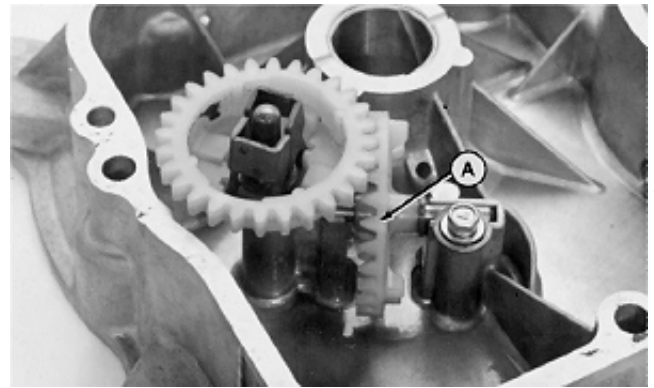
9. Clean the cylinder thoroughly using soap, warm water and clean rags. Continue to clean cylinder until white rags show no discoloration.

10. Dry the cylinder. Apply engine oil to cylinder wall.

M98,2040A,A9 -19-21OCT92

INSPECT AND REPLACE OIL SLINGER—IF EQUIPPED

1. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)
2. Remove oil slinger (A).
3. Inspect oil slinger. Replace if worn or damaged.
4. Install oil slinger.

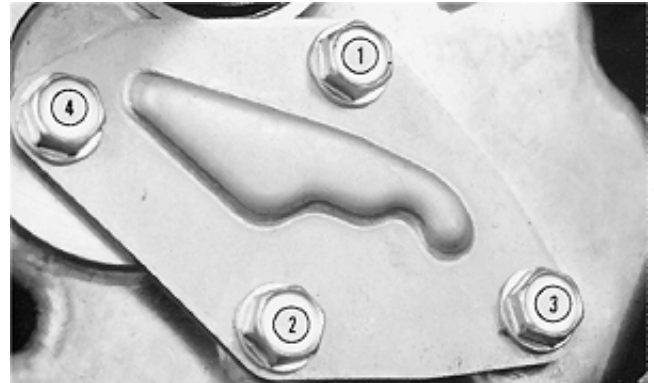
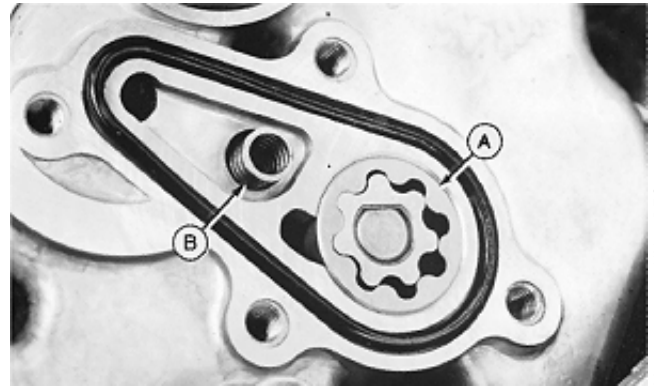


-JUN-31AUG88
M50078

MX,2210BV,54 -19-16JUL96

DISASSEMBLE AND ASSEMBLE OIL PUMP—IF EQUIPPED

1. Remove cover and gasket.
2. Remove oil pump assembly (A), relief spring and ball (B).
3. Inspect all parts. (See Inspect Oil Pump in this group.)
4. Install oil pump assembly, gasket and cover. Tighten the cap screws using the sequence shown.



MX,2210BV,55 -19-16JUL96

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M52443

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M52444

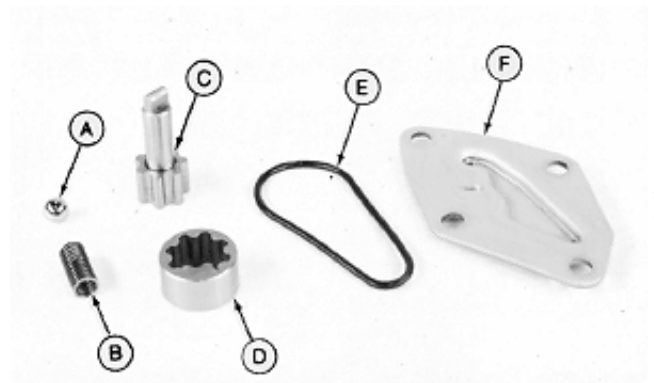
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INSPECT OIL PUMP

NOTE: Oil screen not shown. To inspect or clean screen, remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)

1. Inspect all parts for wear or damage. Replace as necessary.

- | | |
|-----------------|---------------|
| A—Check Ball | D—Outer Rotor |
| B—Relief Spring | E—Gasket |
| C—Rotor Shaft | F—Cover |

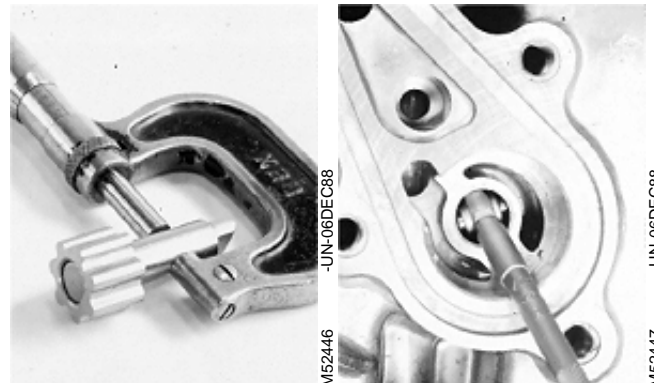


MX,2210BV,56 -19-16JUL96

-UN-06DEC88
M52445

2. Measure outside diameter of shaft. Replace both shaft and outer rotor if less than **9.01 mm (0.335 in.)**.

3. Measure rotor shaft bearing. Replace crankcase cover if greater than **9.14 mm (0.360 in.)**.

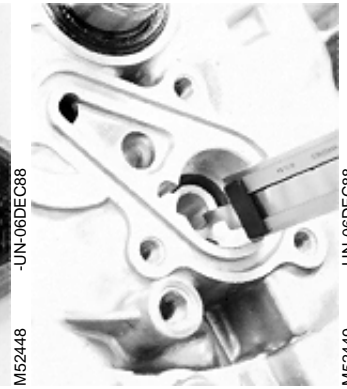


MX,2210BV,57 -19-16JUL96

-UN-06DEC88
M52447

4. Measure thickness of outer rotor. Replace both outer rotor and shaft if less than **11.95 mm (0.471 in.)**.

5. Measure outer rotor bearing depth. Replace crankcase cover if greater than **12.10 mm (0.476 in.)**.



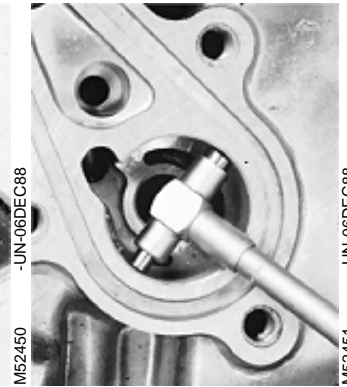
M52448
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M52449
-UN-06DEC88

MX,2210BV,58 -19-16JUL96

6. Measure outside diameter of outer rotor. Replace both outer rotor and shaft if less than **22.93 mm (0.903 in.)**.

7. Measure inside diameter of rotor bearing. Replace crankcase cover if greater than **23.17 mm (0.912 in.)**.



M52450
-UN-06DEC88

M52451
-UN-06DEC88

MX,2210BV,59 -19-16JUL96

8. Measure relief valve spring. Replace if free length is less than specifications.

SPRING FREE LENGTH SPECIFICATIONS (MIN)

Relief Valve Spring	
(Engine S.N. 047346—072217)	17 mm (0.669 in.)
(Engine S.N. 072218—)	19 mm (0.748 in.)



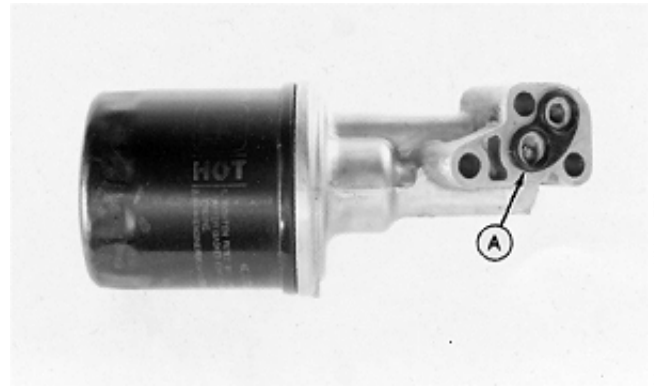
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-UN-31AUG88

MX,2210BV,60 -19-16JUL96

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REMOVE, INSPECT AND INSTALL OIL FILTER MANIFOLD—IF EQUIPPED

1. Remove oil filter and manifold.
2. Inspect oil filter. Replace if excessively contaminated or damaged.
3. Inspect oil passages for clogs. Clean if needed.
4. Inspect gasket (A) for wear or damage. Replace if necessary.
5. Install filter and manifold.



MX,2210BV,61 -19-16JUL96

M80188 -UN-11FEB91

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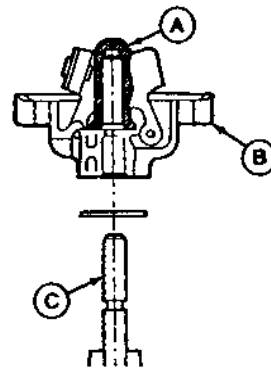
INSPECT AND REPLACE GOVERNOR

IMPORTANT: Removal damages governor. If not damaged, do not remove.

1. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)
2. Inspect governor. If necessary to replace, remove with screwdriver.
3. If removed, press shaft (C) back into block until it protrudes **32.2—32.8 mm (1.267—1.291 in.)**.

NOTE: Assemble sleeve and gear before installing assembly on shaft.

4. Install sleeve (A) onto governor gear (B).
5. Install governor assembly onto shaft. Push down on assembly until it snaps into place.



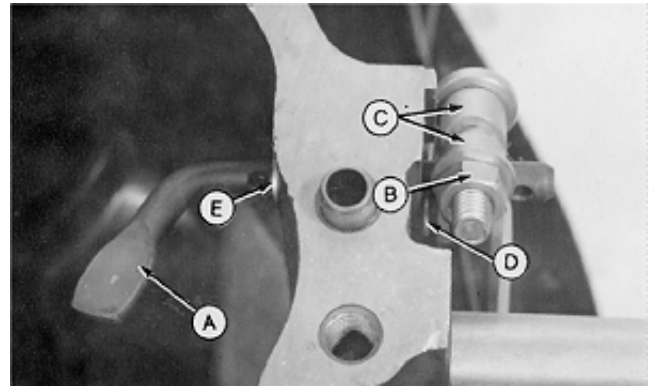
MX,2210BV,62 -19-16JUL96

M51762 -UN-07SEP88

INSPECT AND REPLACE GOVERNOR SHAFT

NOTE: It is not necessary to remove governor shaft unless damaged.

1. Remove crankcase cover. (See Remove and Install Crankcase Cover in this group.)
2. Inspect shaft (A). Replace if damaged.
3. To replace shaft, loosen nut (B) on lever (C).
4. Remove retaining pin (D), governor shaft and washer (E).
5. Install washer, shaft and retaining pin. Tighten nut to **7 N·m (62 lb-in.)**.



A—Governor Shaft
B—Nut
C—Governor Lever
D—Retaining Pin
E—Washer

M50094 -JUN-31AUG88

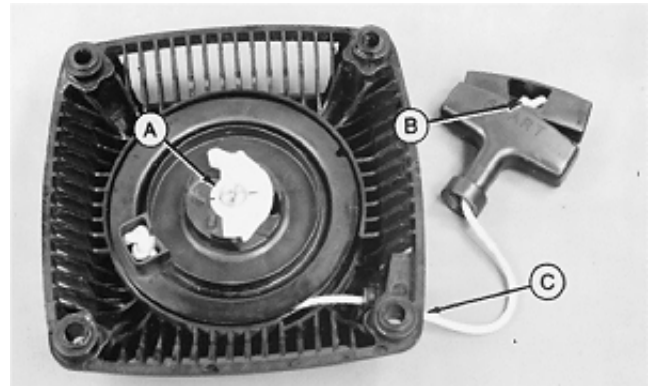
MX,2210BV,63 -19-16JUL96

DISASSEMBLE RECOIL STARTER

1. Remove starter.
2. Pull handle out about 30 cm (1 ft). Tie knot (C) to prevent rope from winding back onto reel.
3. Pry knot (B) out of handle and untie.
4. Remove handle from rope.
5. While holding reel with thumb, untie knot (C). Slowly release reel tension. Do not let rope get wedged between reel and housing.

CAUTION: Wear gloves and protective goggles for remaining steps.

6. Remove screw, washer and retainer (A).
7. Remove pawl and spring.

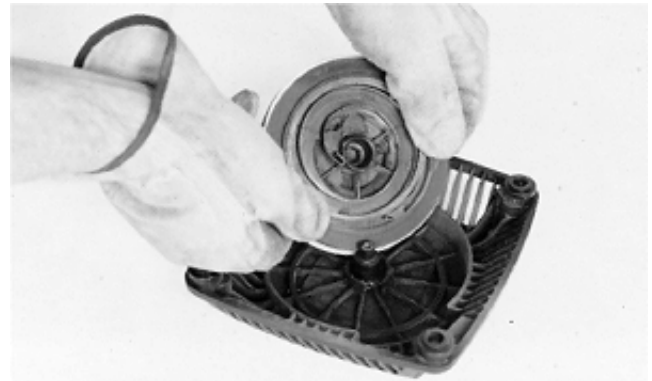


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MX.2215BV,2 -19-16JUL96

CAUTION: A loaded spring operates under great pressure. Make sure spring tension between reel and housing is released before removing reel.

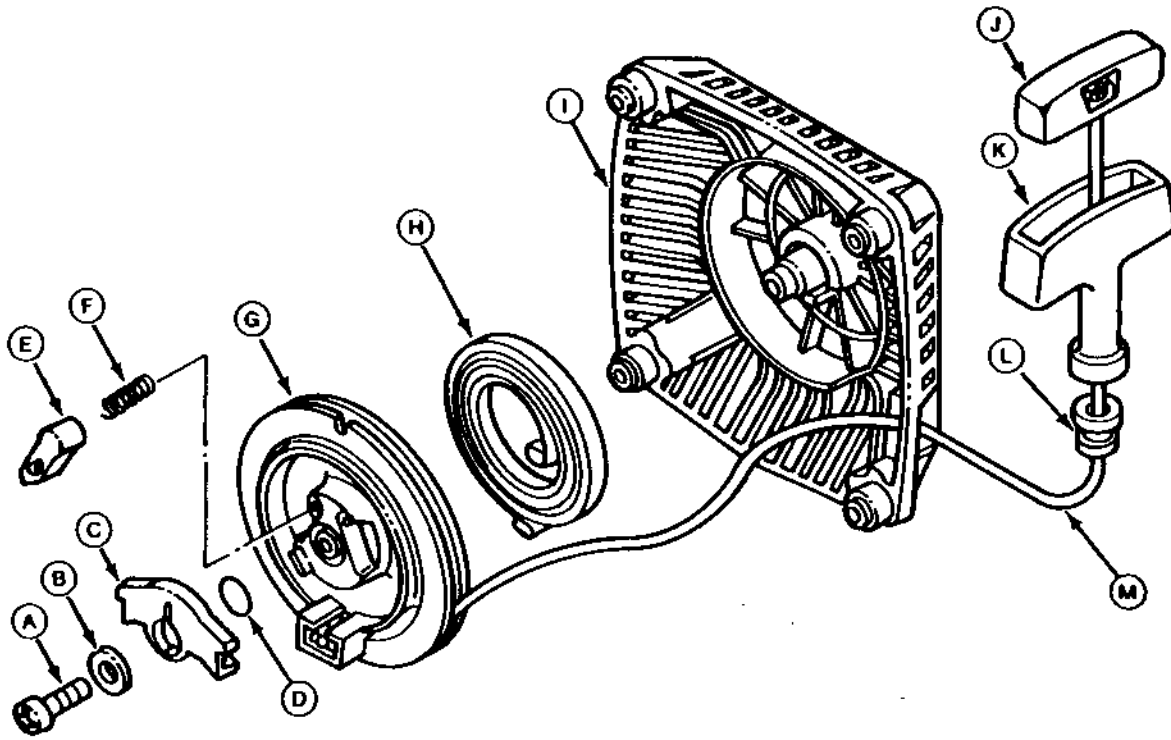
8. Turn the reel one half turn clockwise so no spring tension can be felt.
9. Spring is stored in reel. Carefully remove while holding spring in underside of reel.
10. Inspect starter for wear or damage. (See Inspect Recoil Starter in this group.)



M80193 -UN-11FEB91

MX.2215BV,3 -19-16JUL96

INSPECT RECOIL STARTER



A—Screw
B—Washer
C—Retainer

D—Spring
E—Pawl
F—Spring

G—Reel
H—Torsion Spring
I—Housing

J—Cap
K—Handle
L—Guide

Inspect all parts for wear or damage. Replace as necessary.

MX,2215BV,4 -19-16JUL96

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M80194 -JUN-11FEB91

REPLACE SPRING

⚠ CAUTION: Spring is wound under great tension in reel or spring case. Do not let spring fly loose. Hold spring firmly in place while replacing.

1. Working from the center out, carefully unwind spring from reel.
2. Hook outside spring tang in reel. Wind spring into reel, working toward center.

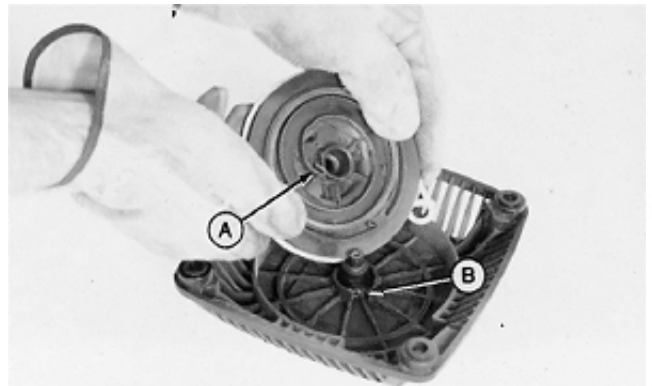


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MX,2215BV,5 -19-16JUL96

ASSEMBLE RECOIL STARTER

1. Wind rope counterclockwise onto reel.
2. Apply multipurpose grease to spring.
3. Install reel with spring in housing. Align inner tang (A) with catch (B).



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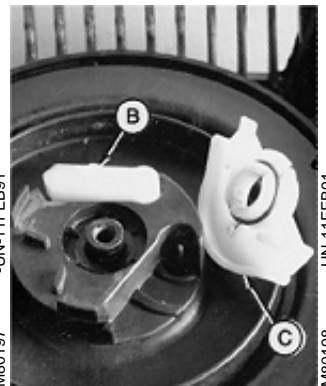
MX,2215BV,6 -19-16JUL96

NOTE: Install spring and pawl on side of retainer marked "R".

4. Install spring (A), pawl (B) and retainer (C).
5. Install washer and screw.



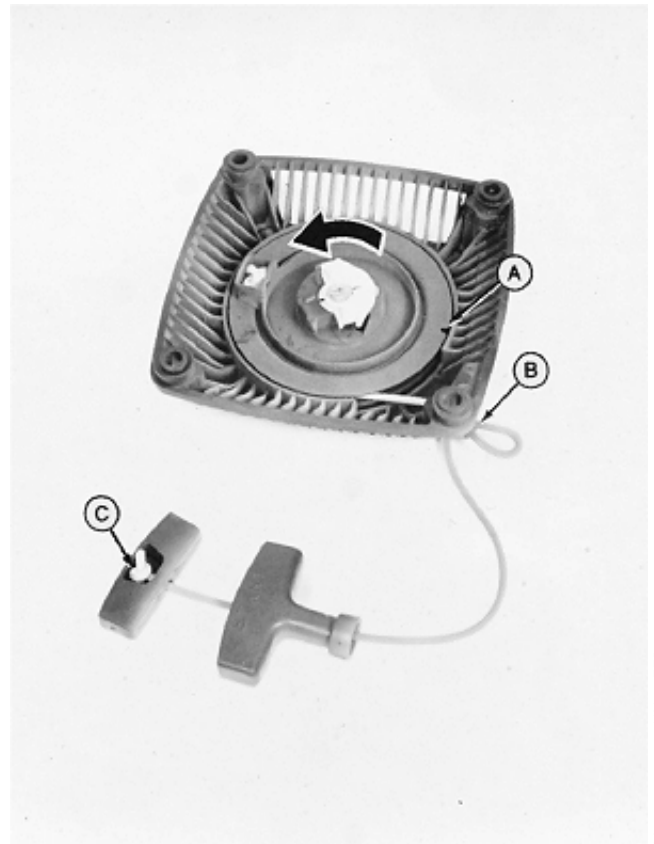
M80197 -UN-11FEB91



M80198 -UN-11FEB91

MX,3030A1,A6 -19-21OCT92

6. Place rope in notch (A). Turn reel counterclockwise until you feel tang hook on catch.
7. Turn reel two turns counterclockwise to preload spring.
8. While holding reel to keep it from unwinding, feed end of rope through guide. Tie knot (B) to hold rope.
9. Install handle and secure with knot (C).
10. Remove knot (B).
11. Pull rope to check for proper operation.
12. Install recoil starter on engine.



MX,3030A1,A7 -19-16JUL96

M80199 -JUN-11FEB91

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ANALYZE ELECTRIC STARTER CONDITION

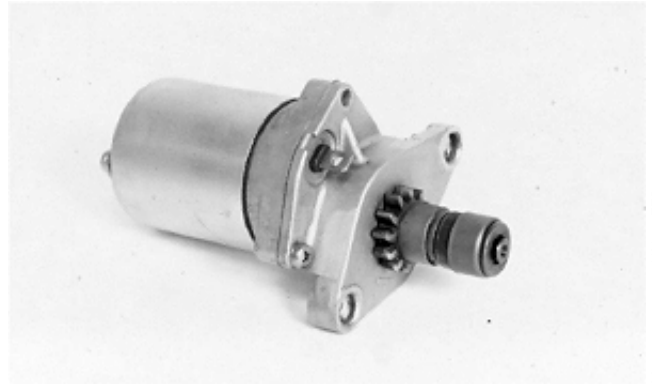
1. The starter overheats because of:
 - Long cranking.
 - Armature binding.
2. The starter operates poorly because of:
 - Armature binding.
 - Dirty or damaged starter drive.
 - Badly worn brushes or weak brush springs.
 - Excessive voltage drop in cranking system.
 - Battery or wiring defective.
 - Shorts, opens, or grounds in armature.

NOTE: Starter repair is limited to brushes, end caps, and starter drive. Fields in starter are permanent magnets and are not serviceable. If housing or armature is damaged, replace starter.

MX,2215BV,7 -19-16JUL96

CHECK STARTER ARMATURE ROTATION

1. Remove starter.
2. Rotate armature (A).
3. If armature does not rotate freely, armature may be bent or bearings may be worn. Disassemble, inspect and clean starter. (See Inspect Electric Starter in this group.)

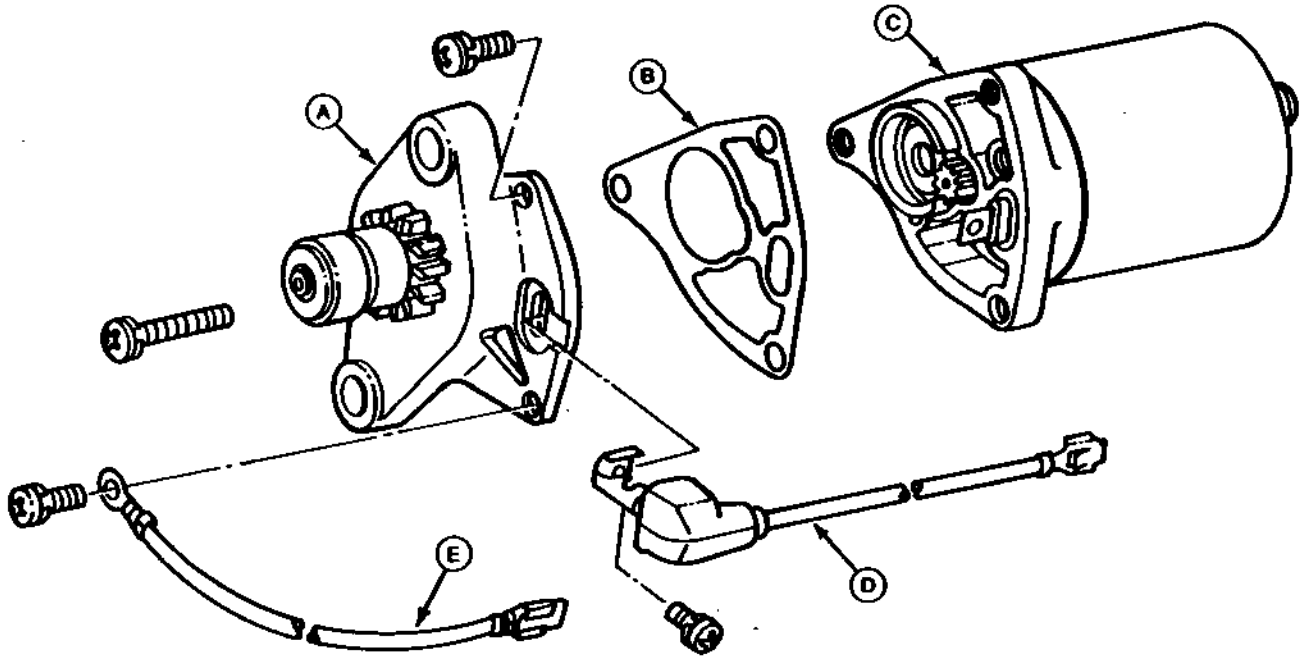


M80200 -JUN-11FEB91

MX,2215BV,8 -19-16JUL96

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INSPECT ELECTRIC STARTER



A—End Cover Assembly
B—Gasket

C—Electric Motor Assembly

D—Wiring Lead

E—Wiring Lead

NOTE: Wiring leads (D and E) are removed when starter is removed from engine.

1. Mark body and cover for correct alignment during reassembly.
2. Remove end cover assembly (A).
3. Inspect all parts for wear or damage. Replace as necessary.

4. Apply a thin coat of multipurpose grease to:
 - sliding surfaces of armature.
 - armature shaft spline.
 - points where shaft contacts cover.
5. Assemble starter.

MX.2215BV.9 -19-16JUL96

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M80201 -JUN-11FEB91

Section 30

FUEL AND AIR—B&S 2-CYCLE ENGINE (12PB/12PC/12SB)

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Group 10—Carburetor Assembly—B&S 2-Cycle

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Group 20—Exhaust System—B&S 2-Cycle

Remove and Install Exhaust System 30-20-2

30

REMOVE AND INSTALL AIR CLEANER ASSEMBLY (12PB, 12PC AND 12SB)

IMPORTANT: DO NOT run engine with air cleaner removed.

1. Remove air cleaner front cover (F).

IMPORTANT: DO NOT clean elements with petroleum solvents or compressed air. **DO NOT** oil elements after cleaning.

2. Inspect foam element (E) and paper element (C). Clean both by tapping on flat surface or by washing in a solution of low-sudsing detergent and warm water. Rinse elements thoroughly with water flowing from inside out until water is clear. Let air dry.

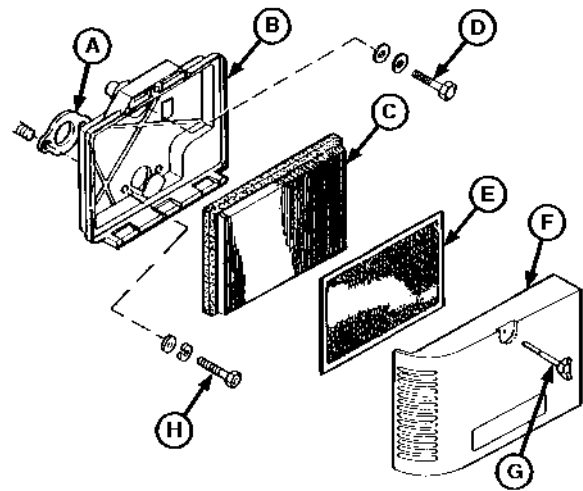
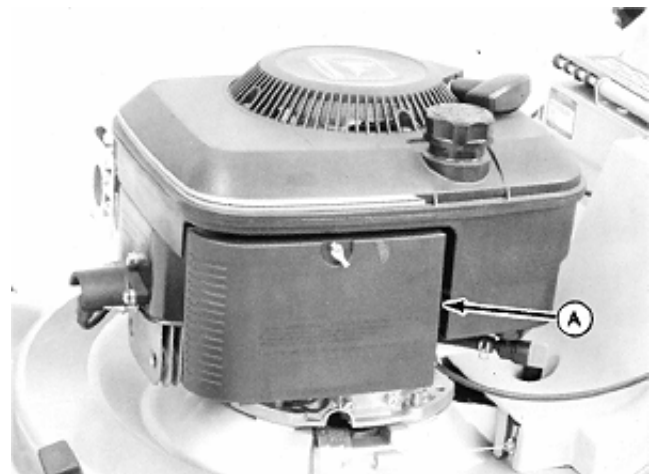
3. Remove screw (D) and nuts (H) to remove mounting base (B). Inspect mounting base (B) and replace as necessary.

NOTE: Inspect gasket (A) if mounting base was removed. Replace if necessary.

4. Install mounting base (if removed). Tighten nut (H) to **4 N·m (35 lb-in.)**.

5. Install air cleaner elements into front cover and fasten to mounting base with three lower hinge tabs and wing bolt.

- A—Gasket
- B—Mounting Base
- C—Paper Element
- D—Cap Screw
- E—Foam Element
- F—Front Cover
- G—Screw
- H—Nut



Air Cleaner Assembly/Remove and Install Air Cleaner Assembly

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SERVICE PARTS KITS

The following kits are available through your parts catalog:

- Carburetor Gasket Kit
- Main Jet High Altitude Kit

MX,3010BV,1 -19-01OCT92

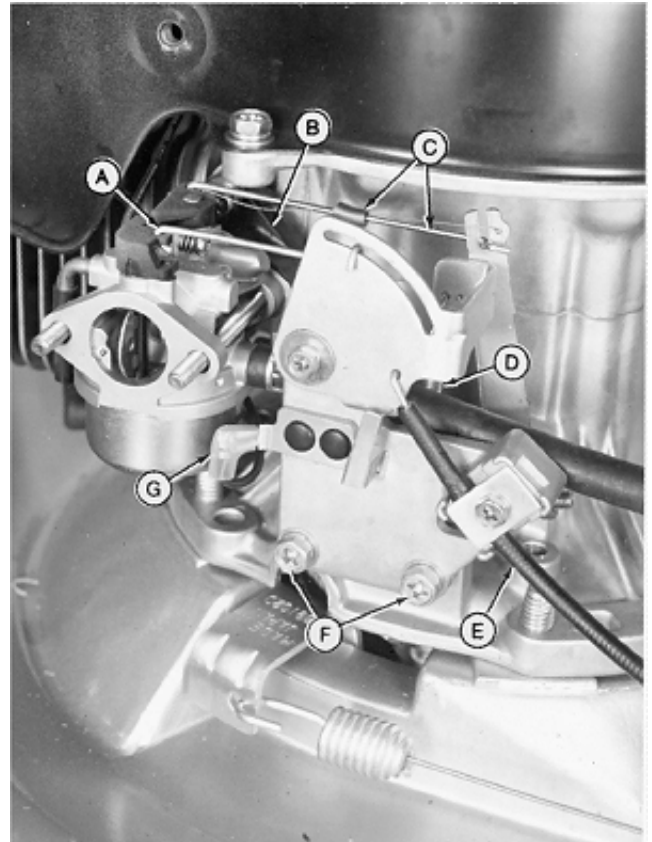
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1

REMOVE AND INSTALL CARBURETOR ASSEMBLY (12PB, 12PC AND 12SB)

1. Turn fuel valve to **OFF** position.
2. Disconnect spark plug wiring lead.
3. Remove fuel tank. (See Group 15—Remove and Install Fuel Tank [12PB, 12PC and 12SB].)
4. Remove air cleaner assembly and back cover. (See Group 05—Remove and Install Air Cleaner [12PB, 12PC and 12SB].)
5. Disconnect cable (E) and wiring lead (G).
6. Remove cap screws (F).

NOTE: When disconnecting spring (D) from control bracket, mark hole from which it was removed. Spring must be installed in same hole.

7. Disconnect link (A) and spring (D).
8. Remove link assembly (C).
9. Remove carburetor and gasket.
10. Remove spacer (B) and gasket.
11. Make repairs as necessary.
12. Install spacer and gasket. Tighten cap screws to **6 N·m (50 lb-in.)**.
13. Install carburetor and gasket.
14. Install control bracket and connect links, springs and wire.
15. Install gasket, back cover, air cleaner assembly and fuel tank. Tighten carburetor mounting nuts to **4 N·m (35 lb-in.)**.
16. Connect and adjust throttle cable. (See Section 220, Group 15.)
17. Connect spark plug wiring lead.
18. Adjust carburetor. (See Section 220, Group 15.)

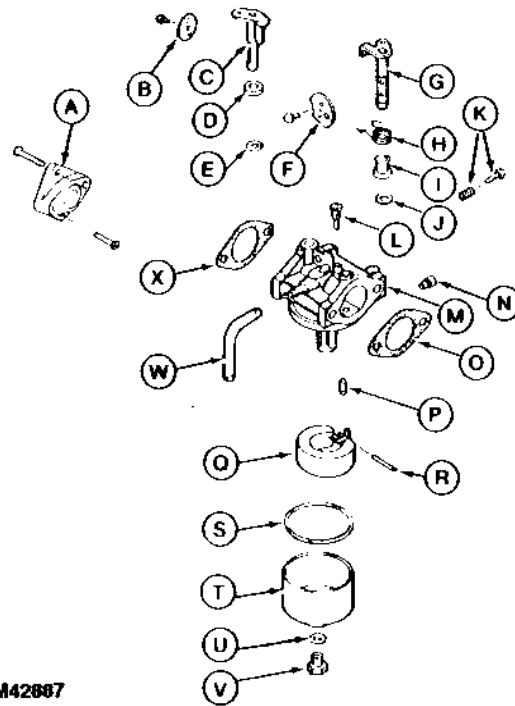


A—Choke Link
 B—Carburetor Spacer
 C—Governor Link
 D—Governor Spring
 E—Throttle Control Cable
 F—Cap Screws
 G—Wiring Lead

-JUN-06AUG90
M54401

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DISASSEMBLE AND ASSEMBLE CARBURETOR (12PB, 12PC AND 12SB)



M42887 -JUN-03SEP92

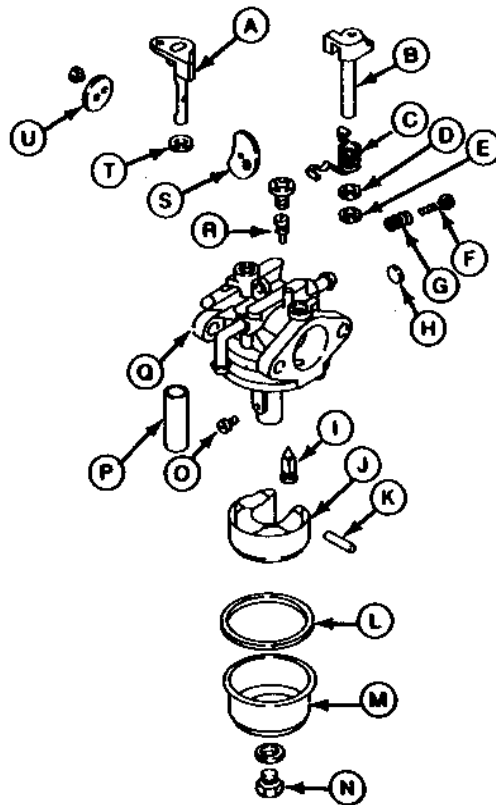
- | | | | |
|------------------|---------------------------------|----------------------------|-----------------------|
| A—Spacer | H—Return Spring | M—Carburetor Body | S—Gasket |
| B—Throttle Valve | I—Nylon Spacer | N—High Speed Jet | T—Float Bowl |
| C—Throttle Shaft | J—Seal | O—Outer Air Cleaner Gasket | U—Gasket |
| D—Nylon Washer | K—Idle Adjust Screw With Spring | P—Inlet Needle Valve | V—Cap Screw |
| E—Seal | L—Idle Speed Jet | Q—Float | W—Vent Tube |
| F—Choke Valve | | R—Float Pin | X—Inner Spacer Gasket |
| G—Choke Shaft | | | |

Exploded View—Mikuni Carburetor

NOTE: Mikuni carburetor was used before engine date code 89040400, while Walbro carburetor is used after engine date code 89040400.

1. Soak carburetor body and all parts, except gaskets and nylon spacers, in carburetor cleaning solvent for 1/2 hour maximum.
2. Spray all passages with a carburetor cleaning spray to verify that all internal passages are open.
3. Rinse carburetor with warm water and dry with compressed air. DO NOT use rags or paper to dry parts, lint may plug holes or passages.
4. Inspect all parts for wear or damage, replace as necessary.
5. Tighten float bowl cap screw (V and N) to **6 N·m (50 lb-in.)**.

DISASSEMBLE AND ASSEMBLE CARBURETOR (12PB, 12PC AND 12SB)—(CONTINUED)



M54350 -JUN-06AUG90

- | | | | |
|--------------------|----------------|--------------|-------------------|
| A—Throttle Shaft | G—Spring | L—Gasket | Q—Carburetor Body |
| B—Choke Shaft | H—Welch Plug | M—Float Bowl | R—Idle Jet |
| C—Return Spring | I—Needle Valve | N—Cap Screw | S—Choke Valve |
| D—Nylon Spacer | J—Float | O—Main Jet | T—Felt Washer |
| E—Felt Washer | K—Float Pin | P—Vent Tube | U—Throttle Valve |
| F—Idle Speed Screw | | | |

Exploded View—Walbro Carburetor

IMPORTANT: To remove float, use a needle nosed pliers on end of float pin (R and K). DO NOT strike opposite end of pin. Damage to pin holder may result. DO NOT clean holes or passages with small drill bits or wire.

IMPORTANT: Rinse carburetor body in warm water to neutralize corrosive action of cleaner on aluminum.

NOTE: Main jet high altitude kits are available.

MX,3010BV,3A -19-16JUL96

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OTHER MATERIAL

Number	Name	Use
	No. 2 PERMATEX® Sealant	Apply to threads of fuel tank shut-off valve.

PERMATEX is a trademark of the Loctite Corp.

MX,3015BV,1 -19-16JUL96

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15
1

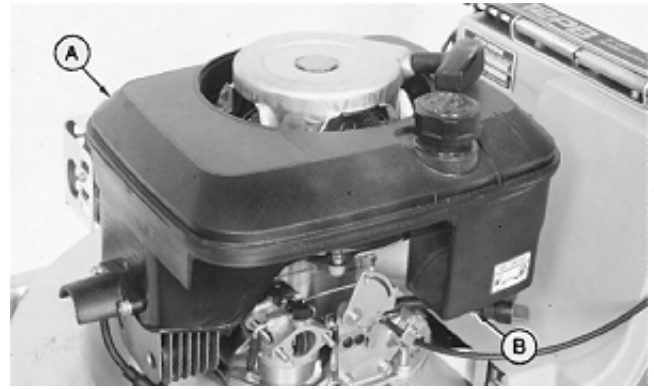
REMOVE AND INSTALL FUEL TANK ASSEMBLY (12PB, 12PC AND 12SB)

⚠ CAUTION: Gasoline is explosive. **DO NOT** expose to spark or flame. Serious personal injury may result. Wipe-up any spilled fuel **IMMEDIATELY**. Allow engine to cool completely before working on exhaust or fuel system.

1. Turn fuel shut-off valve to **OFF** position.
2. Remove recoil start cover and exhaust guard.
3. Remove air cleaner assembly. (See Group 05—Remove and Install Air Cleaner Assembly [12PB, 12PC and 12SB].)

NOTE: Approximate fuel tank capacity is 1.9 L (2 qt.).

4. Put a small flex-neck funnel and a safe container under the fuel shut-off valve.
5. Disconnect fuel line (B) and drain fuel tank.
6. Remove fuel tank (A).
7. Make repairs as necessary.
8. Install fuel tank and exhaust guard.
9. Install recoil start cover. Tighten screws to **3 N-m (27 lb-in.)**.
10. Connect fuel line.
11. Turn fuel shut-off valve to **OPEN** position.
12. Fill fuel tank with proper fuel. (See Section 10, Group 20.)



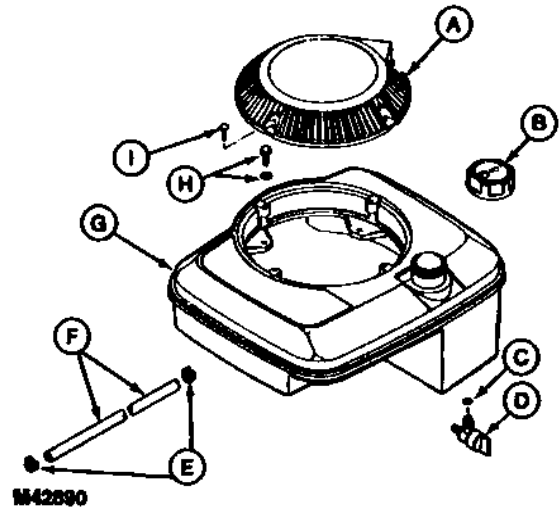
M54402 -JUN-06AUG90

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MX_3015BV,2 -19-16JUL96

EXPLODED VIEW—FUEL TANK ASSEMBLY (12PB, 12PC AND 12SB)

- A—Recoil Start Cover
- B—Fuel Cap
- C—O-Ring
- D—Shut-Off Valve Assembly
- E—Hose Clamps
- F—Hose
- G—Fuel Tank/Engine Cover
- H—Cap Screw and Washer (3 used)
- I—Screw (4 used)



Exploded View—Fuel Tank Assembly

MX,3015BV,3 -19-16JUL96

M42890 -UN-03SEP92

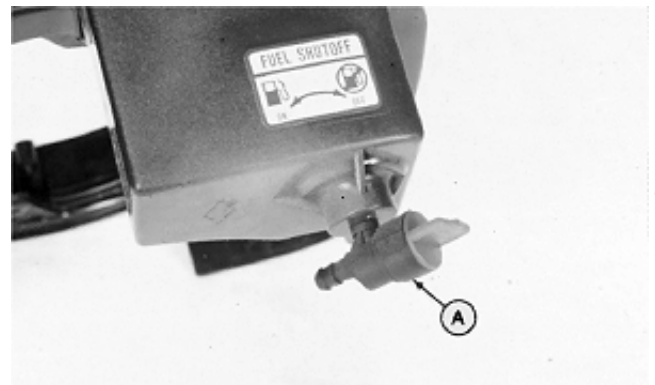
REMOVE AND INSTALL FUEL SHUT-OFF VALVE (12PB, 12PC AND 12SB)

1. You may want to remove the fuel tank, but it's not necessary.

CAUTION: Gasoline is explosive. **DO NOT** expose to spark or flame. Serious personal injury may result. Wipe-up any spilled fuel **IMMEDIATELY**.

NOTE: Approximate fuel tank capacity is **1.9 L (2 qt)**.

2. Disconnect fuel line to drain fuel tank into a safe container.
3. Turn shut-off valve assembly (A) counterclockwise to remove it from fuel tank.
4. Apply a coat of No. 2 PERMATEX on threads of new shut-off valve.
5. Install new O-ring on end of valve and turn valve clockwise to install, connect and clamp fuel line, and turn valve ON.
6. Fill fuel tank with proper fuel. (See Section 10, Group 20.)



M54403 -UN-06AUG90

MX,3015BV,4 -19-16JUL96

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REMOVE AND INSTALL EXHAUST SYSTEM (12PB, 12PC AND 12SB)



CAUTION: Allow engine and exhaust system to cool completely before you begin to work on them; otherwise, severe injury could result.

1. Remove guard (A) from front and rear brackets (E and B), muffler assembly (C), and gasket (D). Clean any excess gasket material from mounting surfaces of engine exhaust port and muffler assembly.

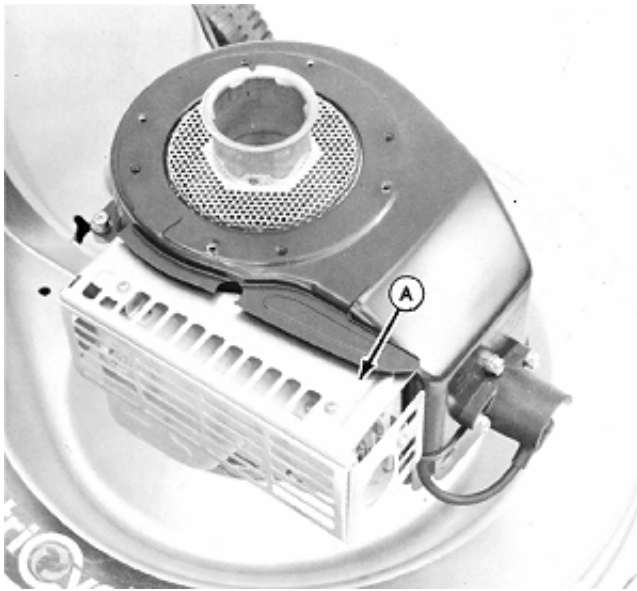
2. Inspect all components. Replace as necessary.

3. Install new gasket.

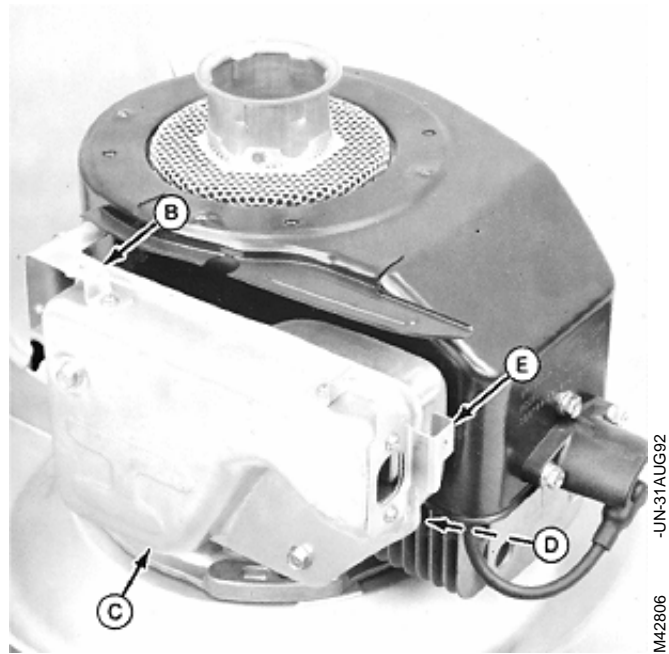
4. Fasten muffler assembly with two long cap screws and washers. Tighten to **6 N·m (50 lb-in.)**.

5. Install guard.

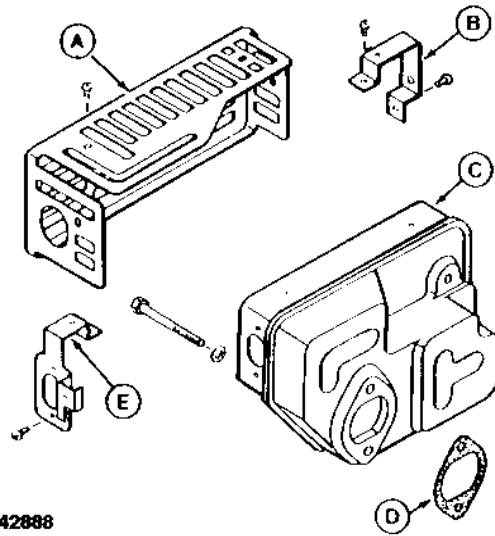
MX,3020BV,1 -19-16JUL96



M42804 -JUN-31AUG92



M42806 -JUN-31AUG92



M42888

M42888 -UN-03SEP92

A—Guard
B—Rear Bracket

C—Muffler Assembly

D—Gasket

E—Front Bracket

30
20
4

Section 31

FUEL AND AIR—BRIGGS & STRATTON 4-CYCLE ENGINE (14PZ/14SZ)

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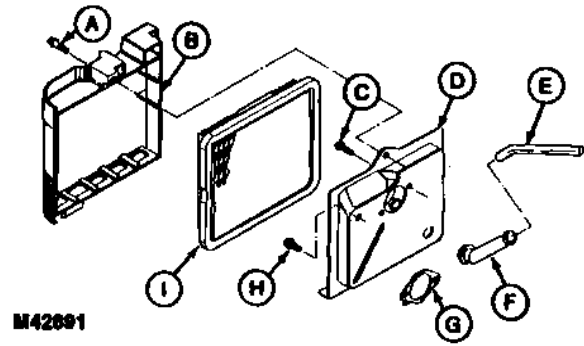
Exploded View—Exhaust System	31-20-1
Remove and Install Exhaust System	31-20-1

31

Group 05 Air Cleaner Assembly—B&S 4-Cycle

AIR CLEANER ASSEMBLY EXPLODED VIEW—14PZ (S.N. —100000) AND 14SZ (S.N. —100000)

- | | |
|-----------------|------------------|
| A—Cap Screw | F—Breather Hose |
| B—Cover | G—Gasket |
| C—Cap Screw | H—Cap Screw |
| D—Base Plate | I—Filter Element |
| E—Breather Tube | |



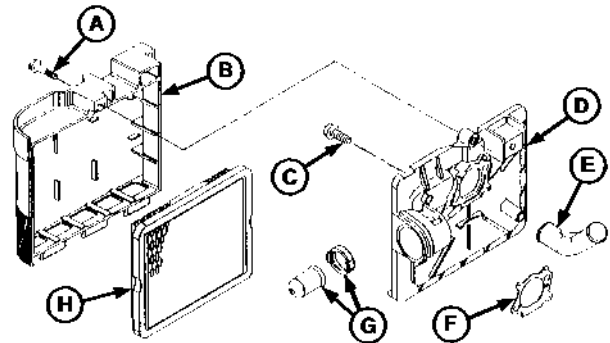
M42891

MX,3105BV,2 -19-16JUL96

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M42891

AIR CLEANER ASSEMBLY EXPLODED VIEW—14PZ (S.N. 100001—) AND 14SZ (S.N. 100001—)

- | |
|------------------|
| A—Cap Screw |
| B—Cover |
| C—Cap Screw |
| D—Base Plate |
| E—Grommet |
| F—Gasket |
| G—Hand Primer |
| H—Filter Element |



MX,3105BV,2A -19-16JUL96

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REMOVE AND INSTALL AIR CLEANER ASSEMBLY (14PZ AND 14SZ)

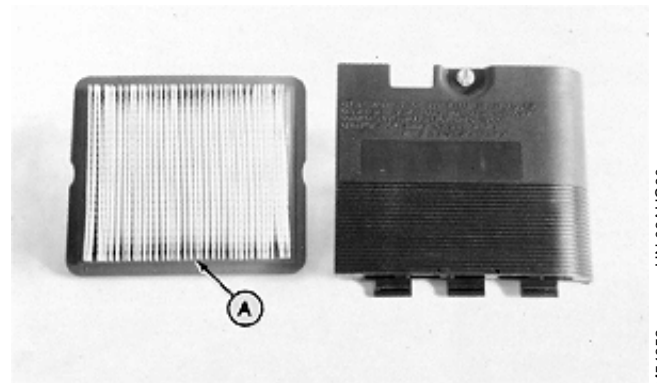
IMPORTANT: DO NOT run engine with air cleaner assembly removed.

1. Remove air cleaner cover and filter element (A).

IMPORTANT: DO NOT use pressurized air or petroleum solvents when cleaning air cleaner filter element. **DO NOT** oil element after cleaning.

2. Lightly tap filter element (A) on flat surface to remove loose dirt. Wash element in low-sudsing detergent and warm water. Rinse thoroughly with clean, low pressure water. Allow filter element to air dry only.

3. Install air cleaner filter element and cover.



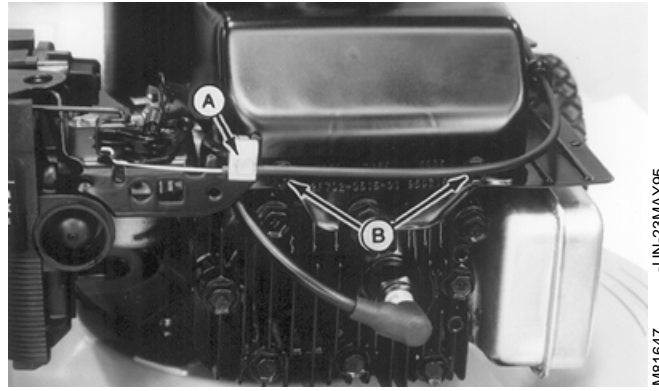
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MX,3105BV,1 -19-16JUL96

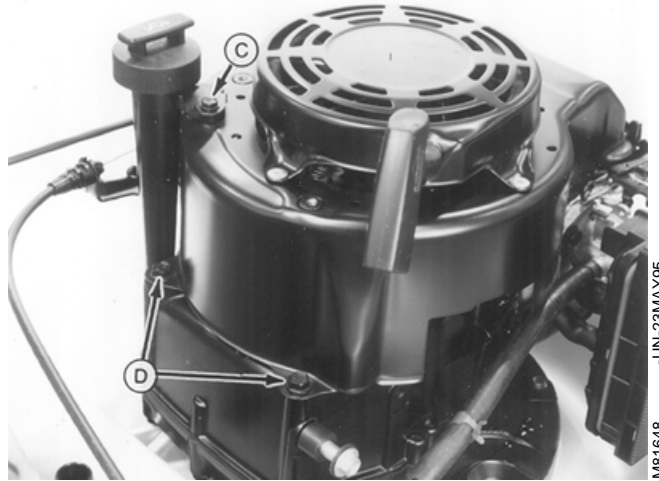
REMOVE AND INSTALL ENGINE FAN SHROUD ASSEMBLY (14PZ AND 14SZ)

IMPORTANT: DO NOT run engine with fan shroud removed.

1. Remove fuel tank assembly. (See Group 15—Remove and Install Fuel Tank Assembly [14PZ and 14SZ].)
2. Loosen throttle cable clamp screw (A).
3. Remove two cap screws (B).
4. Remove oil filler tube cap screw (C).
5. Remove two cap screws (D) to remove fan shroud.
6. Make repairs as necessary.
7. Install fan shroud.
8. Tighten throttle cable clamp screw.
9. Install fuel tank.
10. Check throttle cable adjustment. (See Group 222, Section 15.)



M81647
-UN-23MAY95



M81648
-UN-23MAY95

MX,3105BV,3 -19-16JUL96

SERVICE PARTS KITS

The following kits are available through your parts catalog:

- Carburetor Gasket Kit
- Main Jet High Altitude Kit

MX,3110BV,1 -19-01OCT92

REMOVE AND INSTALL CARBURETOR ASSEMBLY (14PZ AND 14SZ)

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury may result. Wipe-up any spilled fuel IMMEDIATELY.

1. Remove fuel tank. (See Group 15—Remove and Install Fuel Tank Assembly [14PZ and 14SZ].)

2. Remove air cleaner assembly and gasket.

NOTE: Later model carburetors use a primer system instead of a choke.

3. Disconnect choke spring (B) and throttle spring (A).

4. Remove cap screws (C), carburetor, and O-ring. Disengage governor link (D) from either end.

5. Inspect carburetor assembly and make repairs as necessary.

6. Connect governor link (D). Install new O-ring and carburetor. Tighten cap screws (C) to **10 N·m (90 lb-in.)**.

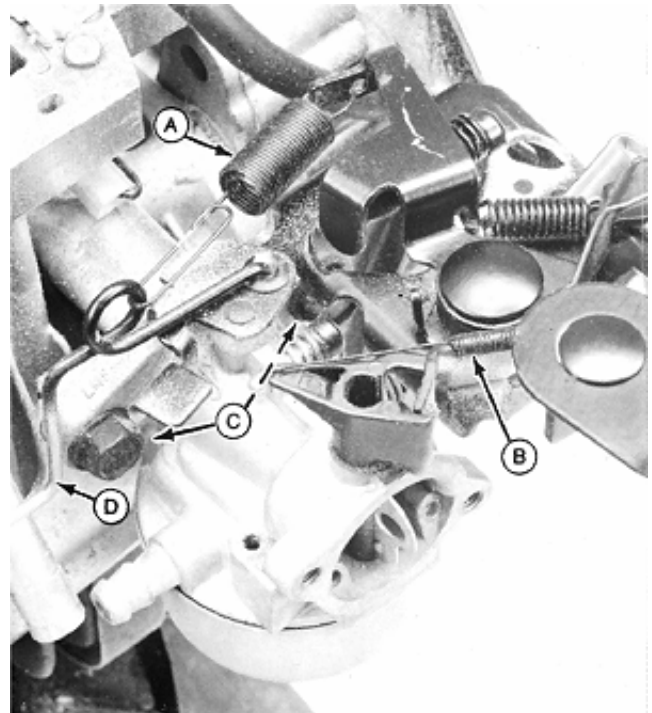
7. Connect springs (A and B).

8. Install gasket and air cleaner assembly.

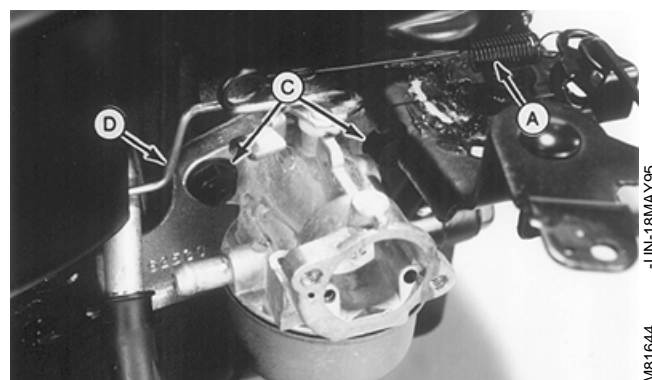
9. Install fuel tank.

10. Adjust throttle linkage. (See Section 222, Group 15.)

A—Throttle Spring
B—Choke Spring
C—Cap Screws
D—Governor Link



Early Model Carburetor



Late Model Carburetor

MX,3110BV,2 -19-16JUL96

DISASSEMBLE AND ASSEMBLE CARBURETOR ASSEMBLY—14PZ (S.N. —100000) AND 14SZ (S.N. —100000)

1. Remove choke plate (Q) by spreading choke shaft (T) with thin screwdriver.
2. Remove welch plug (N) with a small chisel.

IMPORTANT: DO NOT clean holes or passages with small drill bits or wire.

3. Soak metal parts only in carburetor cleaner for 30 minutes maximum.

4. Spray all passages with carburetor cleaner to verify they are open.

IMPORTANT: Rinse carburetor body in warm water to neutralize corrosive action of cleaner on aluminum.

5. Rinse carburetor in warm water and dry with compressed air. DO NOT use rags or paper to dry parts, lint may plug passages.

6. Inspect all parts for wear or damage. Replace as necessary. Replace idle mixture screw (O) if tip is bent or grooved. Replace gaskets (J) and (L), and felt seals (B) and (S) every time carburetor is disassembled.

7. Install welch plug (N) by pressing in until plug is flat. Seal plug with fingernail polish or non-hardening sealant.

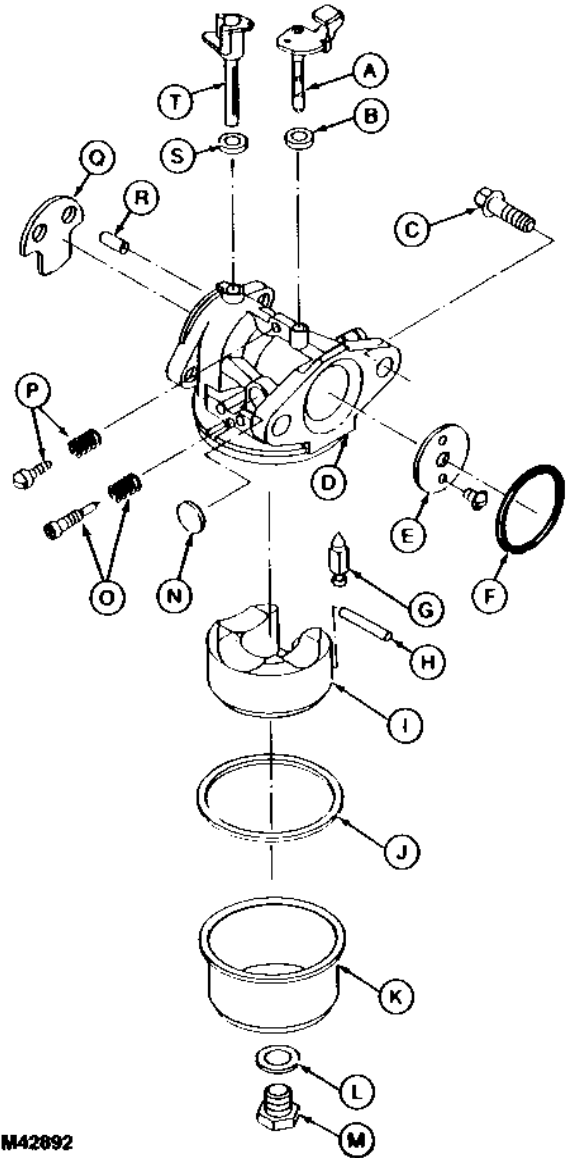
8. Install choke plate (Q) into choke shaft (T) with raised dimples of choke plate facing to the outside of carburetor and squeeze sides of choke shaft tight against choke plate.

9. Install throttle plate (E) with raised dimples facing to the inside of carburetor.

10. Tighten float bowl cap screw (M) to **6 N·m (50 lb-in.)**.

11. Install idle mixture screw (O). Turn screw in until it lightly bottoms. Back out 1-1/4 turns for initial adjustment.

NOTE: Main jet high altitude kits are available.



M42892

- | | |
|----------------------|------------------------|
| A—Throttle Shaft | L—Gasket |
| B—Felt Seal | M—Float Bowl Cap Screw |
| C—Cap Screw | N—Welch Plug |
| D—Carburetor Body | O—Idle Mixture Screw |
| E—Throttle Plate | P—Idle Stop Screw |
| F—O-Ring | Q—Choke Plate |
| G—Inlet Needle Valve | R—Main Jet |
| H—Float Pin | S—Felt Seal |
| I—Float | T—Choke Shaft |
| J—Gasket | |
| K—Float Bowl | |

M42892 -UN-03SEP92

DISASSEMBLE AND ASSEMBLE CARBURETOR ASSEMBLY—14PZ (S.N. 100001—) AND 14SZ (S.N. 100001—)

IMPORTANT: DO NOT clean holes or passages with small drill bits or wire.

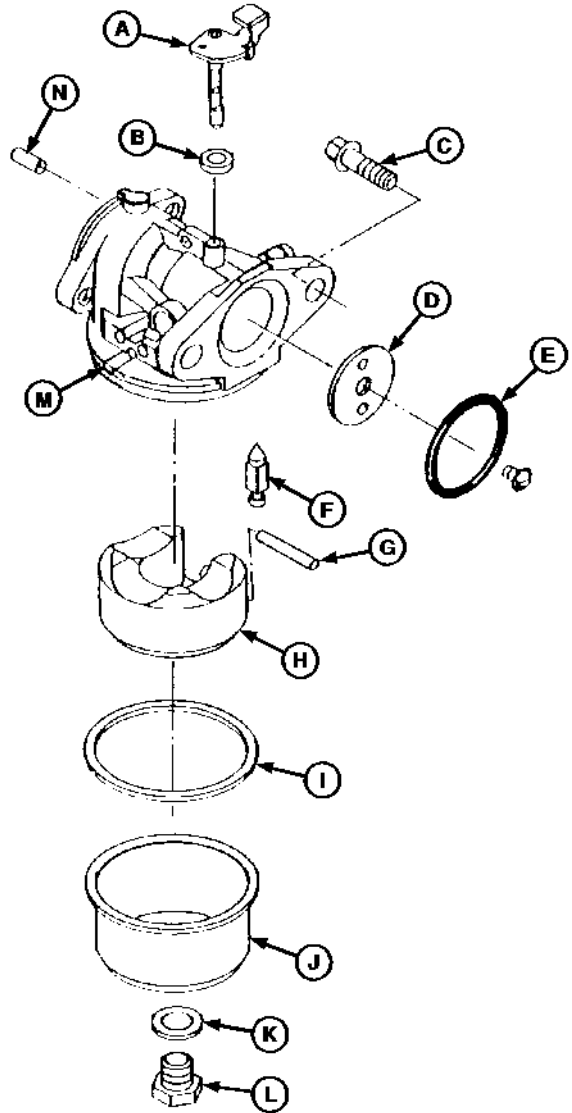
1. Soak metal parts only in carburetor cleaner for 30 minutes maximum.
2. Spray all passages with carburetor cleaner to verify they are open.

IMPORTANT: Rinse carburetor body in warm water to neutralize corrosive action of cleaner on aluminum.

3. Rinse carburetor in warm water and dry with compressed air. DO NOT use rags or paper to dry parts, lint may plug passages.
4. Inspect all parts for wear or damage. Replace as necessary. Replace gaskets (I) and (K) every time carburetor is disassembled.
5. Install throttle plate (D) with raised dimples facing to the inside of carburetor.
6. Tighten float bowl cap screw (L) to **6 N·m (50 lb-in.)**.

NOTE: Main jet high altitude kits are available.

- A—Throttle Shaft
- B—Felt Seal
- C—Cap Screw
- D—Throttle Plate
- E—O-Ring
- F—Inlet Needle Valve
- G—Float Pin
- H—Float
- I—Gasket
- J—Float Bowl
- K—Gasket
- L—Float Bowl Cap Screw
- M—Carburetor Body
- N—Main Jet



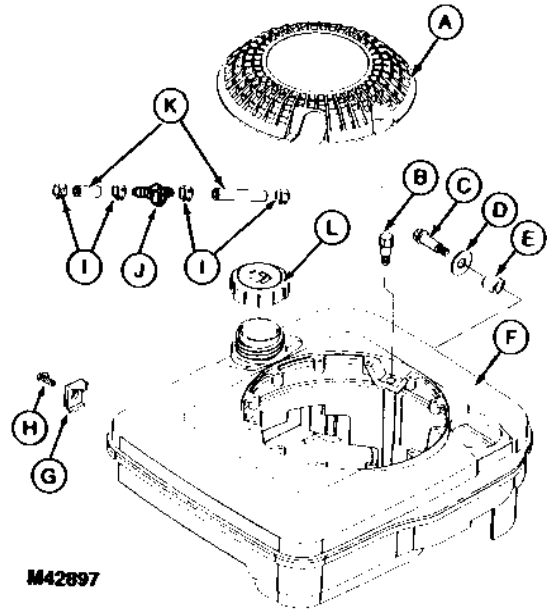
MX,3210BV,3A -19-16JUL96

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**EXPLODED VIEW—FUEL TANK ASSEMBLY
(14PZ AND 14SZ)**

- A—Recoil Start Screen
- B—Cap Screws
- C—Cap Screw
- D—Washer
- E—Spacer
- F—Fuel Tank
- G—Cable Clamp
- H—Cap Screw
- I—Hose Clamps
- J—Fuel Shut-Off Valve
- K—Hose
- L—Fill Cap



M42897 -JUN-10SEP92

MX.3115BV,2 -19-16JUL96

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REMOVE AND INSTALL FUEL TANK ASSEMBLY (14PZ AND 14SZ)

1. Remove recoil start screen by prying tabs at slots (A) around the screen.

NOTE: Fuel shut-off valve has been eliminated on later models (Engines marked 12F702).

2. Turn fuel shut-off valve (B) to **CLOSED** position (if equipped).

CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe-up any spilled fuel IMMEDIATELY.

NOTE: Approximate fuel tank capacity is 1.4 L (1.5 qt).

3. Put small flex-neck funnel and safe container under fuel shut-off valve (B) or fuel line.

4. Disconnect fuel line (C) or open fuel shut-off valve and drain tank.

5. Remove four cap screws (D) and (E) to remove fuel tank.

6. Make repairs as necessary.

7. Install fuel tank.

8. Connect fuel line.

9. Install recoil start screen.

10. Turn fuel shut-off valve to **OPEN** position (if equipped).

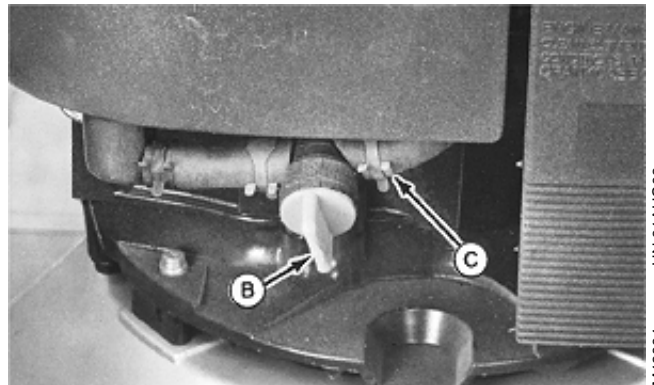
11. Fill tank with proper fuel. (See Section 10, Group 20.)

A—Screen Slots
 B—Fuel Shut-Off Valve
 C—Fuel Line
 D—Cap Screws



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M42895



-UN-31AUG92

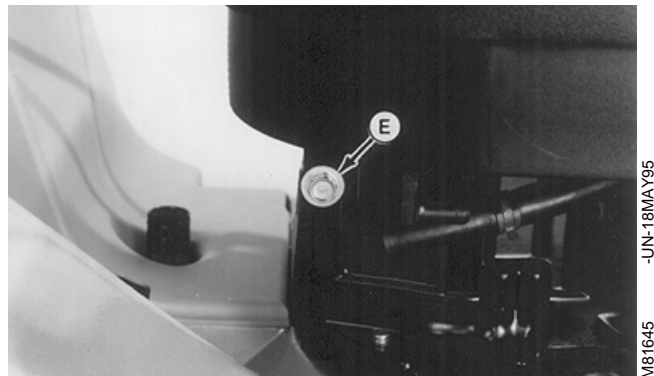
M42894

Early Model Shown



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M81650



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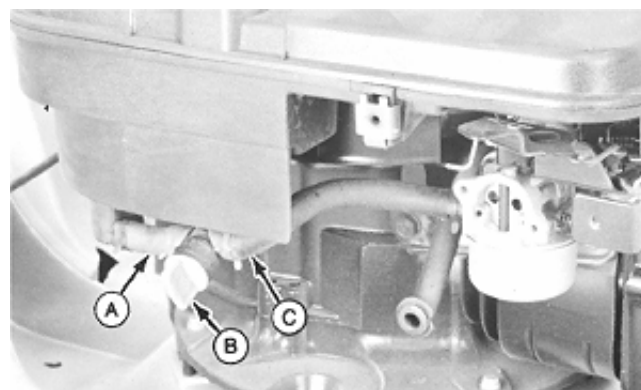
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REMOVE AND INSTALL FUEL SHUT-OFF VALVE—14PZ (S.N. —100000) AND 14SZ (S.N. —100000)

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe-up any spilled fuel IMMEDIATELY.

NOTE: Approximate fuel tank capacity is 1.4 L (1.5 qt).

1. Put small flex-neck funnel and safe container under fuel shut-off valve (B).
2. Disconnect hoses (A and C) to drain tank and remove valve.
3. Inspect parts for wear or damage. Replace as necessary.
4. Install new shut-off valve (B) into hose (A) only.
5. Close valve.
6. Pour enough fuel into tank to check valve.
7. Check for leaks and open and close valve quickly to see that it functions properly.
8. Connect hose (C) and fill tank with proper fuel. (See Section 10, Group 20.)

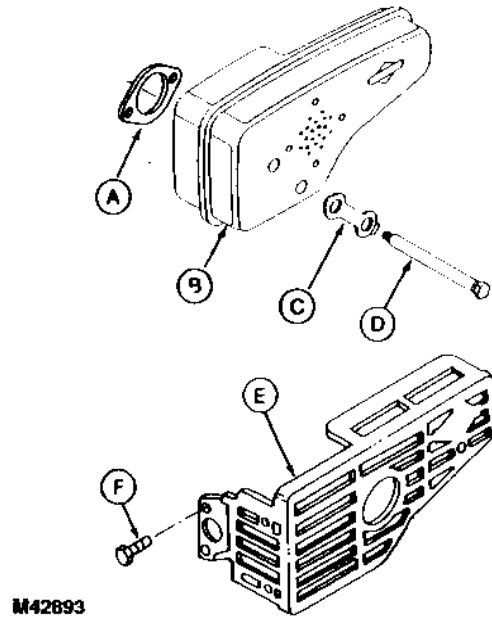


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M42899

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EXPLODED VIEW—EXHAUST SYSTEM (14PZ AND 14SZ)

- A—Gasket
- B—Muffler
- C—Clamp
- D—Cap Screw
- E—Guard (Export Only)
- F—Cap Screw (Export Only)



M42893

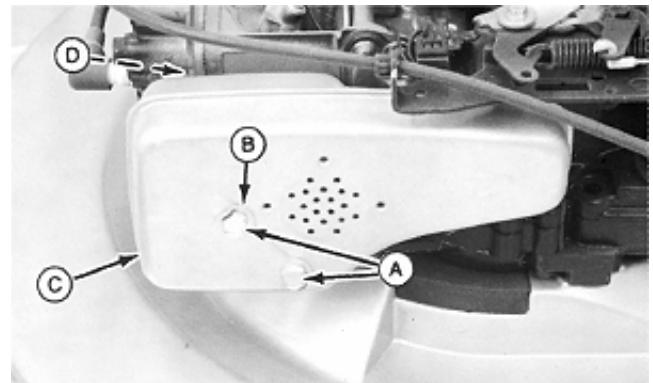
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M42893

MX,3120BV,1A -19-16JUL96

REMOVE AND INSTALL EXHAUST SYSTEM (14PZ AND 14SZ)

CAUTION: Allow engine and exhaust system to cool completely before you begin to work on them; otherwise, severe injury could result.

1. Bend tabs of clamp (B) flat with a pliers or blade of a screwdriver.
2. Remove cap screws (A).
3. Remove muffler (C) and gasket (D). Remove any excess gasket material.
4. Inspect components and replace as necessary.
5. Install new gasket onto muffler lip.
6. Fasten muffler with clamp and cap screws. Tighten cap screws to **6 N·m (50 lb-in.)**.
7. Bend tabs of clamp tight against head of cap screws.



- A—Cap Screws
- B—Clamp
- C—Muffler
- D—Gasket

-UN-31AUG92
M42900

MX,3120BV,1 -19-16JUL96

FUEL AND AIR—KAWASAKI 4-CYC ENG (14PB/14PT/14SB/14SC/14SX/14SE/14ST)

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Group 20—Exhaust System—Kawasaki 4-Cycle

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Remove and Install Exhaust System	32-20-1

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Carburetor Gasket Kit

Main Jet High Altitude Kit

Complete Carburetor

MX,3005A1,A1 -19-21OCT92

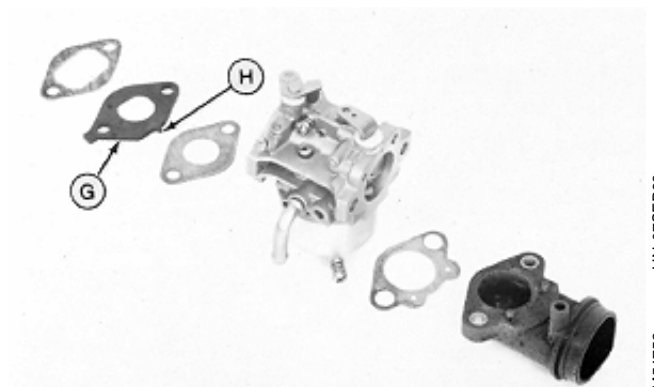
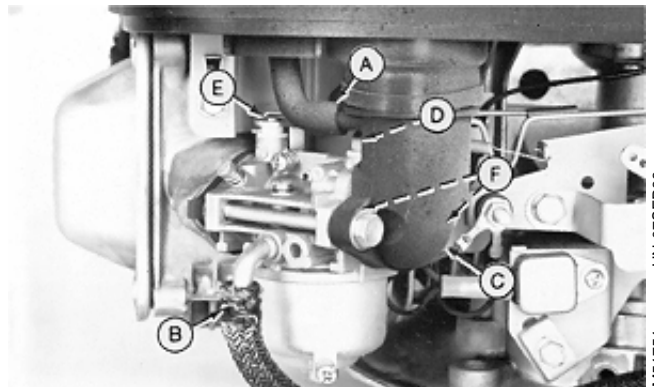
REMOVE AND INSTALL CARBURETOR

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury may result. Wipe-up any spilled fuel IMMEDIATELY.

1. Close fuel shut off valve on fuel tank.
2. Drain fuel from carburetor.
3. Disconnect hoses (A and B).
4. Remove duct (C) and collars (F).
5. Disconnect linkage (D and E) and remove carburetor, gaskets and insulator (G).
6. Make repairs as necessary. (See Disassemble, Clean, Inspect and Assemble Carburetor in this group.)

NOTE: Install carburetor and gaskets with convex side of insulator (G) toward cylinder head and tab (H) pointing down.

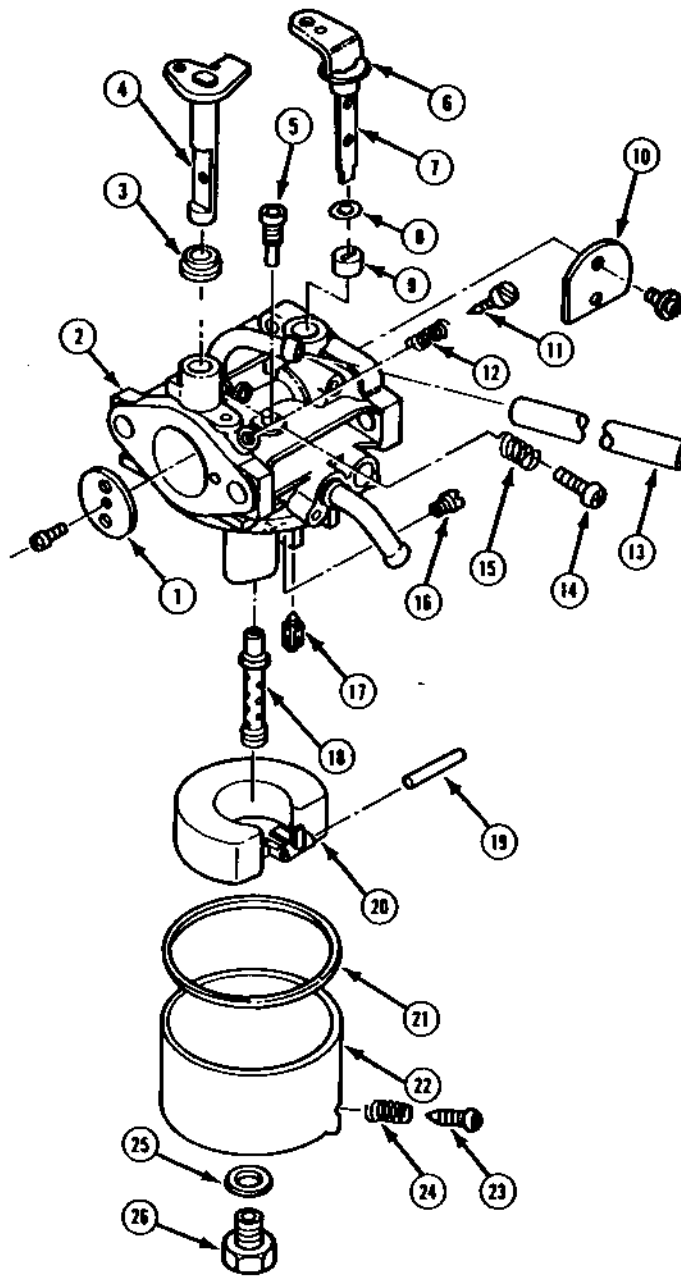
7. Install gaskets, insulator and carburetor. Connect linkage.
8. Install collars, duct and cap screws.
9. Connect hoses.



A—Oil Breather Hose
B—Fuel Hose
C—Air Intake Duct
D—Choke Linkage
E—Throttle Linkage
F—Collar
G—Insulator
H—Tab

MX,3205BV,2 -19-16JUL96

DISASSEMBLE, CLEAN, INSPECT AND ASSEMBLE CARBURETOR



- 1—Throttle Plate
- 2—Carburetor Body
- 3—Bushing
- 4—Throttle Shaft
- 5—Pilot Jet
- 6—Bushing
- 7—Choke Shaft

- 8—Washer
- 9—Collar
- 10—Choke Plate
- 11—Pilot Screw
- 12—Spring
- 13—Hose
- 14—Idle Screw

- 15—Spring
- 16—Main Jet
- 17—Needle Valve
- 18—Main Nozzle
- 19—Float Pin
- 20—Float

- 21—Gasket
- 22—Float Chamber
- 23—Drain Screw
- 24—Spring
- 25—Washer
- 26—Plug

ATTENTION! DO NOT attempt to repair, replace jets, or adjust the engine emissions carburetor unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions Carburetors.

IMPORTANT: To remove float, use a long nosed pliers on end of pin. Do not strike opposite end of pin. Damage to pin holder may result.

Do not clean holes or passages with small drill bits or wire.

1. Soak carburetor body and all parts, except gaskets, float and plastic rings, in carburetor cleaning solvent for 1/2 hour maximum.

2. Spray all passages with a carburetor cleaning spray to verify that all internal passages are open.

IMPORTANT: Rinse carburetor body in warm water to neutralize corrosive action of cleaner on aluminum.

3. Rinse carburetor with warm water and dry with compressed air. Do not use rags or paper to dry parts: lint may plug holes or passages.

4. Inspect all parts for wear or damage, replace as necessary.

NOTE: Main jet high altitude kits are available.

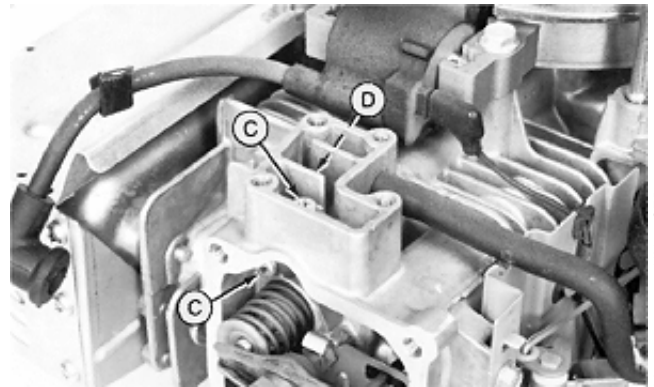
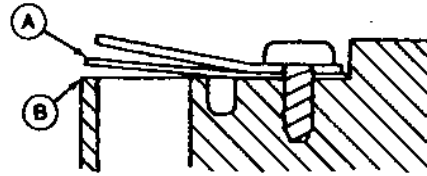
Float is plastic. The float cannot be adjusted. Replace if necessary.

MX,3005A1,A4 -19-16JUL96

SERVICE BREATHER

NOTE: Breather is located in cylinder head.

1. Remove engine cover. (See Group 10.)
2. Remove breather cover and gasket.
3. Remove rocker arm cover.
4. Measure air gap between reed valve (A) and valve seat (B) at valve tip. Replace reed valve if gap is greater than **0.20 mm (0.008 in.)**.
5. Remove breather valve (C).
6. Inspect breather for sticking, binding, cracks or distortion. Replace breather if worn or damaged.
7. Inspect valve seating surface. Surface must be free of nicks or burrs.
8. Check that drain back hole (D) in breather chamber is open.
9. Install breather assembly, gasket and cover.



A—Reed Valve
B—Valve Seat
C—Breather Valve (2 used)
D—Drain Back Hole

MX,3205BV,4 -19-16JUL96

SERVICE AIR CLEANER

1. Remove cover (D) and disassemble the filter elements.

IMPORTANT: Do not clean paper element.

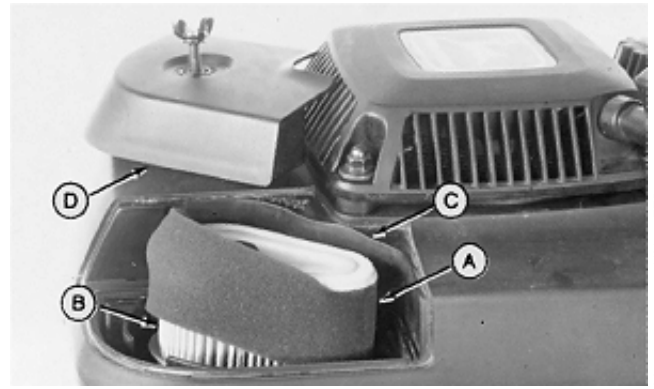
2. Wash foam element (A) in detergent and water. Dry element.

3. Put 12—15 drops of engine oil on foam element (A). Squeeze out excess oil.

4. Replace paper element (B) if:
—Element is oily, dirty, bent, torn, crushed, or obstructed in any way.
—Seal is damaged.
—Engine performance is poor.

5. Inspect housing (C), and cover (D) for damage. Replace if necessary.

6. Assemble and install air cleaner elements.



A—Foam Element
B—Paper Element
C—Housing
D—Cover

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MX.3205BV,5 -19-16JUL96

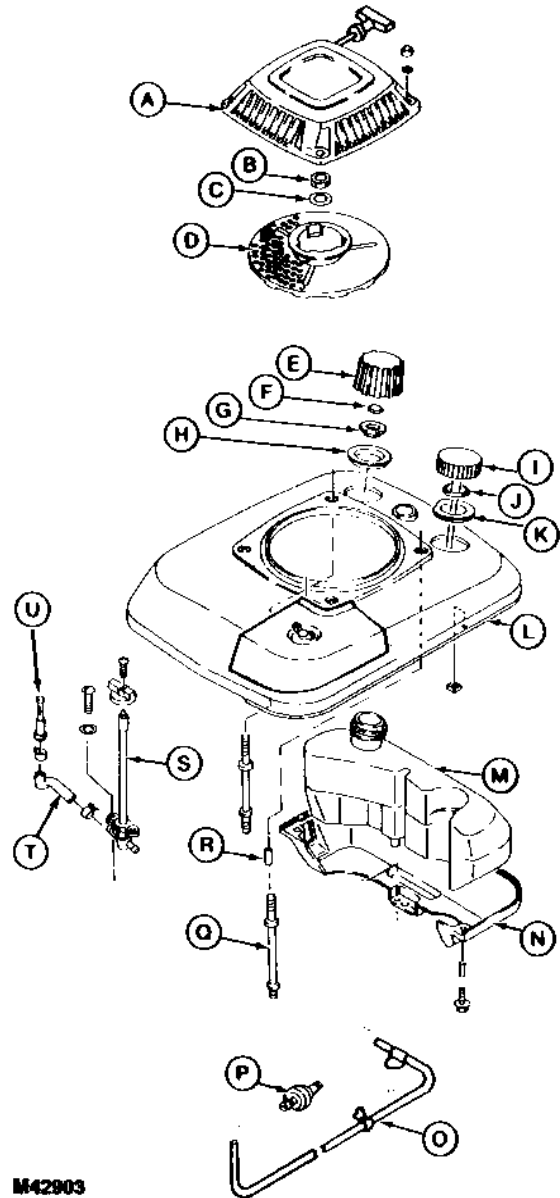
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**EXPLODED VIEW—FUEL TANK ASSEMBLY
 (14PB, 14PT, 14SB, 14SC/14SX, 14SE AND
 14ST)**

This exploded view is provided as a guide to help you in the disassembly and assembly of the fuel tank assembly.

- A—Recoil Start Assembly
- B—Flywheel Nut
- C—Flywheel Washer
- D—Recoil Start Cup/Flywheel Screen Assembly
- E—Fuel Fill Cap
- F—Breather
- G—Gasket
- H—Grommet
- I—Oil Fill Cap/Dipstick
- J—Gasket
- K—Grommet
- L—Engine Cover/Fuel Tank Housing
- M—Fuel Tank
- N—Lower Cover
- O—Fuel Hose
- P—Fuel Filter (Optional)
- Q—Mounting Studs
- R—Spacers
- S—Fuel Tank Valve Assembly
- T—Fuel Hose
- U—Filter



M42903

M42903 -UN-10SEP92

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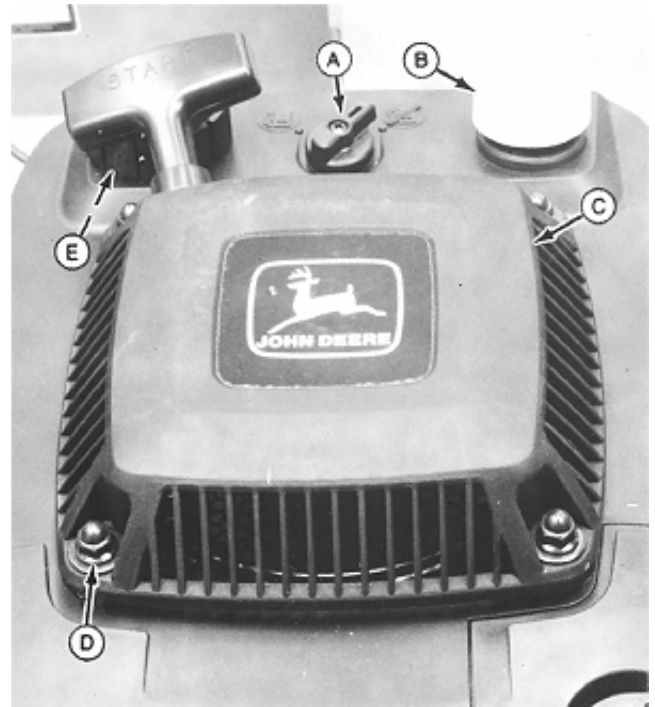
MX,3215BV,8 -19-16JUL96

REMOVE AND INSTALL FUEL TANK (14PB, 14PT, 14SB, 14SC/14SX, 14SE AND 14ST)

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe-up any spilled fuel IMMEDIATELY.

1. Turn fuel tank valve (A) to **CLOSED** position.
2. Remove four nuts (D) to remove recoil start assembly (C).
3. Remove oil fill cap/dipstick (B). DO NOT remove fuel fill cap (E) at this time.

A—Fuel Tank Valve
B—Oil Fill Cap/Dipstick
C—Recoil Start Assembly
D—Nuts
E—Fuel Tank Fill Cap



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MX.3215BV,1 -19-16JUL96

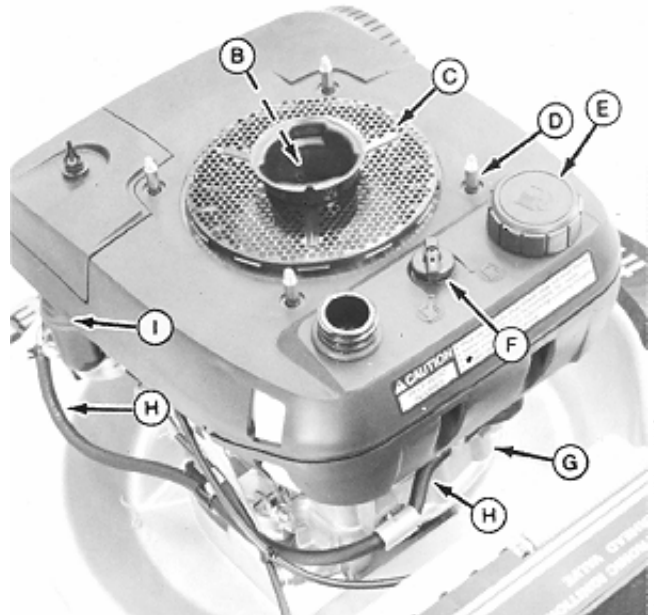
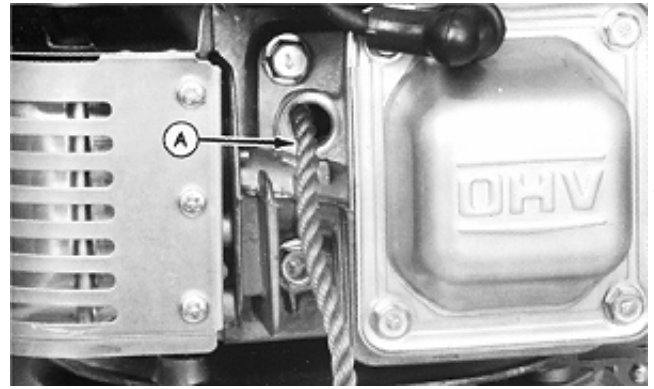
4. Remove spark plug and feed a small diameter nylon rope (A) into cylinder head to stop crankshaft rotation.
5. Remove flywheel nut and washer (B) to remove recoil start cup/flywheel screen assembly (C).
6. Remove four spacers (D).

⚠ CAUTION: Gasoline is explosive. DO NOT expose to spark or flame. Serious personal injury can result. Allow engine to cool completely before working on fuel system. Wipe-up any spilled fuel IMMEDIATELY.

NOTE: Fuel tank assembly is an integral part of the engine cover. Fuel tank capacity is approximately 1.3 L (1.4 qt.).

7. Put a small, flexible neck funnel under carburetor and into a suitable container. Disconnect fuel hose (H) from the carburetor and put it in funnel to drain fuel. Turn fuel tank valve knob (F) to **OPEN** position to drain tank. Remove fill cap (E) so atmospheric pressure will aid in draining fuel from tank.
8. Disconnect hose (H) from fuel tank valve fitting (G).
9. Disconnect air intake boot (I) from air cleaner hole.
10. Remove engine cover/fuel tank assembly to workbench.

- A—Nylon Rope
- B—Flywheel Nut and Washer
- C—Recoil Start Cup/Flywheel Screen Assembly
- D—Spacers
- E—Fuel Fill Cap
- F—Fuel Tank Valve Knob
- G—Fuel Tank Valve Fitting
- H—Fuel Hose
- I—Air Intake Boot

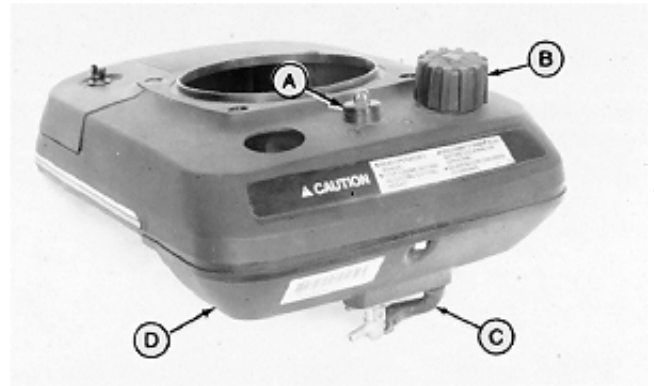


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M42902 -UN-31AUG92

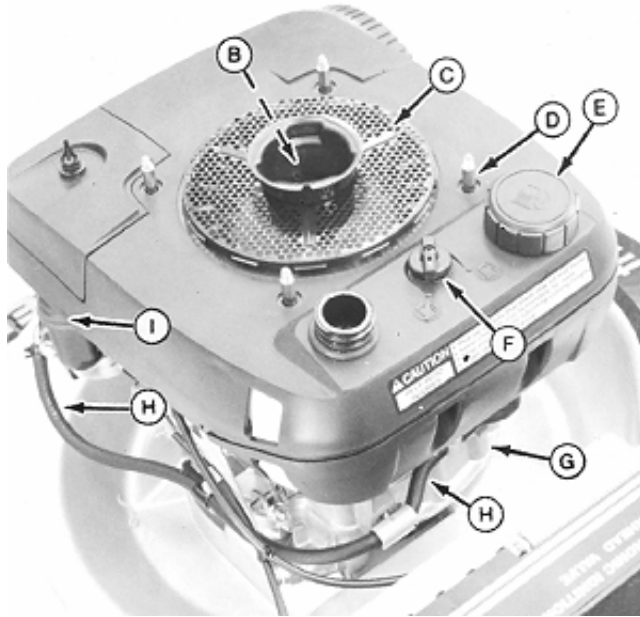
32
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3

11. Remove fuel tank valve knob (A) and fuel fill cap (B).
12. Disconnect hose (C) from fuel tank valve fitting and tank fitting.
13. Remove three cap screws to remove lower cover (D).
14. Remove fuel tank.
15. Inspect and repair or replace components as necessary.
16. Install fuel tank, lower cover, fill cap and valve knob.

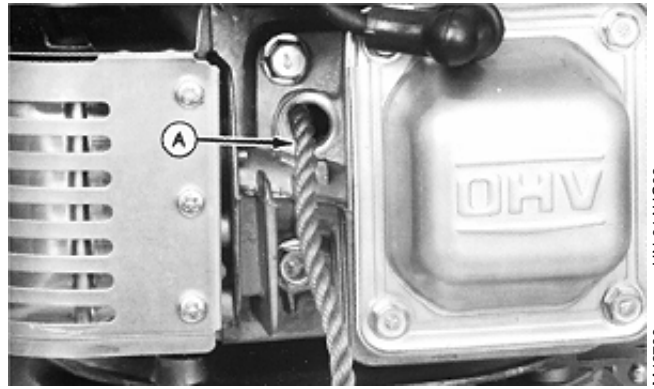


A—Fuel Tank Valve Knob
B—Fuel Fill Cap
C—Fuel Line
D—Lower Cover

MX,3215BV,3 -19-01OCT92



M42902 -UN-31AUG92



M42786 -UN-31AUG92

- | | | | |
|---|-----------------|---------------------------|-------------------|
| A—Nylon Rope | D—Spacers | F—Fuel Tank Valve Knob | H—Fuel Hose |
| B—Flywheel Nut and Washer | E—Fuel Fill Cap | G—Fuel Tank Valve Fitting | I—Air Intake Boot |
| C—Recoil Start Cup/Flywheel Screen Assembly | | | |

17. Install engine cover/fuel tank assembly on engine.
18. Connect fuel hose (H) and boot (I).
19. Install four spacers (D).
20. If you removed the nylon rope (A) after you removed the flywheel nut, once again feed a small diameter nylon rope (A) into cylinder head to stop crankshaft rotation or wedge a block of wood between cutting blade and mower deck.
21. Install recoil start cup/flywheel screen assembly (C). Fasten it with washer and flywheel nut (B). Tighten flywheel nut to **45 N·m (33 lb-ft.)**.
22. Adjust flywheel screen.
23. Install recoil start assembly. Tighten acorn nuts to **6 N·m (50 lb-in.)**.
24. Remove nylon rope (A) and gap spark plug to **0.762 mm (0.030 in.)** before installation. Tighten spark plug to **20 N·m (177 lb-in.)**.

MX,3215BV,4 -19-16JUL96

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25. Install recoil start assembly, oil fill cap/dipstick, and turn fuel shut-off valve to **OPEN** position.

26. Fill fuel tank with proper fuel. (See Section 10, Group 20.)

- A—Fuel Shut-Off Valve
- B—Oil Fill Cap
- C—Recoil Start Assembly
- D—Acorn Nuts
- E—Fuel Tank Fill Cap

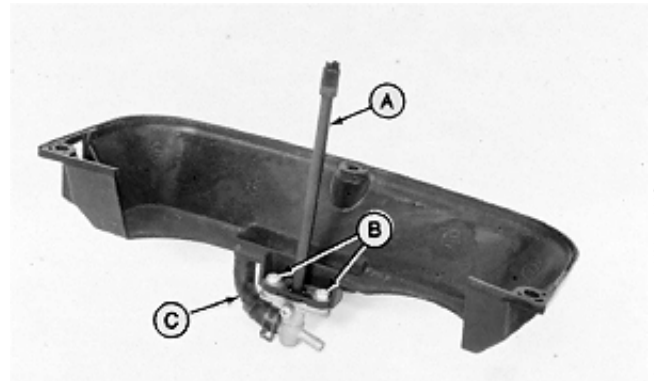


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MX.3215BV,5 -19-16JUL96

REMOVE AND INSTALL FUEL TANK VALVE (14PB, 14PT, 14SB, 14SC/14SX, 14SE AND 14ST)

1. Drain and remove fuel tank.
2. Remove hose (C).
3. Remove screws (B) to remove fuel tank valve (A).
4. Inspect and replace components as necessary.
5. Install valve (A) with screws (B).
6. Install hose (C).



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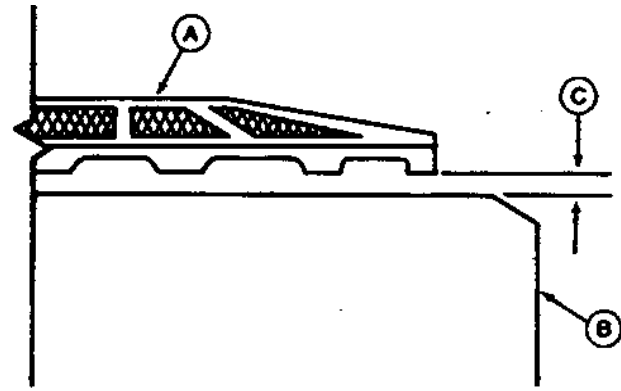
MX.3215BV,6 -19-16JUL96

ADJUST FLYWHEEL SCREEN (14PB, 14PT, 14SB, 14SC/14SX, 14SE AND 14ST)

Adjust gap (C) between blades of flywheel screen (A) and engine cover (B) using additional washers, the same washer as used with flywheel nut, placed between the flywheel and flywheel screen.

INSPECTION SPECIFICATIONS

Flywheel Screen Minimum Gap 1.5 mm (0.059 in.)



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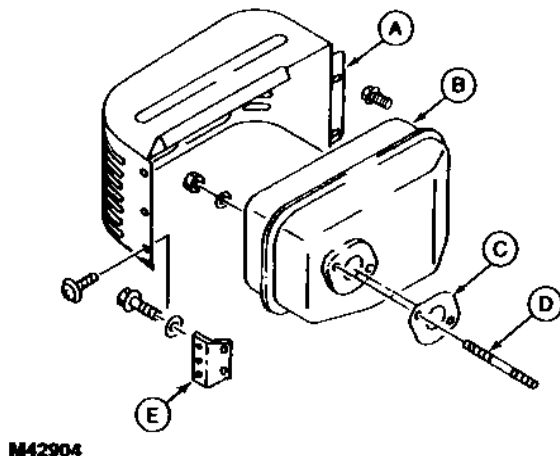
MX,3215BV,7 -19-16JUL96

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**EXPLODED VIEW—EXHAUST SYSTEM
(14PB, 14PT, 14SB, 14SC/14SX, 14SE AND
14ST)**

- A—Guard
- B—Muffler
- C—Gasket
- D—Mounting Studs
- E—Front Bracket



M42904

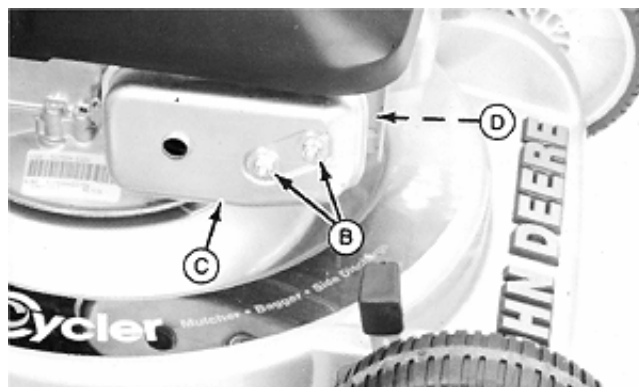
MX,3220BV,2 -19-16JUL96

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M42904

**REMOVE AND INSTALL EXHAUST SYSTEM
(14PB, 14PT, 14SB, 14SC/14SX, 14SE AND
14ST)**

⚠ CAUTION: Allow engine and exhaust system to cool completely before you begin to work on them; otherwise, severe injury could result.

1. Remove five screws (three front without washers and two rear with washers) to remove guard (A).
2. Remove two nuts and washers (B) to remove muffler (C) and gasket (D) from two mounting studs.
3. Remove any residual gasket material from mounting surfaces.
4. Inspect components and replace as necessary.
5. Install new gasket (D) on mounting studs.
6. Fasten muffler (C) to studs with washers and nuts (B). Tighten nuts to **6 N·m (50 lb-in.)**.
7. Fasten guard (A) with five screws (three front without washers and two rear with washers).



- A—Guard
- B—Nuts and Washers
- C—Muffler
- D—Gasket

MX,3220BV,1 -19-16JUL96

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M42906

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Section 40

ELECTRICAL SYSTEM—BRIGGS & STRATTON 2-CYCLE (12PB/12PC/12SB)

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Group 05—Ignition Coil—B&S 2-Cycle

Remove and Install Ignition Coil 40-05-1

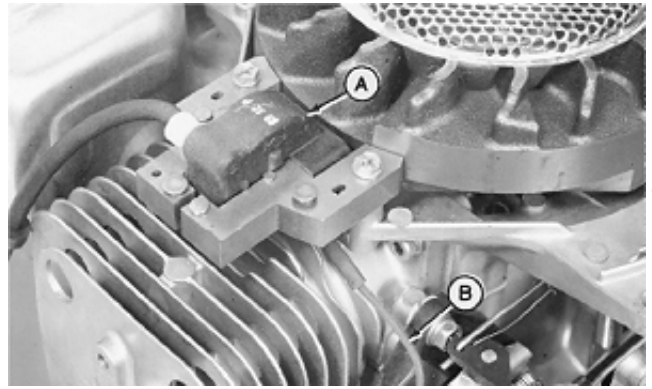
Group 10—Safety Switch—B&S 2-Cycle

Remove and Install Safety Switch 40-10-1

40

**REMOVE AND INSTALL IGNITION COIL
(12PB, 12PC AND 12SB)**

1. Disconnect spark plug wiring lead.
2. Remove air cleaner assembly. (See Section 30, Group 05.)
3. Remove fuel tank. (See Section 30, Group 05.)
4. Remove blower housing.
5. Remove muffler heat shield.
6. Disconnect wiring lead (B).
7. Remove ignition coil (A).
8. Install ignition coil.
9. Adjust air gap. (See Section 240, Group 15).
10. Connect wiring lead.
11. Install blower housing, heat shield and air cleaner assembly.
12. Connect spark plug wiring lead.



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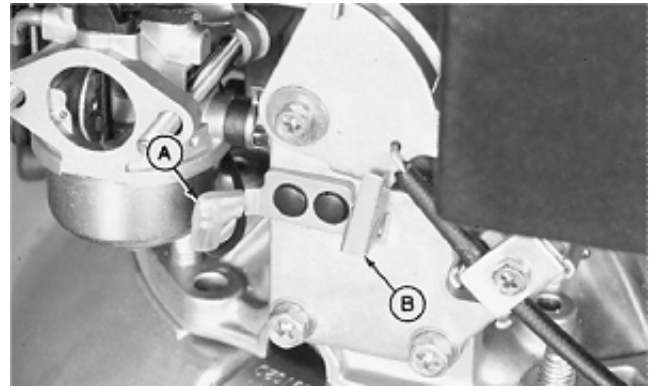
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Ignition Coil—B&S 2-Cycle/Remove and Install Ignition Coil

40
05
2

**REMOVE AND INSTALL SAFETY SWITCH
(12PB, 12PC AND 12SB)**

1. Remove air cleaner assembly. (See Section 30, Group 05.)
2. Disconnect wiring lead (A).
3. Pry off switch (B) using a flat head screwdriver.
4. Install a new switch and connect wiring lead.
5. Install air cleaner assembly.



M54407
-UN-06AUG90

MX,4010BV,1A -19-16JUL96

Section 41

ELECTRICAL SYSTEM—BRIGGS & STRATTON 4-CYCLE (14PZ/14SZ)

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Group 05—Ignition Coil—B&S 4-Cycle

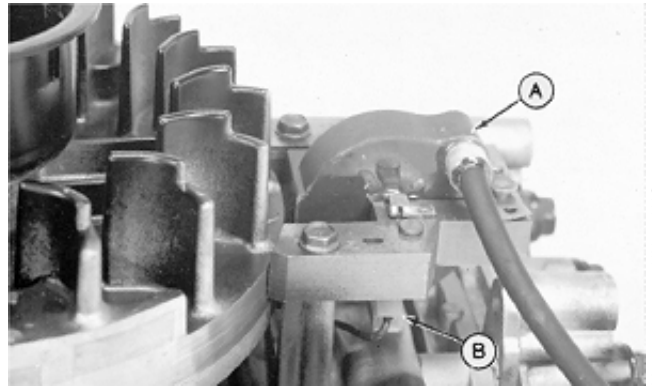
Remove and Install Ignition Coil 41-05-1

Group 10—Safety Switch—B&S 4-Cycle

Remove and Install Safety Switch 41-10-1

**REMOVE AND INSTALL IGNITION COIL
(14PZ AND 14SZ)**

1. Disconnect spark plug wiring lead.
2. Remove fan shroud. (See Section 31, Group 05.)
3. Disconnect wiring lead (B).
4. Remove ignition coil (A).
5. Install ignition coil.
6. Adjust air gap. (See Section 242, Group 15.)
7. Connect wiring lead.
8. Install fan shroud and fuel tank.
9. Connect spark plug wiring lead.



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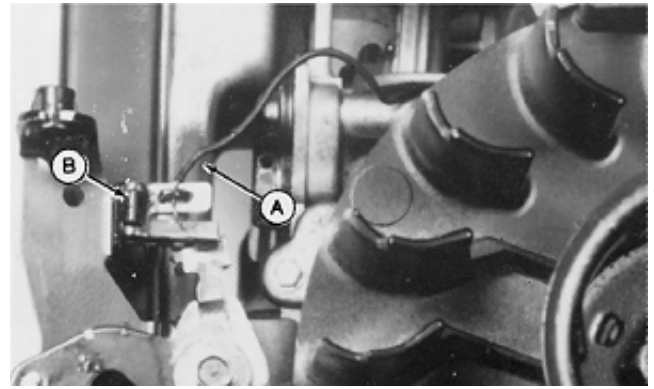
MX,4105BV,1A -19-16JUL96

Ignition Coil—B&S 4-Cycle/Remove and Install Ignition Coil

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2

**REMOVE AND INSTALL SAFETY SWITCH
(14PZ AND 14SZ)**

1. Remove fan shroud. (See Section 31, Group 05.)
2. Disconnect wiring lead (A).
3. Squeeze switch prongs with a needle-nose pliers and remove switch (B) from bracket.
4. Install a new switch and connect wiring lead.
5. Install fan shroud and fuel tank.



M54383
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MX,4110BV,1A -19-16JUL96

ELECTRICAL SYSTEM—KAWASAKI 4-CYC (14PB/14PT/14SB/14SC/14SX/14SE/14ST)

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Remove and Install Battery 42-05-1

Group 10—Key Switch—Kawasaki 4-Cycle

Remove and Install Key Switch 42-10-1

Group 15—Ignition/Charging Repair—Kawasaki 4-Cycle

Remove and Install Stator 42-15-1

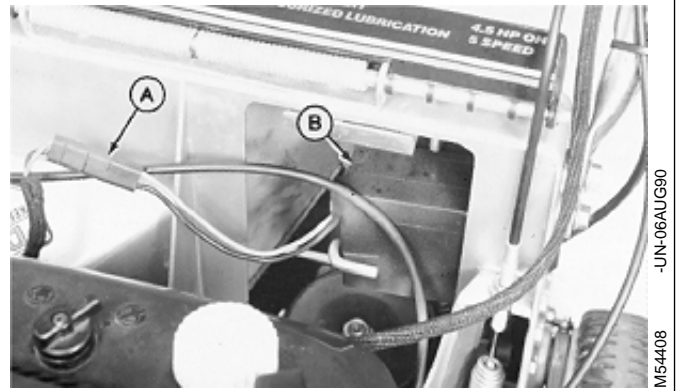
Remove and Install Armature with Coil . . 42-15-1

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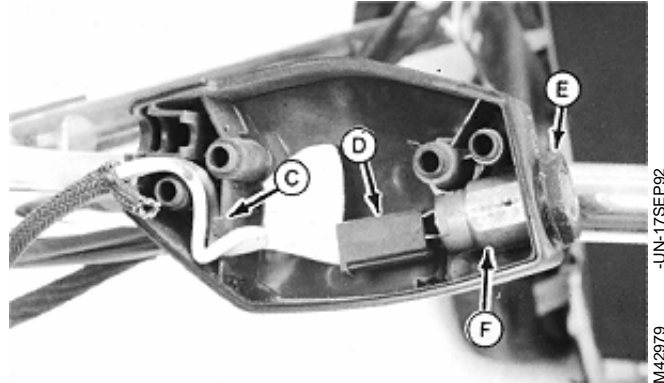
REMOVE AND INSTALL BATTERY (14SE ONLY)

1. Disconnect spark plug wiring lead.
2. Remove mower deck cover.
3. Disconnect wiring connector (A).
4. Remove battery (B).
5. Install battery and connect wiring connector.
6. Install cover.
7. Connect spark plug wiring lead.



MX,4205BV,1A -19-16JUL96

REMOVE AND INSTALL KEY SWITCH (14SE ONLY)



A—Key
B—Cover

C—Harness Lead Slot
D—Connector

E—Ring Nut

F—Key Switch

1. Disconnect battery.
2. Remove key (A), loosen ring nut (E), and remove cover (B) from left side controls assembly.
3. Pull key switch (F) and harness lead from cover.
4. Disconnect harness connector (D) from key switch.
5. Inspect, test, and replace electrical components as necessary.
6. Connect harness lead connector to key switch and install in cover.
7. Install ring nut.
8. Place harness lead in cover slot and install cover.
9. Connect battery and install key.

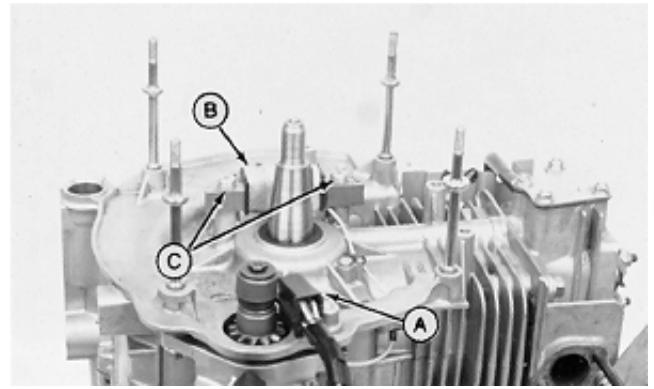
MX,4210BV,1A -19-16JUL96

Key Switch—Kawasaki 4-Cycle/Remove and Install Key Switch

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REMOVE AND INSTALL STATOR

1. Remove flywheel. (See Section 22, Group 10.)
2. Disconnect stator lead from wiring connector (A).
3. Remove screws (C) and stator (B).
4. Install stator.
5. Connect stator lead.
6. Install flywheel.

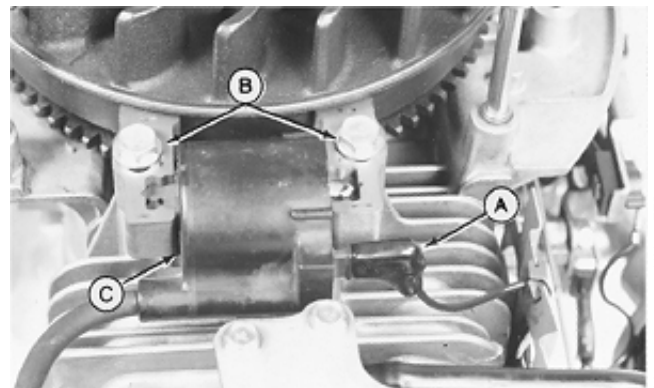


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MX,4215BV,2 -19-16JUL96

REMOVE AND INSTALL ARMATURE WITH COIL

1. Remove engine cover. (See Section 32, Group 10.)
2. Disconnect wiring lead (A).
3. Remove cap screws (B) and armature with coil (C).
4. Loosely install armature with coil.
5. Connect wiring lead.
6. Adjust armature air gap. (See Adjust Armature Air Gap in this group.)
7. Install engine cover.



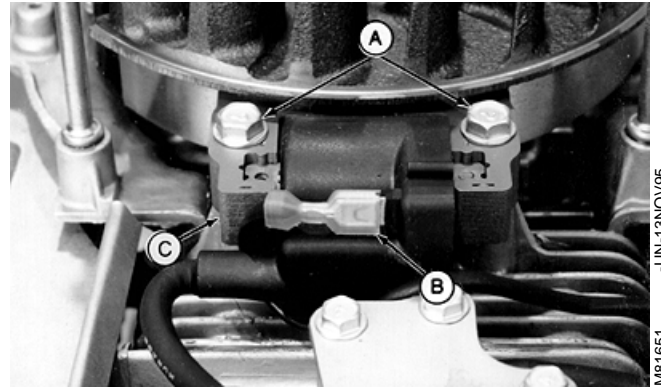
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MX,4215BV,3 -19-16JUL96

REMOVE AND INSTALL INTEGRATED IGNITION COIL (14SB, 14SE AND 14SX)

NOTE: 14SB, 14SE and 14SX units (Engine S.N. FC150VF67581—) with have the ignition module integrated with the ignition coil.

1. Remove fuel tank/engine cover. (See Section 32, Group 10.)
2. Disconnect wiring lead (B).
3. Remove cap screws (A) and ignition coil/ignitier (C).
4. Loosely install ignition coil/ignitier.
5. Connect wiring lead.
6. Adjust armature air gap. (See Section 245, Group 15.)
7. Install fuel tank/engine cover.

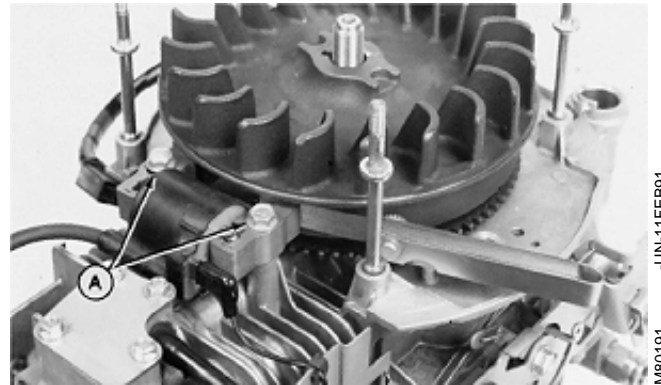


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MX,4215BV,1A -19-16JUL96

ADJUST ARMATURE AIR GAP

1. Turn flywheel magnet away from armature.
2. Insert a **0.30 mm (0.012 in.)** feeler gauge, between flywheel and armature.
3. Push armature against flywheel and tighten screws (A).
4. Turn flywheel to remove feeler gauge.



M80191 -UN-11FEB91

MX,4215BV,4 -19-16JUL96

Section 50

POWER TRAIN—BBC MOWERS (12PB/12SB/14PB/14SB/14SE)

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Group 15—Blade Brake Clutch (BBC) Control Cable, Lever and Bail

Remove and Install BBC Control Cable	50-15-1
Remove and Install BBC Control Lever and Bail Assembly	50-15-4

OTHER MATERIAL

Number	Name	Use
T43512	John Deere Thread Lock and Sealer (Medium Strength)	Apply to threads of cap screws, set screws, etc. where specified.
M79292	Du Bois' MPG-2 [®] Multi-Purpose Polymer Grease, NLGI Grade 1	Apply to any mating surfaces that might seize to each other over long periods of time.

MPG-2[®] is a registered trademark of Du Bois' a division of Chemed Corp.

MX,5005BV,1 -19-16JUL96

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INSPECT OGURA BBC BRAKE PAD (12PB, 12SB, 14PB, 14SB AND 14SE)

CAUTION: Disconnect spark plug lead on all models before working on mowers, especially if you will be working under the mower deck. Also, on electric start models, disconnect battery and remove key.

NOTE: Actual blade brake clutch assembly is NOT SERVICEABLE. DO NOT attempt to disassemble blade brake clutch assembly.

Replace clutch assembly when brake pad thickness (A) is less than **0.76 mm (0.030 in.)**.



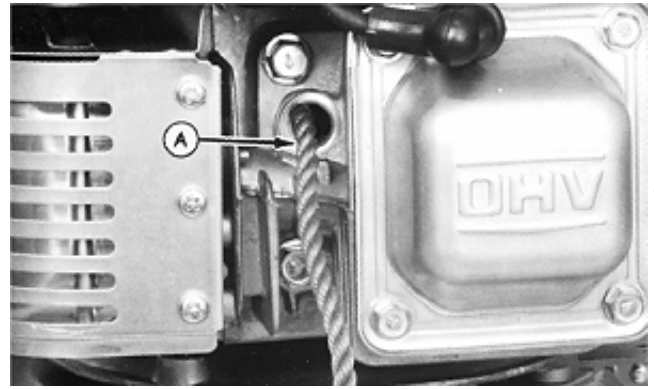
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MX,5005BV,2 -19-16JUL96

REMOVE AND INSTALL OGURA BBC (12PB, 12SB, 14PB, 14SB AND 14SE)

NOTE: You must first remove the engine and BBC assembly as a unit from the mower deck in order to remove the BBC assembly from the engine.

1. Remove engine.
2. Remove spark plug and feed a small diameter nylon rope (A) inside cylinder to stop crankshaft rotation.



Kawasaki Engine Shown

MX,5005BV,3 -19-16JUL96

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3. Remove socket head cap screw, lock washer, and flat washer (B).

NOTE: On self-propelled mowers, two of the special studs fasten the belt guide bracket in place and the other two special studs fasten a leveling strap in place. Keep their orientation in mind for assembly.

Also keep in mind for assembly the orientation of the control arm of BBC with the left side of the engine.

4. Remove four special studs and springs (C) from engine mounting holes.

5. Remove BBC assembly. If it is stuck onto the crankshaft, use a 5/8-11 standard cap screw (D) and the flat washer to pull the BBC from the crankshaft.

6. Inspect BBC assembly for damage or wear. Replace if necessary.

IMPORTANT: Be certain spacer is properly seated in bottom of BBC bore before installation.

7. Apply Du Bois' MPG-2® Multi-Purpose Polymer Grease, NLGI Grade 1 (M79292) to crankshaft and BBC bore (F).

NOTE: Orientate control arm of BBC to left side of engine.

8. Install spacer (E) in bottom of BBC bore (F) and install BBC on crankshaft.

NOTE: On self-propelled mowers, install belt guide bracket and leveling strap before you install special studs.

9. Apply T43512 John Deere Thread Lock and Sealer (Medium Strength) to threads of special studs. Install special studs and springs. Tighten securely.

10. Apply T43512 John Deere Thread Lock and Sealer (Medium Strength) to threads of socket head cap screw. Install flat washer, lock washer, and socket head cap screw. Tighten to specification.

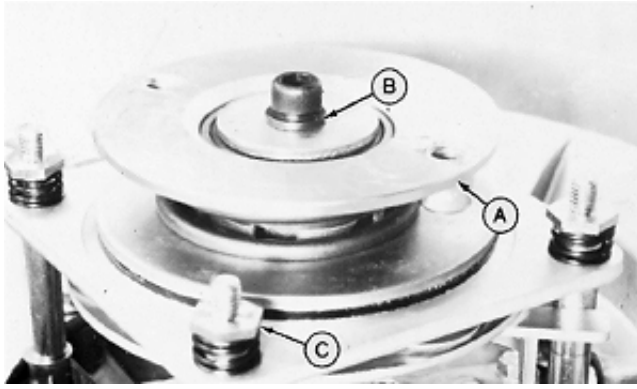
11. Remove nylon rope from cylinder and gap spark plug before installing it. Tighten to specifications.

INSPECTION SPECIFICATIONS

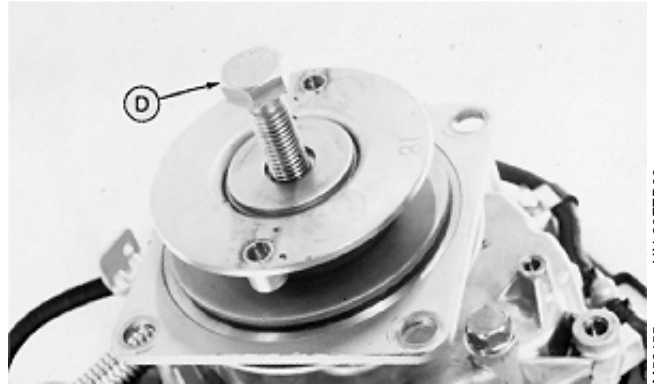
Spark Plug Gap:	
B&S 2-Cycle Engine	0.762 mm (0.030 in.)
B&S 4-Cycle Engine	0.762 mm (0.030 in.)
Kawasaki 4-Cycle Engine	0.762 mm (0.030 in.)

TORQUE SPECIFICATIONS

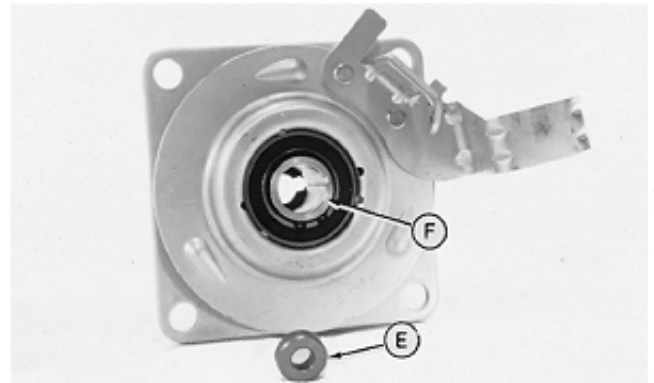
Socket Head Cap Screw	74.5 N·m (55 lb-ft.)
Spark Plug:	
B&S 2-Cycle Engine	18 N·m (160 lb-in.)
B&S 4-Cycle Engine	18 N·m (160 lb-in.)
Kawasaki 4-Cycle Engine	20 N·m (177 lb-in.)



M52454 -UN-06DEC88



M52455 -UN-23FEB89



M52456 -UN-06DEC88

- A—Blade Mounting Plate
- B—Socket Head Cap Screw, Lock Washer, and Flat Washer
- C—Special Studs and Springs
- D—5/8 Cap Screw
- E—Spacer
- F—BBC Bore

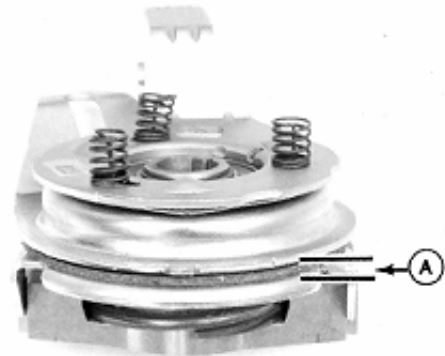
MX,5005BV,4A -19-01OCT92

INSPECT WARNER 1-PIECE BBC BRAKE PAD (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)

⚠ CAUTION: Disconnect spark plug lead on all models before working on mowers, especially if you will be working under the mower deck. Also, on electric start models, disconnect battery and remove key.

NOTE: Actual blade brake clutch assembly is NOT SERVICEABLE. DO NOT attempt to disassemble blade brake clutch assembly.

Replace clutch assembly when brake pad thickness (A) is less than **0.76 mm (0.030 in.)**.



M42788 -UN-31AUG92

MX,5005BV,5 -19-16JUL96

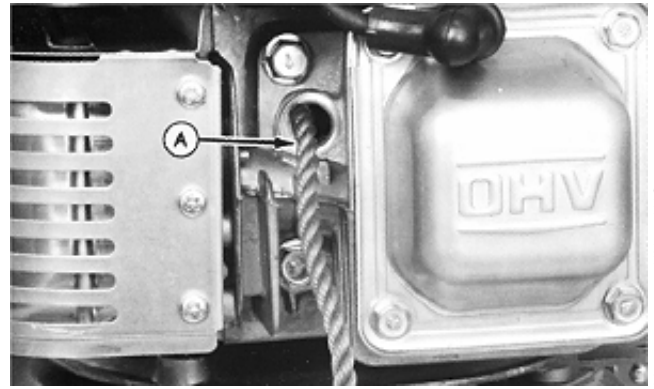
Blade Brake Clutch (BBC)/Inspect Warner 1-Piece BBC Brake Pad

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REMOVE AND INSTALL WARNER 1-PIECE BBC (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)

NOTE: You must first remove the engine and BBC assembly as a unit from the mower deck in order to remove the BBC assembly from the engine.

1. Remove engine.
2. Remove spark plug and feed a small diameter nylon rope (A) inside cylinder to stop crankshaft rotation.



Kawasaki Engine Shown

MX,5005BV,6 -19-16JUL96

REMOVE AND INSTALL WARNER 1-PIECE BBC (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)—(CONTINUED)

NOTE: On self-propelled mowers, anchor bolt (C) fastens one end of belt guide to engine. The other end of the belt guide is fastened by a separate cap screw. Keep in mind for assembly the orientation of the anchor bolt mounting hole and the control arm (H) to the left side of the engine.

3. Remove anchor bolt (C).

NOTE: Special cap screw (A) is fastened internally to blade mounting plate (B) and can't be removed. This has been designed into the Warner BBC assembly so it can pull itself off the crankshaft as the special cap screw is being turned.

4. Turn special cap screw (A) counterclockwise to remove BBC assembly. If it is stuck onto the crankshaft, use an Allen head impact socket and an air impact gun to vibrate it loose.

5. Inspect BBC assembly for damage or wear.

6. Apply Du Bois' MPG-2® Multi-Purpose Polymer Grease, NLGI Grade 1 (M79292) to the crankshaft, crankshaft keyway (F), machined key (D), and BBC bore (E). DO NOT apply any to the threads (G) of the special cap screw.

7. Apply T43512 John Deere Thread Lock and Sealer (Medium Strength) to threads of special cap screw. Install BBC onto crankshaft so control arm (H) and anchor bolt slot will be on the left side of the engine.

NOTE: On self-propelled mowers, anchor bolt (C) also fastens left side of belt guide to engine.

8. Install anchor bolt (C) through slot and into engine mounting hole. Turn special cap screw (A) clockwise to pull BBC assembly onto crankshaft. Tighten to specification.

9. Remove nylon rope from cylinder and gap spark plug before installing it. Tighten to specifications.

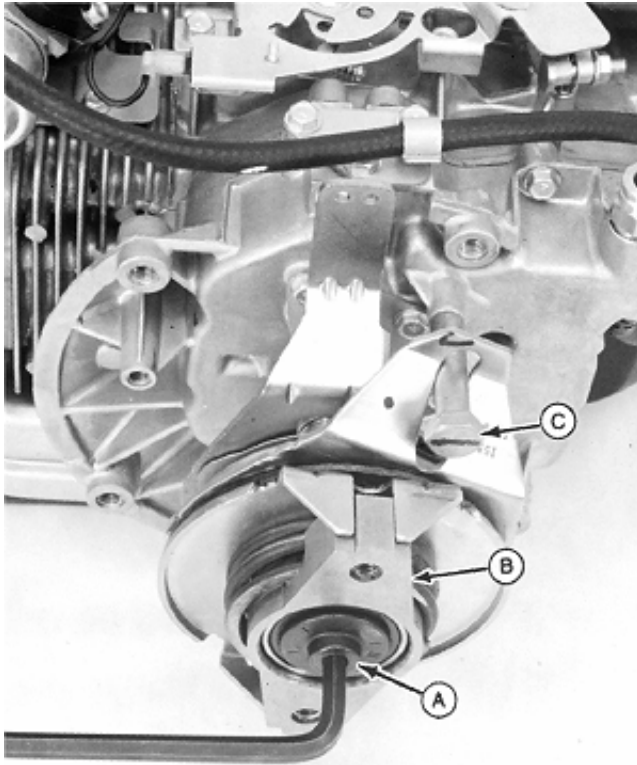
INSPECTION SPECIFICATIONS

Spark Plug Gap:	
B&S 2-Cycle Engine	0.762 mm (0.030 in.)
B&S 4-Cycle Engine	0.762 mm (0.030 in.)
Kawasaki 4-Cycle Engine	0.762 mm (0.030 in.)

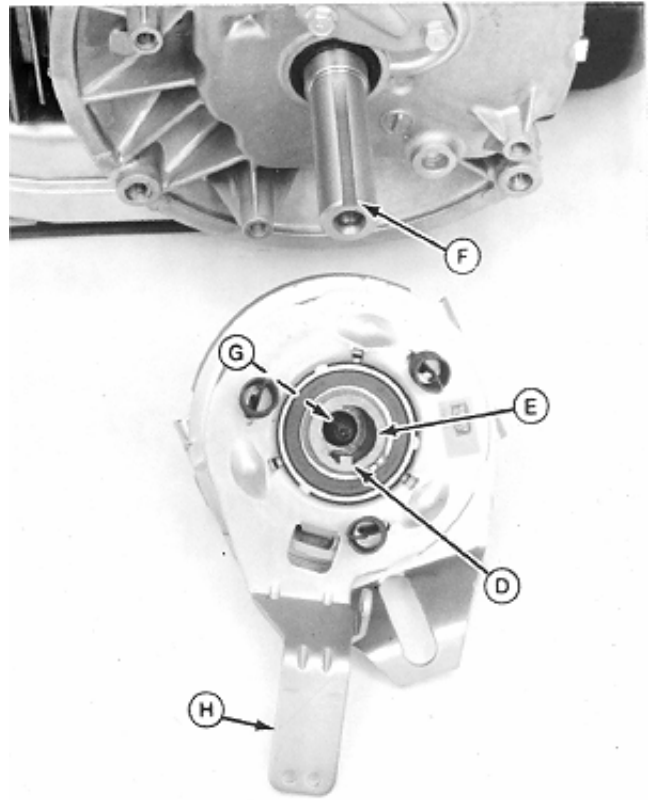
TORQUE SPECIFICATIONS

Socket Head Cap Screw	74.5 N·m (55 lb-ft.)
Spark Plug:	
B&S 2-Cycle Engine	18 N·m (160 lb-in.)
B&S 4-Cycle Engine	18 N·m (160 lb-in.)
Kawasaki 4-Cycle Engine	20 N·m (177 lb-in.)

Blade Brake Clutch (BBC)/Remove and Install Warner 1-Piece BBC



M42787 -JUN-31AUG92



M42789 -JUN-31AUG92

- | | |
|------------------------|--------------------------------|
| A—Special Cap Screw | E—BBC Bore |
| B—Blade Mounting Plate | F—Crankshaft Keyway |
| C—Anchor Bolt | G—Threads of Special Cap Screw |
| D—Machined Key | H—Control Arm |

MX,5005BV,7A -19-01OCT92

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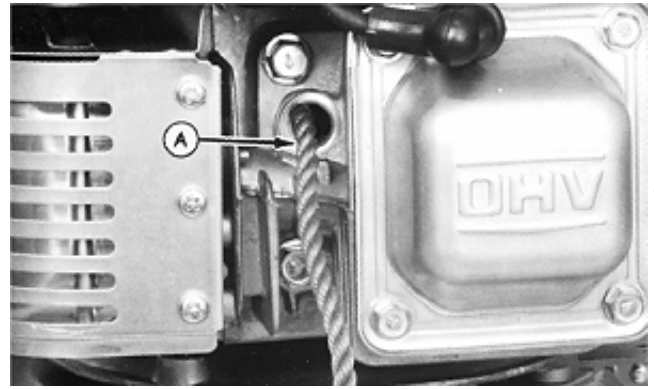
Blade Brake Clutch (BBC)/Remove and Install Warner 1-Piece BBC

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REMOVE AND INSTALL WARNER 2-PIECE BBC (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)

NOTE: You must first remove the engine and BBC assembly as a unit from the mower deck in order to remove the BBC assembly from the engine.

1. Remove engine.
2. Remove spark plug and feed a small diameter nylon rope (A) inside cylinder to stop crankshaft rotation.

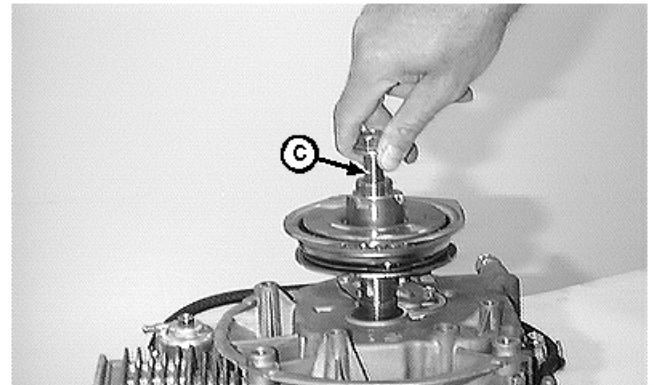
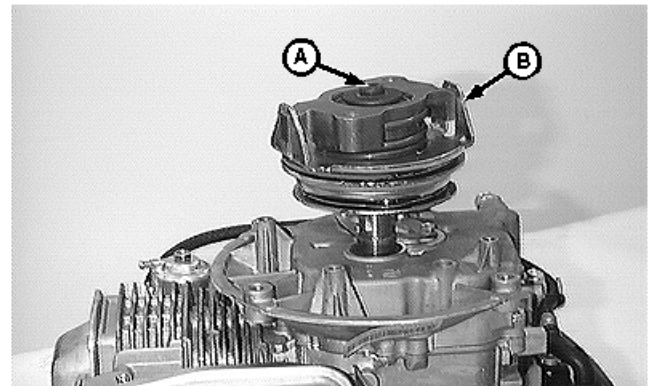


Kawasaki Engine Shown

MX,5005BV,8 -19-16JUL96

3. Remove BBC bolt (A) and remove lower half of BBC clutch (B).
4. Hand thread Puller Bolt (19M8435) (C) into upper half of BBC puller threads.

A—Bolt
B—BBC Clutch (lower half)
C—Puller Bolt (19M8435)



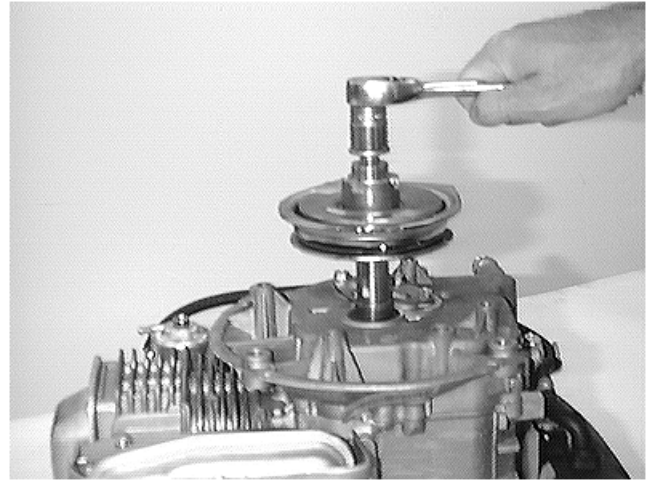
MX,5005BV,9 -19-16JUL96

5. Using a 19 mm socket and ratchet on puller bolt, back off upper half of BBC clutch.

NOTE: A new BBC bolt MUST be used when installing replacement BBC clutch.

6. Apply Du Bois' MPG-2® Multi-purpose Polymer Grease, NLGI Grade 1 (M79292) to the crankshaft and BBC bore.

7. Install BBC clutch in the reverse order of removal. Tighten BBC bolt to **75 N·m (55 lb-ft)**. Tighten blade bolts to **47 N·m (35 lb-ft)**.



M81666 -UN-11JUL96

MX,5005BV,10 -19-16JUL96

IDENTIFY WARNER BBC STYLES

Due to several BBC design changes, it is sometimes difficult to determine which is the correct BBC to use for replacement.

The BBC design was changed from a 1-piece to a 2-piece design.

1-Piece BBC's can be identified by:

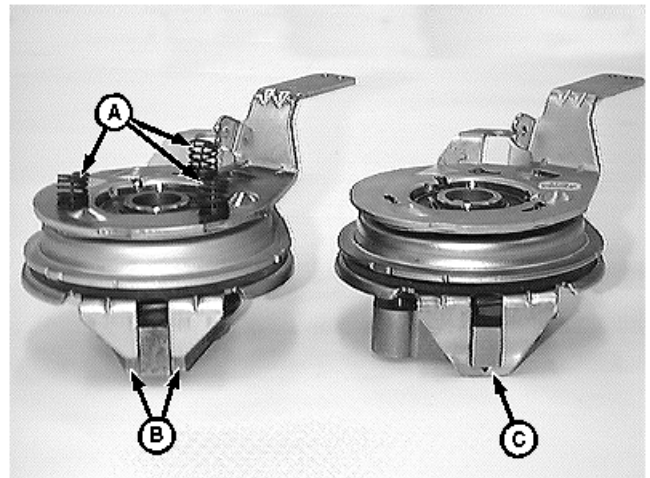
- 3 external springs (A) on top.
- "OPEN" bracket (B) holding blade mounting hub.

2-Piece BBC's can be identified by:

- No external springs.
- "FULL" bracket (C) holding blade mounting bracket.

All service BBC's prior to 1995 automatically sub to new 2-piece BBC, either Intergral or Woodruff key design (see following).

The 2-piece BBC is repairable. Upper and lower halves may be replaced separately. The bearing in the lower half is also replaceable.

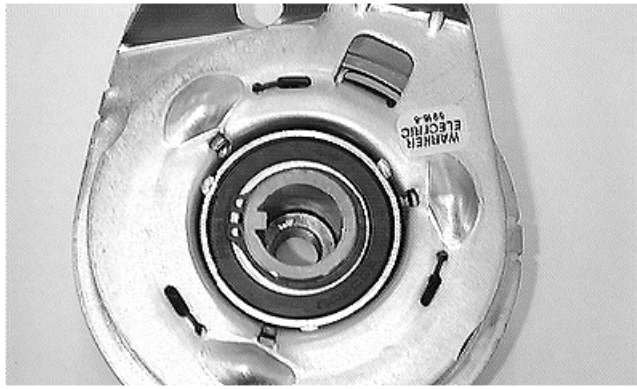


M81667 -UN-08JUL96

A—External Springs
B—"OPEN" Bracket
C—"FULL" Bracket

MX,5005BV,11 -19-16JUL96

Blade Brake Clutch (BBC)/Identify Warner BBC Styles



M81668 -UN-08JUL96

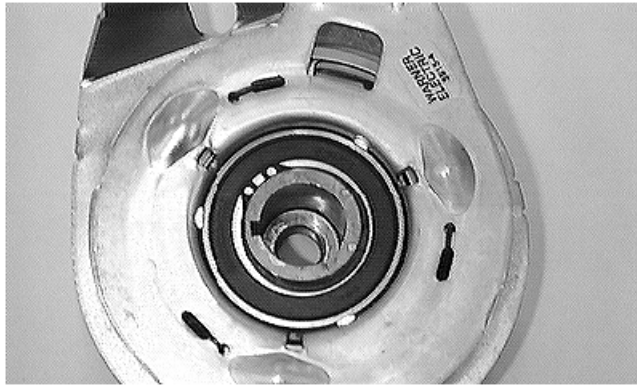
Integral Key Design



Integral Key Design



M81670 -UN-08JUL96



M81669 -UN-08JUL96

Woodruff Key Design



Woodruff Key Design



M81671 -UN-08JUL96

There are also two BBC mounting styles, depending on the engine crankshaft configuration—Integral and Woodruff key design.

MX,5005BV,12 -19-16JUL96

50-05-13

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**REMOVE AND INSTALL DRIVE
BELT—OGURA BBC (12SB, 14SB AND
14SE)**

1. Remove engine.
2. Remove Ogura BBC assembly.
3. Install new belt.
4. Install Ogura BBC assembly.
5. Install engine.

MX,5010BV,1 -19-16JUL96

**REMOVE AND INSTALL DRIVE
BELT—WARNER BBC (12SB, 14SB, 14SE
AND 14SX)**

1. Remove engine.
2. Remove only the anchor bolt from the Warner BBC assembly to remove belt.
3. Install new belt.
4. Install anchor bolt in Warner BBC assembly.
5. Install engine.

MX,5010BV,2 -19-16JUL96

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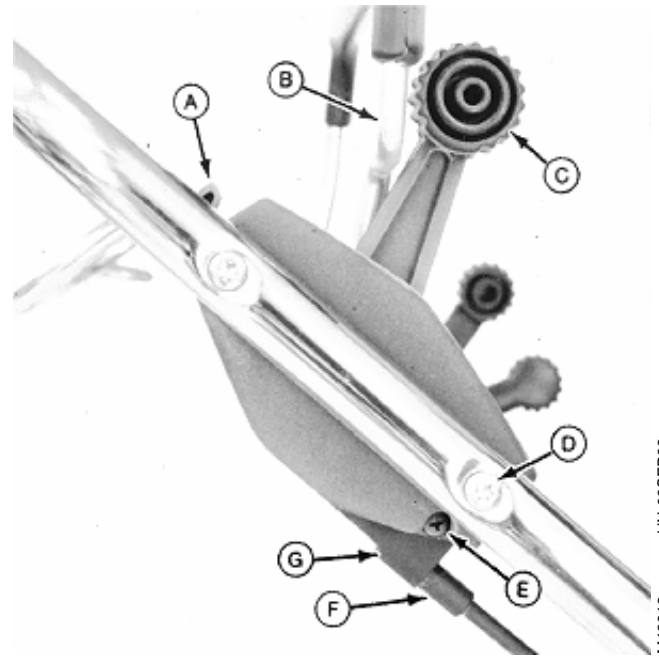
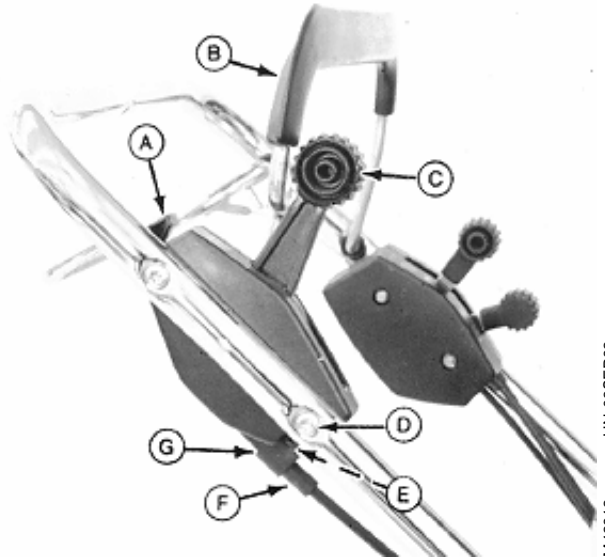
Group 15 Blade Brake Clutch (BBC) Control Cable, Lever and Bail

REMOVE AND INSTALL BBC CONTROL CABLE (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)

IMPORTANT: DO NOT take control lever assembly apart! It is serviced as an assembly only.

1. Remove assembly small screw (E) ONLY.
2. LOOSEN ONLY (DO NOT REMOVE) cap screws and nuts (D) one full turn.
3. Pry apart cable clamp (G) JUST ENOUGH to allow control cable sheath (F) to fit through the clamp.

A—Lock Lever
B—Safety Bail
C—Control Lever
D—Cap Screws and Nuts
E—Small Screw
F—Control Cable Sheath
G—Cable Clamp



MX,5015BV,1 -19-16JUL96

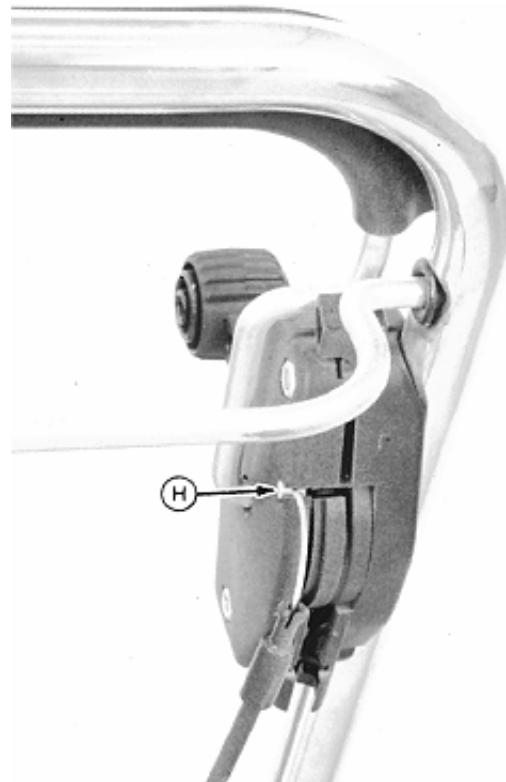
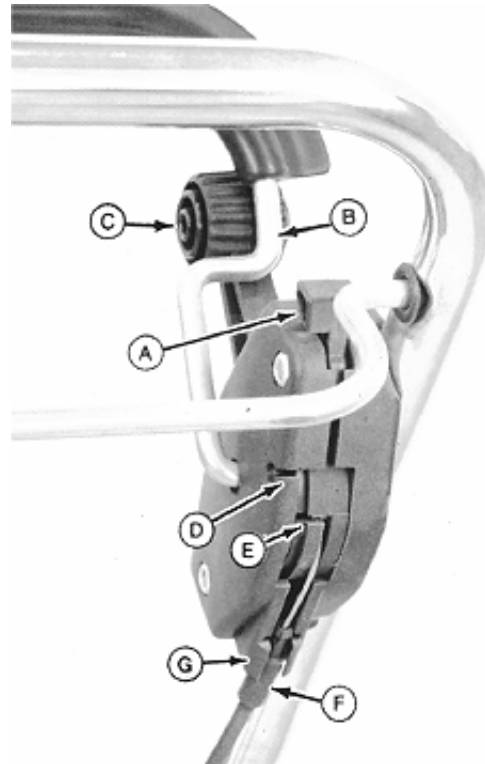
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M42912 -UN-03SEP92

M42913 -UN-03SEP92

4. Remove cable sheath (F) from cable clamp (G).
5. Move safety bail (B) down to disengage lock lever (A).
6. Move control lever (C) forward until slots (D and E) align.
7. Remove cable anchor (H) from aligned slots.

A—Lock Lever
B—Safety Bail
C—Control Lever
D—Cap Screws and Nuts
E—Small Screw
F—Control Cable Sheath
G—Cable Clamp
H—Cable Anchor



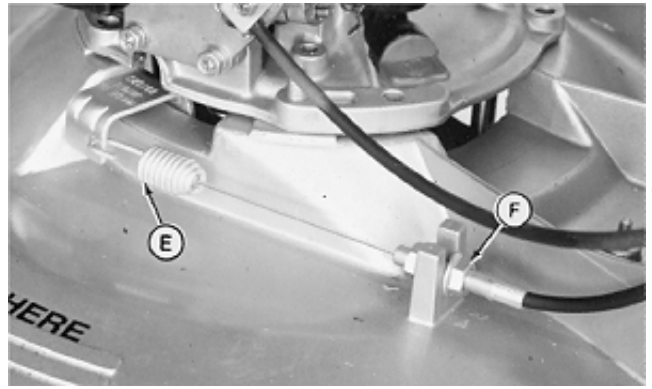
M42914 -UN-03SEP92

M42915 -UN-03SEP92

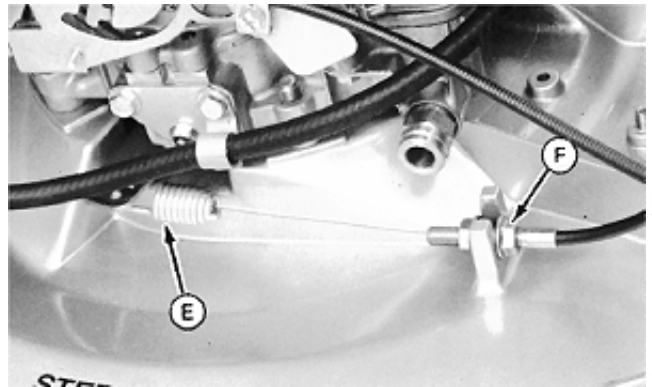
MX,5015BV,2 -19-01OCT92

Blade Brake Clutch (BBC) Control Cable, Lever and Bail/Remove and Install BBC Control Cable

8. Remove mower deck cover.
9. Loosen nut (F) and disconnect spring (E).
10. Remove tie straps and cable.
11. Install new cable and connect spring to BBC lever.
12. Align slots in control lever assembly and install cable anchor.
13. Clamp cable sheath and fasten with small cap screw.
14. Tighten assembly mounting cap screws and nuts.
15. Adjust BBC control cable.
16. Install tie straps as needed.
17. Install mower deck cover.



Early Ogura BBC Shown



Late Warner BBC Shown

MX,5015BV,3 -19-01OCT92

50-15-3
-UN-06AUG90
M54414

-UN-03SEP92
M42916

REMOVE AND INSTALL BBC CONTROL LEVER AND BAIL ASSEMBLY (12PB, 12SB, 14PB, 14SB, 14SE AND 14SX)

IMPORTANT: DO NOT take control lever assembly apart! Internal components of control lever assembly are **NOT SERVICEABLE**. Replace complete assembly if repair is needed.

1. Remove control cable (D) from lever assembly. (See Remove BBC Control Cable in this group.)

2. Hold control lever assembly firmly with one hand so two of your fingers hold the lock nuts (C) inside the assembly cover. With the other hand, remove two mounting cap screws (A).

3. Pull control lever assembly from handle bar and slide assembly off end of safety bail (B) and discard.

IMPORTANT: DO NOT allow new control lever assembly case halves to fall apart or a new assembly will be needed.

4. While holding assembly firmly in one hand, slide new control lever assembly onto end of safety bail, keep control lever ahead of safety bail.

5. Align control lever assembly mounting holes with handle bar holes.

6. Install mounting cap screws from the outside and hold lock nuts in place while you tighten cap screws—**DO NOT** tighten completely at this time, leave them loose enough to install control cable.

7. Install cable.

8. Install and tighten screws.

9. Cycle safety bail and control lever several times to ensure proper installation and function has been accomplished.

10. Adjust BBC control cable.



A—Mounting Cap Screws
B—Safety Bail
C—Lock Nuts
D—Control Cable

M42917 -JUN-03SEP92

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Section 51

POWER TRAIN—ZONE START (12PC/14PT/14PZ/14SC/14SX/14ST/14SZ)

Contents

Page

Group 05—Flywheel Brake Assembly

Remove and Install Flywheel Brake Assembly	51-05-2
Remove and Install Flywheel Brake Assembly—B&S 4-Cycle	51-05-4
Remove and Install Flywheel Brake Assembly—Kawasaki 4-Cycle	51-05-6

Group 10—Drive Belt

Remove and Install Drive Belt	51-10-1
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Group 15—Flywheel Brake Control Cable and Bail

Remove and Install Flywheel Brake Control Cable and Bail	51-15-1
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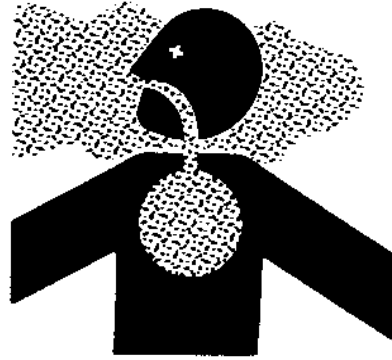
51

REMOVE AND INSTALL FLYWHEEL BRAKE ASSEMBLY—B&S 2-CYCLE ENGINE (12PC ONLY)

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

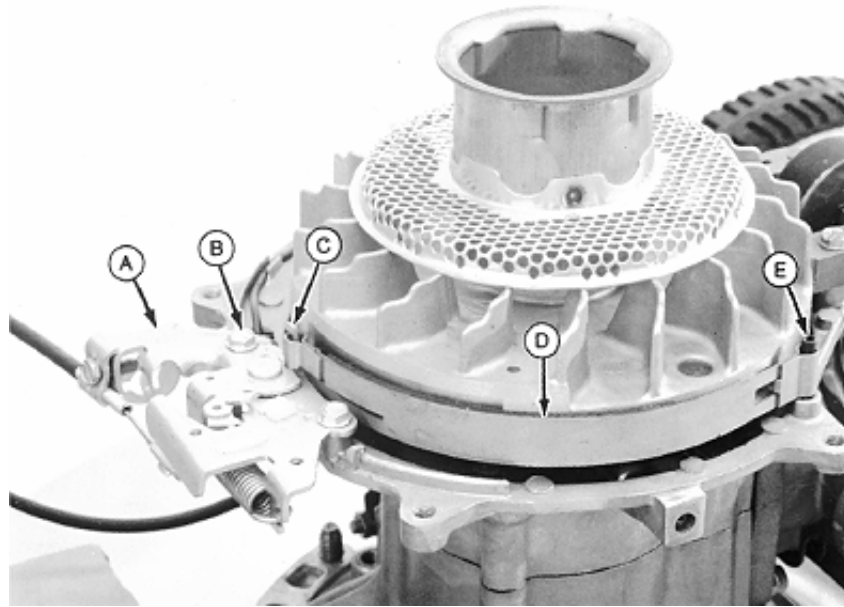
Keep bystanders away from the area.



TS220
-UN-23AUG88

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MX,5105BV,1A -19-16JUL96



A—Flywheel Brake Assembly
B—Mounting Cap Screws

C—Lever Post

D—Flywheel Brake Band

E—Rolled Pin

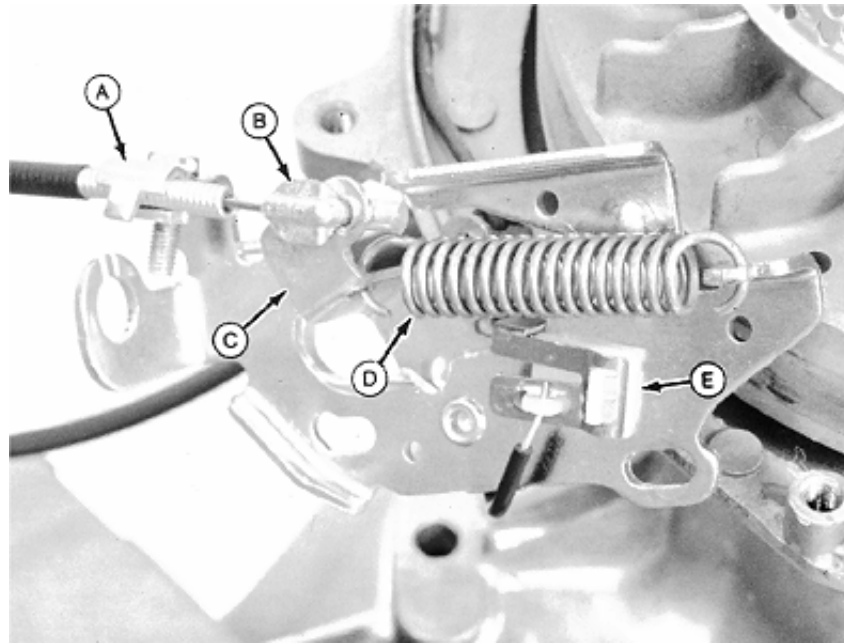
NOTE: Flywheel brake pad is not serviced separately. Complete brake assembly must be replaced if brake pad is worn.

1. Remove recoil start assembly and fuel tank/engine cover assembly. (See Section 30, Group 15.)

2. Engage zone start bail to relax flywheel brake band (D) and remove band from rolled pin (E) and lever post (C).

3. Remove mounting cap screws (B) to remove flywheel brake assembly (A).

MX,5105BV,1 -19-16JUL96



A—Cable Clamp
B—Cable Anchor

C—Lever

D—Return Spring

E—Safety Switch/Wiring Lead

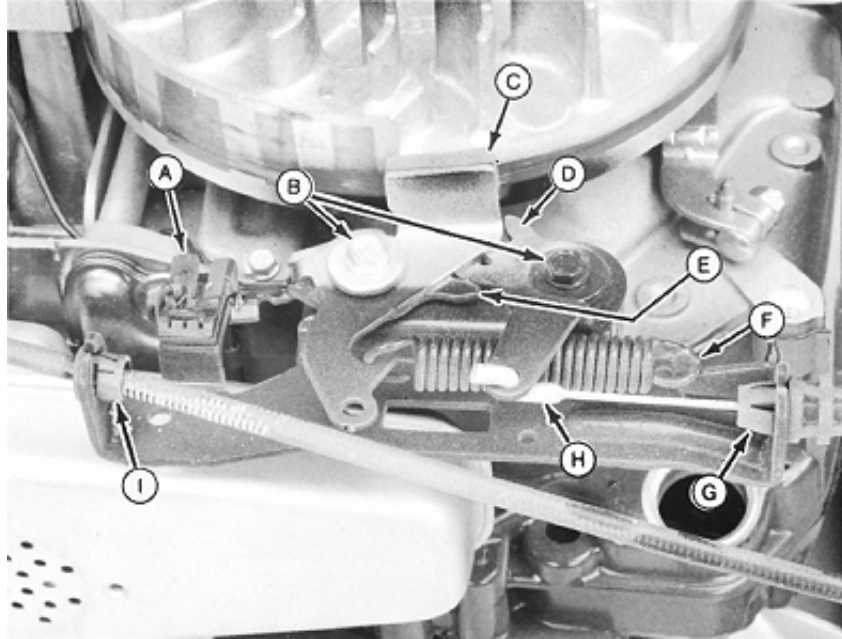
4. Loosen cable clamp (A) to remove cable anchor (B) from lever (C).
5. Remove return spring (D).
6. Remove safety switch/wiring lead (E).
7. Inspect and replace components, as necessary.
8. Install safety switch/wiring lead.
9. Install return spring.
10. Install cable anchor in lever.

11. Install cable inside clamp.
12. Install flywheel brake band onto lever post.
13. Install flywheel brake band onto roll pin as you attach assembly to engine.
14. Tighten cap screws.
15. Adjust flywheel brake band.
16. Install fuel tank/engine cover and recoil start assembly.

MX,5105BV,2 -19-01OCT92

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REMOVE AND INSTALL FLYWHEEL BRAKE ASSEMBLY—B&S 4-CYCLE ENGINE (14PZ AND 14SZ)



A—Safety Switch
B—Mounting Cap Screws
and Washers

C—Brake Pad
D—Brake Lever Teeth
E—Actuating Lever Teeth

F—Brake Spring
G—Brake Cable Clip

H—Brake Cable Anchor
I—Throttle Cable Clip

⚠ CAUTION: Avoid breathing dust that may contain asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Avoid creating dust. Never use compressed air for cleaning. When servicing, wear an approved respirator. If necessary, apply a mist of oil or water on the asbestos material prior to handling.

NOTE: BE SURE to remember the correct orientation of the actuating lever teeth (D) and the engaging teeth (E) of the brake lever. They must be orientated correctly or linkage will not work.

The flywheel brake pad (C) is not serviced separately. The complete brake assembly must be replaced if brake pad is worn.

1. Remove fuel tank/engine cover assembly and blower housing/recoil start assembly. (See Section 31, Group 15.)

2. Disconnect safety switch (A) from bracket.
3. Disconnect throttle cable clip (I) and disconnect throttle cable from carburetor.
4. Disconnect brake control cable anchor (H) and clip (G).
5. Disconnect return spring (F).
6. Remove two mounting cap screws and washers (B) to remove flywheel brake assembly.
7. Inspect components and replace as necessary.
8. Install flywheel brake assembly.
9. Connect cables, return spring, and safety switch.
10. Install fuel tank/engine cover and recoil start assembly.
11. Adjust throttle cable.

REMOVE AND INSTALL FLYWHEEL BRAKE ASSEMBLY—KAWASAKI 4-CYCLE ENGINE (14PT, 14SC AND 14ST)



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

1. Remove recoil start assembly and fuel tank/engine cover assembly. (See Section 32, Group 10.)

2. Remove cotter pin and washer from lever post (B).

3. Remove right-rear fuel tank/engine cover stud (D) (using the double jam-nut method) to remove flywheel brake band.

4. Loosen cable clamp (F) to remove cable from bracket.

5. Remove cable anchor (I) from lever.

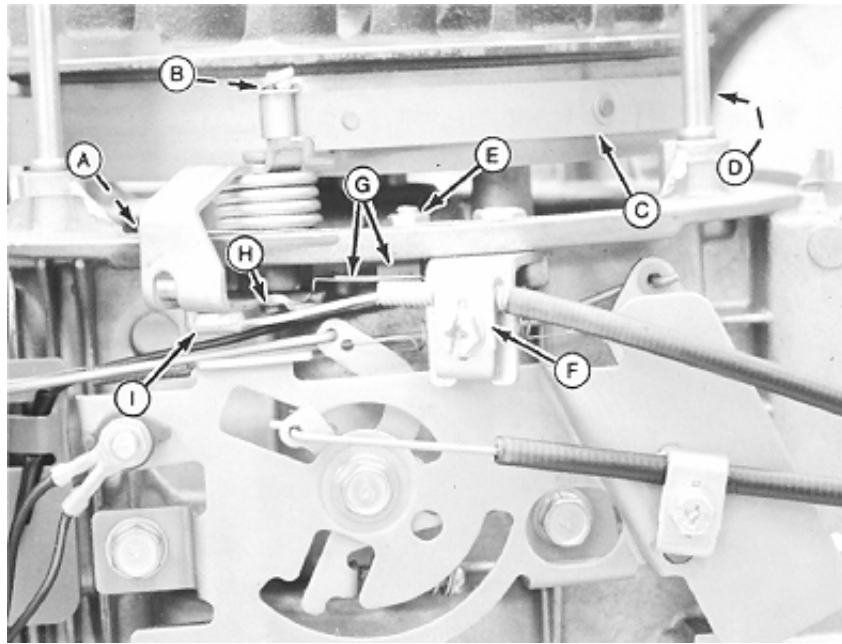
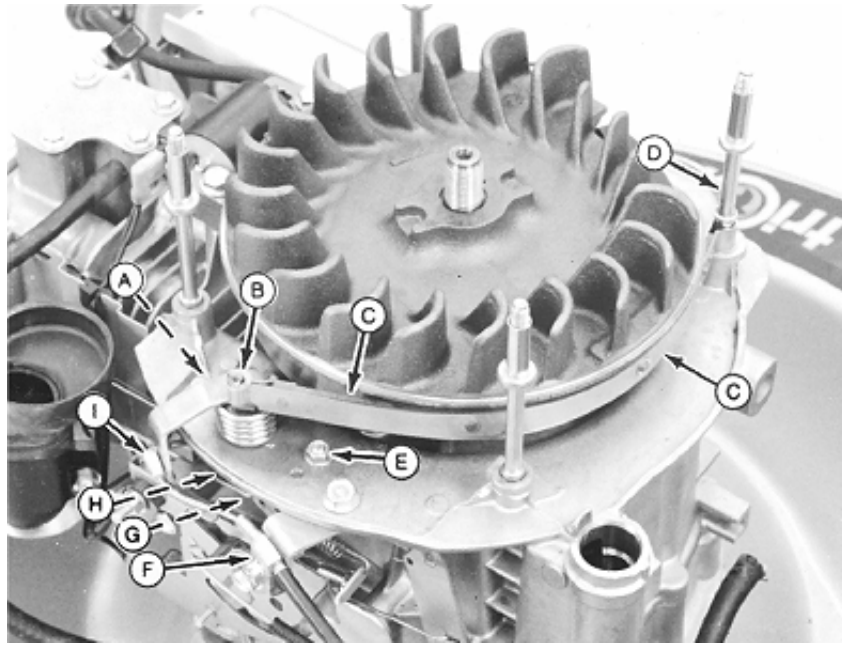
NOTE: Safety switch (G) does not have to be removed unless it is damaged.

6. Remove safety switch (G) by removing cap screw and nut (E).

7. Lift brake spring anchor (A) over outside anchor pin to relieve spring tension.

8. Remove assembly snap ring (H).

MX,5105BV,4 -19-16JUL96



A—Brake Spring Anchor
 B—Lever Post
 C—Brake Band

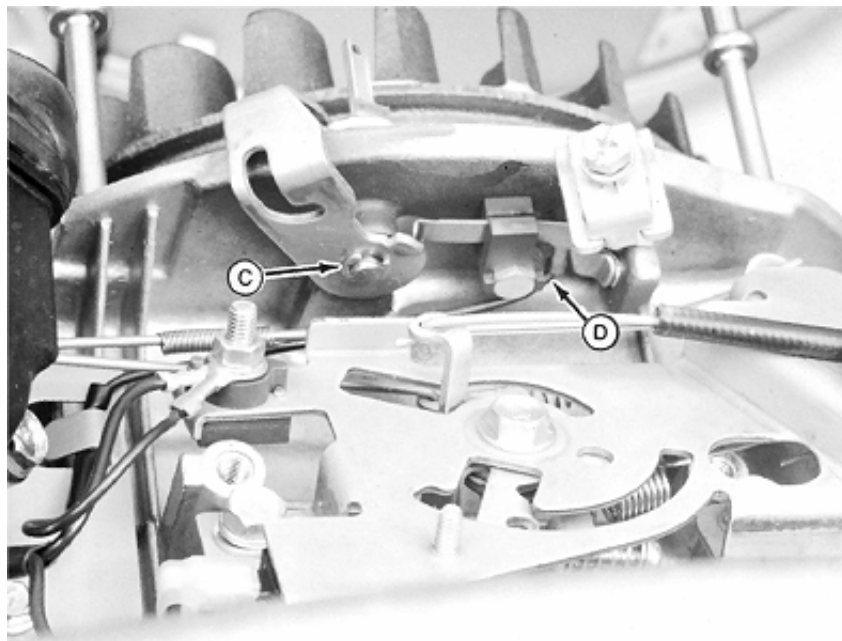
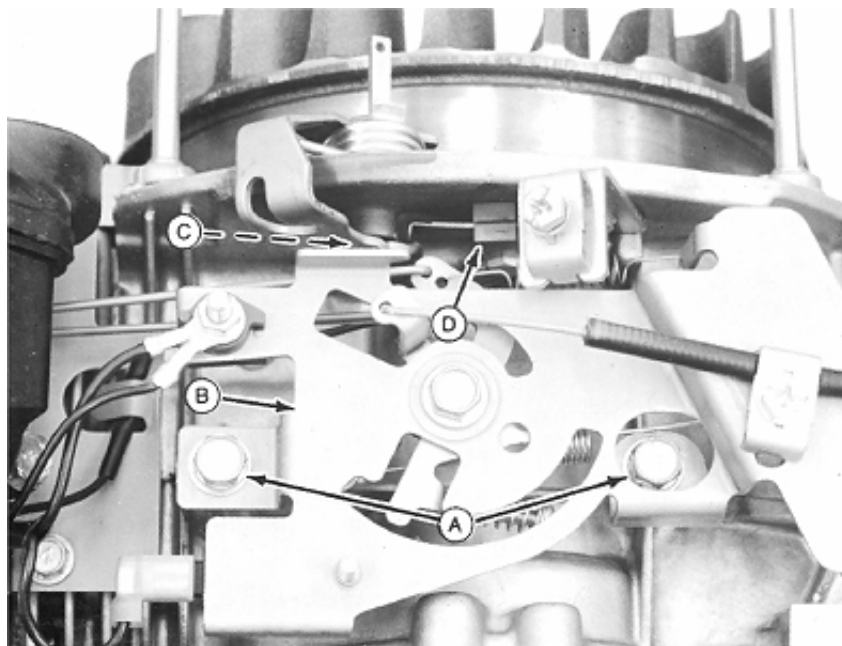
D—Right-Rear Fuel
 Tank/Engine Cover Stud
 E—Cap Screw and Nut

F—Cable Clamp
 G—Safety Switch

H—Assembly Snap Ring
 I—Cable Anchor

MX,5105BV,4A -19-01OCT92

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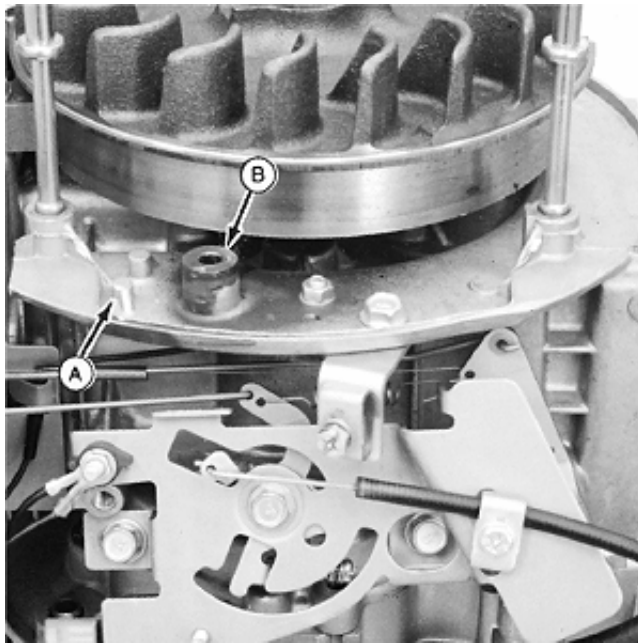
A—Cap Screws and Washers B—Throttle Control Bracket C—Assembly Snap Ring D—Safety Switch

9. Remove two cap screws and washers (A) to move throttle control bracket (B) down to gain access to assembly snap ring (C) and safety switch (D).

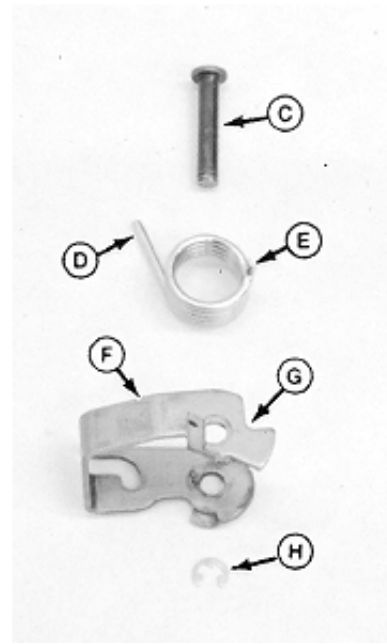
10. Remove snap ring (C) to remove lever assembly.

11. If necessary, remove safety switch (D).

12. Inspect components and replace as necessary.



M42925 -UN-10SEP92



M42926 -UN-10SEP92

A—Outside Anchor Pin
B—Mounting Boss

C—Assembly Pin
D—Long Spring Anchor

E—Short Spring Anchor
F—Lever

G—Short Anchor Notch
H—Snap Ring

13. Install brake spring over mounting boss (B) so long spring anchor (D) points towards anchor pins.

14. Align short anchor notch (G) of lever (F) with short spring anchor (E) as you install lever over mounting boss and brake spring.

15. Install assembly pin (C) from the top and fasten with snap ring (H).

16. Lift long spring anchor (D) over outside anchor pin (A) and seat it between both anchor pins.

17. Install safety switch (if removed or replaced) and align it with lever base.

18. Install throttle control bracket.

19. Install control cable.

20. Install flywheel brake band over lever post and under right-rear fuel tank/engine cover stud.

21. Cycle zone start safety bail several times to insure proper functioning of assembly has been obtained.

22. Install fuel tank/engine cover and recoil start assemblies.

23. Start engine and test. Adjust if necessary.

MX,5105BV,6 -19-01OCT92

51
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9

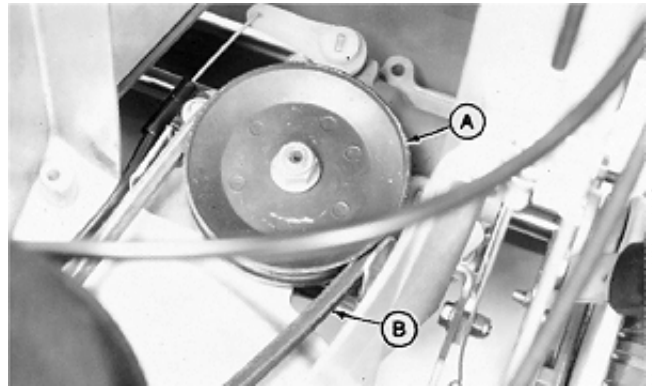
51
05
10

REMOVE AND INSTALL DRIVE BELT—ZONE START MOWERS (14SC/14SX, 14ST AND 14SZ)

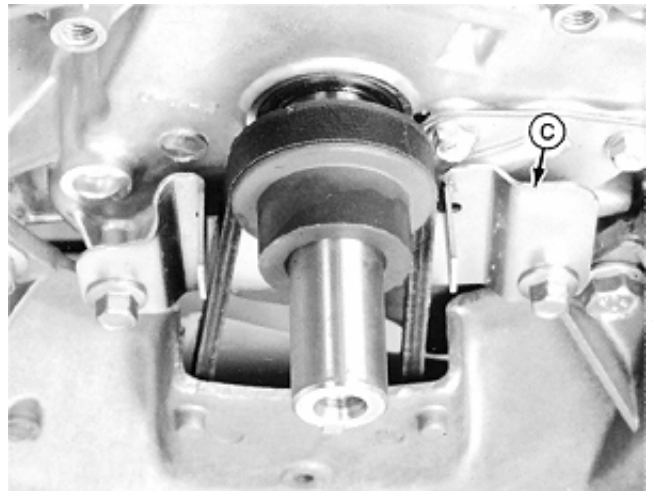
1. Disconnect spark plug lead.
2. Remove mower deck cover.
3. Remove lock nut, drive sheave (A), and belt (B) from transaxle.

⚠ CAUTION: Wear gloves when removing and installing blade.

4. Remove blade and adapter.
5. Loosen belt guide (C) enough to remove drive belt.
6. Install a new belt and tighten belt guide.
7. Install blade and tighten to **47 N·m (35 lb-ft)**.
8. Install belt, drive sheave, lock nut, and mower deck cover. Tighten lock nut to **34 N·m (25 lb-ft)**.
9. Connect spark plug lead.

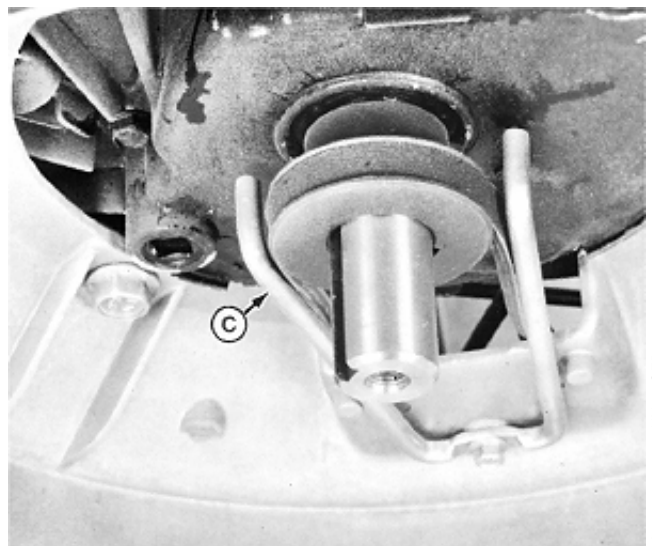


M54424
-UN-06AUG90



M42942
-UN-10SEP92

14SC/14SX



M42943
-UN-10SEP92

14ST AND 14SZ

MX.5110BV,1 -19-16JUL96

Drive Belt/Remove and Install Drive Belt

51
10
2

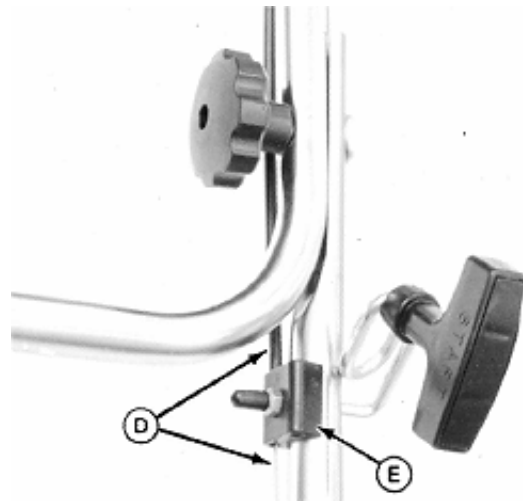
REMOVE AND INSTALL FLYWHEEL BRAKE CONTROL CABLE AND BAIL (12PC, 14PT, 14PZ, 14SC, 14ST AND 14SZ)

1. Remove acorn nut (B) to remove cable eyelet (C).
2. Pull left side bail rod out of handle bar first, then the right side.
3. Remove guide bracket (E).
4. Remove all tie straps.
5. Disconnect cable from flywheel brake assembly on the engine.
6. Inspect and replace components as necessary.
7. Connect cable to flywheel brake assembly on the engine.
8. Install guide bracket.
9. Install bail in handle bars.
10. Fasten cable eyelet to bail.
11. Install tie straps as needed.

- A—Flywheel Brake Control Bail
B—Acorn Nut
C—Cable Eyelet
D—Brake Control Cable
E—Guide Bracket



Right-Rear View



Right-Top View

MX,5115BV,1 -19-16JUL96

51
15
1

M42927 -UN-10SEP92

M42927

M42928 -UN-10SEP92

M42928

51
15
2

Section 52

POWER TRAIN—KANSAKI 2-SPEED TRANSAXLE (14ST/14SZ)

Contents

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Group 05—Remove and Install Transaxle

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Group 15—Shift Cable and Lever Assembly

Remove and Install Shift Cable and Lever.	52-15-1
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Group 20—Clutch Cable and Bail Assembly

Remove and Install Clutch Cable and Lever	52-20-1
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52

OTHER MATERIAL

Number	Name	Use
TY6299	Low Strength Sealant (Clear)	To seal transaxle case.
TY6341	John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America)	To lubricate transaxle components.
	Grease-Gard™—JDM J13E4, NLGI Grade 2 (Europe)	To lubricate transaxle components.

MX,5205BV,1 -19-16JUL96

52
05
1

REMOVE AND INSTALL KANSAKI 2-SPEED TRANSAXLE (14ST AND 14SZ)

NOTE: All photos are shot from the left of the mower, unless otherwise stated in the margin near the photo.

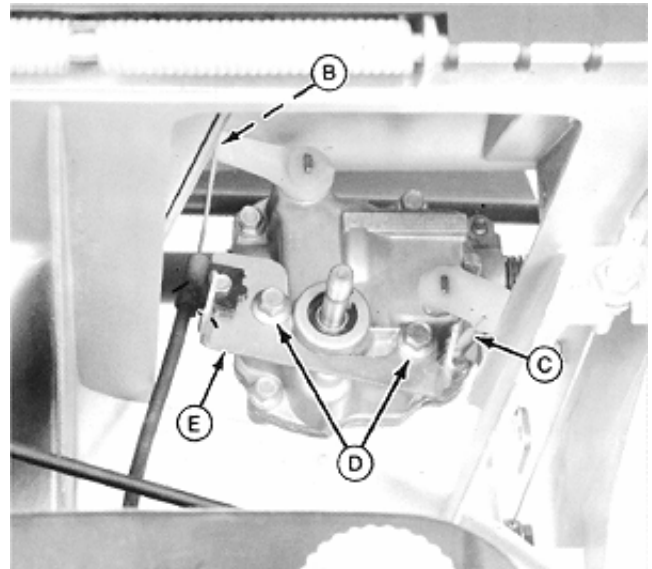
1. Disconnect spark plug wire.
2. Remove mower deck cover.
3. Remove lock nut, drive sheave (A), key, and belt.



M54887 -UN-06AUG90

IMPORTANT: DO NOT stretch clutch spring (C); otherwise, it will not return clutch to neutral position and allow transaxle to freewheel backwards.

4. In the following order, remove clutch spring (C), mounting cap screws (D) to remove belt guide bracket (E), and shift cable (B).



M42930 -UN-10SEP92

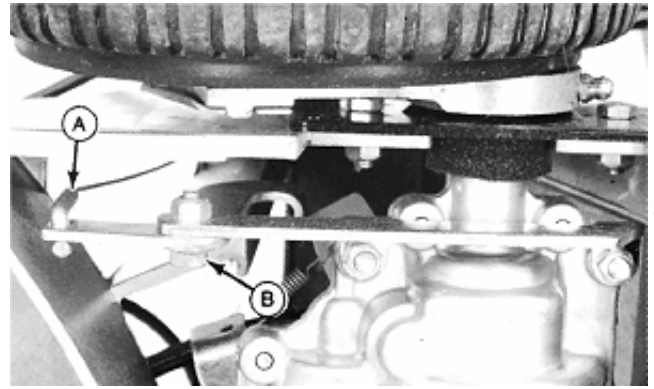
- A—Drive Sheave
- B—Shift Cable
- C—Clutch Return Spring
- D—Mounting Cap Screws
- E—Belt Guide Bracket

MX,5205BV,2 -19-16JUL96

Remove and Install Transaxle/Remove and Install Kansaki 2-Speed Transaxle

NOTE: Clutch cable (A) does not have to be removed unless it is damaged.

5. Remove shoulder bolt and lock nut (B).



MX,5205BV,3 -19-16JUL96

M42931 -UN-10SEP92

6. Remove rear wheels. (See Section 80, Group 05.)



MX,5205BV,4 -19-16JUL96

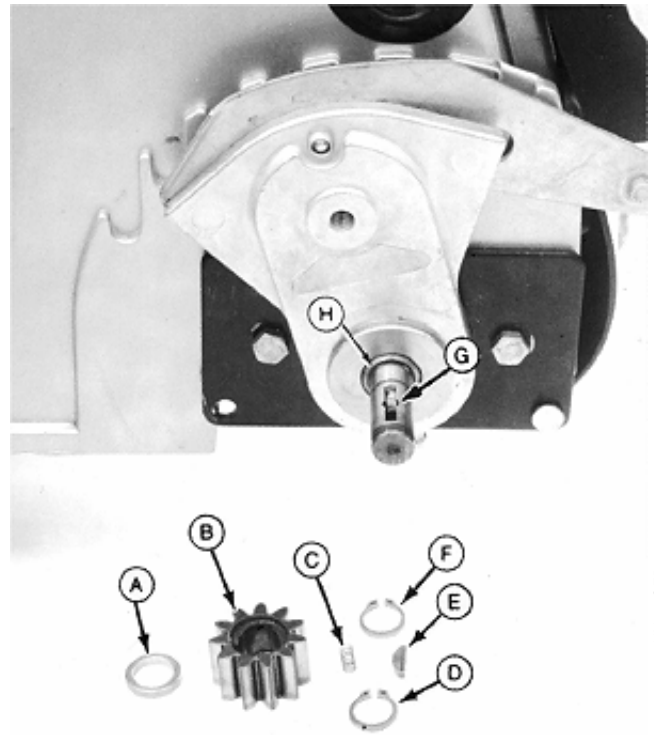
M42929 -UN-10SEP92

52-05-2

NOTE: Removal of the pinion gear is optional at this time. If you do not intend to remove the adjusters from the transaxle or disassemble the transaxle, you can save time by leaving them installed and going on to Step 8.

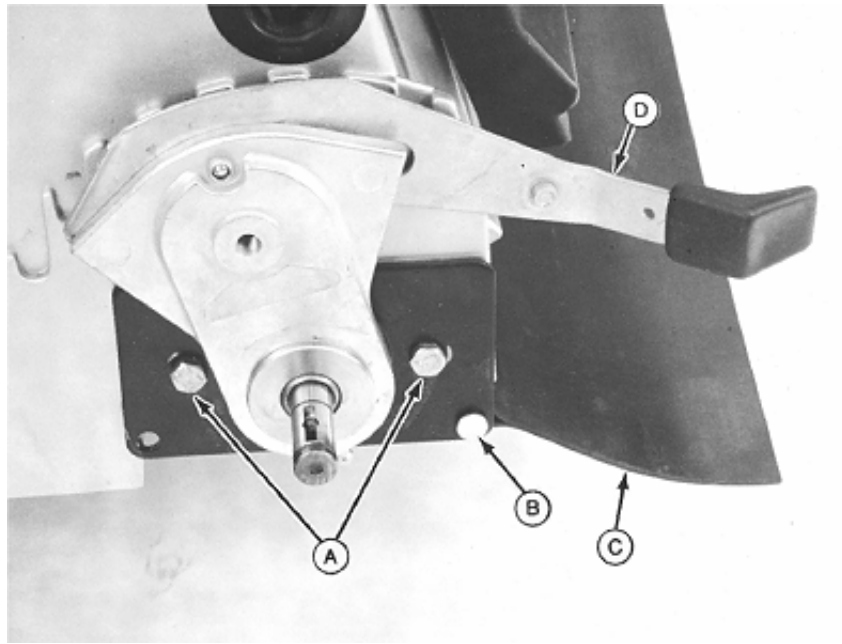
7. In the following order, remove outer snap ring (D), bushing (A) and pinion gear (B), key (E) and spring (C) from shaft keyway (G), and inner snap ring (F). Repeat procedure for right side.

- A—Bushing
- B—Pinion Gear
- C—Spring
- D—Outer Snap Ring
- E—Key
- F—Inner Snap Ring
- G—Shaft Keyway
- H—Inner Bushing



M42932 -UN-10SEP92 52-05-3

MX.5205BV,5 -19-16JUL96



M42933 -UN-10SEP92

A—Cap Screws and Lock Nuts

B—Rod

C—Shield

D—Adjuster Lever

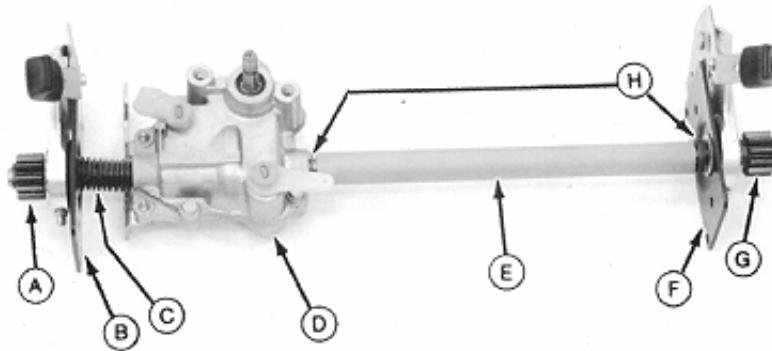
8. Remove cotter pin and washer from the other end of rod (B). Slide rod out of shield and mower deck.

9. Pull out on adjuster lever (D) and center adjuster between two mounting cap screws and lock nuts (A).

IMPORTANT: Block transaxle safely so it does not pivot or drop to the ground when cap screws are removed.

10. Remove cap screws and lock nuts (A). Repeat Steps 9 and 10 for the right side.

MX,5205BV,6A -19-16JUL96



M42934
-UN-10SEP92

A—Left Pinion Gear
Assembly
B—Left Adjuster Assembly

C—Conduit
D—2-Speed Transaxle
E—Plastic Spacer Tube

F—Right Adjuster Assembly
G—Right Pinion Gear
Assembly

H—Spacer Washers

NOTE: Transaxle shown complete to aid in disassembly and assembly procedures. Remember, for installation purposes, the number of spacer washers (H) used at each end of the plastic spacer tube (E).

11. Remove transaxle to workbench.

MX,5205BV,6B -19-01OCT92

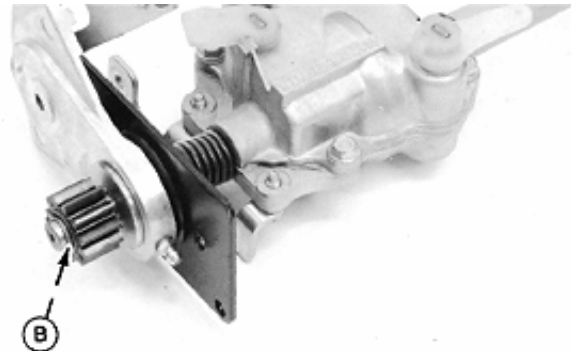
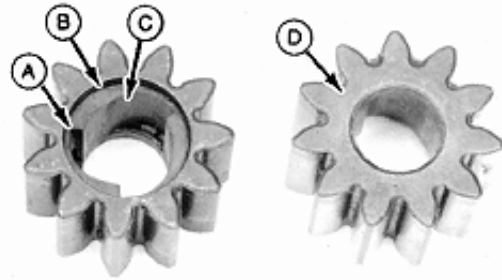
52
05

12. Install transaxle in reverse order of removal.

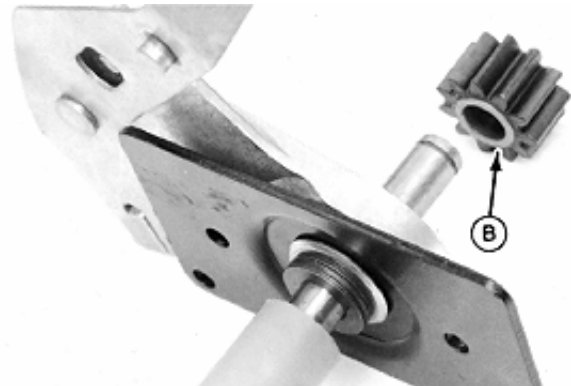
IMPORTANT: Each pinion gear has a smooth side (D) and a recessed side (B). The recessed side holds a bushing. When you install the pinion gears on the axle shafts keep the pinion gears on the axle shafts keep the bushing recessed side (B) pointed to the left and the smooth side (D) pointed to the right. When assembled properly the left pinion gear's bushing recessed side (B) faces outward while the right pinion gear's bushing recessed side (B) faces inward.

Inside the pinion gear are three engagement ramps (C) and flats (A) that interact with the key and spring in the shaft keyway to provide traction or freewheel functions. Only grease the inside of the pinion gear before installation. Use John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe) (or equivalent) for the inside of the pinion gear. **DO NOT** grease the gear teeth.

- A—Engagement Flats
- B—Recessed Side
- C—Engagement Ramps
- D—Smooth Side



Left Side Shown



Right Side Shown

MX,5205BV,7 -19-16JUL96

-JUN-10SEP92

M42935

-JUN-10SEP92

M42936

-JUN-10SEP92

M42937

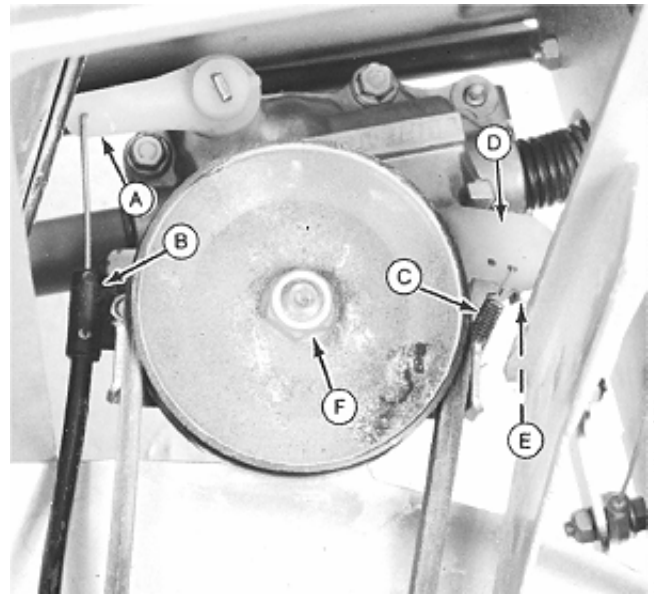
6312

IMPORTANT: BE SURE clutch shift linkage (E) is installed in front of clutch shift arm (D).

DO NOT stretch clutch spring (C); otherwise, it will not return clutch to neutral position and allow transaxle to freewheel backwards. Make it the last component you install before installing the drive sheave and belt.

Move lever of handlebar shift assembly to verify proper engagement of both first and second gears at the transaxle shift arm (A). Adjust shift cable position (B), if necessary, to gain both gear positions.

13. Tighten transaxle drive sheave lock nut (F) to **34 N·m (25 lb-ft.)**.



A—Transaxle Shift Arm
B—Shift Cable Adjuster
C—Clutch Spring
D—Clutch Shift Arm
E—Clutch Shift Linkage
F—Drive Sheave Lock Nut

MX,5205BV,8 -19-16JUL96

M42938 -UN-10SEP92

52-05-7

Remove and Install Transaxle/Remove and Install Kansaki 2-Speed Transaxle

52-05-8

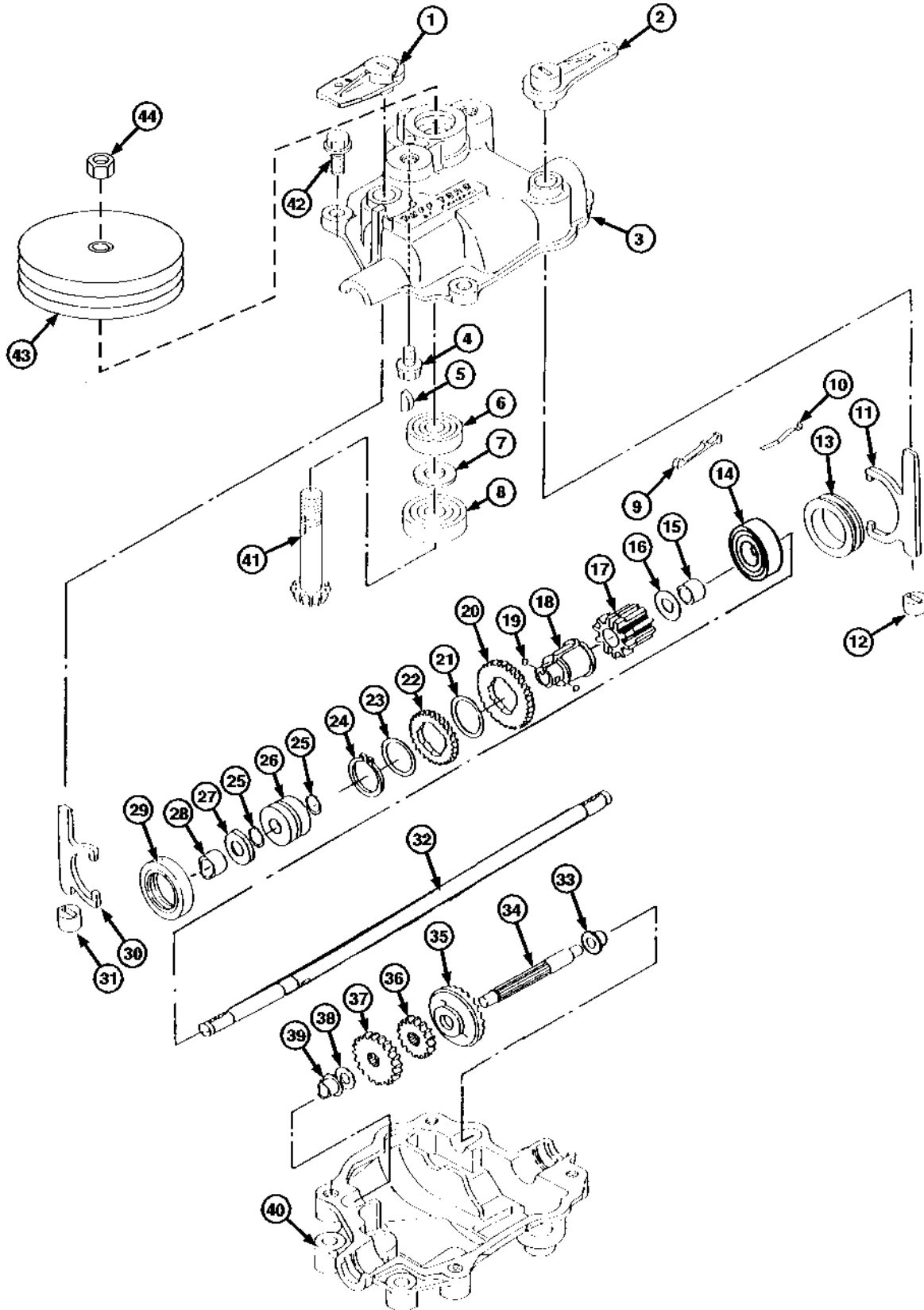
EXPLODED VIEW—KANSAKI 2-SPEED TRANSAXLE (14ST AND 14SZ)

- | | | | |
|---|--|---|---|
| 1—Clutch Arm | 15—Bushing | 24—Snap Ring | 37—Reduction Shaft Gear (16T)—
(meshes with 16 to makeup 1st gear) |
| 2—Shift Arm | 16—Washer | 25—Snap Ring | 38—Washer |
| 3—Upper Case Half | 17—Shaft Key Carrier Bushing | 26—Shift Collar | 39—Sleeve Bushing |
| 4—Anchor Cap Screw for Input Shaft Assembly | 18—Shift Collar | 27—Washer | 40—Lower Case Half |
| 5—Key | 19—Shift Detent Balls | 28—Bushing | 41—Input Shaft with Pinion Gear (13T) |
| 6—Sealed Bearing | 20—Axle Drive Gear (36T)—
(meshes with 27 to makeup 2nd gear) | 29—Seal | 42—Cap Screws (6 used) |
| 7—Washer | 21—Washer | 30—Clutch Fork | 43—Drive Sheave |
| 8—Ball Bearing | 22—Axle Drive Gear (30T)—
(meshes with 28 to makeup 1st gear) | 31—Support Bushing | 44—Lock Nut |
| 9—Shift Key (2 used) | 23—Washer | 32—Axle Shaft | |
| 10—Shift Key Spring (2 used) | | 33—Sleeve Bushing | |
| 11—Shift Fork | | 34—Reduction Shaft | |
| 12—Support Bushing | | 35—Pinion Gear (35T) | |
| 13—Shift Collar | | 36—Reduction Shaft Gear (22T)—
(meshes with 14 to makeup 2nd gear) | |
| 14—Seal | | | |

This exploded view is provided to aid you in the disassembly and assembly of the Kansaki 2-Speed Transaxle.

NOTE: Seals (14) and (29) are used in later model transmissions (Transmission Date Code 08L3—).

Disassemble and Assemble Transaxle/Exploded View—Kansaki 2-Speed Transaxle



52
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3

JUN-17MAY95

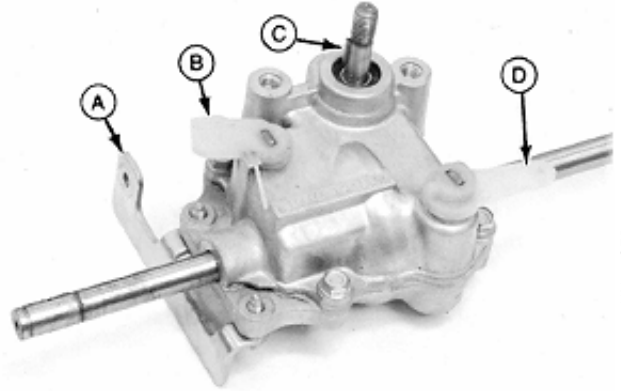
M81642

MX,5210BV,2A -19-16JUL96

DISASSEMBLE AND ASSEMBLE KANSAKI 2-SPEED TRANSAXLE (14ST AND 14SZ)

1. Remove shift arm (D) and clutch arm (B).
2. Remove linkage bracket (A).
3. Remove key (C).
4. Remove upper case from lower case.

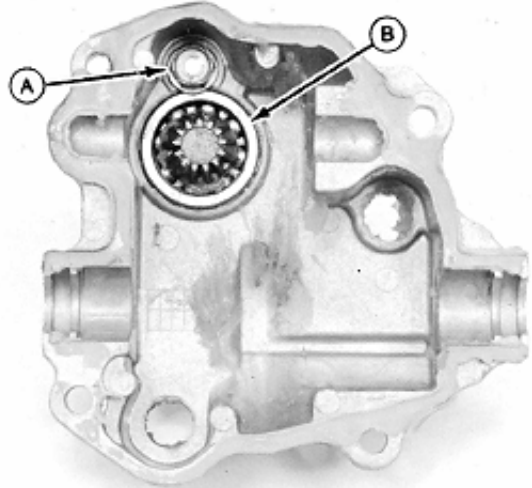
A—Linkage Bracket
B—Clutch Arm
C—Key
D—Shift Arm



M54389 -UN-10SEP92

MX,5210BV,3 -19-16JUL96

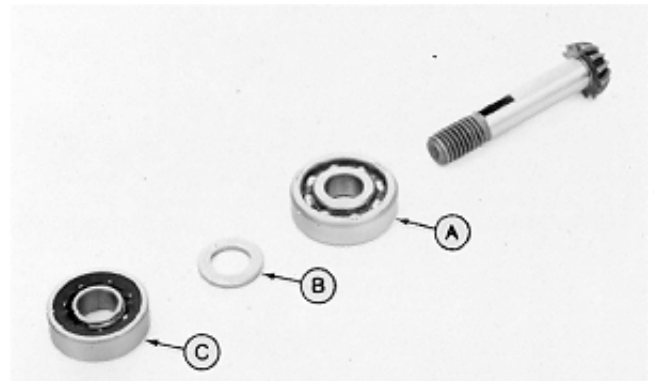
5. Remove cap screw and washer (A).
6. Press out input pinion shaft assembly (B).



M54390 -UN-11SEP92

MX,5210BV,4 -19-01OCT92

7. Inspect bearings (A and C).
8. Remove burrs from input shaft. Inspect shaft and teeth.
9. Remove bearings and washer (B). Replace any worn or damaged parts.



M52383 -UN-12DEC88

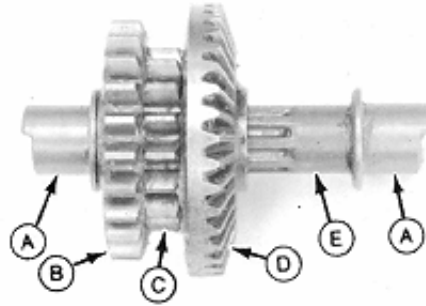
MX,5210BV,5 -19-01OCT92

10. Remove reduction shaft assembly.

11. Remove and inspect sleeves (A), gears (B, C, and D) and shaft (E) for cracks and chipped teeth.

Replace worn or damaged parts.

- A—Sleeve
- B—Gear
- C—Gear
- D—Ring Gear
- E—Reduction Shaft



MX,5210BV,6 -19-01OCT92

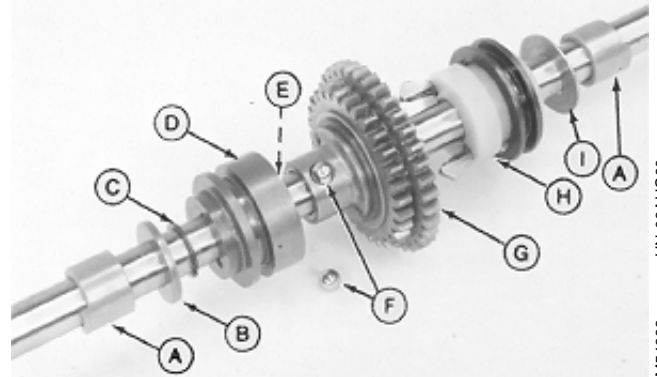
M54392 -UN-11SEP92

12. Remove axle shaft assembly.

13. Remove parts (A—I).

14. Inspect axle shaft and parts (A—I) for wear or damage. Replace parts as necessary.

- | | |
|------------------|-------------------|
| A—Bushing | F—Clutch Balls |
| B—Collar Washer | G—Gear Assembly |
| C—Snap Ring | H—Collar Assembly |
| D—Sliding Collar | I—Washer |
| E—Snap Ring | |

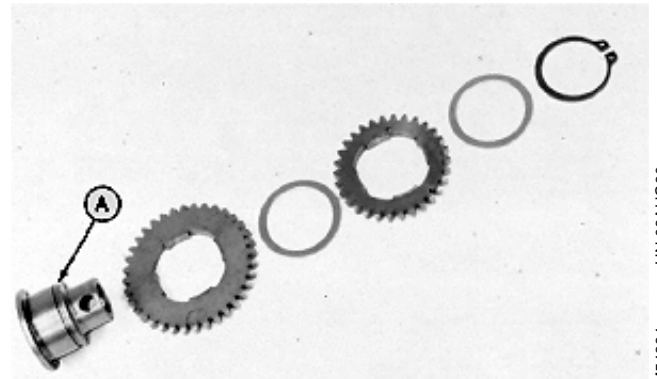


MX,5210BV,7 -19-01OCT92

M54393 -UN-06AUG90

NOTE: Apply John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe) (or equivalent) to all parts including the internal ramps, key, and spring of the axle pinion gears.

15. Assemble thrust washers and gears on shift collar (A). Secure with snap ring.

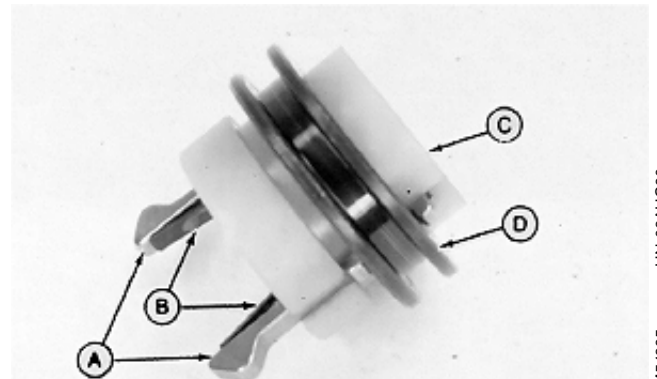


MX,5210BV,8 -19-16JUL96

M54394 -UN-06AUG90

16. Assemble springs (B), keys (A) and collar (D) to holder (C).

- A—Shift Keys
- B—Springs
- C—Key Holder
- D—Sliding Collar

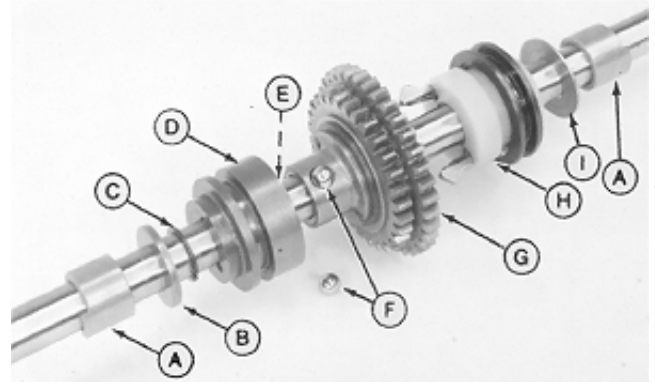


MX,5210BV,9 -19-01OCT92

M54395 -UN-06AUG90

Disassemble and Assemble Transaxle/Kansaki 2-Speed Transaxle

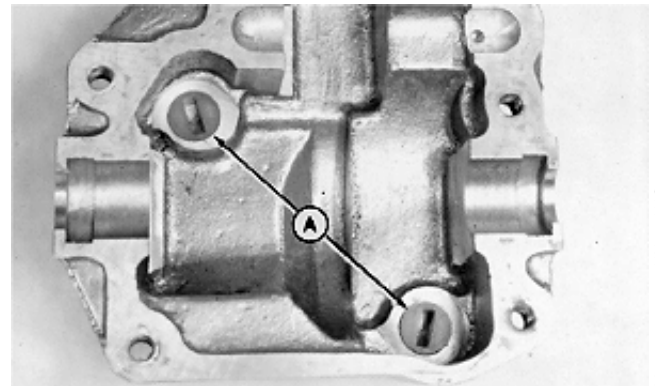
17. Install snap ring (E).
18. Install assemblies (G and H).
19. Slide keys of assembly (H) into collar of gear assembly.
20. Install balls (F).
21. Install collar (D).
22. Install snap ring (C).
23. Install washers (B and I).
24. Install bushings (A). Check that locating tab points away from assembly.



- | | |
|------------------|-------------------|
| A—Bushing | F—Clutch Balls |
| B—Collar Washer | G—Gear Assembly |
| C—Snap Ring | H—Collar Assembly |
| D—Sliding Collar | I—Washer |
| E—Snap Ring | |

MX,5210BV,10 -19-01OCT92

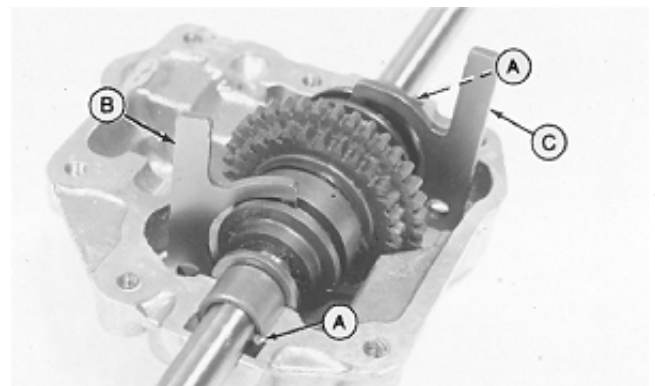
25. Install shift fork supports (A).



MX,5210BV,11 -19-01OCT92

NOTE: Locating tab of each bushing (A) must be positioned in bore of transaxle lower case.

26. Install clutch fork (B) and shift fork (C).
27. Install axle shaft assembly to transaxle lower case.

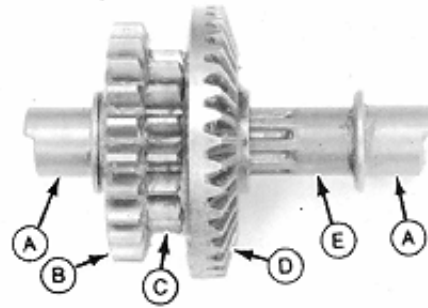


Early Model Shown

MX,5210BV,12 -19-16JUL96

28. Install parts (A—D) on reduction shaft (E).

- A—Sleeve
- B—Gear
- C—Gear
- D—Ring Gear
- E—Reduction Shaft



MX,5210BV,13 -19-01OCT92

M54392 -UN-11SEP92

29. Install reduction shaft assembly (A).



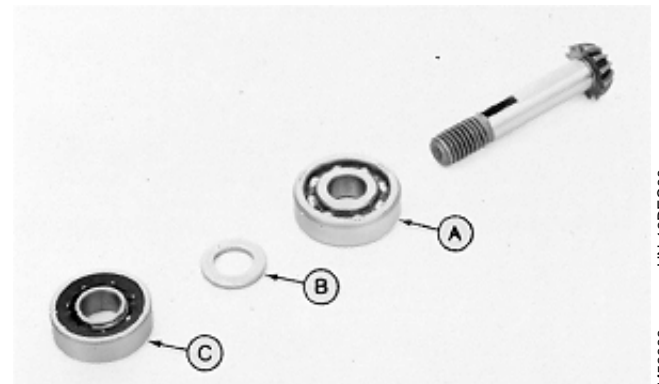
Early Model Shown

MX,5210BV,14 -19-16JUL96

M54391 -UN-10SEP92

IMPORTANT: Bearing (C) must be installed with seal side away from pinion gear.

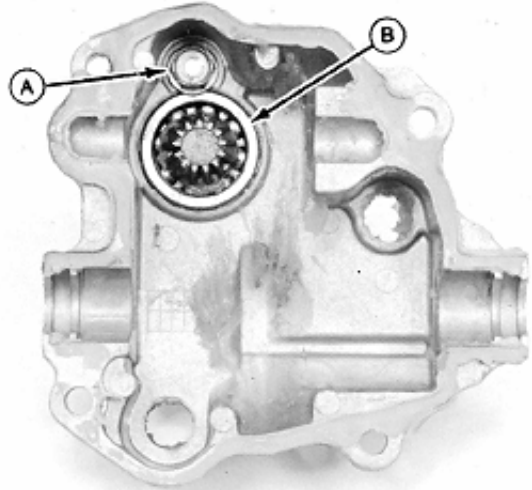
30. Assemble bearing (A), washer (B), and bearing (C) onto input shaft.



MX,5210BV,15 -19-01OCT92

M52383 -UN-12DEC88

31. Install input shaft assembly (B).
32. Install washer and cap screw (A).
33. Pack case with 70 g (2.5 oz) of John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe) (or equivalent).
34. Apply Liquid Gasket Maker—TY6299 or equivalent to sealing surface of case.



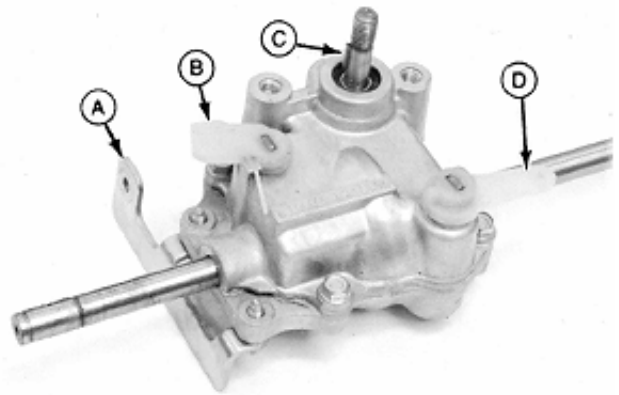
M54390 -UN-11SEP92

MX,5210BV,16 -19-16JUL96

NOTE: Linkage bracket (A) is secured using the two longer cap screws.

If the transmission has been replaced, the linkage bracket cap screws will have to be replaced with self-tapping screws. (Refer to SIB-96-11-10-10.)

35. Fasten transaxle upper case to lower case. Install linkage bracket (A) to lower case. Tighten cap screws to **9.8 N·m (159 lb-in.)**.
36. Install clutch arm (B) and shift arm (D).
37. Install key (C).



M54389 -UN-10SEP92

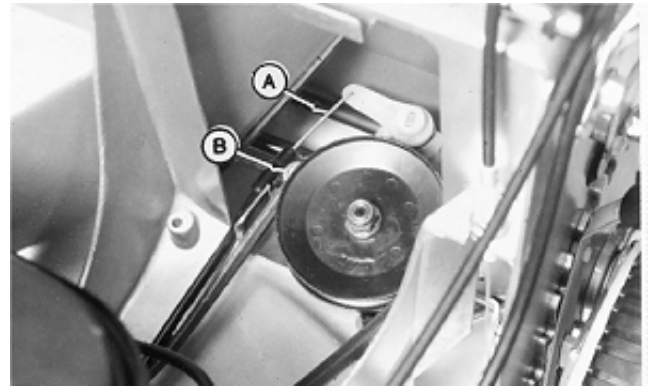
A—Linkage Bracket
B—Clutch Arm

C—Key
D—Shift Arm

MX,5210BV,17 -19-16JUL96

REMOVE AND INSTALL SHIFT CABLE AND LEVER (14ST AND 14SZ)

1. Remove mower deck cover.
2. Remove self-tapping screw and clamp (B) and remove shift cable (A) from shift arm.
3. Remove all tie straps.
4. Remove throttle control lever and transaxle shift lever assembly cover (C).

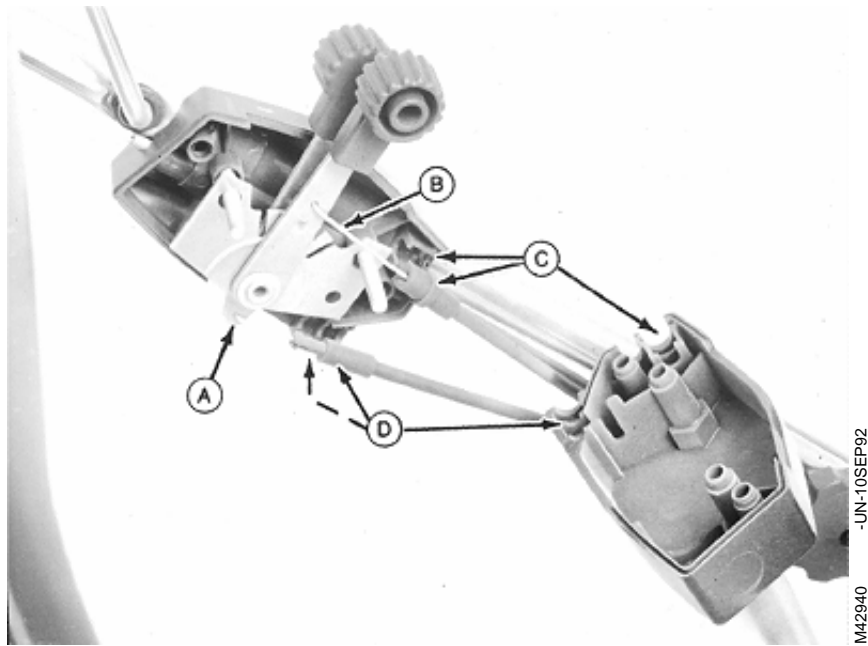


M54429 -UN-06AUG90



M42939 -UN-10SEP92

MX,5215BV,1 -19-16JUL96



A—Shift Cable

B—Throttle Cable

**C—Throttle Cable Sheath
Anchor Points**

**D—Shift Cable Sheath
Anchor Points**

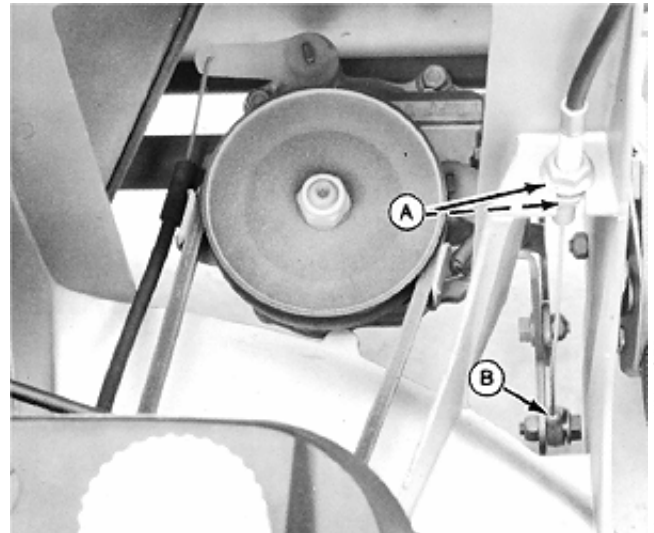
5. Remove shift cable (A) from shift lever.
6. Inspect components and replace as necessary.
7. Install shift cable (A).
8. Align throttle cable sheath anchor with upper cavities of assembly case halves (C). Do the same for the shift cable (D).
9. Sandwich the assembly case halves together and fasten with cap screws and lock nuts.

10. Run shift cable with other cables and secure with tie straps as before.
11. Install shift cable in shift arm and clamp cable to belt guide.
12. Adjust shift lever. (See Section 255, Group 15.)
13. Install mower deck cover.

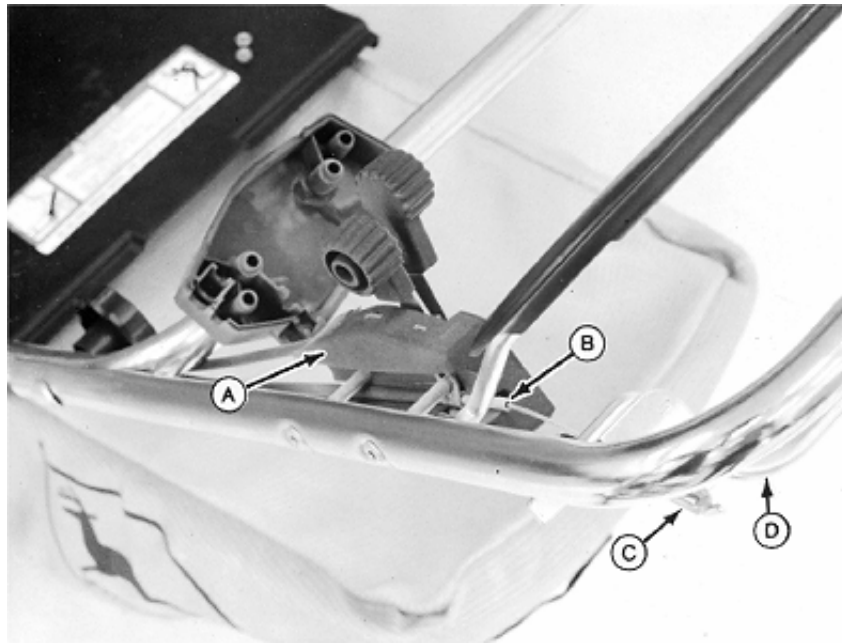
MX,5215BV,2 -19-16JUL96

REMOVE AND INSTALL CLUTCH CABLE AND LEVER (14ST AND 14SZ)

1. Remove mower deck cover.
2. Loosen adjustment nuts (A) and slide cable adjuster out of slot.
3. Remove shoulder bolt and nut to disconnect cable eyelet (B).
4. Remove all tie straps.
5. Remove throttle control lever and transaxle shift lever assembly cover (C).



MX,5220BV,1 -19-16JUL96



A—Left Case Half

B—Clutch Cable

C—Upper Clutch Cable
Eyelet

D—Clutch Bail

6. Pull left case half (A) over far enough to pull clutch cable (B) free.

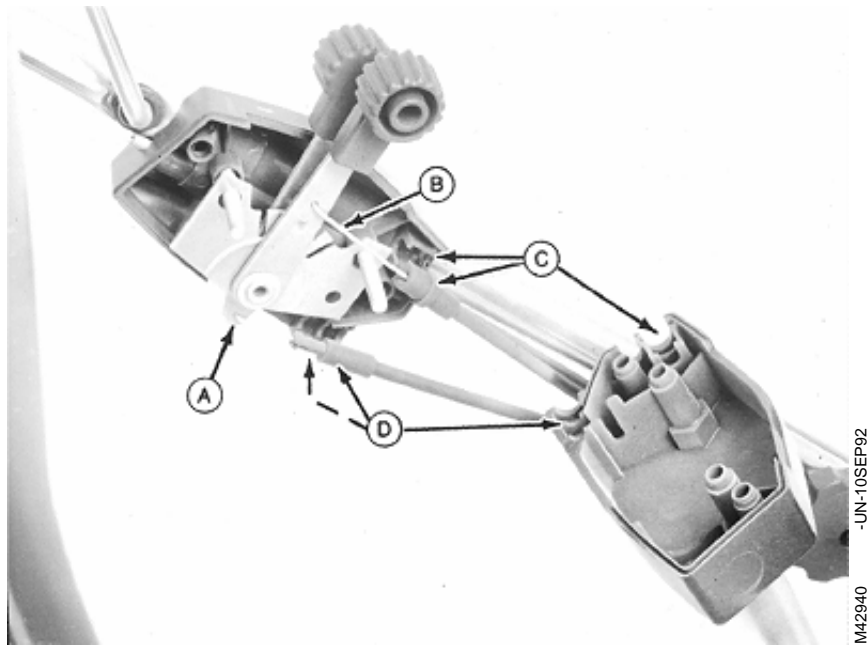
7. Unhook upper cable eyelet (C) from clutch bail (D).

8. Remove clutch bail, if necessary, by pulling right end from handlebar first, then the left end.

9. Inspect components and replace as necessary.

10. Hook upper cable eyelet onto bail and install clutch cable in slot of left case half.

MX,5220BV,2 -19-16JUL96



A—Shift Cable

B—Throttle Cable

**C—Throttle Cable Sheath
Anchor Points**

**D—Shift Cable Sheath
Anchor Points**

11. Align throttle cable sheath anchor with upper cavities of assembly case halves (C). Do the same for the shift cable (D).

12. Sandwich the assembly case halves together and fasten with cap screws and lock nuts.

13. Run clutch cable with other cables and secure with tie straps as before.

14. Install lower clutch cable eyelet with shoulder bolt and lock nut.

15. Slide cable adjuster into slot and tighten two adjuster nuts.

16. Adjust clutch cable.

17. Install mower deck cover.

MX,5220BV,3 -19-01OCT92

52
20
4

POWER TRAIN—KANSAKI 5-SPEED TRANSAXLE (12SB/14SB/14SC/14SX/14SE)

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Group 20—Clutch Cable and Bail Assembly

Remove and Install Clutch Cable and Bail.	53-20-1
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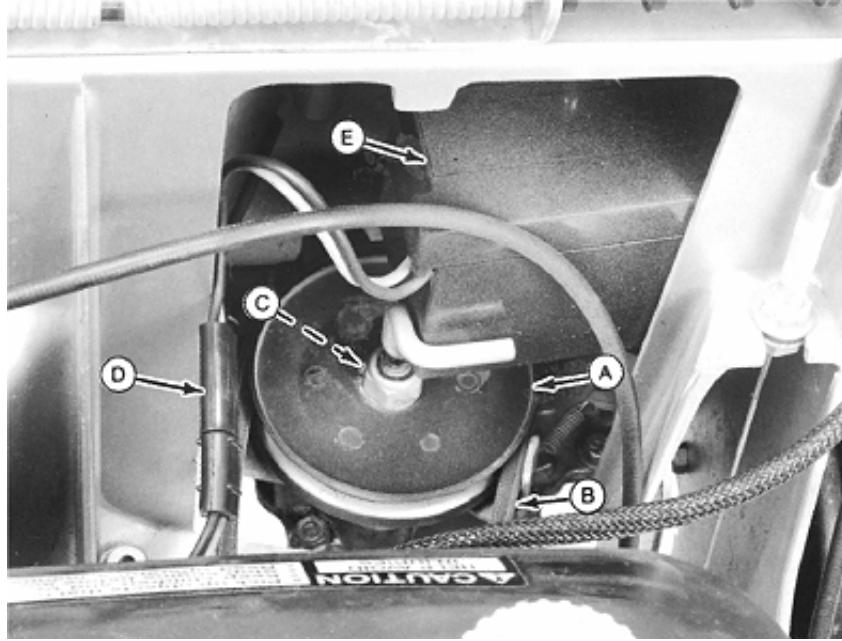
OTHER MATERIAL

Number	Name	Use
TY6299	Low Strength Sealant (Clear)	To seal transaxle case.
TY6341	John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America)	To lubricate transaxle components.
	Grease-Gard™—JDM J13E4, NLGI Grade 2 (Europe)	To lubricate transaxle components.

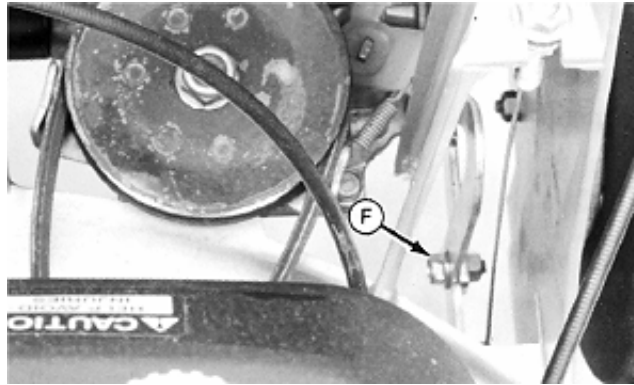
MX,5305BV,1 -19-16JUL96

53
05
1

REMOVE AND INSTALL KANSAKI 5-SPEED TRANSAXLE (12SB, 14SB, 14SC/14SX AND 14SE)



Model 14SE Shown



A—Drive Sheave
B—Belt

C—Key
D—Battery Connector

E—Battery
F—Shoulder Bolt and Lock Nut

1. Disconnect spark plug wire.
2. Remove mower deck cover.

3. Remove drive sheave (A), belt (B), key (C), and shoulder bolt and lock nut (F). On Model 14SE only, disconnect battery connector (D) and remove battery (E).

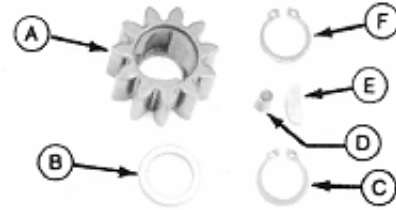
MX_5305BV,2 -19-16JUL96

4. Remove drive wheels. (See Section 80, Group 05.)
5. Remove drive pinion gear assembly.

- A—Drive Pinion Gear (11T)
- B—Washer
- C—Outer Snap Ring
- D—Spring
- E—Key
- F—Inner Snap Ring
- G—Axle Keyway



Late Model Mowers



Late Model Mowers

MX,5305BV,3A -19-16JUL96

M42929 -UN-10SEP92

M42929

53-05-3

-UN-17SEP92

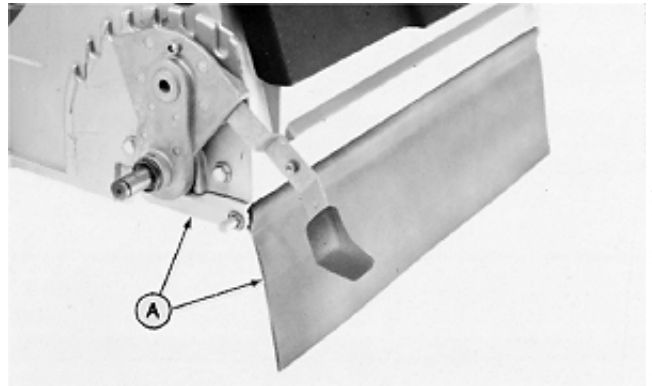
M42947

IMPORTANT: Block transaxle safely so it does not pivot or drop to the ground when cap screws are removed.

6. Early Models: Remove bracket and shield assembly (A) from both sides.

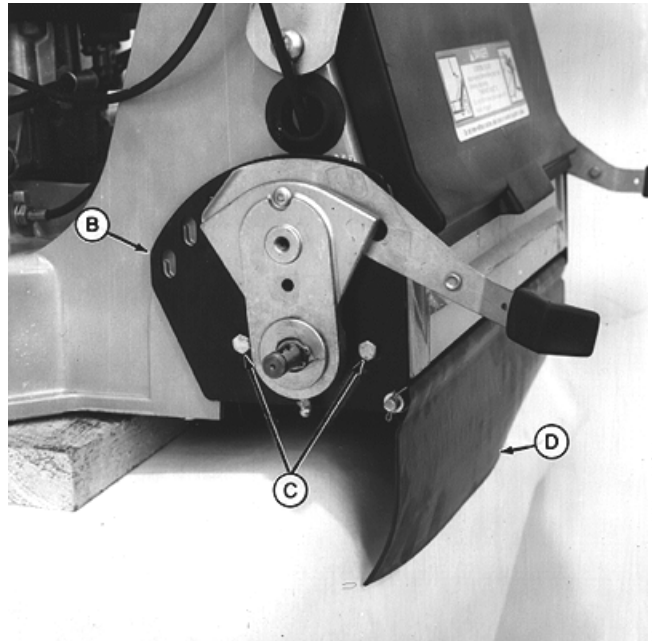
Later Models: Remove shield assembly (D). Remove cap screws (C) and adjuster brackets (B).

- A—Bracket and Shield Assembly
- B—Adjuster Bracket Assembly
- C—Cap Screws
- D—Shield Assembly



Early Model Mowers

M52597 -UN-12DEC88



Late Model Mowers

M81653 -UN-07NOV95

MX,5305BV,3B -19-16JUL96

4 0313

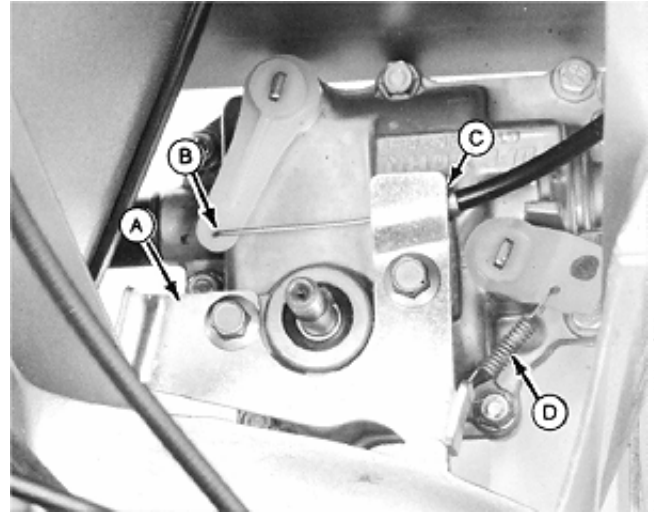
IMPORTANT: DO NOT stretch clutch spring (D); otherwise, it will not return clutch arm far enough forward to allow transaxle to freewheel backwards.

7. Carefully remove spring (D) without stretching it.

NOTE: Mark position of shift cable sheath end (C) on transaxle case before removing bracket (A). Install cable in same position.

8. Scribe a mark on shift cable sheath end and remove belt guide bracket.

9. Remove shift cable (B) and remove transaxle to workbench.



- A—Belt Guide Bracket
- B—Shift Cable
- C—Sheath End
- D—Clutch Spring

M42945 -JUN-17SEP92

53053

MX,5305BV,4 -19-01OCT92

10. Push adjuster inward to remove snap ring (A).
Repeat on other side.

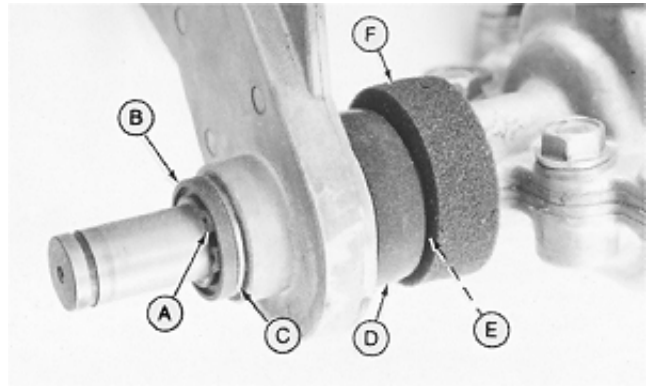
11. Remove washers (B and C), adjuster, bushing (D), flat washer (E) and foam washer (F). Repeat on other side.

12. Remove conduit spacer (G) on 14SC/14SX commercial mowers and foam spacer (H) on late model residential mowers. Inspect all components and replace as necessary.

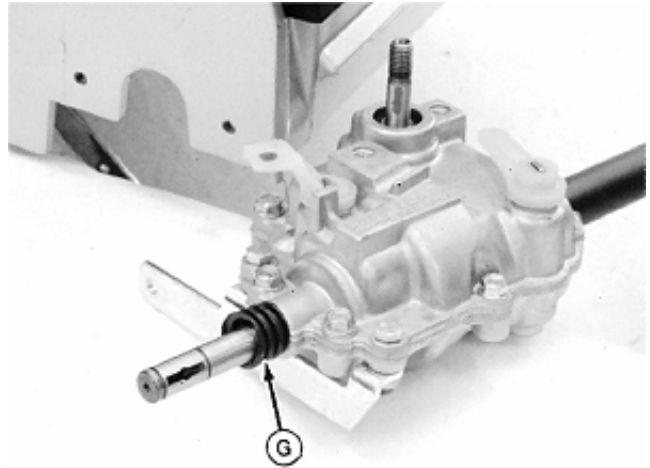
NOTE: On early model mowers, washer (B) must be installed with snap ring recess facing out.

13. On early model mowers, install washers, bushing, adjuster, and shield.

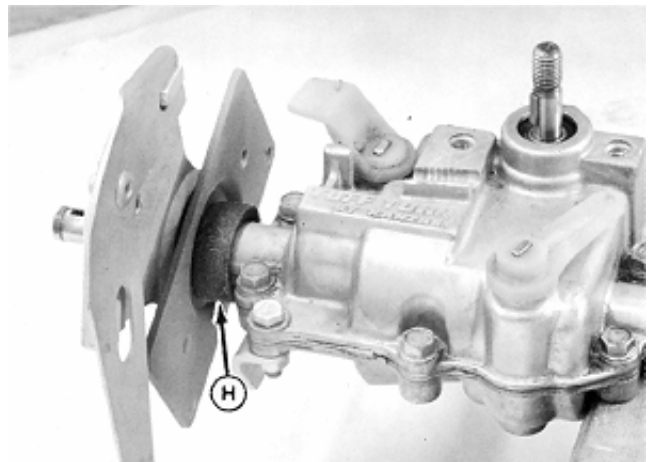
- A—Snap Ring
- B—Collar Washer
- C—Washers (2 used)
- D—Plastic Bushing
- E—Flat Washer
- F—Foam Washer
- G—Conduit Spacer
- H—Foam Spacer



Early Model Mowers



14SC/14SX Model Commercial Mower Shown



Late Model Mowers

MX,5305BV,5A -19-16JUL96

63133

M52594 -UN-07AUG90

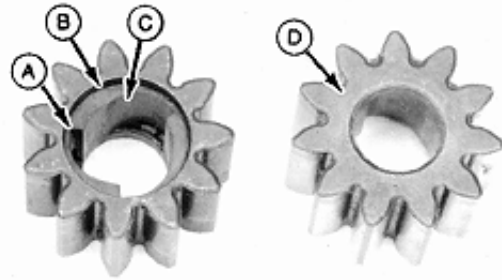
M42948 -UN-17SEP92

M42949

M42949 -UN-17SEP92

M42949

IMPORTANT: Each pinion gear has a smooth side (D) and a recessed side (B). The recessed side holds a bushing. When you install the pinion gears on the axle shafts keep the bushing recessed side (B) pointed to the left and the smooth side (D) pointed to the right. When assembled properly the left pinion gear's bushing recessed side (B) faces outward while the right pinion gear's bushing recessed side (B) faces inward.



Late Model Mowers

- A—Engagement Flat
- B—Recess
- C—Engagement Ramp
- D—Smooth Side

Inside the pinion gear are three engagement ramps (C) and flats (A) that interact with the key and spring in the shaft keyway to provide traction or freewheel functions. Only grease the inside of the pinion gear before installation. Use John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe) (or equivalent) for the inside of the pinion gear. **DO NOT** grease the gear teeth.

14. Install drive pinion gears.

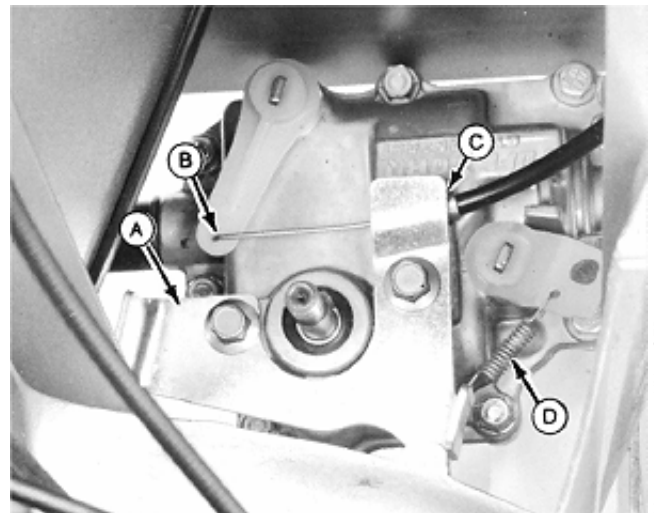
MX,5305BV,5B -19-16JUL96

15. Install clutch linkage, shift cable (B), and belt guide bracket (A). BE SURE to align the scribe mark made earlier with the edge of the bracket.

IMPORTANT: DO NOT stretch clutch spring (D); otherwise, clutch arm will not return to neutral and allow transaxle to freewheel backwards.

16. Install clutch spring (D) and move shift lever to verify proper engagement of all gears. Adjust shift cable position if necessary.

- A—Belt Guide Bracket
- B—Shift Cable
- C—Sheath End
- D—Clutch Spring



MX,5305BV,5C -19-16JUL96

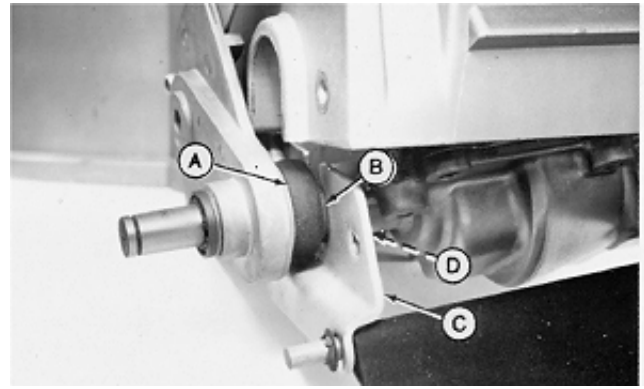
IMPORTANT: Plastic bushing (A) and washer (B) must be positioned between adjuster and bracket (C).

Foam washer (D) must be positioned between bracket (C) and transaxle. (Left hand side only.)

17. Install key, belt, sheave and lock nut. Tighten lock nut to **34 N·m (25 lb-ft)**.

18. Install mower deck cover.

19. Install rear wheels.



Early Model Mowers

A—Plastic Bushing
B—Washer
C—Bracket
D—Foam Washer

MX,5305BV,6 -19-16JUL96

M52595 -JUN-23FEB89

EXPLODED VIEW—KANSAKI 5-SPEED TRANSAXLE (12SB, 14SB, 14SC/14SX, AND 14SE)

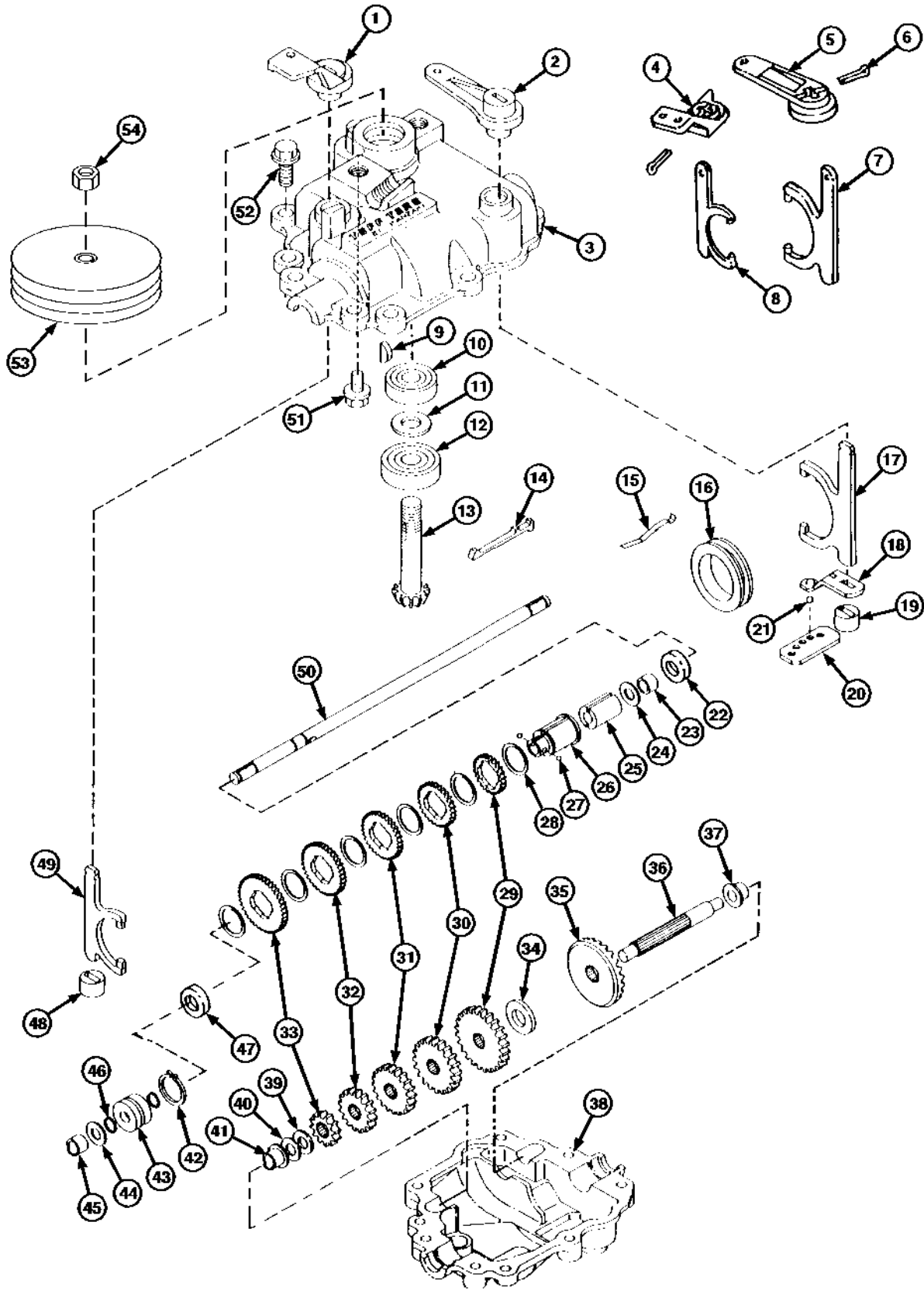
- | | | | |
|---------------------------------------|-------------------------------------|--------------------------------------|--|
| 1—Late Model Clutch Arm | 19—Support Bushing | 31—Axle Shaft Gear (33T) and Mating | 39—Washer |
| 2—Late Model Shift Arm | 20—Detent Bracket | Reduction Shaft Gear (19T)—3rd Gear | 40—Washer (12SB, 14SB, 14SE) |
| 3—Upper Case Half | 21—Detent Ball | 32—Axle Shaft Gear (36T) and Mating | 41—Sleeve Bushing |
| 4—Early Model Clutch Arm | 22—Seal | Reduction Shaft Gear (16T)—2nd Gear | 42—Snap Ring |
| 5—Early Model Shift Arm | 23—Bushing | 33—Axle Shaft Gear (40T) and Mating | 43—Shift Collar |
| 6—Early Model Cotter Pin (2 used) | 24—Washer | Reduction Shaft Gear (12T)—1st Gear | 44—Washer |
| 7—Early Model Shift Fork | 25—Shift Key Carrier Bushing | 34—Washer (12SB, 14SB, 14SE) | 45—Bushing |
| 8—Early Model Clutch Fork | 26—Shift Collar | 35—Reduction Shaft Pinion Gear (35T) | 46—Lock Ring (2 used) |
| 9—Key | 27—Detent Balls (2 used) | 36—Reduction Shaft | 47—Seal |
| 10—Sealed Bearing | 28—Washer (6 used) | 37—Sleeve Bushing | 48—Support Bushing |
| 11—Washer | 29—Axle Shaft Gear (26T) and Mating | 38—Lower Case Half | 49—Late Model Clutch Fork |
| 12—Ball Bearing | 30—Axle Shaft Gear (30T) and Mating | | 50—Axle Shaft |
| 13—Input Shaft with Pinion Gear (13T) | Reduction Shaft Gear (22T)—4th Gear | | 51—Anchor Cap Screw for Input Shaft Assembly |
| 14—Shift Key (2 used) | | | 52—Case Cap Screws (9 used) |
| 15—Shift Key Spring (2 used) | | | 53—Belt Drive Sheave |
| 16—Shift Collar | | | 54—Lock Nut |
| 17—Late Model Shift Fork | | | |
| 18—Detent Spring Arm | | | |

This exploded view of the Kansaki 5-Speed Transaxle is provided to aid you in the disassembly and assembly of the transaxle.

NOTE: Seals (22) and (47) are used in later model transmissions, 14SB and 14SE (Transmission Date Code 11K3—) and 14SC/SX (Transmission Date Code 08L3—).

MX,5310BV,1B -19-16JUL96

Disassemble and Assemble Transaxle/Exploded View—Kansaki 5-Speed Transaxle



330

-JUN-17MAY95

M81643

MX,5310BV,2A -19-16JUL96

TM1471 (16JUL96)

53-10-3

21" RDWB MOWER

031096
PN=322

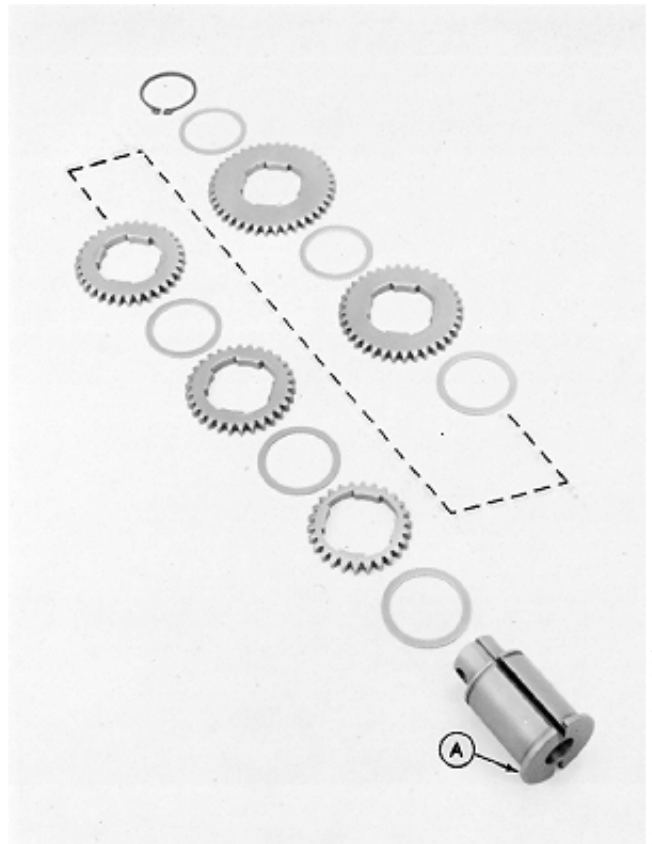
DISASSEMBLE AND ASSEMBLE KANSAKI 5-SPEED TRANSAXLE (12SB, 14SB, 14SC/14SX AND 14SE)

NOTE: For disassembly of transaxle, refer to the exploded view on the previous pages. Take care to remember the exact location of all components as you disassemble the transaxle. Clean all components with an approved cleaning solvent and inspect each component closely cracks, chipped teeth, and wear. Replace as necessary.

Apply John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe)(or equivalent) to all parts including the internal ramps, key, and spring of the outer axle pinion gears.

IMPORTANT: Gears must be installed with tooth bevel facing shift collar flange (A).

1. Assemble thrust washers and gears onto shift collar. Secure with snap ring.



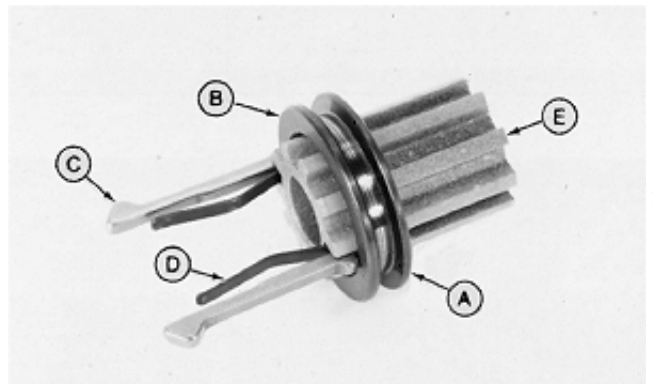
M52574 -JUN-12DEC88

MX,5310BV,3 -19-16JUL96

IMPORTANT: Collar (A) must be installed with thick flange (B) on same side as long end of keys (C).

2. Assemble springs (D), keys (C) and collar (A) to holder (E).

A—Sliding Collar
B—Flange
C—Shift Keys
D—Springs
E—Key Holder

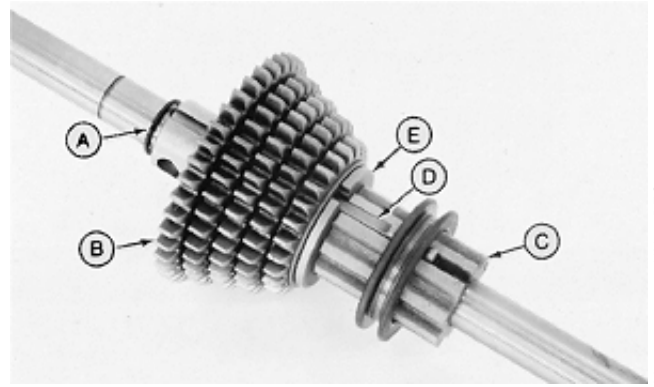


M52575 -JUN-12DEC88

MX,5310BV,4 -19-01OCT92

3. Install snap ring (A) to axle shaft.
4. Install assemblies (B and C).
5. Slide keys (D) into shift collar (E).

- A—Snap Ring
- B—Gear Assembly
- C—Shift Key Assembly
- D—Shift Keys
- E—Shift Collar



MX,5310BV,5 -19-01OCT92

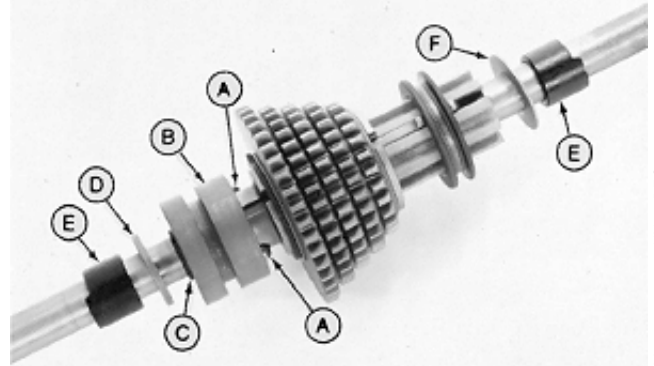
M52576 -UN-12DEC88

6. Install clutch balls (A) to shift collar.
7. Install sliding collar (B). Secure with snap ring (C).

IMPORTANT: Collar washer (D) must be installed with recessed side facing snap ring.

8. Install washers (D and F).
9. Install each bushing (E) with locating tab pointing away from assembly.

- A—Clutch Balls
- B—Sliding Collar
- C—Snap Ring
- D—Collar Washer
- E—Bushings
- F—Flat Washer



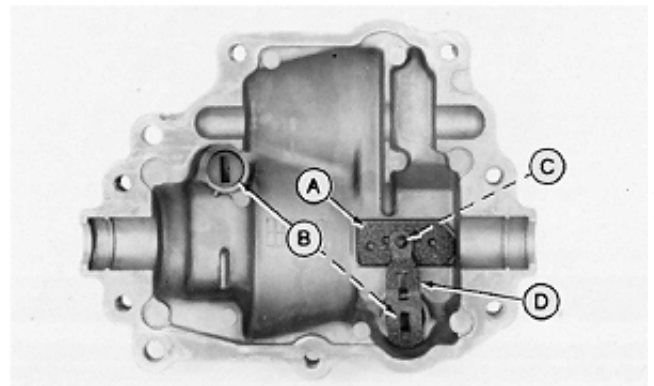
MX,5310BV,6 -19-01OCT92

M52577 -UN-12DEC88

IMPORTANT: Detent plate (A) must be installed with chamfered holes face up.

10. Install plate (A), supports (B), ball (C) and spring (D).

- A—Detent Plate
- B—Fork Supports
- C—Detent Ball
- D—Spring

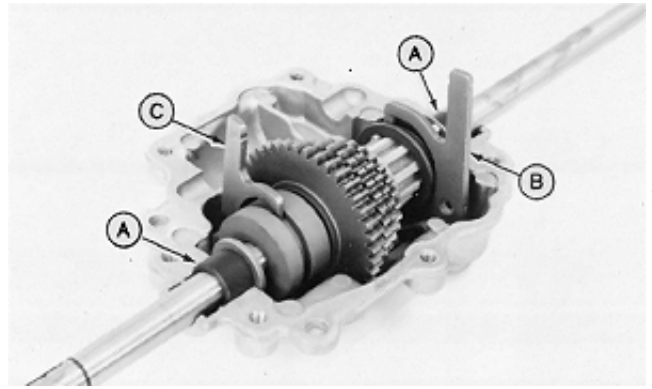


MX,5310BV,7 -19-01OCT92

M52578 -UN-12DEC88

IMPORTANT: Locating tab of each bushing (A) must be positioned in the bore of transaxle lower case.

11. Install shift fork (B) and clutch fork (C).
12. Install axle shaft assembly to transaxle lower case.



Early Model Shown

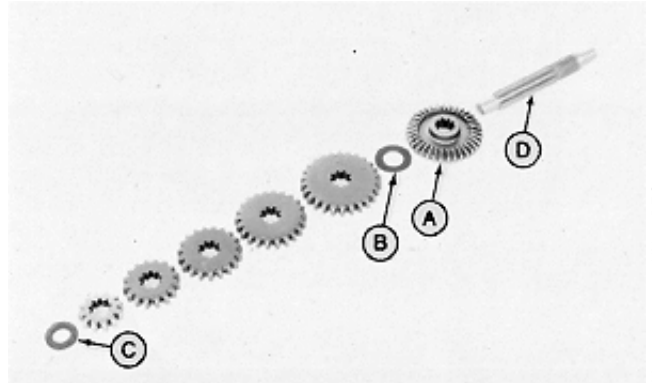
MX,5310BV,8 -19-16JUL96

M52579 -UN-12DEC88

IMPORTANT: Gears must be installed with tooth bevel facing ring gear (A).

13. Assemble gear (A), washer (B), gears and washer (C) to shaft (D).

- A—Ring Gear
- B—Washer
- C—Washer
- D—Reduction Shaft



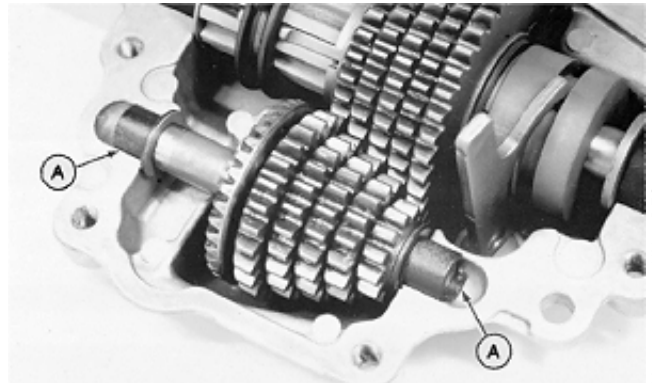
MX,5310BV,9 -19-01OCT92

M52580 -UN-12DEC88

14. Install bushings (A) to reduction shaft with locating tab away from gear assembly.

IMPORTANT: Locating tabs of bushings must be positioned in transaxle lower case bore.

15. Install reduction shaft assembly to transaxle lower case.

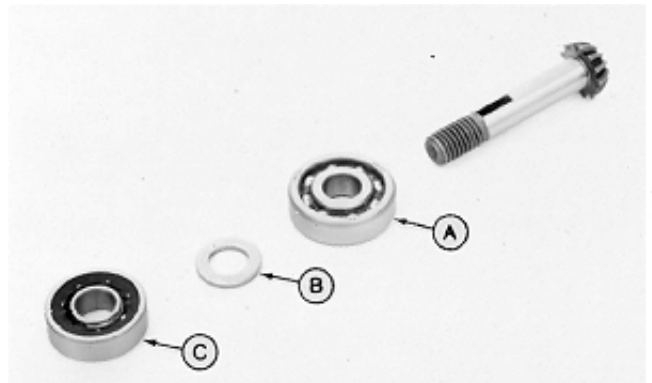


MX,5310BV,10 -19-01OCT92

M52442 -UN-12DEC88

IMPORTANT: Bearing (C) must be installed with seal side away from pinion gear.

16. Assemble bearing (A), washer (B) and bearing (C) to input shaft.



MX,5310BV,11 -19-01OCT92

M52383 -UN-12DEC88

Disassemble and Assemble Transaxle/Kansaki 5-Speed Transaxle

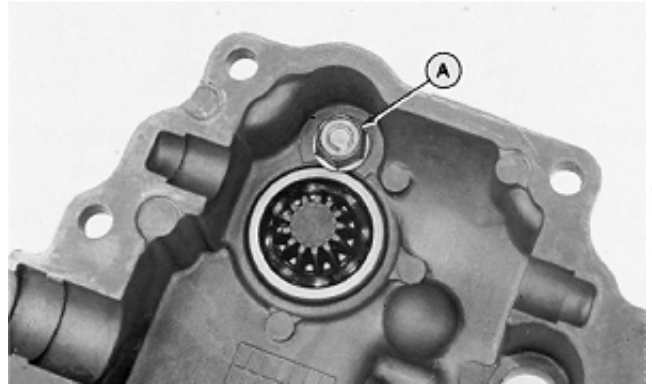
17. Install input shaft assembly to transaxle upper case. Secure with anchor cap screw (A).

18. Pack transaxle lower case with 70 g (2.5 oz) of John Deere Non-Clay High-Temperature EP Grease®—JDM J13E4, NLGI Grade 2 (North America) or GREASE-GARD™—JDM J13E4, NLGI Grade 2 (Europe)(or equivalent).

IMPORTANT: DO NOT get sealant into gear case.

19. Apply TY6299 Low Strength Sealant to transaxle lower case sealing surface.

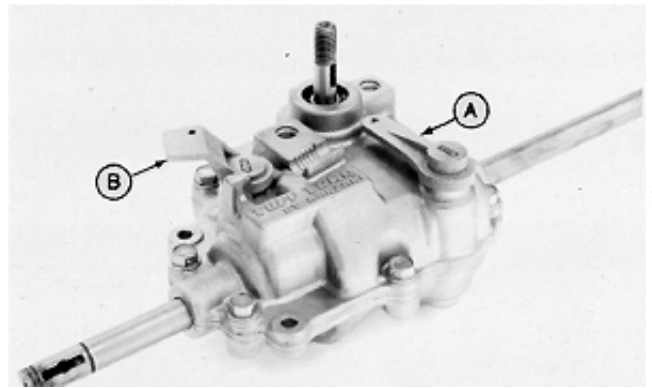
20. Install transaxle upper case to lower case. Install cap screws and tighten to **9.8 N·m (159 lb-in.)**.



M52388 -UN-12DEC88

MX,5310BV,12 -19-16JUL96

21. Install shift lever (A) and clutch lever (B).



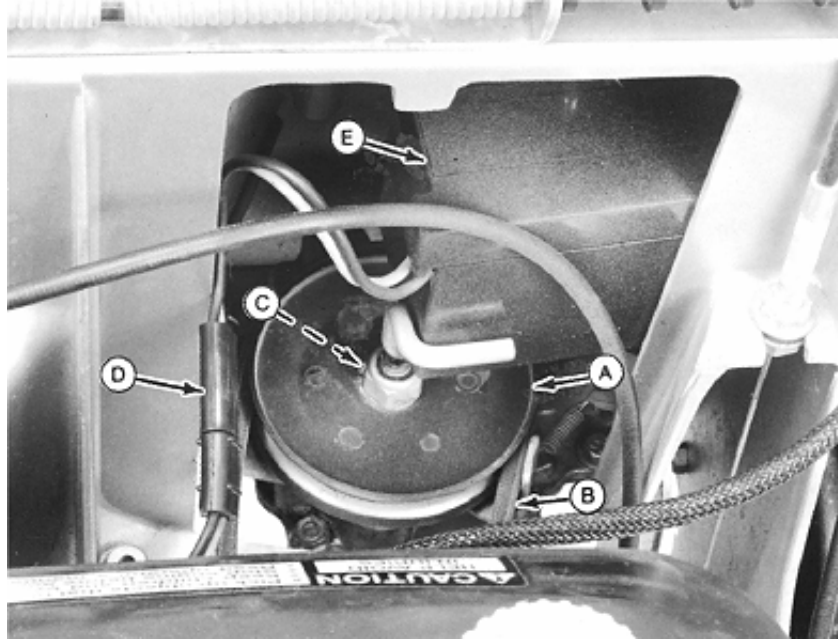
M52389 -UN-12DEC88

MX,5310BV,13 -19-01OCT92

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REMOVE AND INSTALL SHIFT CABLE AND LEVER ASSEMBLY (12SB, 14SB, 14SC/14SX AND 14SE)



M42909 -UN-31AUG92

- | | | | |
|----------------|------------|---------------------|-----------|
| A—Drive Sheave | C—Lock Nut | D—Battery Connector | E—Battery |
| B—Drive Belt | | | |

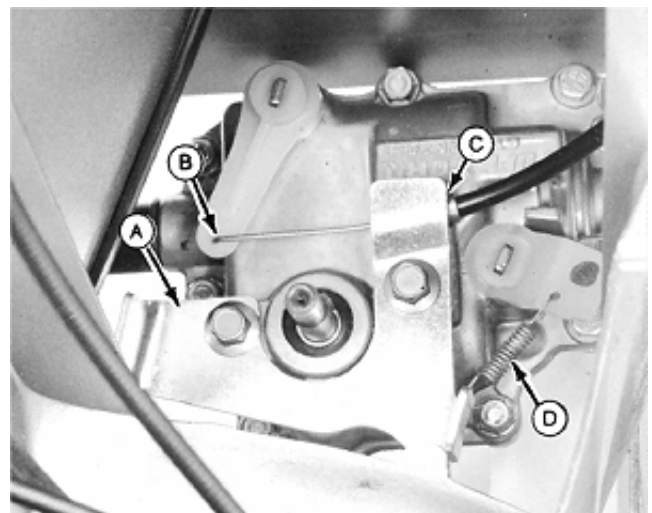
1. Remove mower deck cover.
2. Remove lock nut (C), drive sheave (A), and drive belt (B). On 14SE models only, disconnect battery connector (D) and remove battery (E).

MX,5315BV,1 -19-16JUL96

IMPORTANT: DO NOT stretch the clutch spring (D); otherwise, the clutch arm will not move into neutral and allow the transaxle to freewheel backwards.

3. Carefully disconnect clutch spring (D). DO NOT stretch the spring.
4. Remove belt guide bracket (A) to disengage sheath end (C) and disconnect shift cable (B) from shift arm.
5. Remove all tie straps.

- | |
|----------------------|
| A—Belt Guide Bracket |
| B—Shift Cable |
| C—Sheath End |
| D—Clutch Spring |



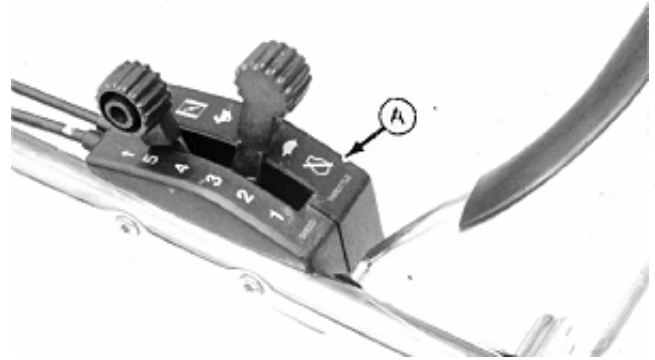
M42945 -UN-17SEP92

MX,5315BV,2 -19-16JUL96

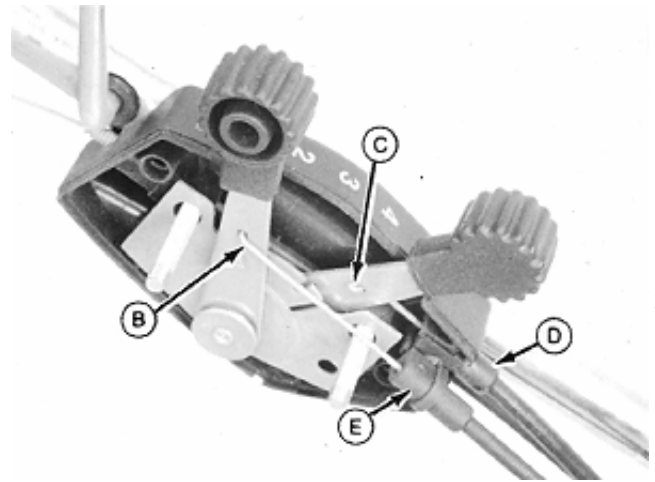
Shift Cable and Lever Assembly/Remove and Install Shift Cable and Lever

6. Remove throttle and shift lever assembly cover (A).
7. Pull control lever bracket off mounting screws and unhook shift cable (C).
8. Inspect components and replace as necessary.
9. Install new shift cable (C) and put lever assembly onto mounting screws.
10. Seat shift cable sheath anchor (D) and throttle cable sheath anchor (E) into their cover slots.
11. Install cover (you may have wiggle the control lever assembly to make cover halves snap together).
12. Run cables along left handlebar. Install tie straps as before.

- A—Cover
- B—Throttle Cable
- C—Shift Cable
- D—Shift Cable Sheath Anchor
- E—Throttle Cable Sheath Anchor



M42801 -UN-17SEP92



M42801 -UN-17SEP92

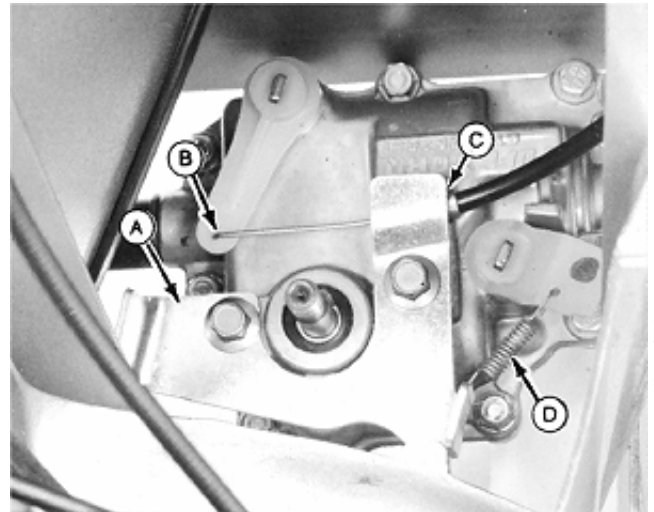
MX,5315BV,3 -19-01OCT92

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13. Connect new shift cable (B) to shift arm.
14. Move shift lever into 5th gear position and push shift arm all the way to the right (as viewed from the operator's station) to ensure 5th gear is engaged.
15. Seat ridge of sheath end (C) into transaxle slot and install belt guide bracket (A).

IMPORTANT: DO NOT stretch clutch spring (D); otherwise, clutch arm will not move into neutral completely to allow transaxle to freewheel backwards.

16. Carefully install clutch spring (D). DO NOT stretch clutch spring.
17. Install drive belt, sheave, and lock nut. Tighten lock nut to specification. On 14SE models only, install battery and make connection to harness.
18. Install mower deck cover.



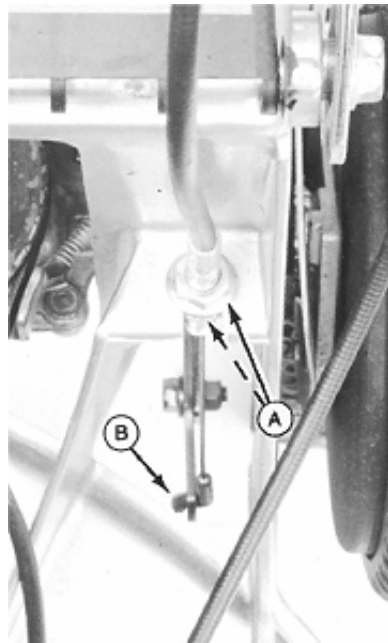
A—Belt Guide Bracket
B—Shift Cable
C—Sheath End
D—Clutch Spring

M42945 -JUN-17SEP92

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MX_5315BV_4 -19-16JUL96

REMOVE AND INSTALL CLUTCH CABLE AND BAIL (12SB, 14SB, 14SC/14SX AND 14SE)



Early Model Shown

M42803 -UN-17SEP92



M42802 -UN-17SEP92

**A—Clutch Cable Adjuster
Jam Nuts**
**B—Lower Clutch Cable
Anchor**

C—Cable Clamp
D—Clutch Cable

E—Clutch Bail
**F—Upper Clutch Cable
Anchor**

1. Remove mower deck cover.
2. Early Model - Loosen adjuster jam nuts (A) and disconnect lower anchor (B) to remove clutch cable from mower deck mounting.

Late Model - Remove transaxle bracket to access cable eyelet. Remove shoulder bolt and nut to disconnect eyelet.
3. Remove all tie straps.
4. Remove throttle and shift lever assembly nuts.
5. Slide lever assembly away from handlebar. Remove screw, clutch cable (D) and clamp (C). Disconnect upper cable anchor (F) from bail.

6. Remove bail by pulling opposite end from right handlebar then the left handlebar.
7. Inspect and replace components as necessary.
8. Install bail and clutch cable in reverse order.
9. Early Model - Hook lower anchor into linkage before installing adjuster into mounting slot.

Late Model - Install cable eyelet using shoulder-bolt and nut. Install transaxle bracket.
10. Install tie straps as before.
11. Adjust clutch cable.
12. Install mower deck cover.

53
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1

Clutch Cable and Bail Assembly/Remove and Install Clutch Cable and Bail

53
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2

Section 80

MISCELLANEOUS REPAIR

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REMOVE AND INSTALL FRONT WHEELS—RESIDENTIAL MOWER (14PZ ONLY)



M42805 -JUN-17SEP92



M42793 -JUN-17SEP92

1. Raise and support mower.
2. Remove cap (A) from wheel.
3. Remove shoulder bolt (B) and lock nut (C) to remove front wheels.
4. Clean and inspect components. Replace as necessary.

IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

5. Install front wheels in reverse order of removal. Tighten wheel mounting cap screw to **25 N-m (222 lb-in.)**.

MX,8005BV,1 -19-16JUL96

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REMOVE AND INSTALL FRONT WHEELS—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14SB, 14SE, 14ST AND 14SZ)

1. Raise and block mower deck.
2. Remove cap (A), shoulder bolt (B), and washer (C) to remove front wheels.
3. Clean and inspect all components, including inside sealed bearing (D) and outside bushing (E). Replace components as necessary.

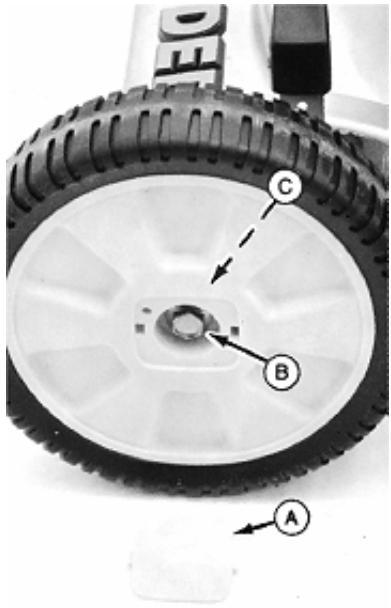
IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

NOTE: All wheel washers are hardened. DO NOT replace with soft washers.

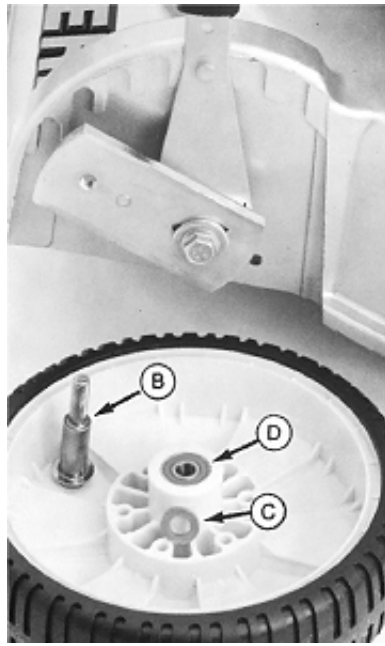
4. Install rear wheels in reverse order of removal. Install bearing and bushing flush with wheel hubs. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

MX,8005BV,3 -19-16JUL96

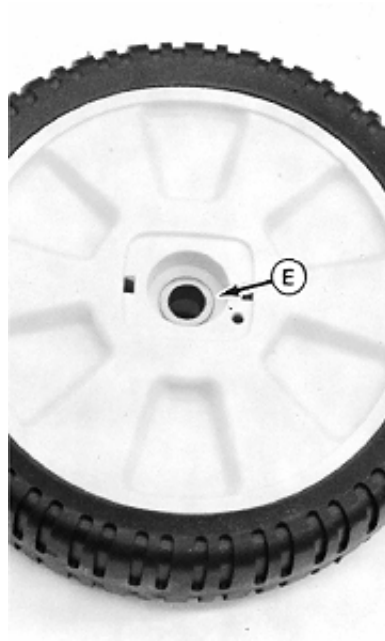
Wheels/Remove and Install Front Wheels



M42842 -UN-17SEP92



M42843 -UN-17SEP92



M42844 -UN-17SEP92

- A—Cap
- B—Shoulder Bolt
- C—Washer
- D—Sealed Bearing
- E—Bushing

MX,8005BV,3A -19-01OCT92

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REMOVE AND INSTALL FRONT WHEELS—COMMERCIAL MOWERS (12PC AND 14SC/14SX)

1. Raise and block mower deck.
2. Remove cap screw (A), small washer (B), and lock nut (C) to remove front wheels.
3. Clean and inspect components, including sealed bearings (D) and bushing (E). (Bearings and bushing must be removed or installed using a hydraulic press.) Replace components as necessary.

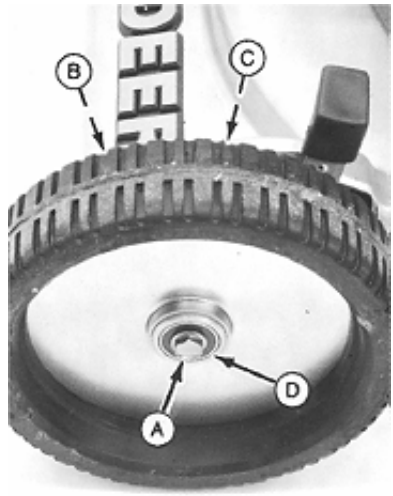
IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

NOTE: All wheel washers used are hardened. DO NOT replace with soft washers.

4. Install front wheels in reverse order of removal. Install bearings and bushing flush with wheel hubs. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

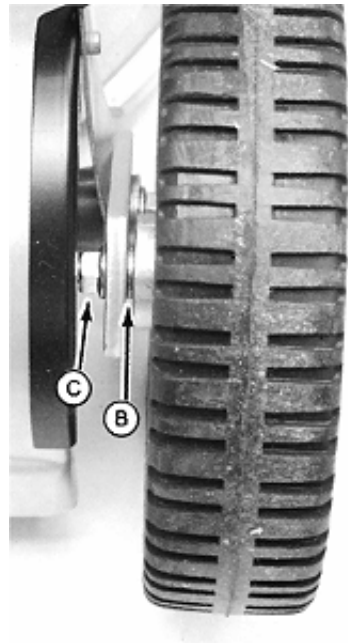
MX,8005BV,6 -19-16JUL96

Wheels/Remove and Install Front Wheels



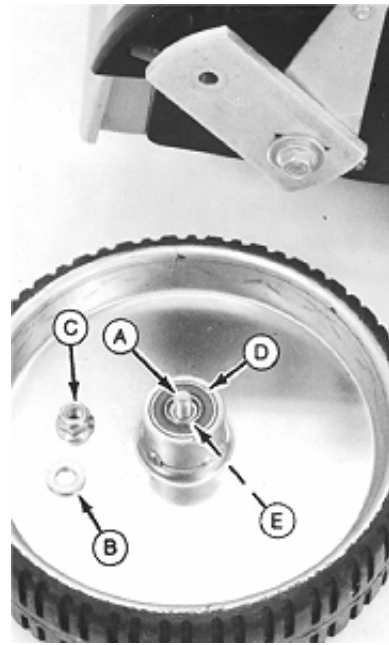
-UN-17SEP92

M42953



-UN-17SEP92

M42954



-UN-17SEP92

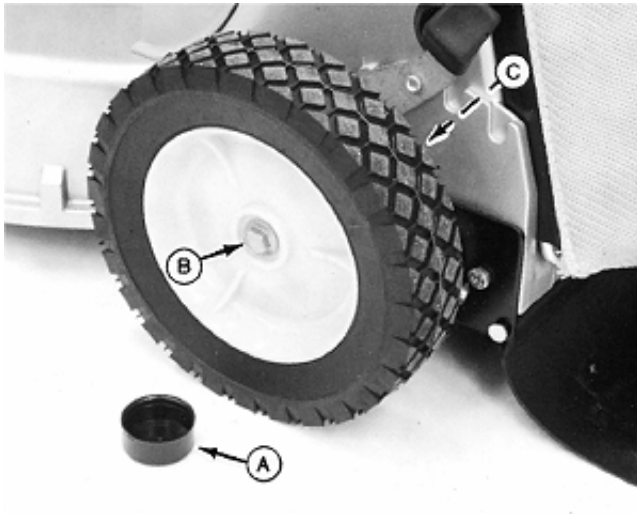
M42955

- A—Cap Screw
- B—Small Washer
- C—Lock Nut
- D—Sealed Bearings (2 used)
- E—Bushing

MX,8005BV,6A -19-01OCT92

51958

REMOVE AND INSTALL REAR WHEELS—RESIDENTIAL MOWER (14PZ ONLY)



NOTE: Rear wheels use an additional large washer (C) on backside of wheel. These wheel washers are hardened. DO NOT replace with soft washers.

1. Raise and support mower.
2. Remove cap (A) from wheel.
3. Remove shoulder bolt (B) and large washer (C) to remove rear wheels.

4. Clean and inspect components. Replace as necessary.

IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

5. Install rear wheels in reverse order of removal. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

MX,8005BV,2 -19-16JUL96

Wheels/Remove and Install Rear Wheels

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REMOVE AND INSTALL REAR WHEELS—RESIDENTIAL PUSH MOWERS (12PB, 14PB AND 14PT)

1. Raise and block mower deck.
2. Remove cap (A), shoulder bolt (B), small washer (C), and two large washers (D) to remove rear wheels.
3. Clean and inspect components, including bushing (E) and sealed bearing (F). Replace as necessary.

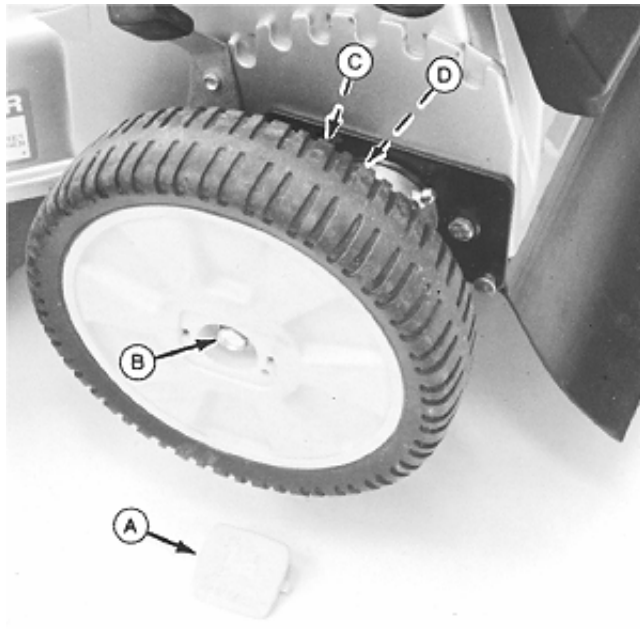
IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

NOTE: Rear wheels use additional large washers on backside of wheel. All wheel washers used are hardened. DO NOT replace with soft washers. Small washer (C) is installed next to sealed bearing (F).

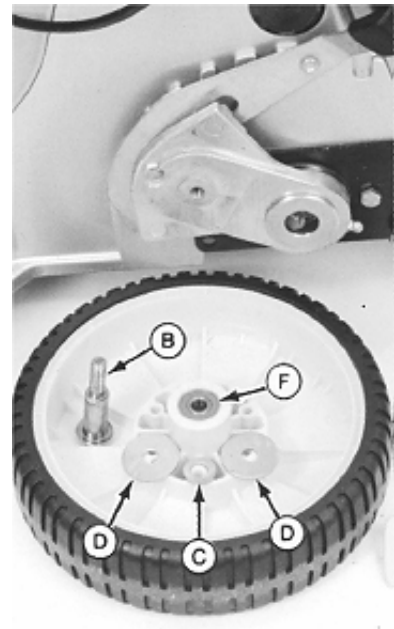
4. Install rear wheels in reverse order of removal. Install bearing and bushing flush with wheel hubs. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

MX,8005BV,4 -19-16JUL96

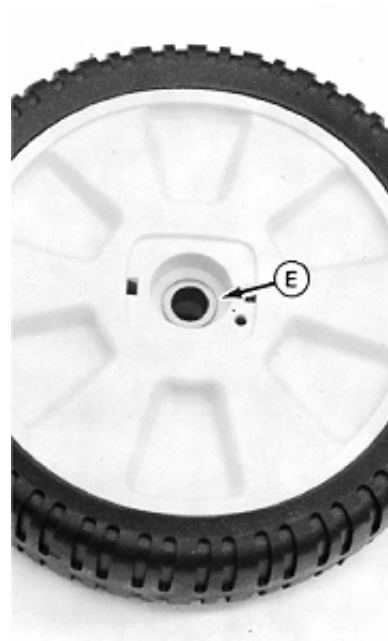
Wheels/Remove and Install Rear Wheels



M42795 -UN-30JUL92



M42950 -UN-17SEP92



M42844 -UN-17SEP92

- A—Cap
- B—Shoulder Bolt
- C—Small Washer
- D—Large Washers
- E—Bushing
- F—Sealed Bearing

MX,8005BV,4A -19-01OCT92

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REMOVE AND INSTALL REAR WHEELS—RESIDENTIAL SELF-PROPELLED MOWERS (12SB, 14SB, 14SE, 14ST AND 14SZ)

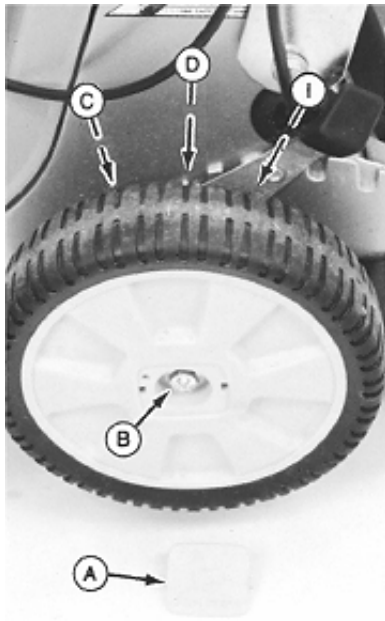
1. Raise and block mower deck.
2. Remove cap (A), shoulder bolt (B), small washer (C), and two large washers (D) to remove rear wheels.
3. Clean and inspect components, including bushing (E), sealed bearing (F), drive gear (G), and dust cover (I). Replace as necessary.

IMPORTANT: DO NOT grease or oil shoulder bolt, wheel hub, or teeth of drive gear (G). This attracts dirt which increases the wear factor of the mating surfaces.

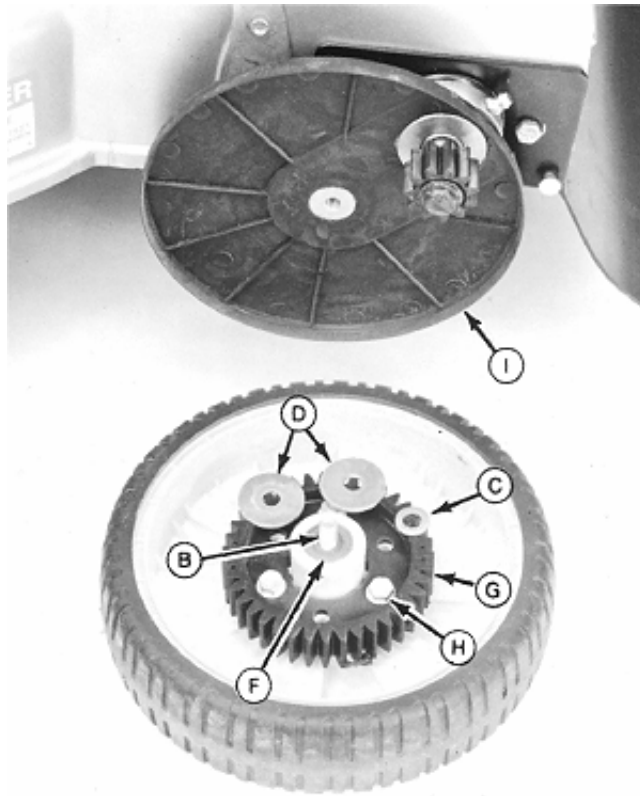
NOTE: Rear wheels use additional large washers on backside of wheel. All wheel washers used are hardened. DO NOT replace with soft washers. Small washer (C) is installed next to sealed bearing (F).

4. Install rear wheels in reverse order of removal. Install bearing and bushing flush with wheel hubs. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

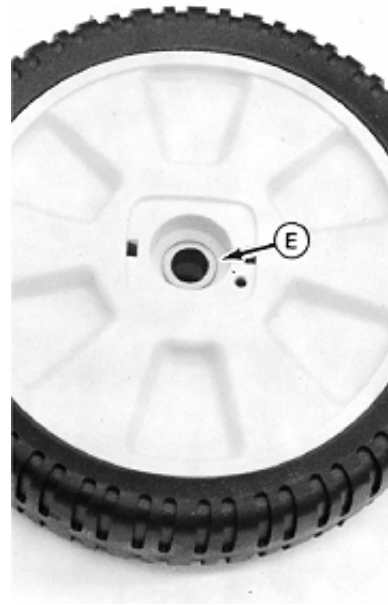
Wheels/Remove and Install Rear Wheels



M42951 -UN-17SEP92



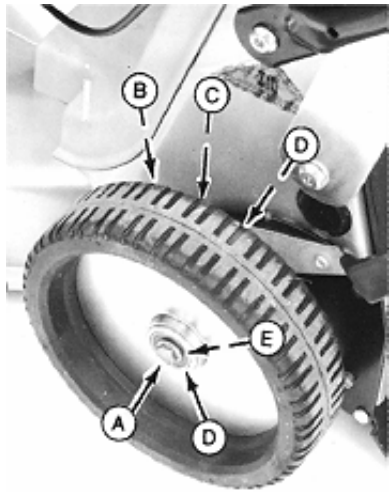
M42952 -UN-17SEP92



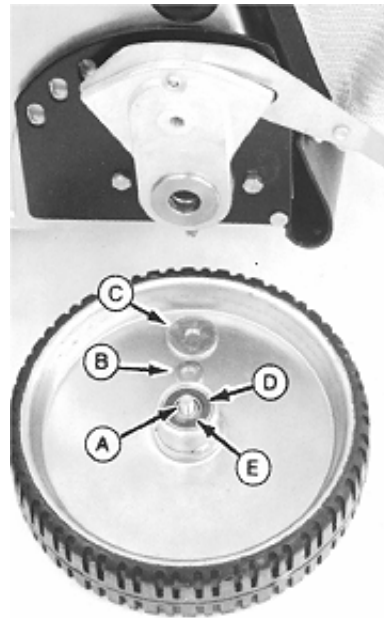
M42844 -UN-17SEP92

- | | |
|--------------------------|----------------------|
| A—Cap | E—Bushing |
| B—Shoulder Bolt | F—Sealed Bearing |
| C—Small Washer | G—Drive Gear |
| D—Large Washers (2 used) | H—Cap Screw (3 used) |
| | I—Dust Cover |

REMOVE AND INSTALL REAR WHEELS—COMMERCIAL PUSH MOWER (12PC ONLY)



M42956 -UN-17SEP92



M42957 -UN-17SEP92

A—Cap Screw
B—Small Washer

C—Large Washer

D—Sealed Bearings (2 used) E—Bushing

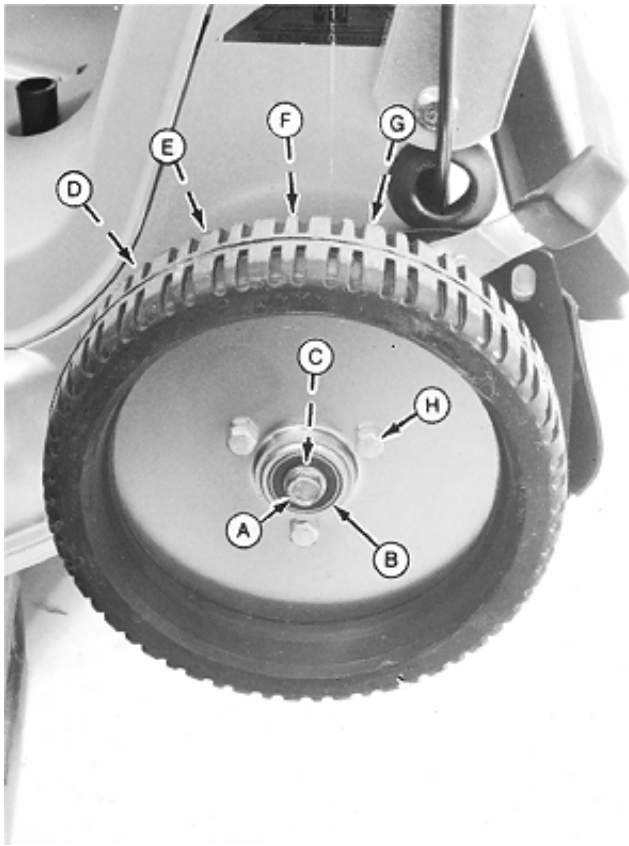
1. Raise and block mower deck.
2. Remove cap screw (A), small washer (B), and large washer (C) to remove rear wheels.
3. Clean and inspect components, including sealed bearings (D) and bushing (E). (Bearings and bushing must be removed or installed using a hydraulic press.) Replace components as necessary.

NOTE: All wheel washers used are hardened. DO NOT replace with soft washers.

4. Install rear wheels in reverse order of removal. Install bearings and bushing flush with wheel hubs. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.

IMPORTANT: DO NOT grease or oil shoulder bolt or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

REMOVE AND INSTALL REAR WHEELS—SELF-PROPELLED MOWER (14SC/14SX ONLY)



M42958 -JUN-17SEP92



M42959 -JUN-17SEP92

- A—Cap Screw
- B—Sealed Bearings (2 used)
- C—Bushing
- D—Small Washer
- E—Large Washer

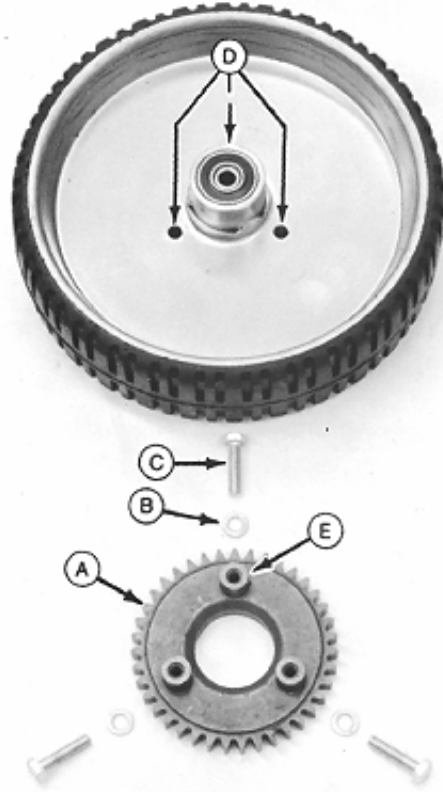
- F—Dust Cover
- G—Drive Gear (39T)
- H—Cap Screws and Lock Washers (3 used)

1. Raise and block mower deck.
2. Remove cap screw (A), small washer (D), and large washer (E) to remove rear wheels.

3. Clean and inspect components, including sealed bearings (B) and bushing (C), dust cover (F), and drive gear (G). Replace components as necessary. Bearings and bushing must be removed or installed using a hydraulic press and driver set.

MX,8005BV,8 -19-16JUL96

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M42960 -JUN-17SEP92

A—Drive Gear
B—Lock Washer (3 used)

C—Cap Screw (3 used)

D—Wheel Holes

E—Mounting Embossments

4. Remove three cap screws (C) and lock washers (B) to remove drive gear (A). Match three raised mounting embossments (E) with three wheel holes (D) and fasten with three lock washers and cap screws.

IMPORTANT: DO NOT grease or oil drive gear, shoulder bolt, or wheel hub. This attracts dirt which increases the wear factor of the mating surfaces.

NOTE: All wheel washers used are hardened. DO NOT replace with soft washers.

5. Install rear wheels in reverse order of removal. Install bearings and bushing flush with each end of wheel hubs. Tighten three drive gear cap screws to **11 N-m (97 lb-in.)** and wheel mounting cap screw to **25 N-m (222 lb-in.)**

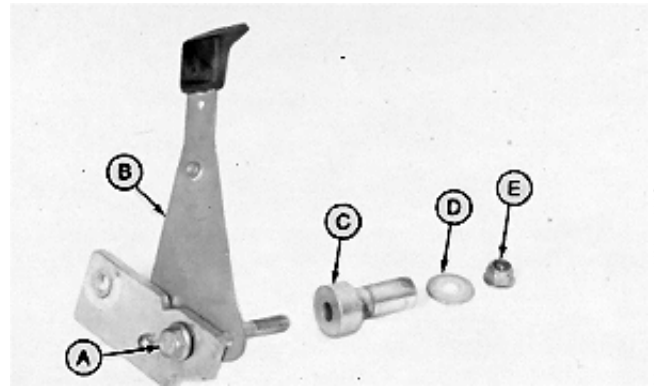
MX.8005BV.9 -19-16JUL96

80-05-14

REMOVE AND INSTALL FRONT HEIGHT ADJUSTER—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ)

EARLY MODEL MOWERS (12PB, 12SB, 14PB, 14SB, 14SE AND 14PZ)

1. Remove wheel.
2. Remove parts (A through E).
3. Inspect parts for wear or damage. Replace as necessary.
4. Install all parts and front wheel. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.



Early Model Residential Mowers

- A—Cap Screw
- B—Height Adjuster
- C—Spacer
- D—Washer
- E—Lock Nut

MX,8010BV,1 -19-16JUL96

M54419 -JUN-06AUG90

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**REMOVE AND INSTALL FRONT HEIGHT ADJUSTER—RESIDENTIAL MOWERS
(12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ)
(CONTINUED)**

**LATE MODEL MOWERS (12PB, 12SB, 14PB, 14PT,
14PZ, 14SB, 14SE, 14ST AND 14SZ)**

1. Remove front wheel.

*NOTE: Scribe a match mark on wheel bracket (C),
adjuster lever (D), and triangular faced
bushing (E) before disassembly to ensure
correct assembly later on.*

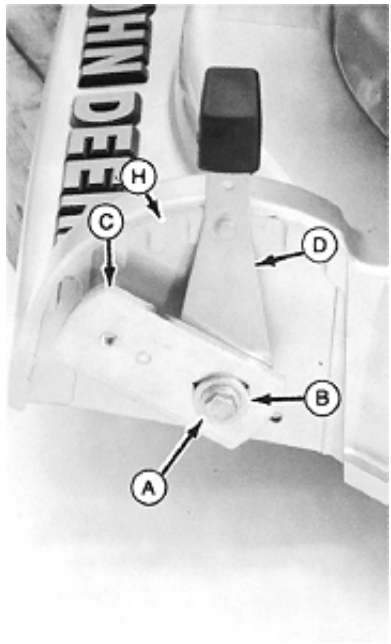
2. Remove parts (A through F).

3. Inspect and replace parts as necessary, including
mower deck adjuster slots (H). If adjuster slots are
damaged, you may install the commercial adjuster
plate rather than replace the entire mower deck
frame.

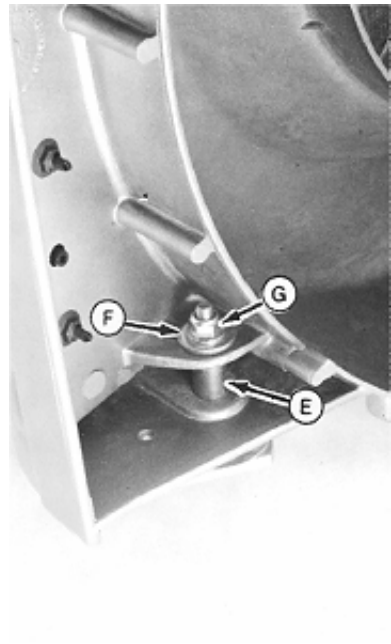
4. Install all parts and front wheel. Tighten wheel
mounting cap screw to **25 N·m (222 lb-in.)**.

MX,8010BV,2 -19-16JUL96

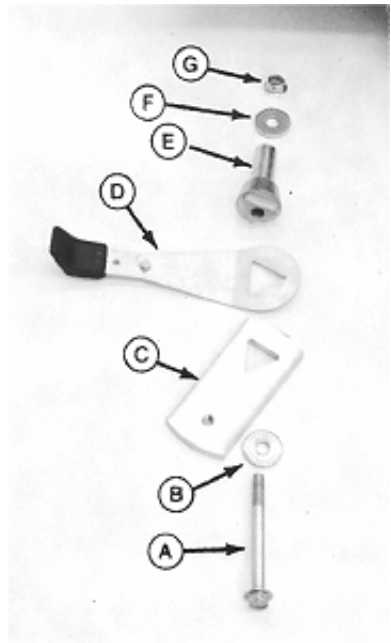
Wheel Height Adjusters/Remove and Install Front Adjusters



M42961 -UN-17SEP92



M42962 -UN-17SEP92

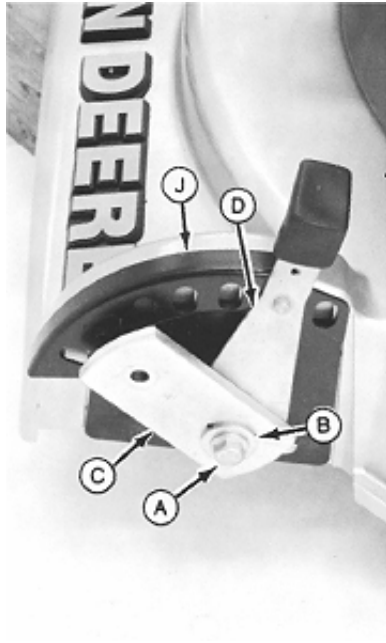


M42963 -UN-17SEP92

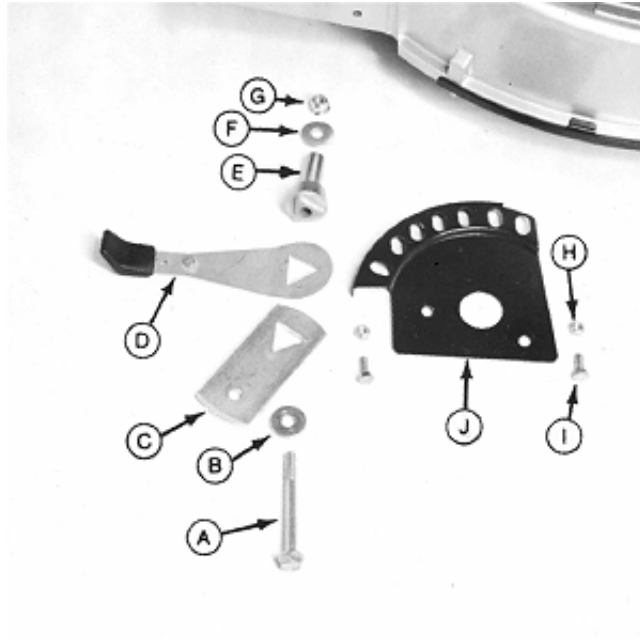
- A—Cap Screw
- B—Washer
- C—Wheel Bracket
- D—Adjuster Lever
- E—Triangular Faced Bushing
- F—Washer
- G—Lock Nut
- H—Adjuster Slots

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REMOVE AND INSTALL FRONT HEIGHT ADJUSTER—COMMERCIAL MOWERS (14PC AND 14SC/14SX)



M42966
-UN-17SEP92



M42967
-UN-17SEP92

A—Cap Screw
B—Washer
C—Wheel Bracket

D—Adjuster Lever
E—Triangular Bushing
F—Washer

G—Lock Nut
H—Lock Nuts (2 used)

I—Cap Screws (2 used)
J—Wear Plate

1. Remove wheel.

NOTE: Mark components (C, D, and E) before disassembly so you can install them correctly, later on.

2. Remove parts (A—G).

3. Inspect and replace components as necessary.

4. Install components in reverse order. Install front wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.

Wheel Height Adjusters/Remove and Install Front Adjusters

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REMOVE AND INSTALL REAR HEIGHT ADJUSTER—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ)

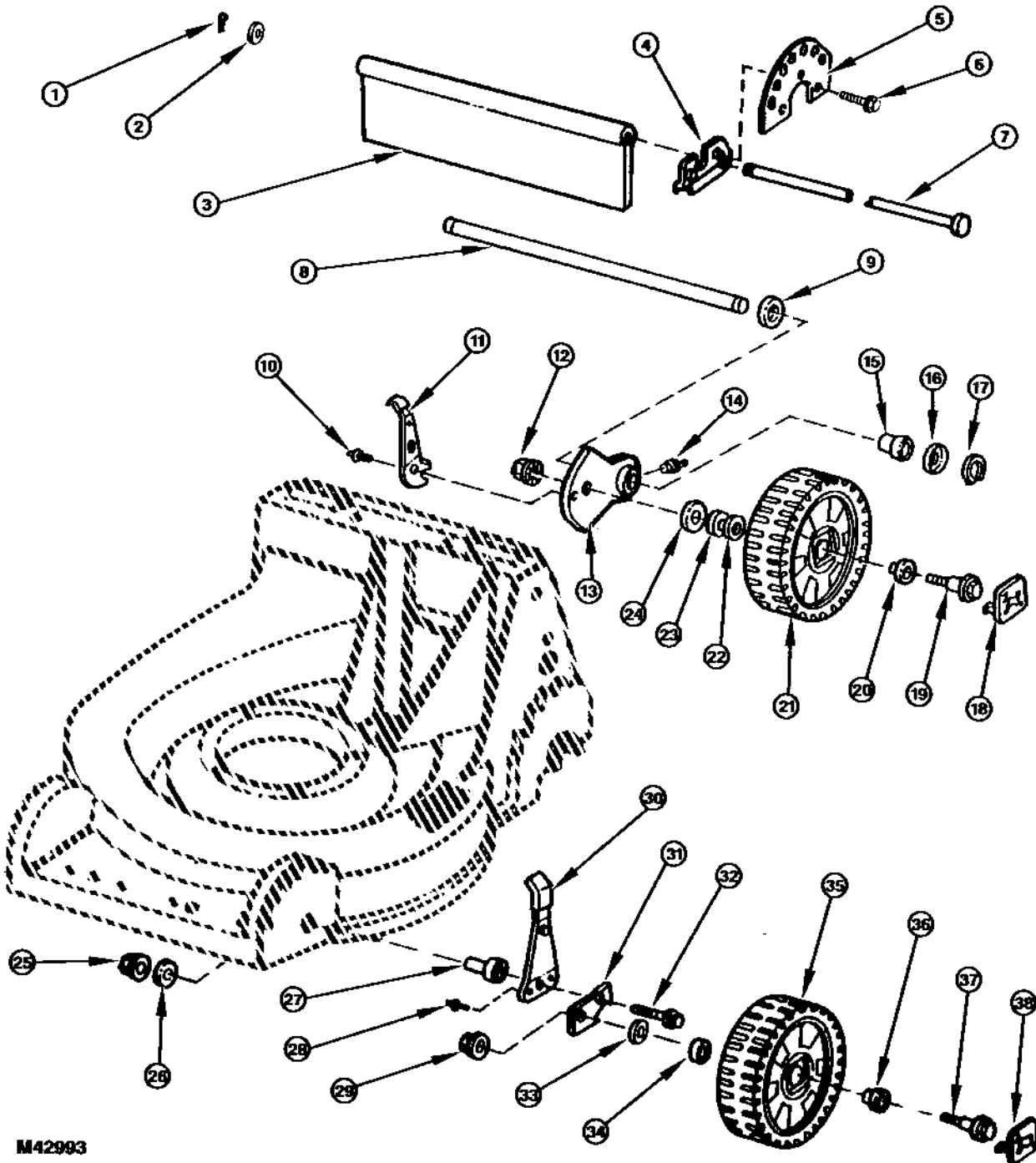
1—Cotter Pin	11—Adjuster Lever	21—Rear Wheel	30—Adjuster Lever
2—Washer	12—Lock Nut	22—Sealed Bearing	31—Adjuster Bracket
3—Safety Shield	13—Adjuster Bracket	23—Washer	32—Cap Screw
4—Wear Plate Bracket	14—Grease Fitting	24—Washer	33—Washer
5—Wear Plate	15—Bushing	25—Lock Nut	34—Sealed Bearing
6—Cap Screw (2 used)	16—Washer	26—Washer	35—Front Wheel
7—Safety Shield Rod	17—Snap Ring	27—Bushing	36—Bushing
8—Support Rod	18—Cap	28—Rivet	37—Shoulder Bolt
9—Bushing	19—Shoulder Bolt	29—Lock Nut	38—Cap
10—Rivet	20—Bushing		

EARLY MODEL PUSH MOWERS (12PB, 14PB AND 14PZ)

1. Remove rear wheel.
2. Remove snap ring (17), washer (16), and height adjuster (13).
3. Inspect and replace parts as necessary, including support rod (8), bushing (9), and mower deck

adjuster slots. If adjuster slots are damaged, you may install the service wear plate (5) or the commercial adjuster plate rather than replace the entire mower deck frame.

4. Install components in reverse order. Install rear wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.



M42993

EARLY MODEL RESIDENTIAL PUSH MOWERS

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M42993 -UN-17SEP92

REMOVE AND INSTALL REAR HEIGHT ADJUSTER—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ) (CONTINUED)

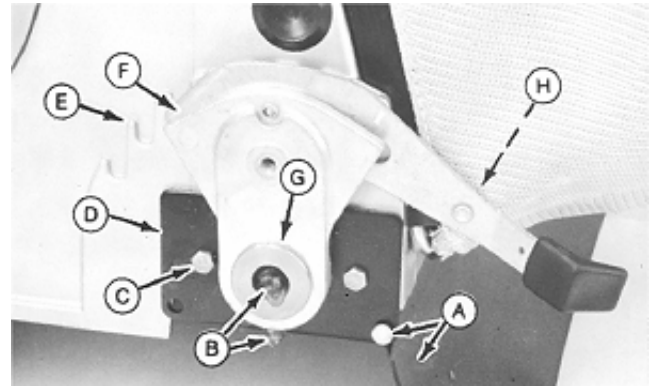
LATE MODEL PUSH MOWERS (12PB, 14PB, 14PT AND 14PZ)

1. Remove wheel.
2. Remove safety shield and rod (A), mounting bracket cap screws and lock nuts (C), and adjuster assembly (F).

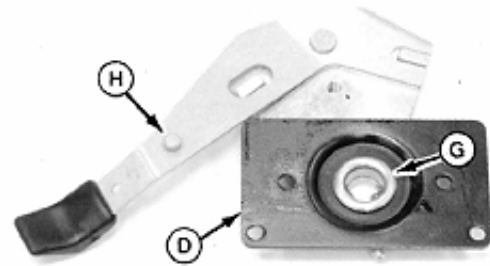
NOTE: Bushing (G) is form fitted to mounting bracket (D) and adjuster assembly (F). If it is worn or damaged, you must replace the entire assembly.

3. Inspect and replace components as necessary, including grease fitting and channel (B), mounting bracket (D), bushing (G), adjuster pin (H), and mower deck adjuster slots (E). You should use the commercial wear plate rather than replace the entire mower deck frame.

4. Install components in reverse order. Install wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.



M42964 -JUN-17SEP92



M42965 -JUN-17SEP92

- A—Safety Shield and Rod
- B—Grease Fitting and Channel
- C—Cap Screws and Lock Nuts (2 used)
- D—Mounting Bracket
- E—Mower Deck Adjuster Slots
- F—Adjuster Assembly
- G—Bushing
- H—Adjuster Pin

MX,8010BV,4 -19-16JUL96

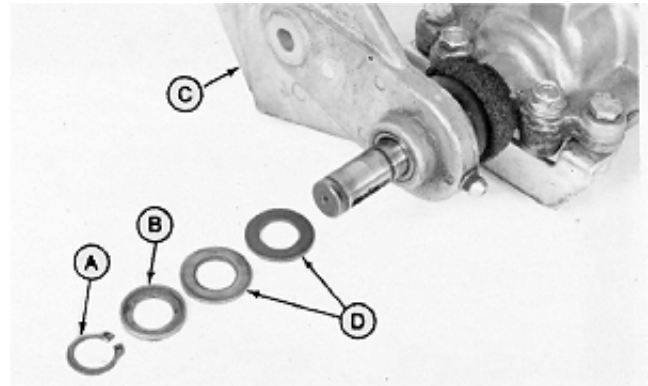
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REMOVE AND INSTALL REAR HEIGHT ADJUSTER—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ)

EARLY MODEL SELF-PROPELLED MOWERS (12SB, 14SB, 14SE AND 14SZ)

1. Remove rear wheel.
2. Move height adjuster (C) inward and remove parts (A through D).
3. Inspect and replace parts as necessary, including plastic bushing, washer, and foam washer (shown between height adjuster (C) and transaxle).

NOTE: Washer (B) must be installed with recess facing out.



Early Self-Propelled Mower Shown

- A—Snap Ring
- B—Collar Washer
- C—Height Adjuster
- D—Washers (2 used)

MX,8010BV,5 -19-16JUL96

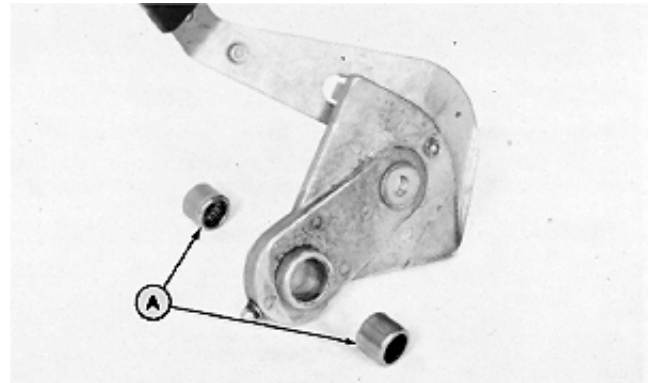
M54418 -UN-06AUG90

NOTE: Remove bushings only if replacement is necessary.

4. Inspect bushings for wear or damage. Replace if necessary.
5. Replace bushings (A) using a bearing, bushing and seal driver set.

IMPORTANT: Install bushings with letters facing toward the outside.

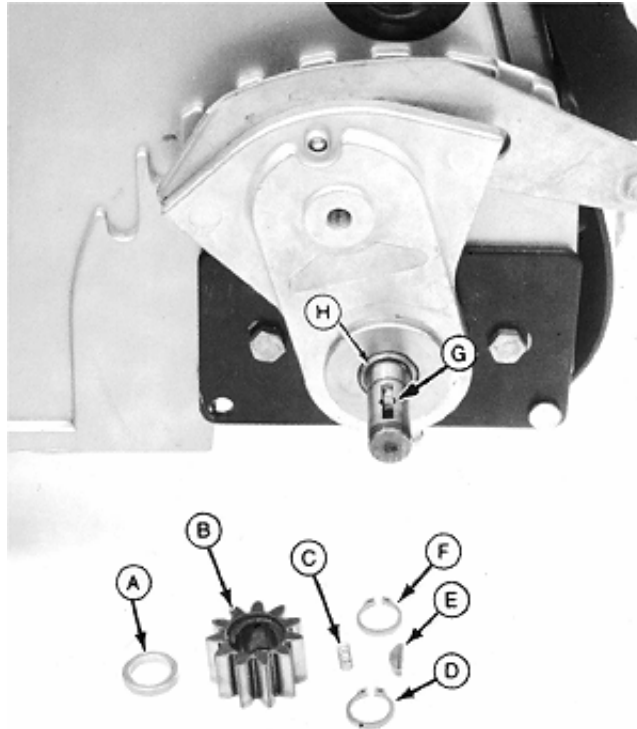
6. Install bushings flush with adjuster.
7. Install components in reverse order. Install rear wheel. Tighten wheel mounting cap screw to **25 N·m (222 lb-in.)**.



MX,8010BV,5A -19-16JUL96

M54420 -UN-06AUG90

**REMOVE AND INSTALL REAR HEIGHT ADJUSTER—RESIDENTIAL MOWERS
(12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ) (CONTINUED)**



M42932 -UN-10SEP92

A—Washer
B—Pinion Gear

C—Spring
D—Snap Ring

E—Key
F—Snap Ring

G—Axle Keyway
H—Bushing

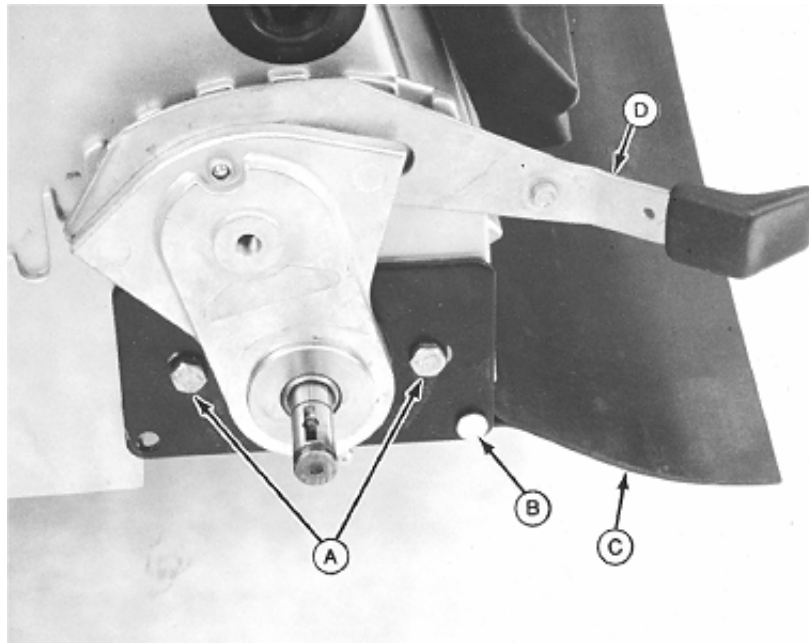
**LATE MODEL SELF-PROPELLED MOWERS (12SB,
14SB, 14SE, 14ST AND 14SZ)**

1. Remove rear wheel.

2. Remove outer snap ring (D), washer (A), pinion gear (B), key (E) and spring (C) from axle keyway (G), and inner snap ring (F).

MX,8010BV,6 -19-16JUL96

Wheel Height Adjusters/Remove and Install Rear Adjusters



A—Cap Screws and Lock Nuts (2 used)

B—Rod

C—Safety Shield

D—Adjuster Lever

3. Remove cotter pin and washer from opposite end to remove rod (B) and safety shield (C).

4. Safely raise and block transaxle. Move adjuster lever (D) rearward until you can remove cap screws and lock washers (A) to remove rear height adjuster assembly.

5. Inspect and replace components as necessary, including bushing (H) in first photo.

NOTE: Pinion gear has a recessed side and a flat side. The recessed side and bushing MUST

be installed facing the left side of the machine (from operators station) on both sides of the machine.

If installed incorrectly, the machine will not drive forward when traction bail is engaged, and reverse freewheel turns will lock-up in one direction or the other.

6. Install components in reverse order. Install rear wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.

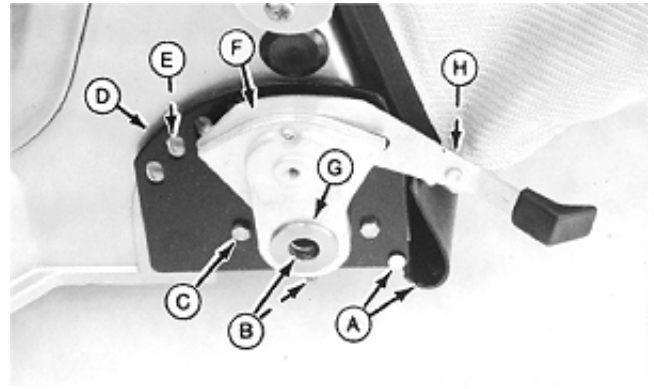
MX,8010BV,6A -19-16JUL96

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REMOVE AND INSTALL REAR HEIGHT ADJUSTER—COMMERCIAL MOWERS (12PC AND 14SC/14SX)

PUSH MOWER (12PC)

1. Remove wheel.
2. Remove cotter pin and washer to remove rod and safety shield (A).
3. Safely raise and block transaxle. Move adjuster lever (F) rearward until you can remove wear plate (D) cap screws and lock washers (C) to remove rear height adjuster assembly (F).
4. Inspect and replace components as necessary, including grease fitting and channel (B), bushing (G), wear plate (D), mower deck adjuster slots (E), and adjuster lever pin (H).
5. Install components in reverse order. Install rear wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.



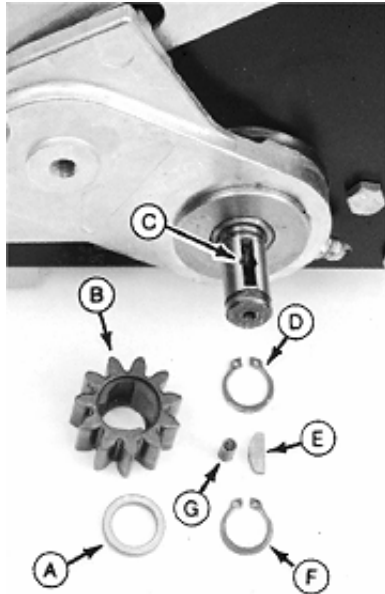
- A—Safety Shield and Rod
- B—Grease Fitting and Channel
- C—Cap Screws and Lock Washers (2 used)
- D—Wear Plate
- E—Mower Deck Adjuster Slots
- F—Adjuster Assembly
- G—Bushing
- H—Adjuster Pin

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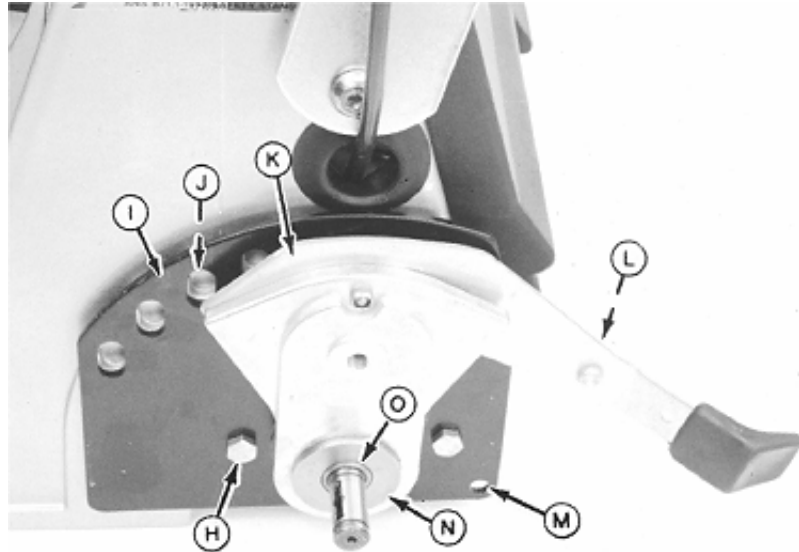
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MX,8010BV,8 -19-16JUL96

REMOVE AND INSTALL REAR HEIGHT ADJUSTER—COMMERCIAL MOWERS (12PC AND 14SC/14SX) (CONTINUED)



Left Side Shown



A—Bushing
B—Pinion Gear
C—Axle Keyway
D—Inner Snap Ring
E—Key

F—Outer Snap Ring
G—Spring
H—Cap Screws and Lock Nuts (2 used)
I—Wear Plate

J—Mower Deck Adjuster Slots
K—Adjuster Assembly
L—Adjuster Lever Pin

M—Safety Shield and Rod Mounting Hole
N—Bushing
O—Inner Bushing

SELF-PROPELLED MOWERS (14SC/14SX)

1. Remove wheel.
2. Remove safety shield and rod from rear mounting hole (M).
3. Safely raise and block transaxle. Remove outer snap ring (F), bushing (A), pinion gear (B), key (E) and spring (G) from axle keyway (C), and inner snap ring (D).
4. Move adjuster assembly (K) rearward to remove mounting cap screws (H) and lock washers.
5. Slide adjuster assembly off axle.
6. Inspect and replace components as necessary, including grease fitting, inner bushing (O), formed

bushing (N), wear plate (I), mower deck adjuster slots (J), and adjuster lever pin (L).

NOTE: Pinion gear (B) has a recessed side and a flat side. The recessed side and bushing (A) MUST be installed facing the left side of the machine (from operators station) on both sides of the machine.

If installed incorrectly, the machine will not drive forwards when traction bail is engaged, and reverse freewheel turns will lock-up in one direction or the other.

7. Install components in reverse order. Install rear wheel and tighten mounting cap screw to **25 N·m (222 lb-in.)**.

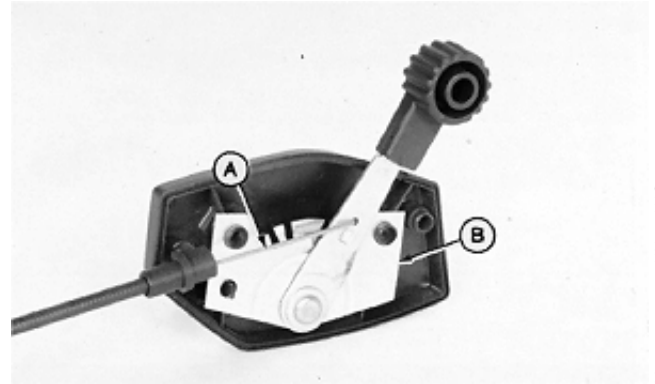
Wheel Height Adjusters/Remove and Install Rear Adjusters

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14

**REMOVE AND INSTALL THROTTLE CABLE
AND CONTROL LEVER—PUSH MOWERS
(12PB, 12PC, 14PB, 14PT AND 14PZ)**

**EARLY MODEL PUSH MOWERS (12PB, 12PC, 14PB
AND 14PZ)**

1. Remove throttle control lever assembly from handlebar.
2. Pry apart control lever housing.
3. Remove lever (B).
4. Disconnect cable (A).
5. Inspect lever for wear or damage. Replace if necessary.
6. Connect cable control lever.
7. Install throttle control lever assembly on mounting screws and install cover.



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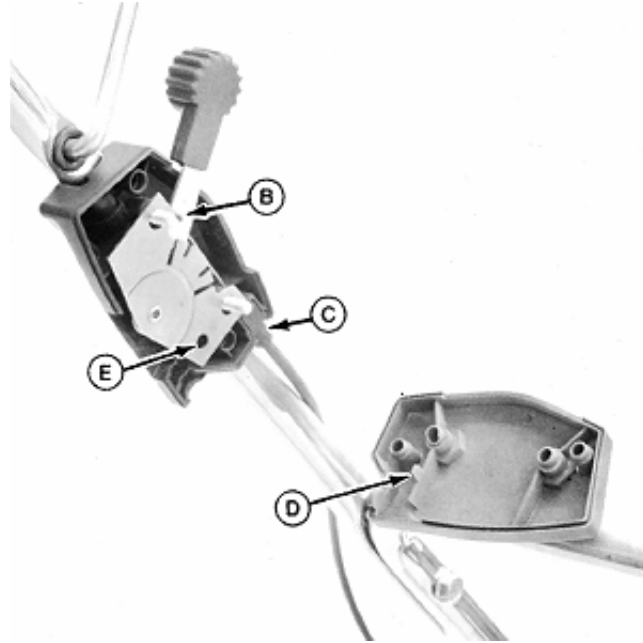
MX,8015BV,1 -19-16JUL96

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**REMOVE AND INSTALL THROTTLE CABLE AND CONTROL LEVER—PUSH MOWERS
(12PB, 12PC, 14PB, 14PT AND 14PZ) (CONTINUED)**



M42971
-UN-17SEP92



M42972
-UN-17SEP92

A—Cover
B—Cable

C—Sheath Anchor

D—Alignment Tab

E—Alignment Hole

**LATE MODEL PUSH MOWERS (12PB, 12PC, 14PB,
14PT AND 14PZ)**

1. Remove control lever assembly cover (A).

2. Pull sheath anchor (C) from its' slot and slide throttle bracket off mounting screws to unhook cable (B).

3. Remove tie straps.

MX,8015BV,2 -19-16JUL96

Throttle Cable and Control Lever/Late Model Push Mowers

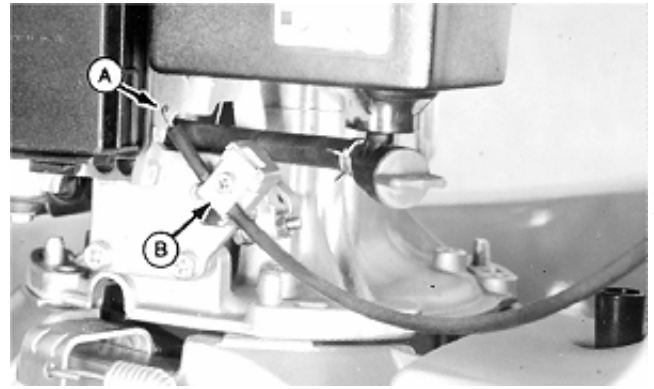
4. Remove cable (A) from throttle linkage and clamps (B) and (C).

5. Inspect and replace components as necessary.

6. Attach cable to throttle linkage on engine.

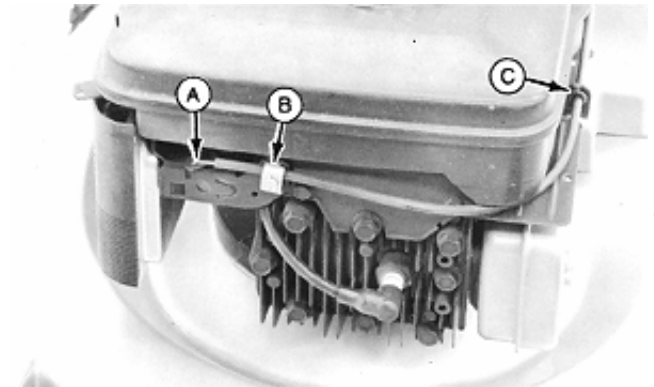
7. Attach cable to control lever and install bracket on mounting cap screws. Install cover (BE SURE to align cover tab with bracket alignment hole) and fasten with lock nuts. You may have to wiggle control lever assembly around a little to allow cover to snap into place.

8. Install tie straps as before.



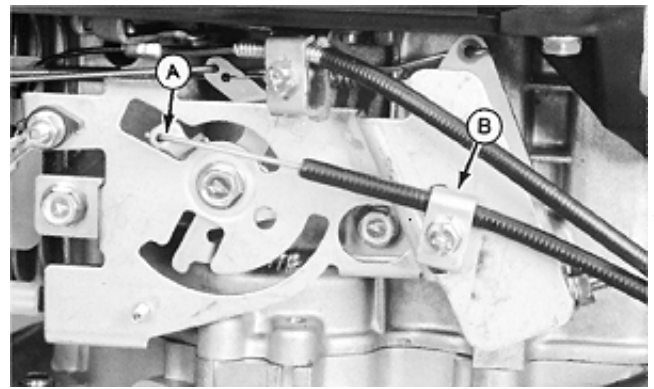
B&S 2-Cycle Engine

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B&S 4-Cycle Engine

M42976 -UN-17SEP92



Kawasaki 4-Cycle Engine

M42977 -UN-17SEP92

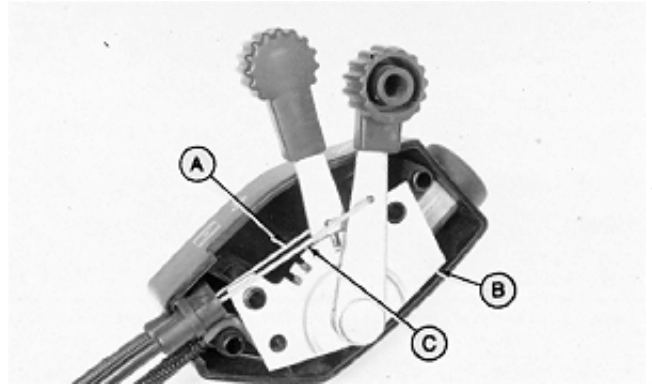
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**REMOVE AND INSTALL THROTTLE CABLE
AND CONTROL LEVER—PUSH MOWERS
(12PB, 12PC, 14PB, 14PT AND 14PZ)
(CONTINUED)**

**EARLY MODEL SELF-PROPELLED MOWERS (12SB,
14SB, 14SC, 14SE AND 14SZ)**

1. Remove control lever assembly cover.
2. Pull sheath anchors from their slots and slide control lever bracket (B) off mounting cap screws to unhook throttle cable (A).
3. Remove tie straps.

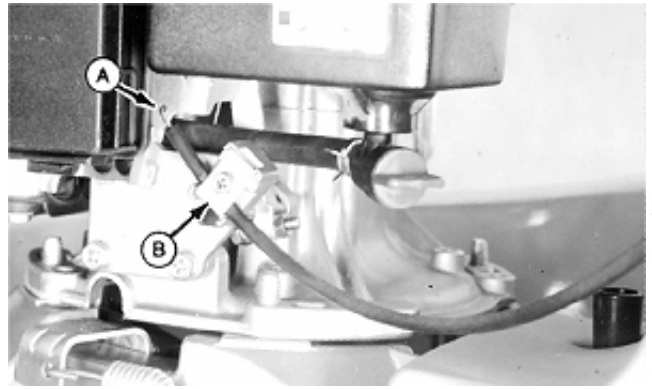


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MX,8015BV,4 -19-16JUL96

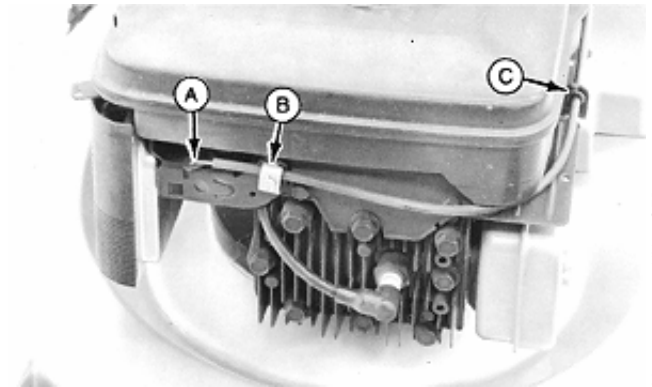
Throttle Cable and Control Lever/Early Model Self-Propelled Mowers

4. Remove cable (A) from throttle linkage and clamps (B) and (C).
5. Inspect and replace components as necessary.
6. Attach cable to throttle linkage on engine.
7. Attach cable to control lever and install bracket on mounting cap screws. Install cover (BE SURE to align cover tab with bracket alignment hole) and fasten with lock nuts. You may have to wiggle control lever assembly around a little to allow cover to snap into place.
8. Install tie straps as before.



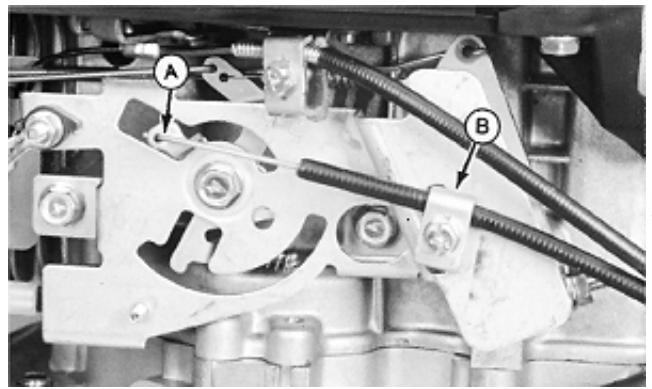
B&S 2-Cycle Engine

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-UN-17SEP92



B&S 4-Cycle Engine

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-UN-17SEP92



Kawasaki 4-Cycle Engine

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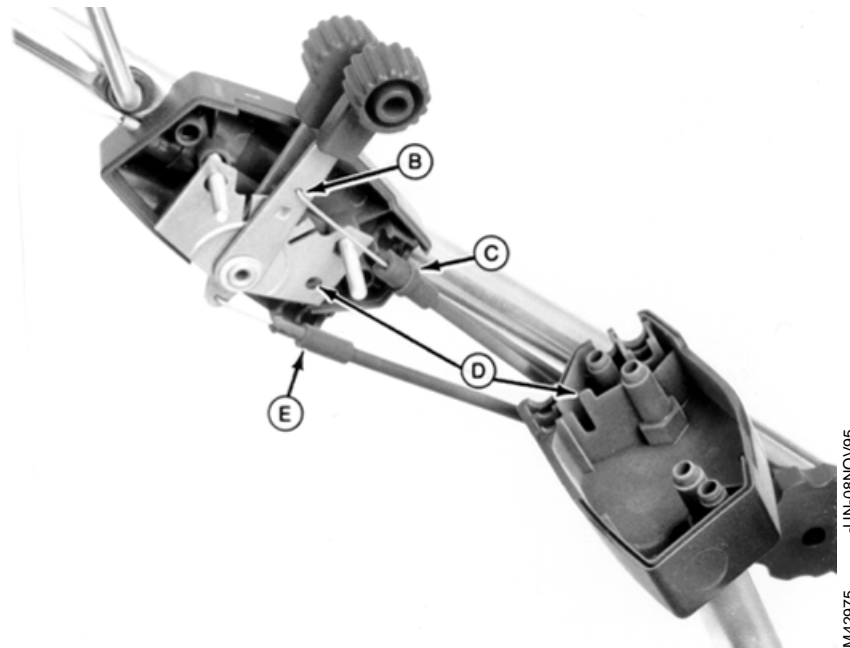
REMOVE AND INSTALL THROTTLE CABLE AND CONTROL LEVER—PUSH MOWERS (12PB, 12PC, 14PB, 14PT AND 14PZ) (CONTINUED)



2-Speed Transaxle Models



5-Speed Transaxle Models



A—Cover
B—Cable

C—Sheath Anchor
D—Cover Alignment Tab and
Bracket Alignment Hole

E—Shift Cable Sheath
Anchor

LATE MODEL SELF-PROPELLED MOWERS (12SB, 14SB, 14SC/14SX, 14SE, 14ST AND 14SZ)

1. Remove control lever assembly cover (A).

2. Pull sheath anchors (C and E) from their slots and slide control lever bracket off mounting cap screws to unhook throttle cable (B).

3. Remove tie straps.

MX,8015BV,6 -19-16JUL96

Throttle Cable and Control Lever/Late Model Self-Propelled Mowers

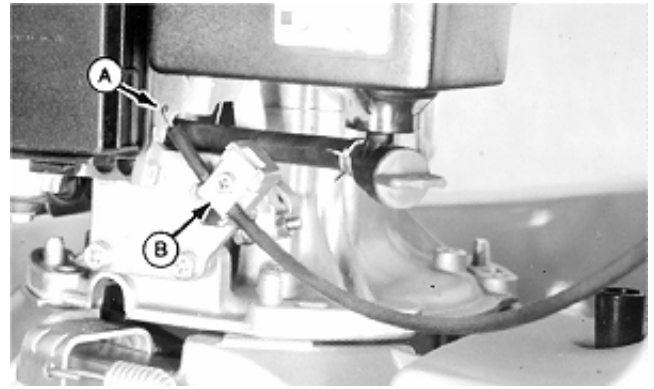
4. Remove cable (A) from throttle linkage and clamps (B) and (C).

5. Inspect and replace components as necessary.

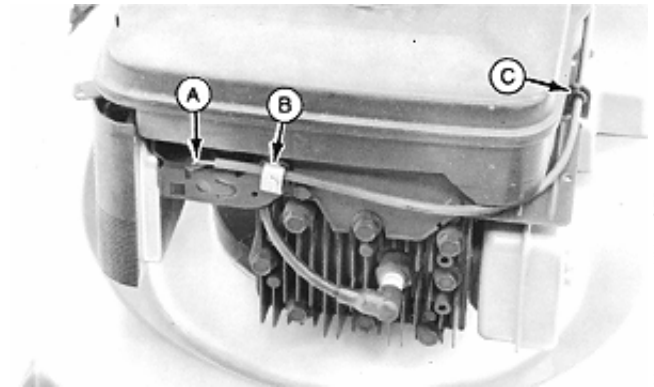
6. Attach cable to throttle linkage on engine.

7. Attach throttle cable to control lever and install bracket on mounting cap screws. Install cover (BE SURE to align cover tab with bracket alignment hole) and fasten with lock nuts. You may have to wiggle control lever assembly around a little to allow cover to snap into place.

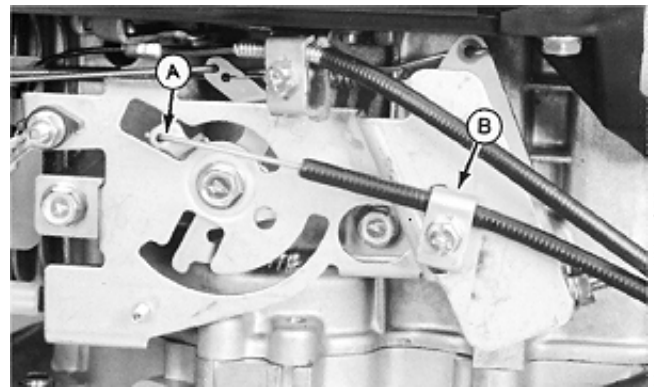
8. Install tie straps as before.



B&S 2-Cycle Engine



B&S 4-Cycle Engine



Kawasaki 4-Cycle Engine

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M42977 -UN-17SEP92

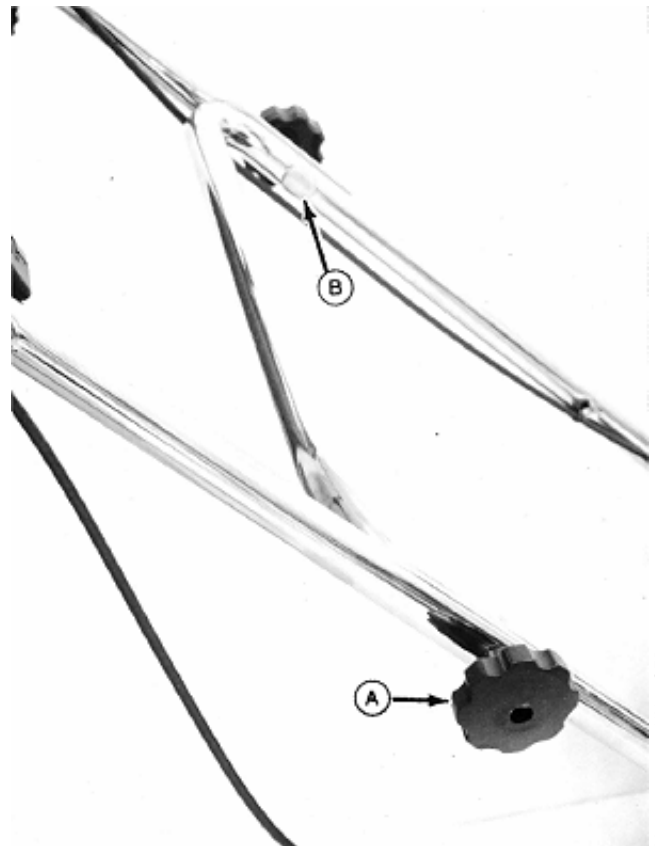
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REMOVE AND INSTALL HANDLEBARS—RESIDENTIAL MOWERS (12PB, 12SB, 14PB, 14PT, 14PZ, 14SB, 14SE, 14ST AND 14SZ)

1. Remove all tie straps.
2. Remove all control lever assemblies and safety bails.
3. Remove black knobs (A and D).
4. Remove special cap screws (B and C).
5. Remove mower deck cap screws and lock nuts (E).
6. Inspect and replace components as necessary.
7. Install components in reverse order.
8. Install all control lever assemblies and safety bails as before.

- A—Knob (4 used)
- B—Special Cap Screws (4 used)
- C—Special Cap Screws (4 used)
- D—Knob (4 used)
- E—Cap Screws and Lock Nuts (4 used)



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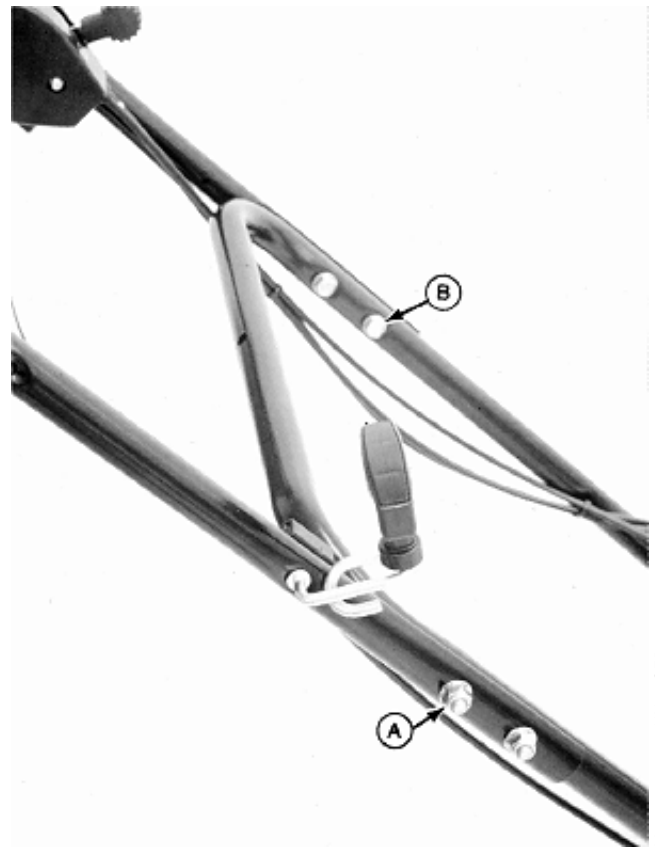
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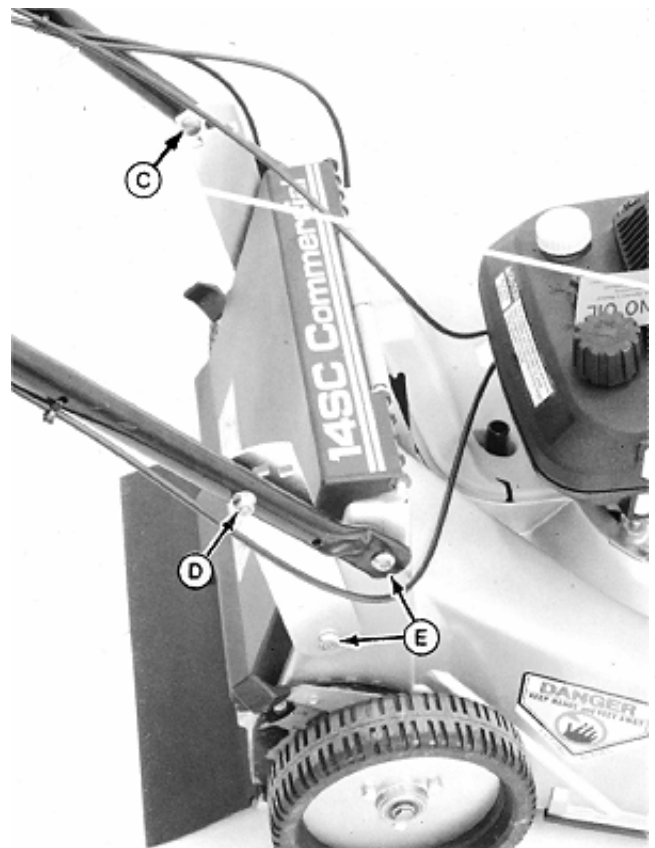
REMOVE AND INSTALL HANDLEBARS—COMMERCIAL MOWERS (12PC AND 14SC/14SX)

1. Remove all tie straps.
2. Remove all control lever assemblies and safety bails.
3. Remove cap screws (B), carriage bolts (C), and lock nuts (A and D).
4. Remove mower deck cap screws and lock nuts (E)—lock nuts are up, inside mower deck frame.
5. Inspect and replace components as necessary.
6. Install components in reverse order.
7. Install all control lever assemblies and safety bails as before.

- A—Lock Nuts
- B—Cap Screws
- C—Carriage Bolts
- D—Lock Nuts
- E—Mower Deck Cap Screws and Lock Nuts



M42983 -JUN-17SEP92

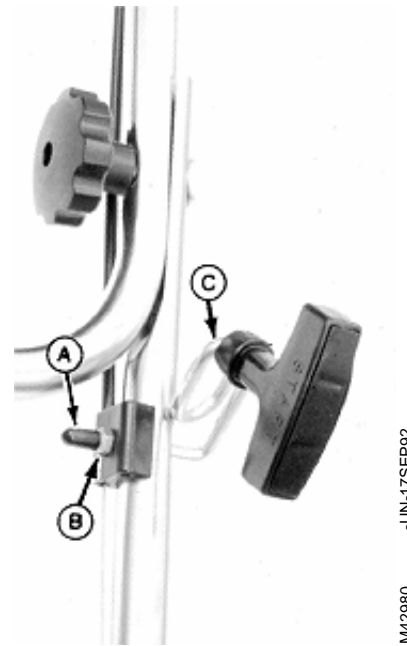


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REMOVE AND INSTALL RECOIL START BRACKET—ZONE START MODELS (12PC, 14PT, 14PZ, 14SC, 14ST AND 14SZ)

1. Remove shipping grommet (A); it should have been removed during pre-delivery.
2. Pull coiled bracket (C) rearward to enable you to disengage recoil rope and T-handle.
3. Remove nut (B) and coiled bracket (C).
4. Inspect and replace components as necessary.
5. Install components in reverse order.
6. Engage recoil rope and T-handle and push coiled bracket forward against the handlebar.



MX,8025BV,1 -19-16JUL96

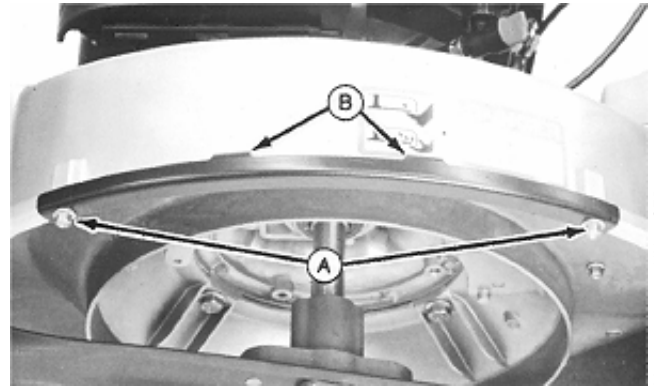
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Recoil Start Bracket/Remove and Install Recoil Start Bracket

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REMOVE AND INSTALL MOWER DECK WEAR PLATES—COMMERCIAL MOWERS ONLY (12PC AND 14SC/14SX)

1. Inspect, remove, and install height adjuster wear plates.
2. Remove self-tapping cap screws (A) and slide lip tabs (B) from mower deck lip.
3. Install lip tabs of wear plate over mower deck lip and fasten with self-tapping cap screws (A). Repeat procedure for opposite side.



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MX,8030BV,1 -19-16JUL96

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Mower Deck Wear Plates/Remove and Install Mower Deck Wear Plates

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Group 35
Mower Deck Discharge Cover

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REMOVE AND INSTALL MOWER DECK DISCHARGE COVER—ALL MODELS

1. Remove push nut (A) from one end of rod (B).

NOTE: Recoil springs are under slight tension when cover is in the closed position. As the rod is removed they will relax completely in a slight forward rotation. DO NOT attempt to remove or install recoil springs with cover in the raised position.

2. With the grass catcher removed and the cover in the closed position, slowly remove rod from recoil springs and cover.

3. Recoil springs anchor in the plastic cover (C) and in-front-of bracket tab (D). Pull springs from cover if they or cover need to be replaced.

4. Inspect and replace components as necessary.

5. Install components in reverse order with cover in the closed position.

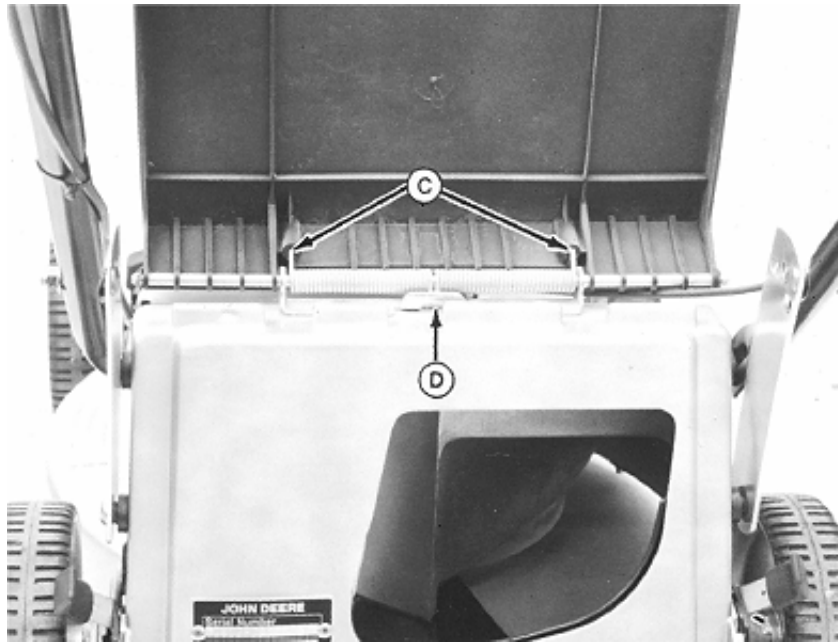
6. Install grass catcher.

MX,8035BV,1 -19-16JUL96

Mower Deck Discharge Cover/Remove and Install Mower Deck Discharge Cover



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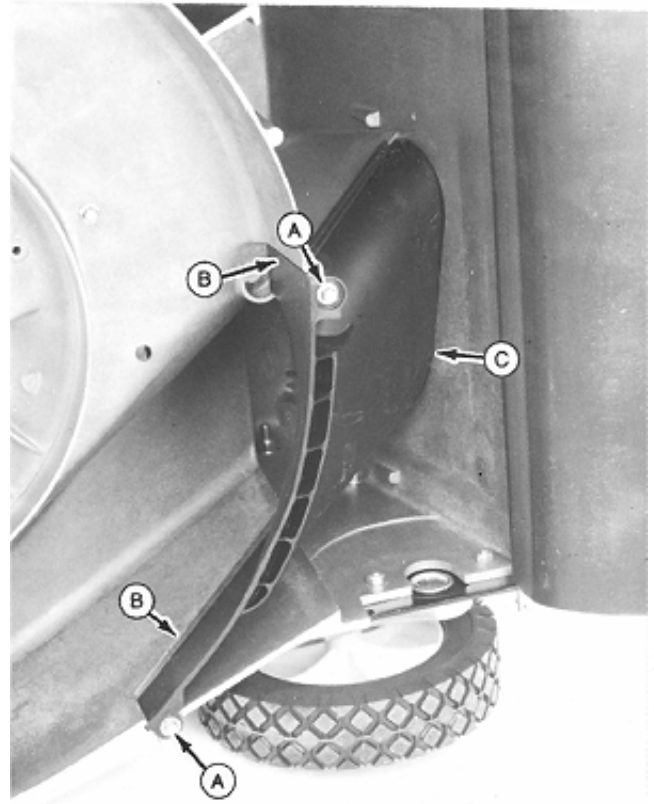
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Mower Deck Discharge Cover/Remove and Install Mower Deck Discharge Cover

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4

**REMOVE AND INSTALL MOWER DECK
DISCHARGE CHUTE—ALL MODELS**

1. Remove cap screws (A) to remove discharge chute.
2. Install discharge chute in mower deck grooves (B) and opening (C).



MX,8040BV,1 -19-16JUL96

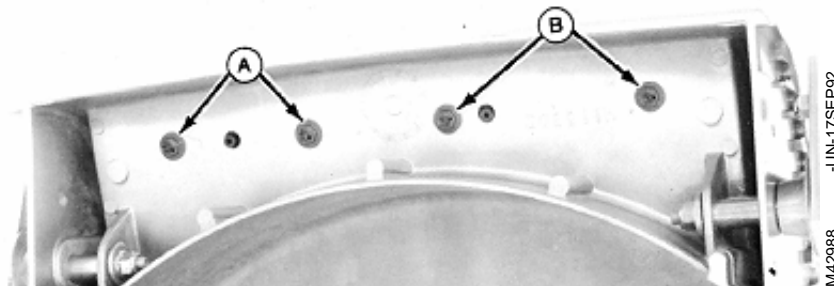
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Mower Deck Discharge Chute/Remove and Install Mower Deck Discharge Chute

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REMOVE AND INSTALL MOWER DECK EMBLEM—ALL MODELS



1. Raise and block front end of mower deck to remove lightweight nuts (A) for JOHN and (B) for DEERE.

2. Install emblems and fasten with light weight nuts to a slight torque for a snug fit. DO NOT over-tighten.

MX,8045BV,1 -19-16JUL96

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Mower Deck Emblem/Remove and Install Mower Deck Emblem

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2

Section 210

TEST AND ADJUSTMENT SPECIFICATIONS/OPERATIONAL CHECKOUT PROCEDURE

Contents

Page

Group 05—Test and Adjustment Specifications	
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Group 10—Operational Checkout Procedure	
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210

TEST AND ADJUSTMENT SPECIFICATIONS

ITEM	SPECIFICATION
ENGINE:	
Briggs & Stratton 2-Cycle	
Compression	Minimum 621 kPa (90 psi)
Briggs & Stratton 4-Cycle	
Compression	Sharp rebound when rotated against direction of operation
Crankcase Vacuum	Minimum 152 mm (6.0 in.) of Water at 3000 ±100 rpm
Valve Clearance (Cold)	
Intake	0.12—0.18 mm (0.005—0.007 in.)
Exhaust	0.18—0.23 mm (0.007—0.009 in.)
Automatic Compression Release Lift	0.25 mm (0.010 in.)
Kawasaki	
Compression	155—656 kPa (22.5—95 psi)
Crankcase Vacuum	Minimum 170 mm (6.7 in.) of Water at 3075 ±75 rpm
Valve Clearance (Cold)	
Intake	0.12 mm (0.005 in.)
Exhaust	0.12 mm (0.005 in.)
Automatic Compression Release Lift	Minimum 0.5 mm (0.020 in.)
FUEL/AIR:	
Briggs & Stratton 2-Cycle	
Low Idle Speed	1750 rpm
High Idle and Operating Speed	3100 ±100 rpm
Briggs & Stratton 4-Cycle	
Low Idle Speed	1750 rpm
Low Idle Mixture Screw Setting (Initial) ¹	1 1/4 Turns
High Idle and Operating Speed	3000 ±100 rpm
Kawasaki	
Low Idle Speed	1500 rpm
Low Idle Mixture Screw Setting (Initial)	1 Turn
High Idle and Operating Speed	3075 ±75 rpm

¹Low idle adjustment has been eliminated from later models (engines marked 12F702).

Specifications continued on next page

MX,21005BV,1 -19-16JUL96

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SPECIFICATIONS (CONTINUED)

ITEM	SPECIFICATION
ELECTRICAL:	
Briggs & Stratton 2-Cycle	
Spark Plug Gap	0.76 mm (0.030 in.)
Coil Air Gap	0.2—0.4 mm (0.008—0.016 in.)
Coil Resistance	
Primary Winding	0.2—0.6 Ohms
Secondary Winding	2500—5500 Ohms
Briggs & Stratton 4-Cycle	
Spark Plug Gap	0.76 mm (0.030 in.)
Coil Air Gap	0.15—0.25 mm (0.006—0.010 in.)
Coil Resistance	
Primary Winding	0.2—0.6 Ohms
Secondary Winding	2500—5500 Ohms
Kawasaki	
Spark Plug Gap	0.76 mm (0.030 in.)
Coil Air Gap	0.30 mm (0.012 in.)
Coil Resistance	
Primary Winding	0.67—1.10 Ohms
Secondary Winding	6000—10000 Ohms
Alternator Output	Minimum 0.50 Amps

210
05
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MX,21005BV,2 -19-16JUL96

OPERATIONAL CHECKOUT PROCEDURE

The procedures covered in this group are used to give a quick checkout of all the systems and components on the unit. These checkouts should be run to insure proper operation after any extended storage, when the unit comes in for service and after repairs have been made on the unit. They can also be helpful in determining the value of the unit at trade-in time. The unit should be placed on a level surface to run the checkouts. All the checkouts should be done and all of the steps of each checkout should be followed.

Each checkout lists:

- Conditions—How the unit should be set up for the checkout.
- Procedure—The specific action to be done.
- Normal—What should happen or be heard or be seen.
- If Not Normal—Where to go if other tests or adjustments are needed.

When performing the checkout, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The “Normal” paragraph gives the result that should happen when performing the checkout. If the results are not normal, go to the Section and Group listed in the “If Not Normal” paragraph to determine the cause and repair the malfunction.

The photograph that accompanies each checkout procedure is included to help conduct the checkout.

MX,21010BV,1 -19-16JUL96

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ENGINE START TEST—ZONE START UNITS

Conditions:

- Traction drive bail disengaged, on self-propelled units.
- Zone start bail engaged.
- Throttle set to choke position.

Procedure:

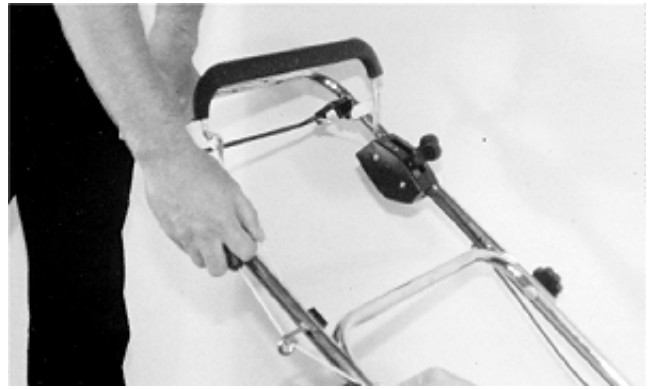
- Rapidly pull starter rope.

Normal:

- Engine starts in several pulls, and after running for 2 minutes to warm up, runs smoothly with throttle in high or low idle position.

If Not Normal:

- For Briggs & Stratton 2-cycle engine, if the problem seems engine or fuel/air related, go to Section 220, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Briggs & Stratton 4-cycle engine, if the problem seems engine or fuel/air related, go to Section 222, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Kawasaki engine, if the problem seems engine or fuel/air related, go to Section 225, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Briggs & Stratton 2-cycle engine, if the problem seems ignition related, go to Section 240, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Briggs & Stratton 4-cycle engine, if the problem seems ignition related, go to Section 242, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Kawasaki engine, if the problem seems ignition related, go to Section 245, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.



M48996 -JUN-19JUL90

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MX,21010BV,2 -19-16JUL96

ENGINE START TEST—MANUAL START BLADE BRAKE CLUTCH UNITS

Conditions:

- Traction drive bail disengaged on self-propelled units.
- Blade brake clutch control and bail disengaged on blade brake clutch units.
- Throttle set to choke position.

Procedure:

- Rapidly pull starter rope.

Normal:

- Engine starts in several pulls, and after running for 2 minutes to warm up, runs smoothly with throttle in high or low idle position.

If Not Normal:

- For Briggs & Stratton 2-cycle engine, if the problem seems engine or fuel/air related, go to Section 220, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Briggs & Stratton 2-cycle engine, if the problem seems ignition related, go to Section 240, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Kawasaki engine, if the problem seems engine or fuel/air related, go to Section 225, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- For Kawasaki engine, if the problem seems ignition related, go to Section 245, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.



M48997 -JUN-24OCT90

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MX,21010BV,3 -19-16JUL96

ENGINE START TEST—ELECTRIC START UNITS

Conditions:

- Traction drive bail disengaged on self-propelled units.
- Blade brake clutch disengaged.
- Throttle set to choke position.

Procedure:

- Turn key switch to start position, spin engine with starter for 5 seconds, stop starter and wait 10 seconds.
- Repeat above procedure until engine starts.

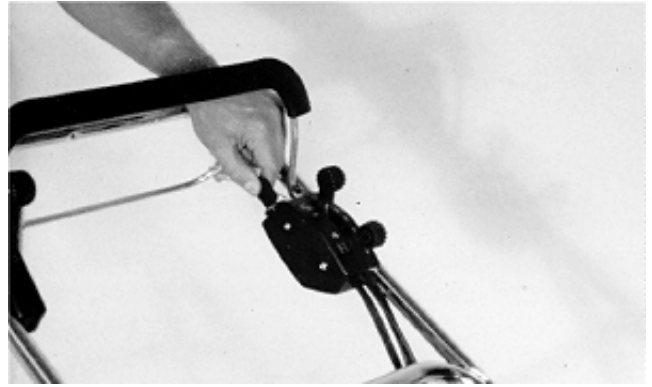
NOTE: Depending on air temperature, this sequence may need to be repeated several times.

Normal:

- Engine starts, and after running for 2 minutes to warm up, runs smoothly with throttle in high or low idle position.

If Not Normal:

- If the problem seems engine or fuel/air related, go to Section 225, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.
- If the problem seems electrical or ignition related, go to Section 245, Group 15 and check the specific diagnostic procedures that cover the malfunction of the mower.



M48998 -JUN-19JUL90

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MX,21010BV,4 -19-16JUL96

ENGINE HIGH AND LOW IDLE OPERATION

Conditions:

- Engine running and warmed up for at least 2 minutes.
- Traction drive bail disengaged on self-propelled units.
- Blade brake clutch disengaged on blade brake clutch units.
- Zone start bail engaged on zone start units.

Procedure:

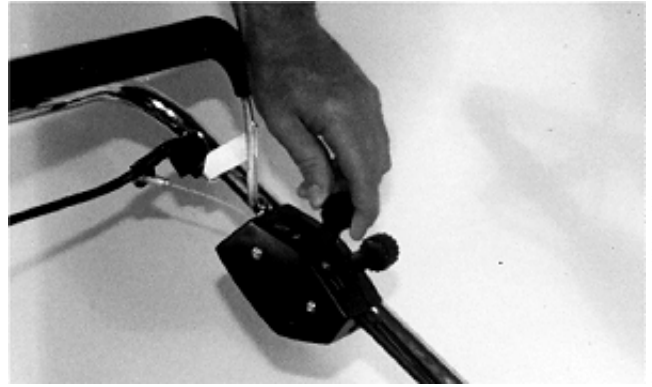
- Run engine with throttle set at both high and low idle positions.

Normal:

- Engine runs smoothly at both high and low idle positions.
- Engine accelerates smoothly from low to high idle positions.
- Engine decelerates smoothly from high to low idle positions.

If Not Normal:

- For Briggs & Stratton 2-cycle engine, go to Section 220, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.
- For Briggs & Stratton 4-cycle engine, go to Section 222, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.
- For Kawasaki engine, go to Section 225, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.



M48999 -JUN-19JUL90

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MX,21010BV,5 -19-16JUL96

ENGINE LOADED OPERATION

Conditions:

- Engine running and warmed up for at least 2 minutes.
- Speed control set to 2nd speed on 2-speed self-propelled units.
- Speed control set to 3rd speed on 5-speed self-propelled units.
- Traction drive bail engaged on self-propelled units.
- Blade brake clutch engaged on blade brake clutch units.
- Zone start bail engaged on zone start units.

Procedure:

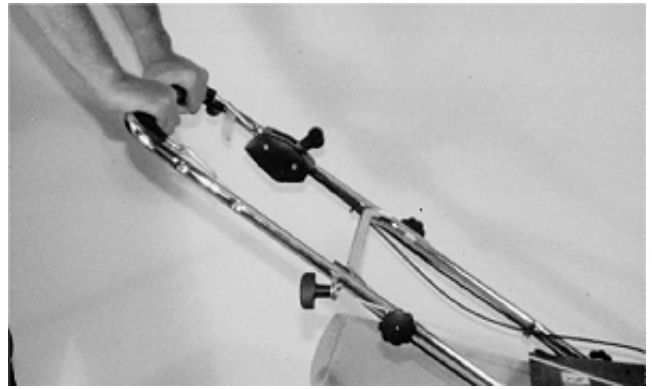
- Operate mower through a variety of cutting conditions.

Normal:

- Mower cuts well and governor reacts to various load conditions.

If Not Normal:

- For Briggs & Stratton 2-cycle engine, go to Section 220, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.
- For Briggs & Stratton 4-cycle engine, go to Section 222, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.
- For Kawasaki engine, go to Section 225, Group 15 and check the specific diagnostic procedures that cover the mower malfunction.



-JUN-19JUL90

M49281

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MX,21010BV,6 -19-16JUL96

BLADE BRAKE CLUTCH ENGAGEMENT

Conditions:

- Engine running at high idle and warmed up for at least 2 minutes.
- Traction drive bail disengaged on self-propelled units.
- Blade brake clutch bail engaged.

Procedure:

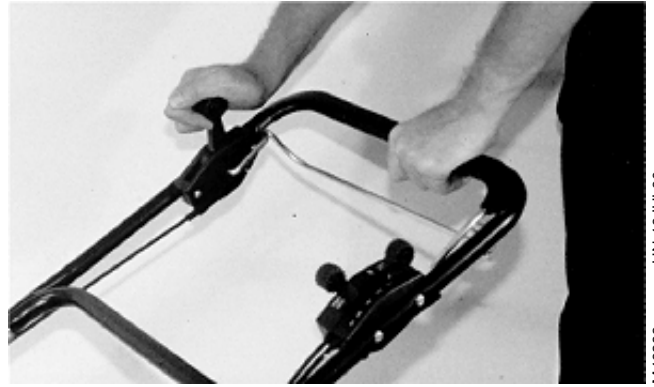
- Rapidly engage blade brake clutch control lever.

Normal:

- Mower blade starts to spin. A slight drop in engine rpm's and a short squeal may be heard.

If Not Normal:

- Go to Section 240, Group 15, and check the specific diagnostic procedure on blade brake clutch malfunctions.



M49283
-UN-19JUL90

MX,21010BV,7 -19-16JUL96

BLADE BRAKE CLUTCH DISENGAGEMENT

Conditions:

- Engine running at high idle and warmed up for at least 2 minutes.
- Traction drive bail disengaged on self-propelled units.
- Blade brake clutch bail engaged.
- Blade brake clutch control engaged.

Procedure:

- Release blade brake clutch bail.

Normal:

- Blade brake clutch control should snap back to disengaged position and mower blade should stop.

If Not Normal:

- Go to Section 240, Group 15 and check the specific diagnostic procedure on blade brake clutch malfunctions.



M49282
-UN-19JUL90

MX,21010BV,8 -19-16JUL96

BLADE AND ENGINE STOP—ZONE START UNITS

Conditions:

- Zone start bail engaged.
- Traction drive bail disengaged on self-propelled units.
- Engine running at high idle and warmed up for at least 2 minutes.

Procedure:

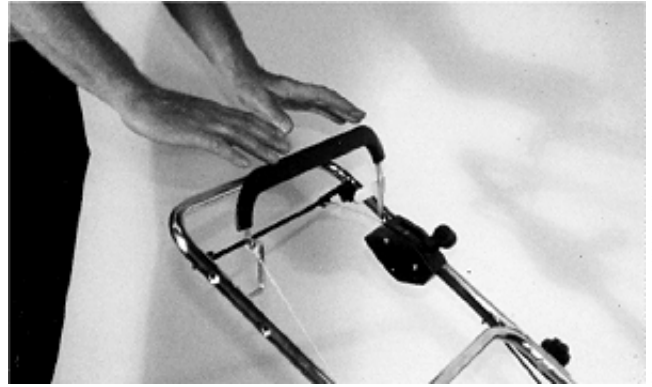
- Release zone start bail.

Normal:

- Engine and blade stop.

If Not Normal:

- Go to Section 245, Group 15 and check the specific diagnostic procedure that covers zone start malfunctions.



M49284 -JUN-19JUL90

MX,21010BV,9 -19-16JUL96

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TRACTION DRIVE OPERATION—5-SPEED TRANSAXLE

Conditions:

- Engine running at high idle and warmed up for at least 2 minutes.
- Blade brake clutch bail disengaged on blade brake clutch units.
- Zone start bail engaged on zone start units.
- Speed control set at speed 1.

Procedure:

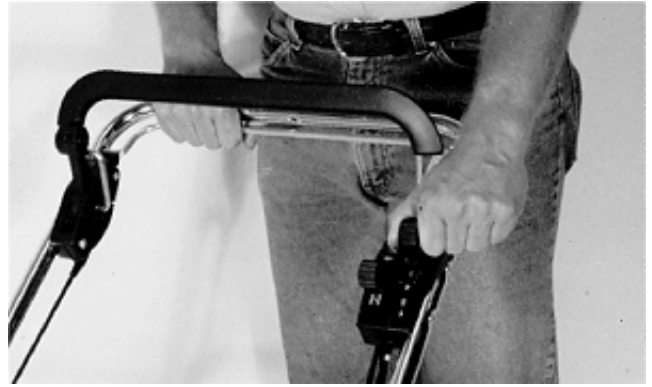
- Engage traction drive bail.
- Repeat for speeds 2 through 5.

Normal:

- Drive engages and mower starts to move. Different ground speeds noticed for different speed settings.
- A slight ratcheting may be noticed at engagement.

If Not Normal:

- Go to Section 250, Group 15 and check the specific diagnostic procedures that cover traction drive malfunctions.



M49285 -JUN-19JUL90

MX,21010BV,10 -19-16JUL96

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9

TRACTION DRIVE OPERATION—2-SPEED TRANSAXLE

Conditions:

- Engine running at high idle and warmed up for at least 2 minutes.
- Blade brake clutch bail disengaged.
- Speed control set at speed 1.

Procedure:

- Engage traction drive bail.
- Repeat for speed 2.

Normal:

- Drive engages and mower starts to move. Different ground speeds noticed for different speed settings.
- A slight ratcheting may be noticed at engagement.

If Not Normal:

- Go to Section 255, Group 15 and check the specific diagnostic procedures that cover traction drive malfunctions.



-UN-19JUL90

M49286

MX,21010BV,11 -19-16JUL96

FREE WHEELING OPERATION—SELF-PROPELLED UNITS

Conditions:

- Engine not running.
- Blade brake clutch control and bail disengaged on blade brake clutch units.
- Zone start bail disengaged on zone start units.
- Traction drive bail disengaged.

Procedure:

- Push mower forward.
- Pull mower backward.

Normal:

- Mower should roll easily in both directions.

If Not Normal:

- For 5-speed transaxle, go to Section 250, Group 15 traction drive bail adjustment.
- For 2-speed transaxle, go to Section 255, Group 15 traction drive bail adjustment.



-UN-19JUL90

M49287

MX,21010BV,12 -19-16JUL96

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Section 220 ENGINE OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON 2-CYCLE

Contents

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Component Location Information	220-05-1
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Group 15—Diagnosis, Tests and Adjustments

Diagnostic Information	220-15-1
Starts Hard or Will Not Start	220-15-2
Will Not Stay Running or Runs Rough	220-15-4
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Uneven or Uncontrolled RPM	220-15-10
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Carburetor Slow Idle Test and Adjustment	220-15-16
Governor Test and Adjustment	220-15-17
Throttle Cable Adjustment	220-15-18

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COMPONENT LOCATION INFORMATION

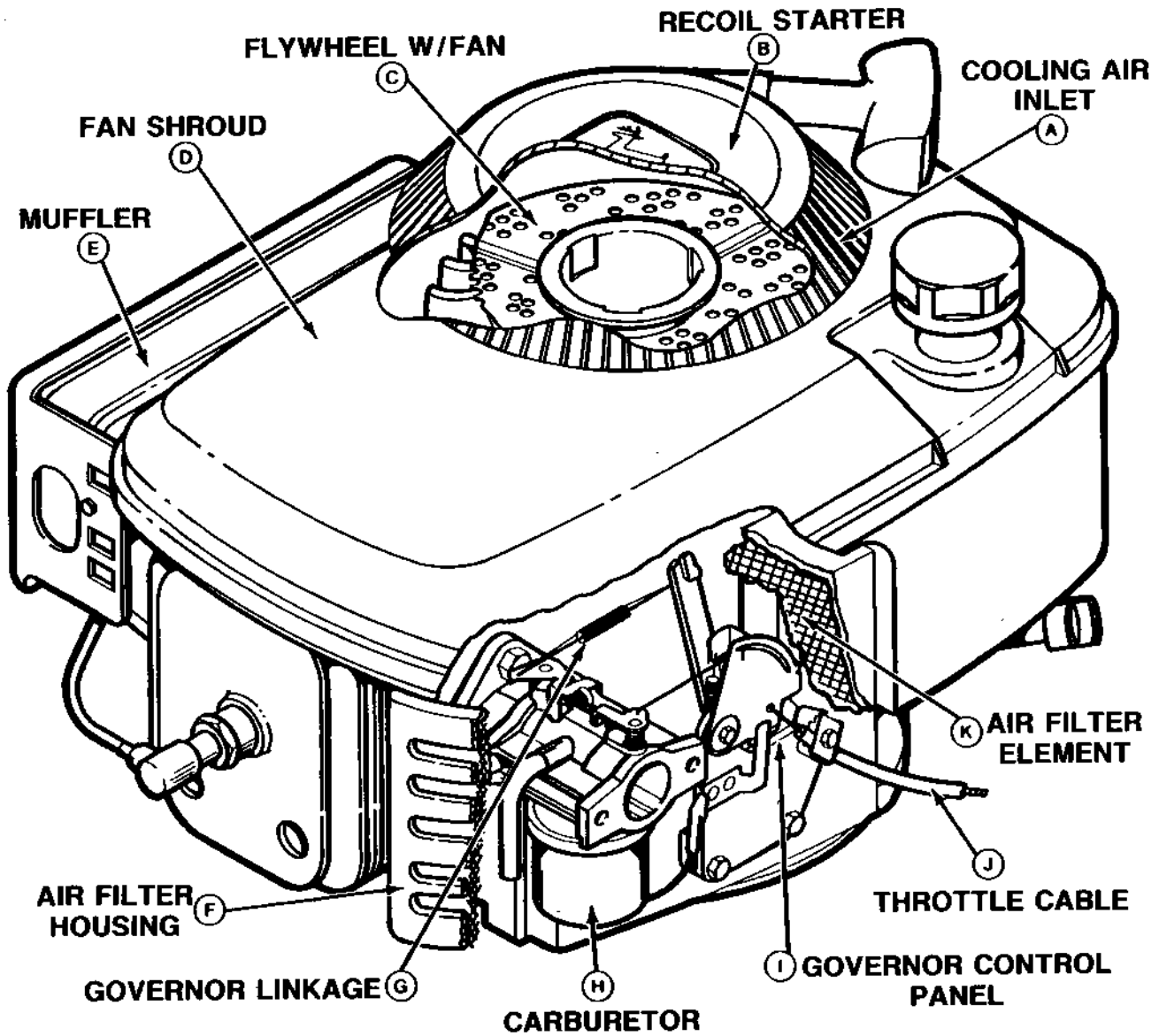
This group contains component location drawings for the following engine system components:

- External Components

Use the drawings when diagnosing an engine problem and to help locate the components to be tested.

MX,22005BV,1 -19-16JUL96

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M48718 EXTERNAL COMPONENTS - BRIGGS & STRATTON 2-CYCLE

- | | | | |
|---------------------|----------------------|--------------------------|----------------------|
| A—Cooling Air Inlet | D—Fan Shroud | G—Governor Linkage | J—Throttle Cable |
| B—Recoil Starter | E—Muffler | H—Carburetor | K—Air Filter Element |
| C—Flywheel w/Fan | F—Air Filter Housing | I—Governor Control Panel | |

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M48718 -19-26JUN90

MX,22005BV,2 -19-16JUL96

DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem. Select the appropriate symptom from the list that best matches your problem and follow the test procedures under that heading. The symptom headings are:

- Engine starts hard or will not start
- Engine will not stay running or runs rough
- Engine has black or blue smoke
- Engine surges
- Engine has uneven or uncontrolled rpm
- Engine has low power
- Engine vibrate excessively—1995 BBC units

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the specification or condition that should be obtained when performing the test or check. If the results are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow shows the exact point where the test is to be made.

MX,22015BV,1 -19-16JUL96

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ENGINE STARTS HARD OR WILL NOT START

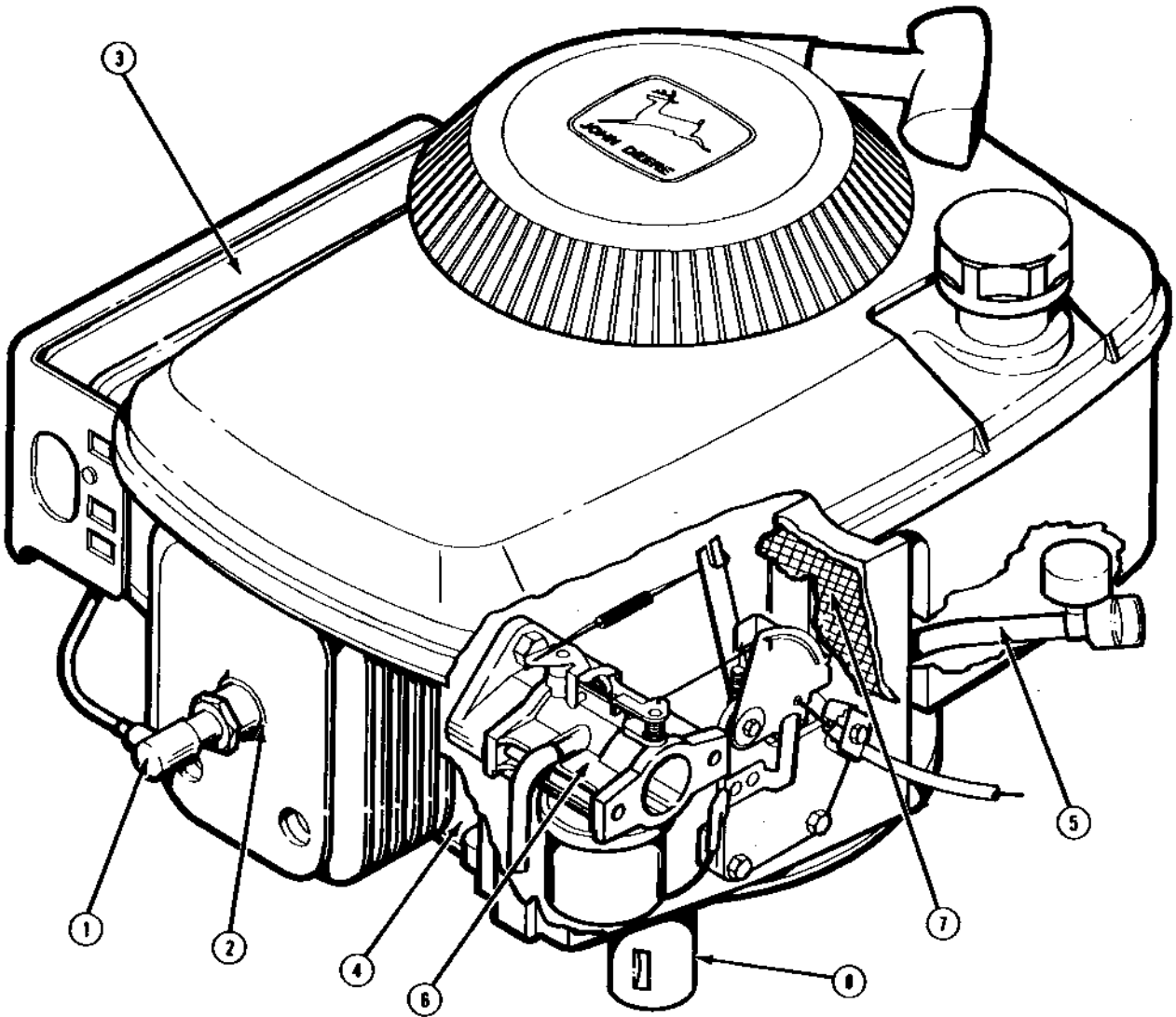
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.

- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 240 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Cylinder.	Minimum compression of 621 kPa (90 psi).	Check for loose cylinder to crankcase mounting. Check condition of rings, piston and cylinder walls.
3. Muffler.	Clean, not damaged and hardware tight.	Check for damaged or plugged muffler. Check for loose muffler mounting hardware.
4. Crankcase.	Crankcase holds pressure.	Check for loose cylinder to crankcase mounting. Check for leaking crankshaft seals. Check for leaking crankcase gasket.
5. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
6. Carburetor.	Fuel in float bowl. Choke linkage free and choke fully closed when throttle control in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
7. Air filter elements.	Not dirty or oil soaked.	Clean or replace elements as needed.
8. Crankshaft.	Traction drive components free. Blade brake clutch not binding.	Check traction drive cable adjustment. Check blade brake clutch adjustment. Check for faulty blade brake clutch.
9. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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W48737

ENGINE STARTS HARD OR WILL NOT START

MX,22015BV,3 -19-16JUL96

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ENGINE WILL NOT STAY RUNNING OR RUNS ROUGH

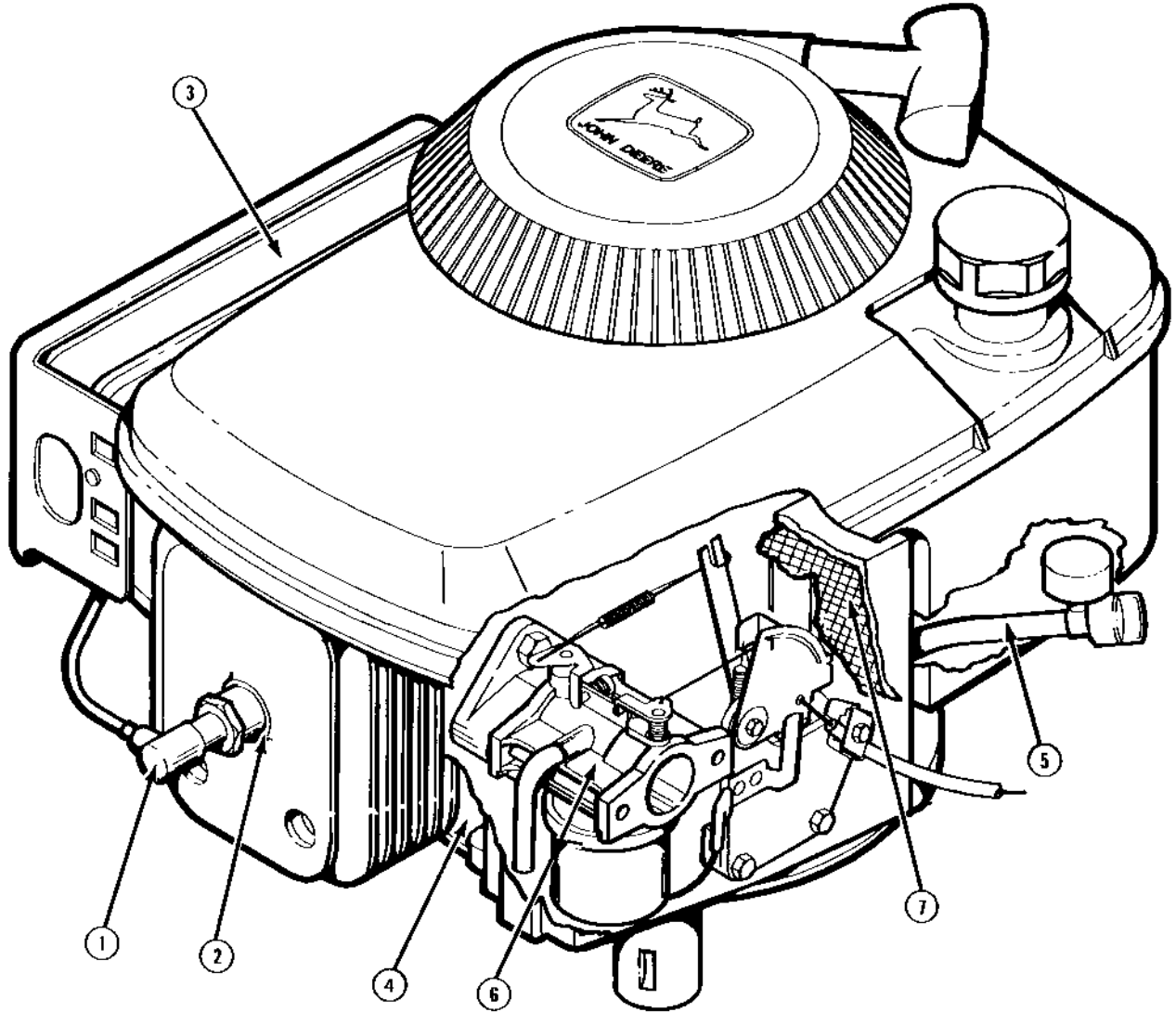
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.

- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 240 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorting kill wire or high tension lead.
2. Cylinder.	Minimum compression of 621 kPa (90 psi).	Check for loose cylinder to crankcase mounting. Check condition of rings, piston and cylinder walls.
3. Muffler.	Clean, not damaged and hardware tight.	Check for damaged or plugged muffler. Check for loose muffler mounting hardware.
4. Crankcase.	Crankcase holds pressure.	Check for loose cylinder to crankcase mounting. Check for leaking crankshaft seals. Check for leaking crankcase gasket.
5. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
6. Carburetor.	Fuel in float bowl. Choke linkage free and choke fully open when throttle control not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
7. Air filter elements.	Not dirty or oil soaked.	Clean or replace elements as needed.
8. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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**ENGINE WILL NOT STAY RUNNING
OR RUNS ROUGH**

M48738

MX,22015BV,5 -19-16JUL96

-19-01DEC95

M48738 220
15
5

ENGINE HAS BLACK OR BLUE SMOKE

Conditions:

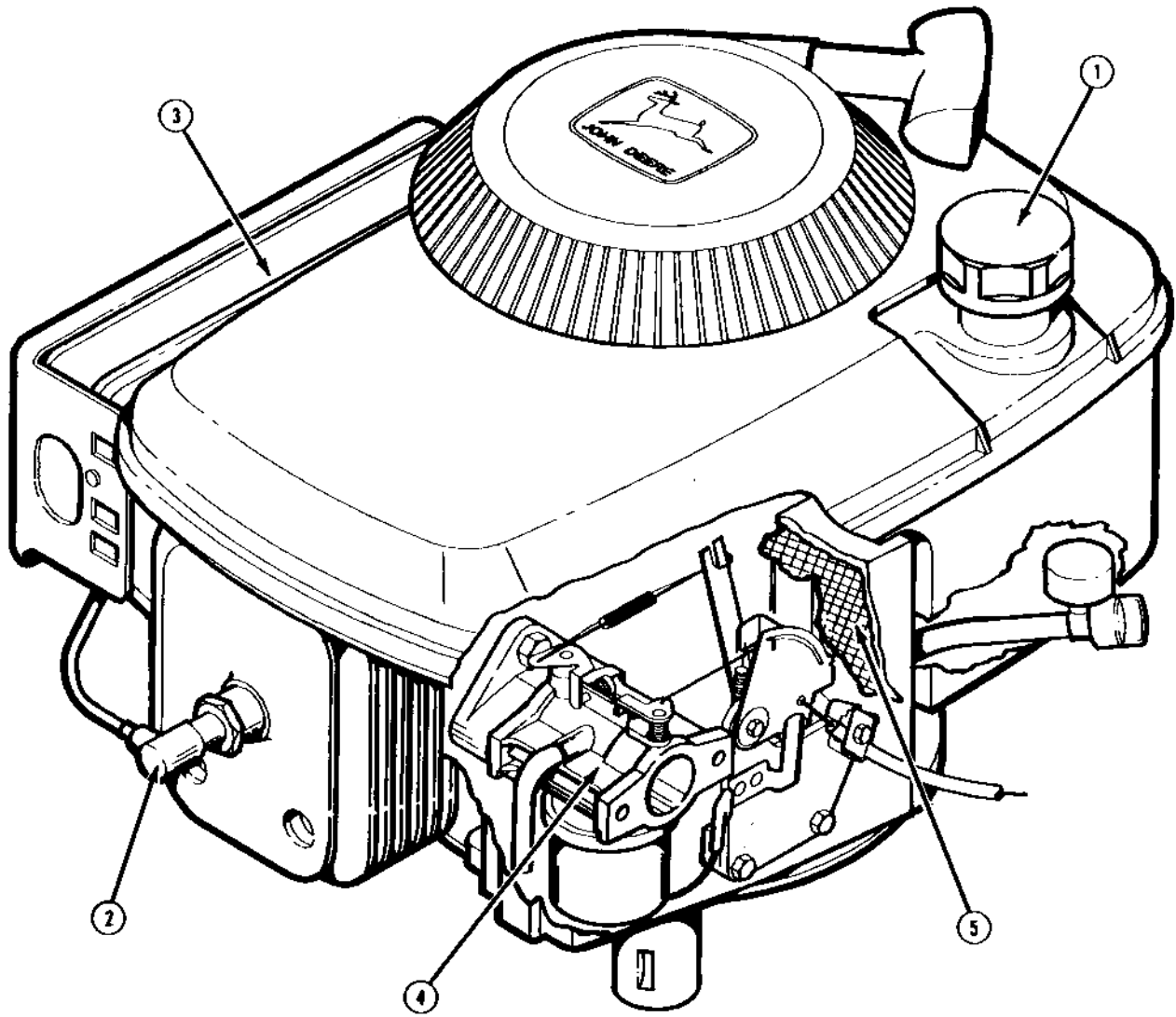
- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Fuel supply.	Fuel/oil mixture ratio of 50:1. Proper fuel and oil being used.	Replace fuel.
2. Spark plug.	Plug dry.	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel.
3. Muffler.	Clean, not damaged and hardware tight.	Repair or replace as needed.
4. Carburetor.	Fuel not leaking from float bowl. Choke linkage free and choke fully open when throttle control not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
5. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.

NOTE: Some smoke is normal on this unit during downhill operation due to the design of the crankcase. Engines starting with build date 900401 have been changed to minimize this.

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MX,22015BV,6 -19-16JUL96



M48739

ENGINE HAS BLACK OR BLUE SMOKE

MX,22015BV,7 -19-16JUL96

M48739 -19-26JUN90

220
15
7

ENGINE SURGES

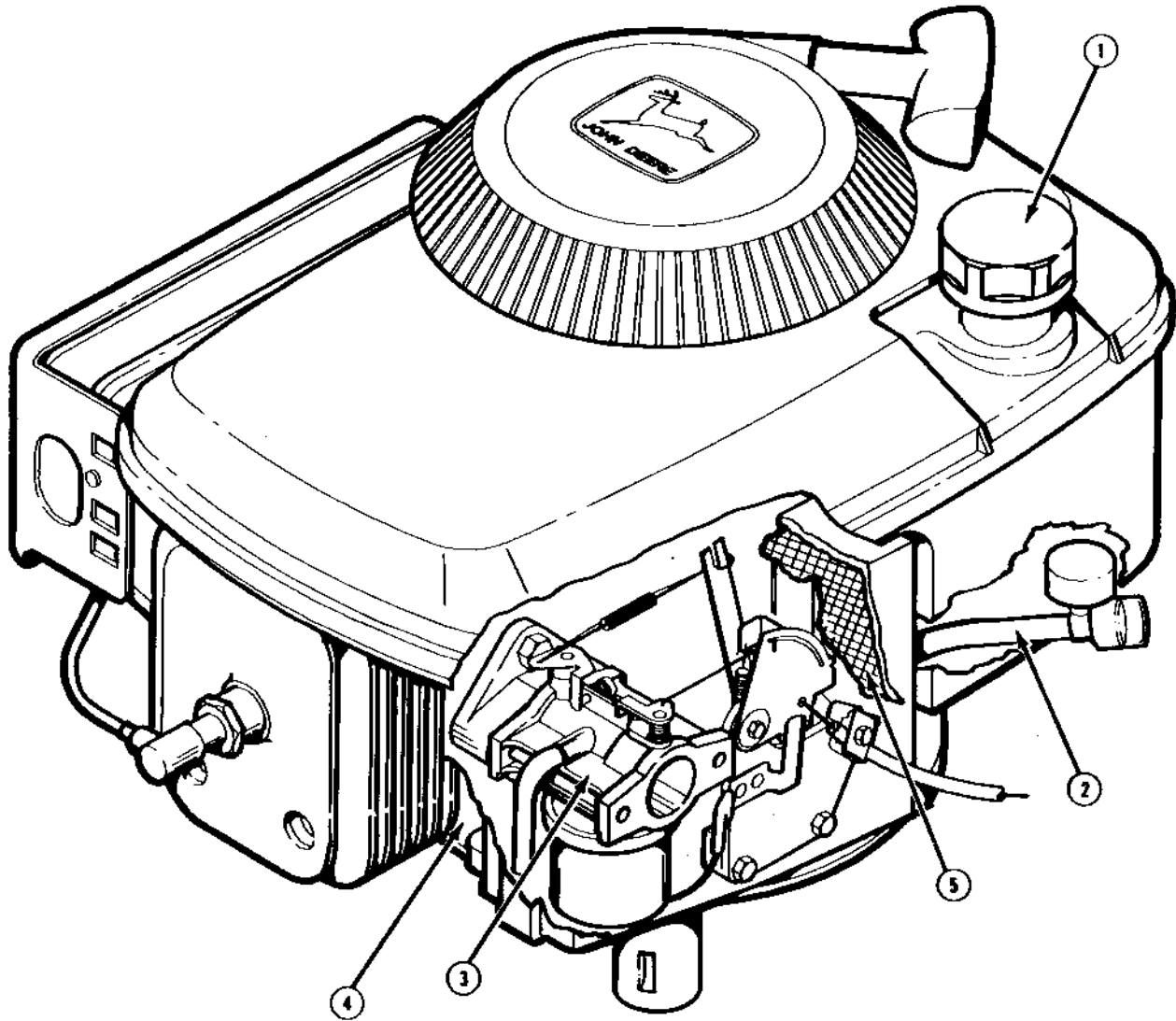
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Fuel tank.	Fresh, clean fuel in tank.	Replace fuel.
2. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
3. Carburetor.	Fuel in float bowl. Choke linkage free and choke fully open when throttle control not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
4. Crankcase.	Crankcase holds pressure.	Check for loose cylinder to crankcase mounting. Check for leaking crankshaft seals. Check for leaking crankcase gasket.
5. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.

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MX,22015BV,8 -19-16JUL96



M48740

ENGINE SURGES

MX,22015BV,9 -19-16JUL96

M48740 -19-26JUN90

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9

ENGINE HAS UNEVEN OR UNCONTROLLED RPM

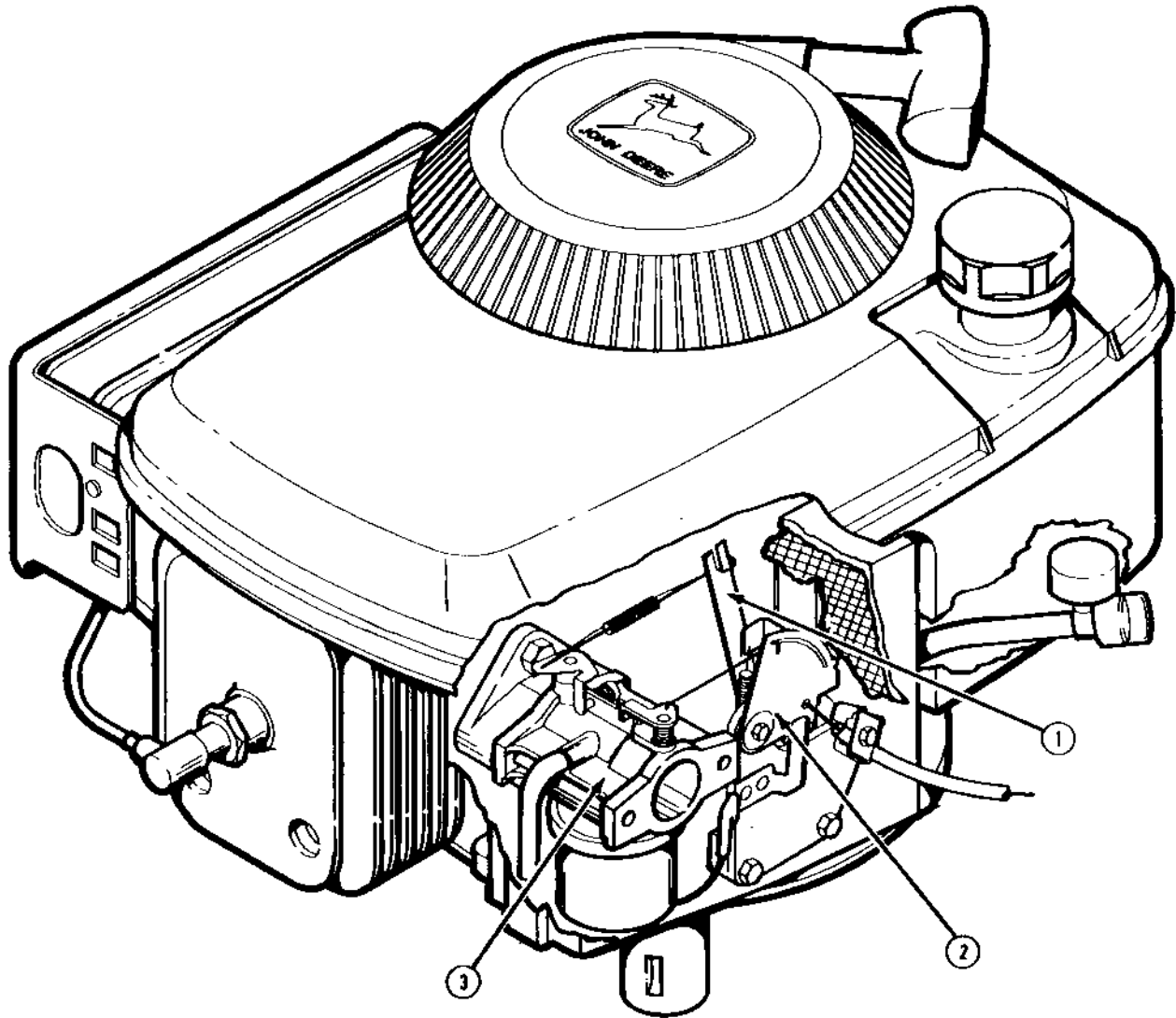
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Governor arm tight on governor shaft.	Adjust governor and tighten clamp nut.
	Governor arm and governor shaft both rotated as far counter-clockwise as possible.	Adjust governor.
	Resistance to movement of governor arm. (Engine running at fast idle.)	Disassemble engine and check governor components.
2. Governor control panel.	Linkage not binding or damaged.	Repair or replace components as needed.
3. Carburetor.	Throttle valve and linkage not binding.	Repair or replace components as needed.
	Slow idle stop screw adjusted correctly.	Adjust slow idle.

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MX,22015BV,10 -19-16JUL96



M48741

**ENGINE HAS UNEVEN
OR UNCONTROLLED RPM**

MX,22015BV,11 -19-16JUL96

-19-26JUN90

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11

ENGINE HAS LOW POWER

Conditions:

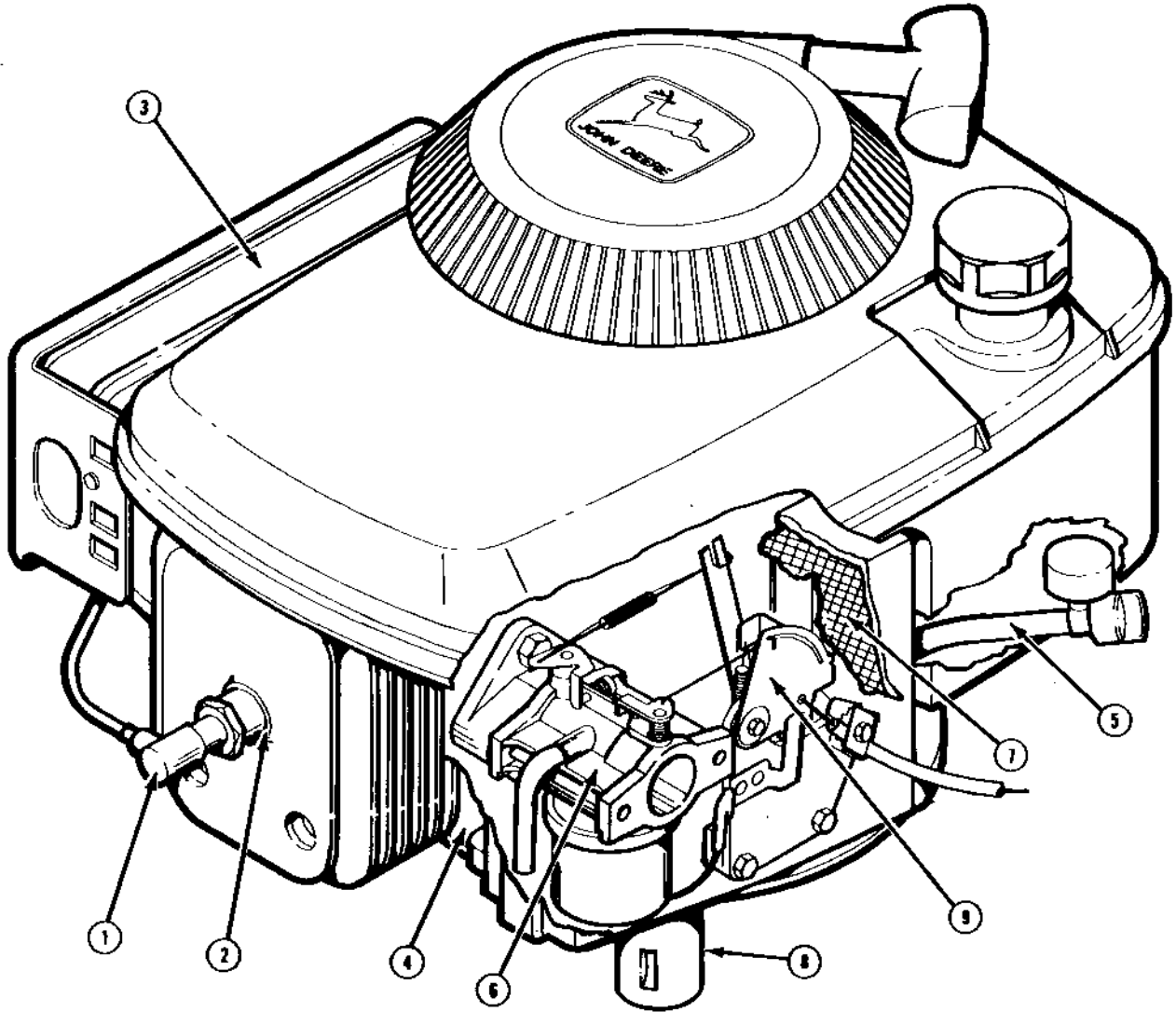
- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.

- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 240 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check carburetor inlet needle sealing. Check for correct adjustment of choke linkage. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Cylinder.	Minimum compression of 621 kPa (90 psi).	Check for loose cylinder to crankcase mounting. Check condition of rings, piston and cylinder walls.
3. Muffler.	Clean, not damaged and hardware tight.	Check for damaged or plugged muffler. Check for loose muffler mounting hardware.
4. Crankcase.	Crankcase holds pressure.	Check for loose cylinder to crankcase mounting. Check for leaking crankshaft seals. Check for leaking crankcase gasket.
5. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
6. Carburetor.	Fuel not leaking from float bowl. Choke linkage free and choke fully open when throttle control not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
7. Air filter elements.	Not dirty or oil soaked.	Clean or replace elements as needed.
8. Crankshaft.	Traction drive components free. Blade brake clutch not binding.	Check traction drive cable adjustment. Check blade brake clutch adjustment. Check for faulty blade brake clutch.
9. Governor control panel.	Engine operating at specified 3100 ±100 rpm.	Adjust governor.
10. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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MX,22015BV,12 -19-16JUL96



M48742

ENGINE HAS LOW POWER

MX,22015BV,13 -19-16JUL96

M48742 -19-26JUN90

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13

ENGINE VIBRATES EXCESSIVELY—1995 BBC UNITS

NOTE: Some 1995 BBC units may have excessive vibration due to roughness on the end of the crankshaft and BBC fit up.

Products Effected: All 1995 Model year Silver Walk-Behind Mowers with BBC. (Refer to TP PIP 95GX008.)

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged.



-JUN-20NOV/95
M81663

Test Location

Normal

If Not Normal

1. Blade.

Total blade deflection reading is equal to or less than 1.03 mm (0.040 in.).

Repair.
REFER TO TP PIP 95GX008 FOR DETAILED INFORMATION AND REPAIR PROCEDURES.

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MX,22015BV,19 -19-16JUL96

COMPRESSION TEST

Reason:

Determine the condition of the rings, piston and cylinder walls.

Equipment:

- JDM-59 Compression Gauge

Connections:

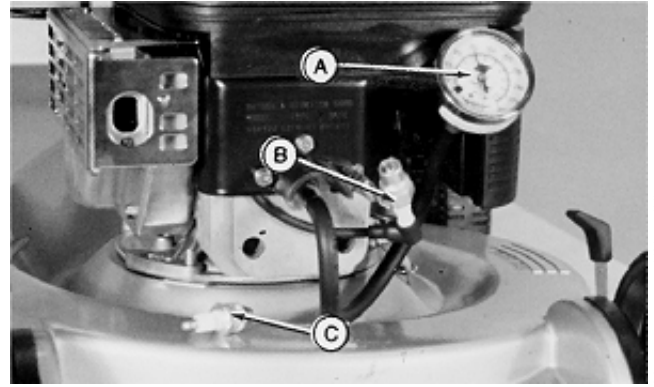
1. Remove spark plug (C) from engine and install compression gauge (A) in spark plug hole of head. Tighten finger tight.
2. Ground spark plug high tension lead (B) to engine.
3. On zone start units, engage zone start bail.

Procedure:

1. Set throttle control to fast position.
2. Pull recoil starter rapidly 5 or 6 times.

Results:

- If compression is below **621 kPa (90 psi)**, go to Section 20; disassemble and check condition of rings, piston and cylinder walls.
- If compression is above **1100 kPa (160 psi)**, check for plugged or damaged muffler.



M49288 -JUN-19JUL90

MX,22015BV,14 -19-16JUL96

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CARBURETOR SLOW IDLE TEST AND ADJUSTMENT

Reason:

Check and adjust slow idle operating rpm of the engine.

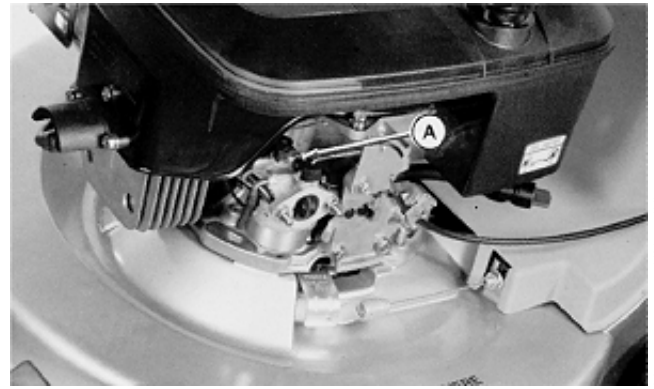
Equipment:

- JT07270 Digital Pulse Tachometer

Procedure:

NOTE: Air cleaner assembly removed for photo only, DO NOT remove for adjustment.

1. Start engine, set throttle control to fast idle and warm up for 2 minutes.
2. Set throttle to slow idle position.
3. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and turn screw (A) until engine is running at **1750 rpm**.



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M49309

MX,22015BV,15 -19-16JUL96

220
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GOVERNOR TEST AND ADJUSTMENT

Reason:

Check and adjust the fast idle or operating rpm of the engine.

Equipment:

- JT07270 Digital Pulse Tachometer

Adjustment Procedure:

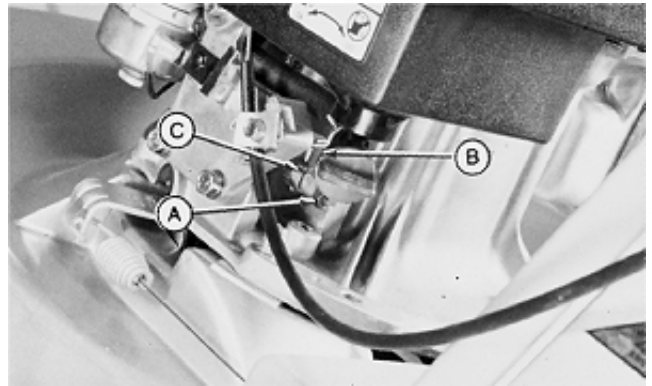
1. Remove air cleaner assembly for access.
2. Reinstall mounting hardware to keep carburetor tight during adjustment.
3. Adjust throttle cable.
4. Move throttle control to fast position.
5. Loosen nut (A).
6. Make sure that arm (B) is rotated clockwise so throttle valve of carburetor is in wide open position.
7. Using a screwdriver, rotate shaft (C) clockwise as far as it will go.
8. Tighten nut.
9. Install air cleaner assembly.

Test Procedure:

1. Start engine, set throttle control at fast idle and warm up for 2 minutes.
2. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and check engine rpm. Fast idle speed should be **3100 ±100 rpm**.

Results:

- If fast idle is uneven or not to specification, readjust governor linkage and retest.
- If fast idle is still not correct, check for faulty governor components.



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MX,22015BV,16 -19-16JUL96

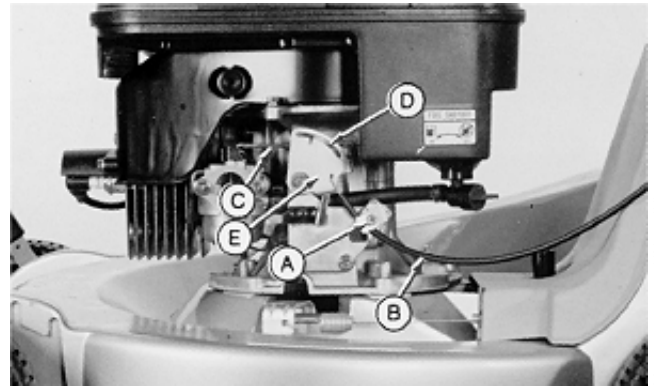
THROTTLE CABLE ADJUSTMENT

Reason:

Make sure that throttle valve and choke valve are adjusted correctly in relation to throttle control.

Procedure:

1. Remove air cleaner assembly for access.
2. Move throttle control to fast position.
3. Loosen screw (A).
4. Move cable housing (B) until choke link (C) just contacts end of slot (D) in governor control arm (E).
5. Check choke valve to make sure that it is open completely. If not, readjust cable housing.
6. Tighten screw.
7. Install air cleaner assembly.



A—Screw
B—Cable Housing
C—Choke Link
D—Slot
E—Governor Control Arm

MX,22015BV,17 -19-16JUL96

Section 222

ENGINE OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON 4-CYCLE

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COMPONENT LOCATION INFORMATION

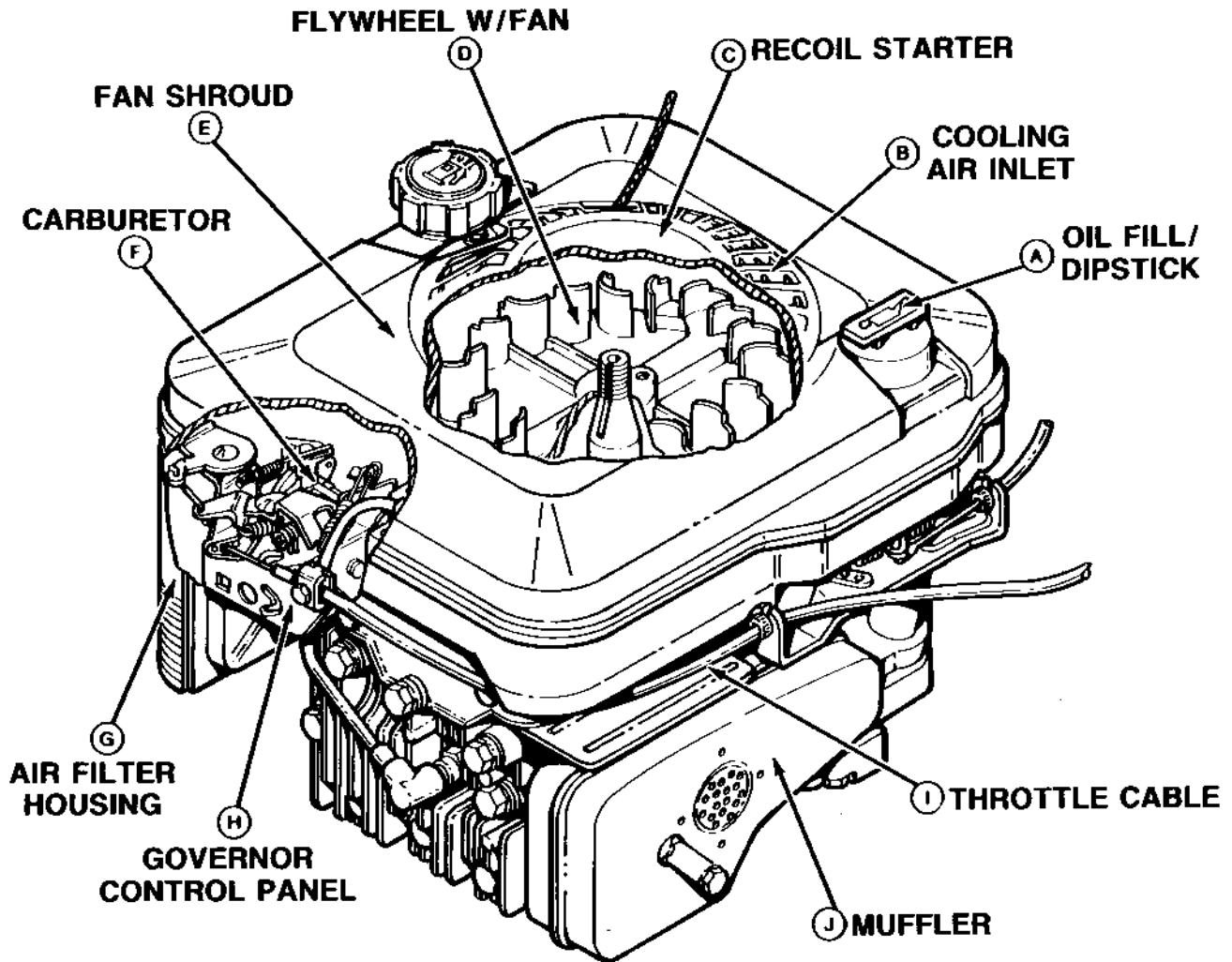
This group contains component location drawings for the following engine system components:

- External Components

Use the drawings when diagnosing an engine problem and to help locate the components to be tested.

MX,22205BV,1 -19-16JUL96

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M48727 EXTERNAL COMPONENTS - BRIGGS & STRATTON 4-CYCLE

- | | | | |
|---------------------|------------------|--------------------------|------------------|
| A—Oil Fill/Dipstick | D—Flywheel W/Fan | G—Air Filter Housing | I—Throttle Cable |
| B—Cooling Air Inlet | E—Fan Shroud | H—Governor Control Panel | J—Muffler |
| C—Recoil Starter | F—Carburetor | | |

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M48727

MX,22205BV,2 -19-16JUL96

THEORY OF OPERATION INFORMATION

This group divides the engine into individual components or systems by function. The story contains information on function, component identification and theory of operation.

The following systems are covered:

- Engine
- Lubrication System

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1

ENGINE OPERATION—BRIGGS & STRATTON 4-CYCLE

A—Flywheel w/Fan
B—Crankshaft
C—Counterweights

D—Fan Shroud
E—Piston
F—Head

G—Valves
H—Cylinder Block

I—Tappets
J—Camshaft

Function:

Supply power to operate the mower.

Major Components:

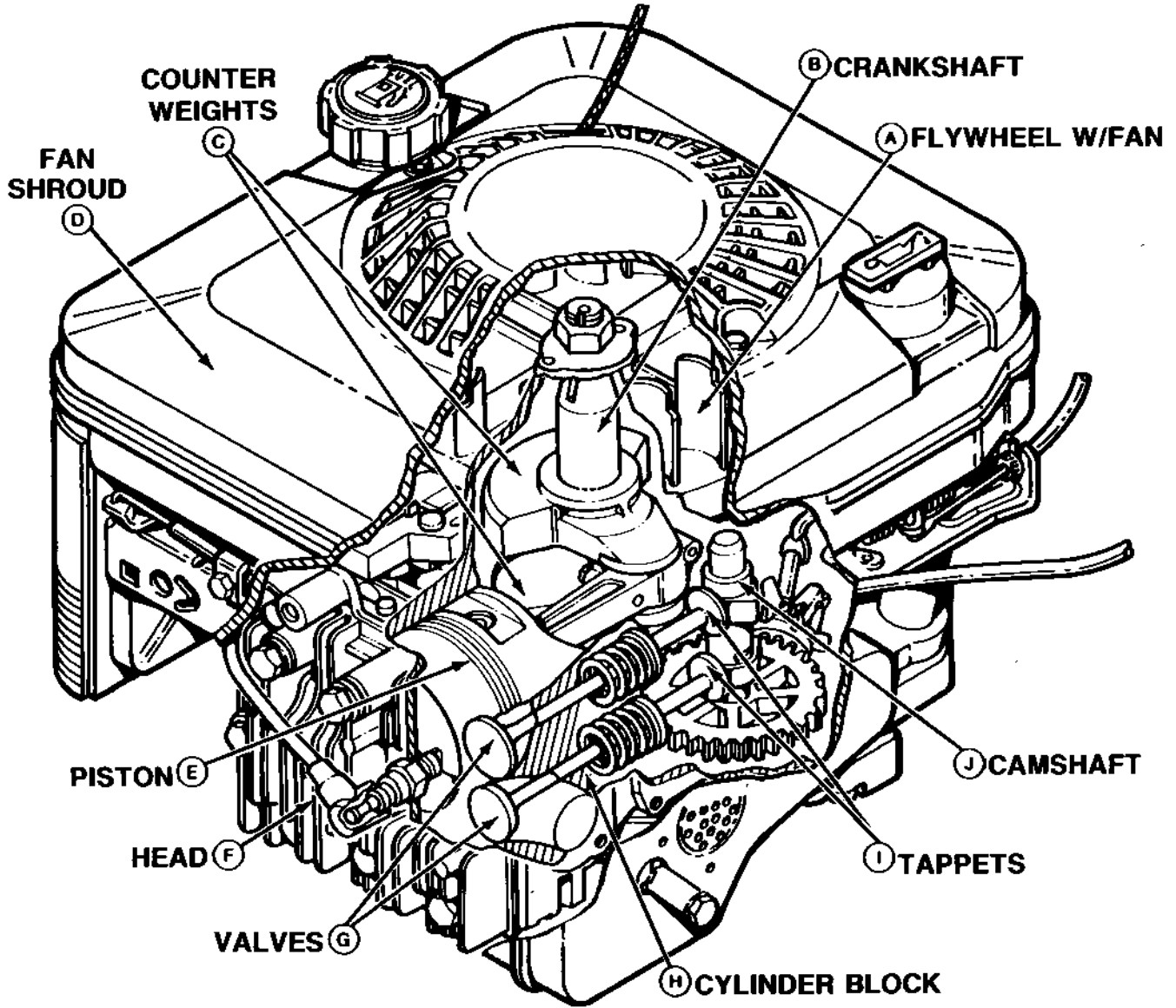
- Valve Train
- Flywheel w/Fan
- Crankshaft

Theory of Operation:

This engine is a 4-cycle of an "L", or flat-head (F), valve design. This means that the valves (G) are in the cylinder block (H) of the engine. The camshaft (J) pushes on the tappets (I) which push directly on the valves. Push rods or rocker arms are not needed. This keeps the valve train simple. The engine is air cooled with the fins of the fan a part of the flywheel (A). Air is directed around the block and head by the fan shroud (D). There are no separate components for dynamic balancing other than the counterweights (C) of the crankshaft (B).

MX,22210BV,2 -19-16JUL96

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M48821

ENGINE OPERATION - BRIGGS & STRATTON 4-CYCLE

MX,22210BV,3 -19-16JUL96

-19-26JUN90

M48821

222
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3

LUBRICATION SYSTEM OPERATION—BRIGGS & STRATTON 4-CYCLE ENGINE

A—Connecting Rod Journal
B—Main Bearings

C—Crankshaft
D—Piston

E—Camshaft Gear
F—Governor Gear

G—Paddles
H—Oil

Function:

Maintain a protective coating of oil on wear surfaces.

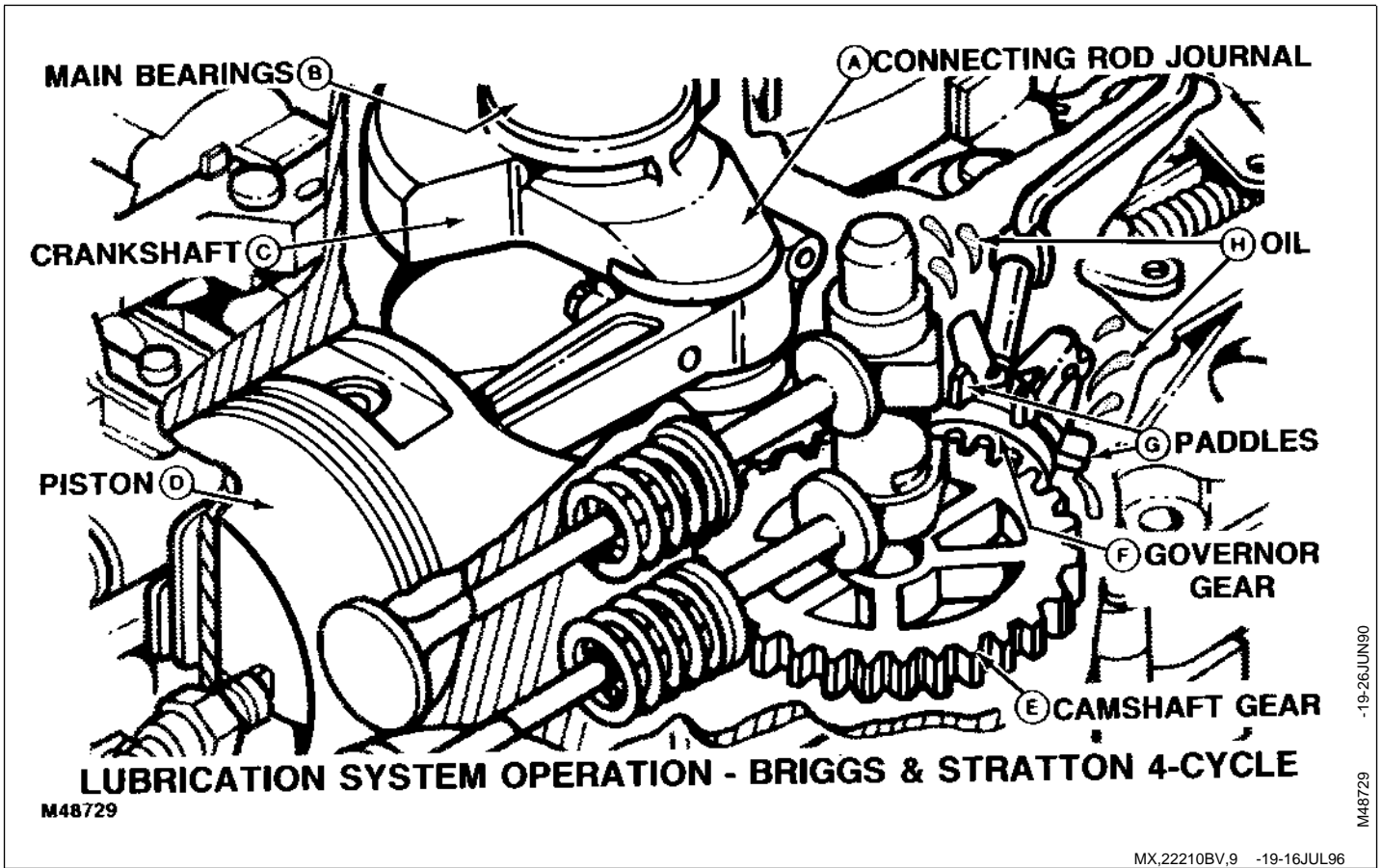
Major Components:

- Oil Slinger w/Gear
- Camshaft Gear

Theory of Operation:

The lubrication system on this engine is a non-pressure splash type. Lubrication of the crankshaft (C), main bearings (B), connecting rod journal (A), piston (D) and other wear surfaces is accomplished by the throwing of oil (H) by the paddles (G) on the governor gear (F). The governor gear is driven by the camshaft gear (E). There is no filtering of the oil so it is important that specified servicing procedures be followed.

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem. Select the appropriate symptom from the list that best matches your problem and follow the test procedures under that heading. The symptom headings are:

- Engine will not start or starts hard
- Engine will not stay running or runs rough
- Engine pulls over hard or recoil snaps back
- Engine has black smoke at start or during operation
- Engine has blue smoke at start or during operation
- Engine has excessive oil consumption
- Engine surges
- Engine backfires at shut-down
- Engine has uneven or uncontrolled RPM
- Engine has low power
- Engine vibrates excessively—1995 BBC units

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the specification or condition that should be obtained when performing the test or check. If the results are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow shows the exact point where the test is to be made.

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1

ENGINE WILL NOT START OR STARTS HARD

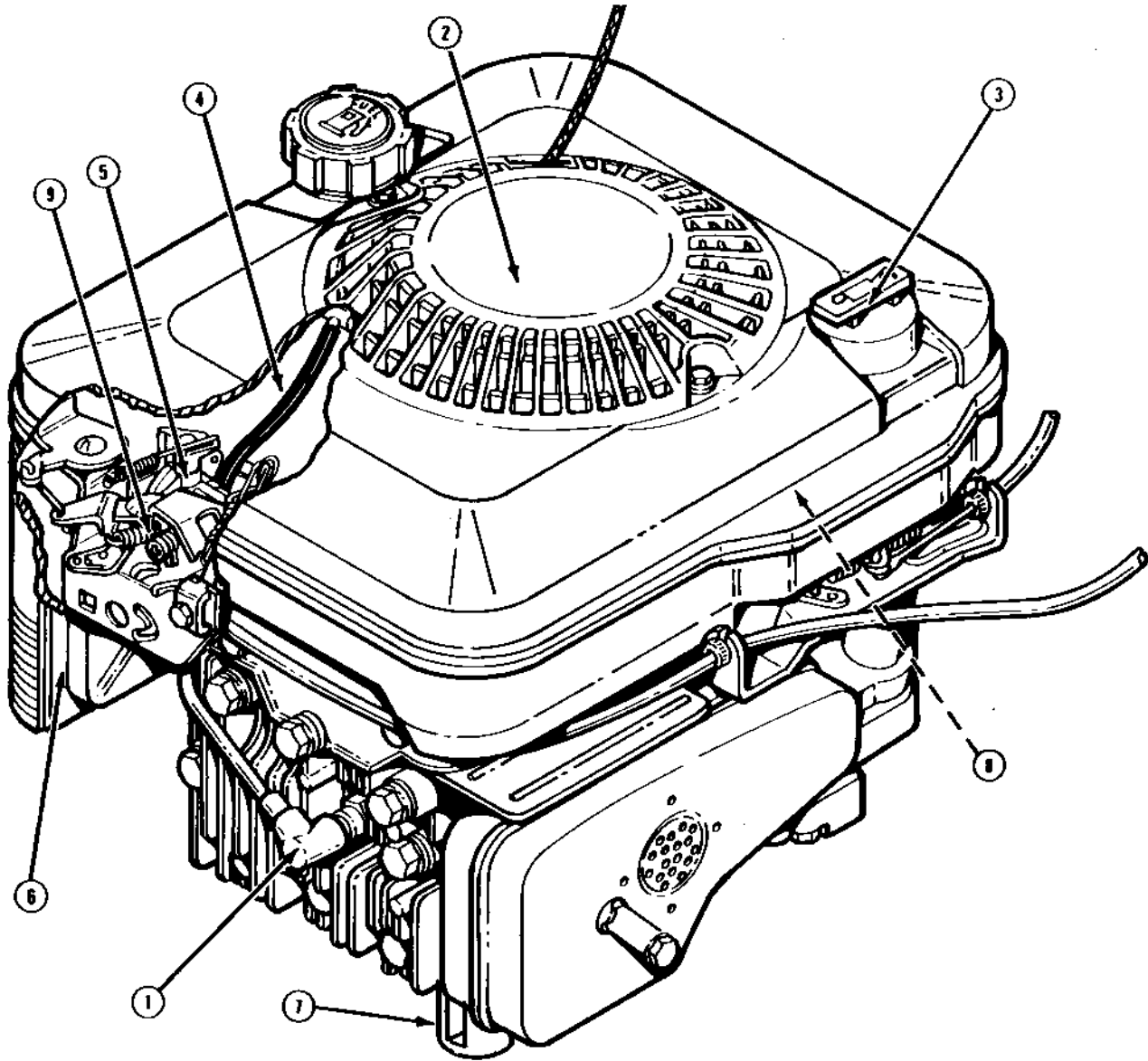
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.

- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 242 Group 15.
- Power train tests found in Section 255 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle not in stop position, zone start bail engaged and spark plug connected.)	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Cylinder.	Sharp rebound when crankshaft rotated against direction of operation on compression stroke.	Check condition of rings, piston and cylinder walls. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 152 mm (6 in.) of water. (Engine running at 3000 ±100 rpm.) Correct level and weight of oil.	Check for leaking crankcase seals and gaskets. Check for sticking or damaged breather components. Check condition of rings, piston, cylinder walls and valves. Replace with specified oil.
4. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
5. Carburetor.	Fuel not leaking from float bowl. Choke linkage ¹ free and choke fully closed when throttle control is in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.
7. Crankshaft.	Traction drive components free.	Check traction drive cable adjustment.
8. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.
9. Governor control panel.	Correctly adjusted and not binding.	Adjust or repair as needed.

¹ Later model carburetors (S.N. 100001—) use a primer system instead of a choke.



M48743

ENGINE WILL NOT START OR STARTS HARD

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-19-26JUN90

M48743

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ENGINE WILL NOT STAY RUNNING OR RUNS ROUGH

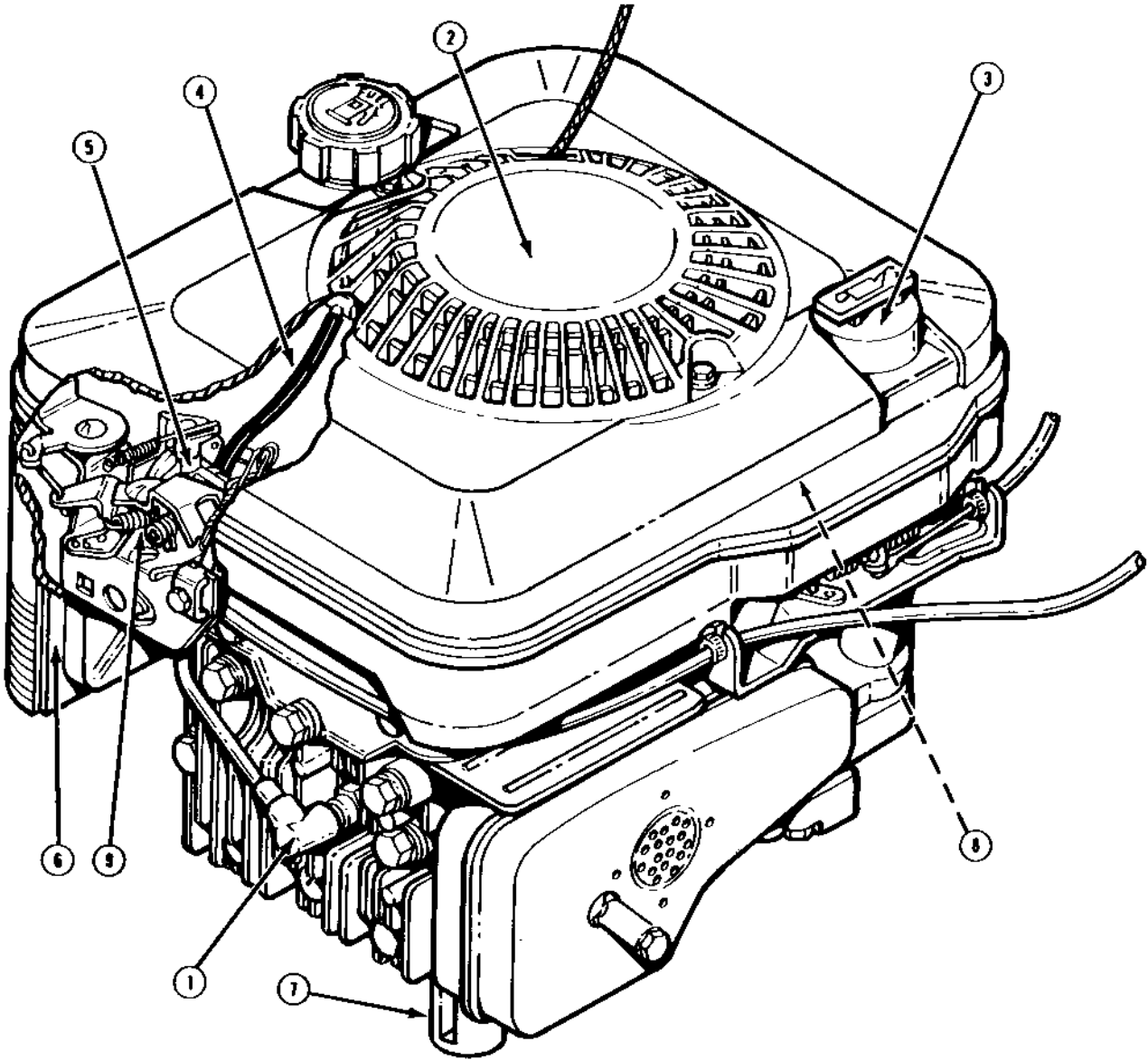
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.

- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 242 Group 15.
- Power train tests found in Section 255 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle not in stop position, zone start bail engaged and spark plug connected.)	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Cylinder.	Sharp rebound when crankshaft rotated against direction of operation on compression stroke.	Check condition of rings, piston and piston and cylinder walls. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 152 mm (6 in.) of water. (Engine running at 3000 ±100 rpm.)	Check for leaking crankcase seals and gaskets. Check for sticking or damaged breather components. Check condition of rings, piston, cylinder walls and valves.
4. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
5. Carburetor.	Fuel not leaking from float bowl. Choke linkage ¹ free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.
7. Crankshaft.	Traction drive components free.	Check traction drive cable adjustment.
8. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.
9. Governor control panel.	Engine operating at specified 3000 ±100 rpm.	Adjust governor.

¹ Later model carburetors (S.N. 100001—) use a primer system instead of a choke.



M48744

ENGINE WILL NOT STAY RUNNING OR RUNS ROUGH

MX,22215BV,5 -19-16JUL96

-19-26JUN90

M48744

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ENGINE PULLS OVER HARD OR RECOIL SNAPS BACK

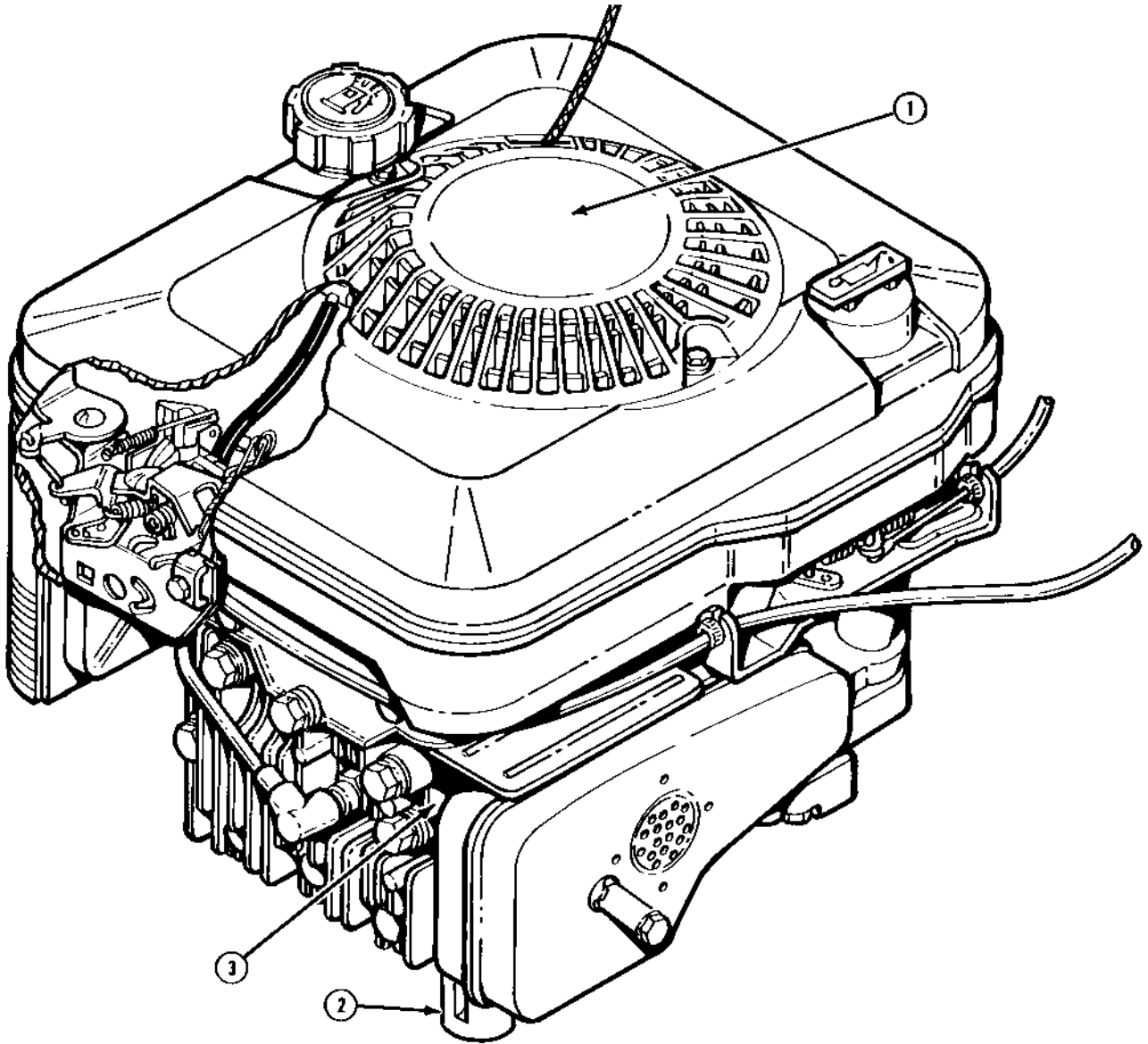
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 242 Group 15.
- Power train tests found in Section 255 Group 15.

Test Location	Normal	If Not Normal
1. Flywheel.	Crankshaft flywheel nut tight.	Check for sheared flywheel key.
	Coil air gap 0.15—0.25 mm (0.008—0.016 in.)	Adjust coil air gap.
	Zone start brake not contacting flywheel when bail engaged.	Check zone start cable adjustment. Check linkage for binding or damage.
2. Crankshaft.	Traction drive free when bail not engaged.	Check traction drive cable adjustment. Check for binding or damaged components.
3. Cylinder.	Intake valve clearance 0.12—0.18 mm (0.005—0.007 in.).	Check components for binding or damage. Adjust valve clearance.
	Exhaust valve clearance 0.18—0.23 mm (0.007—0.009 in.).	
4. Blade (1995 BBC units)	Total blade deflection is less than 1.03 mm (0.040 in.).	Refer to PIP—95GX008.

MX,22215BV,6 -19-16JUL96

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M48745

**ENGINE PULLS OVER HARD
OR RECOIL SNAPS BACK**

MX,22215BV,7 -19-16JUL96

M48745 -19-01DEC95

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7

ENGINE HAS BLACK SMOKE AT START OR DURING OPERATION

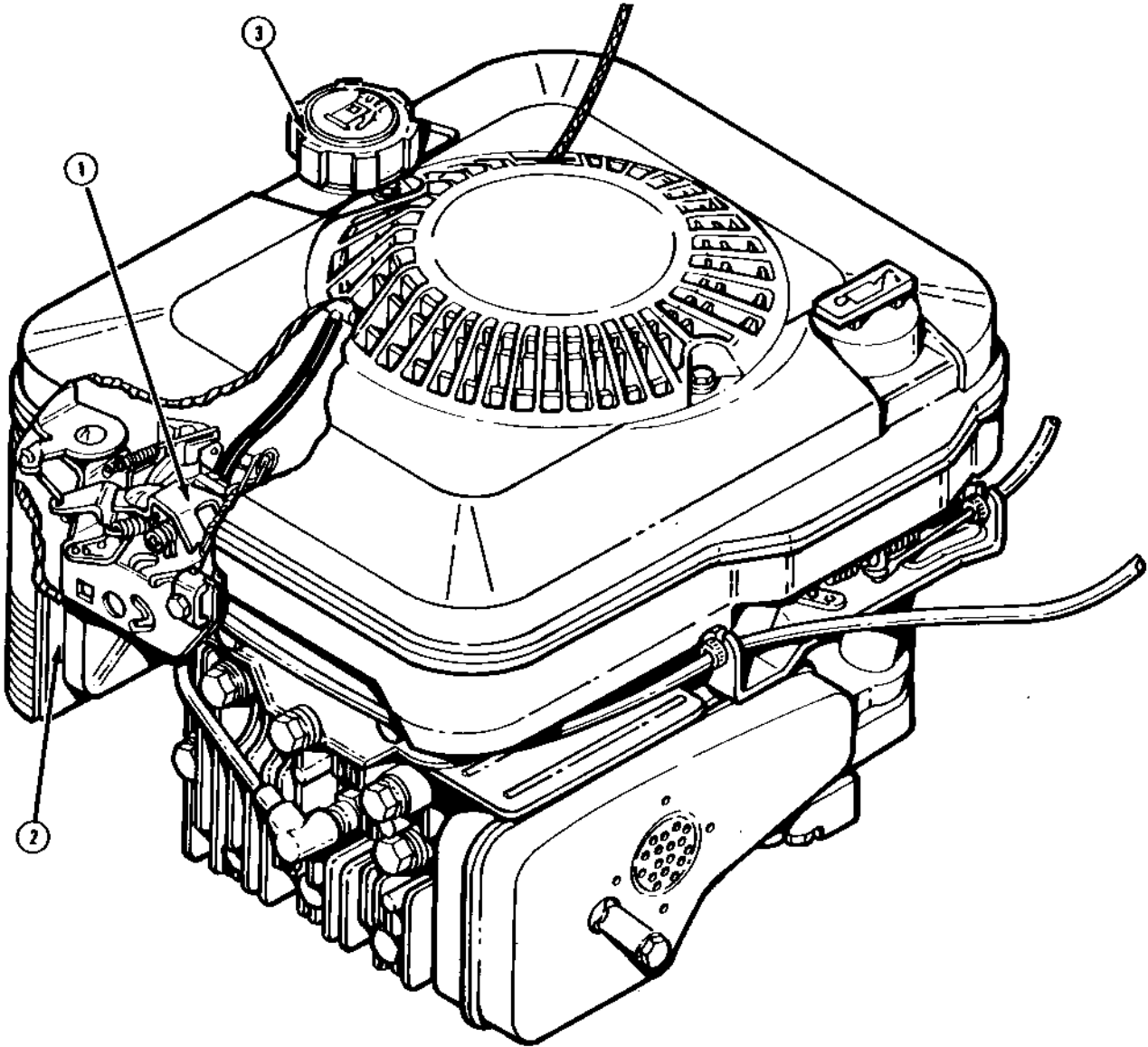
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Carburetor.	Carburetor clean. Fuel not leaking.	Clean carburetor. Clean carburetor, check for damaged inlet needle and seat. Check float for leaks. Check idle mixture screw for damage and adjustment. Check for damaged or missing main jet.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Fuel tank.	Pressure released from tank when cap removed.	Check tank vent, clean and replace faulty components.

MX,22215BV,8 -19-16JUL96

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M48746

**ENGINE HAS BLACK SMOKE
AT START OR DURING OPERATION**

MX,22215BV,9 -19-16JUL96

-19-26JUN90

M48746

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ENGINE HAS BLUE SMOKE AT START OR DURING OPERATION

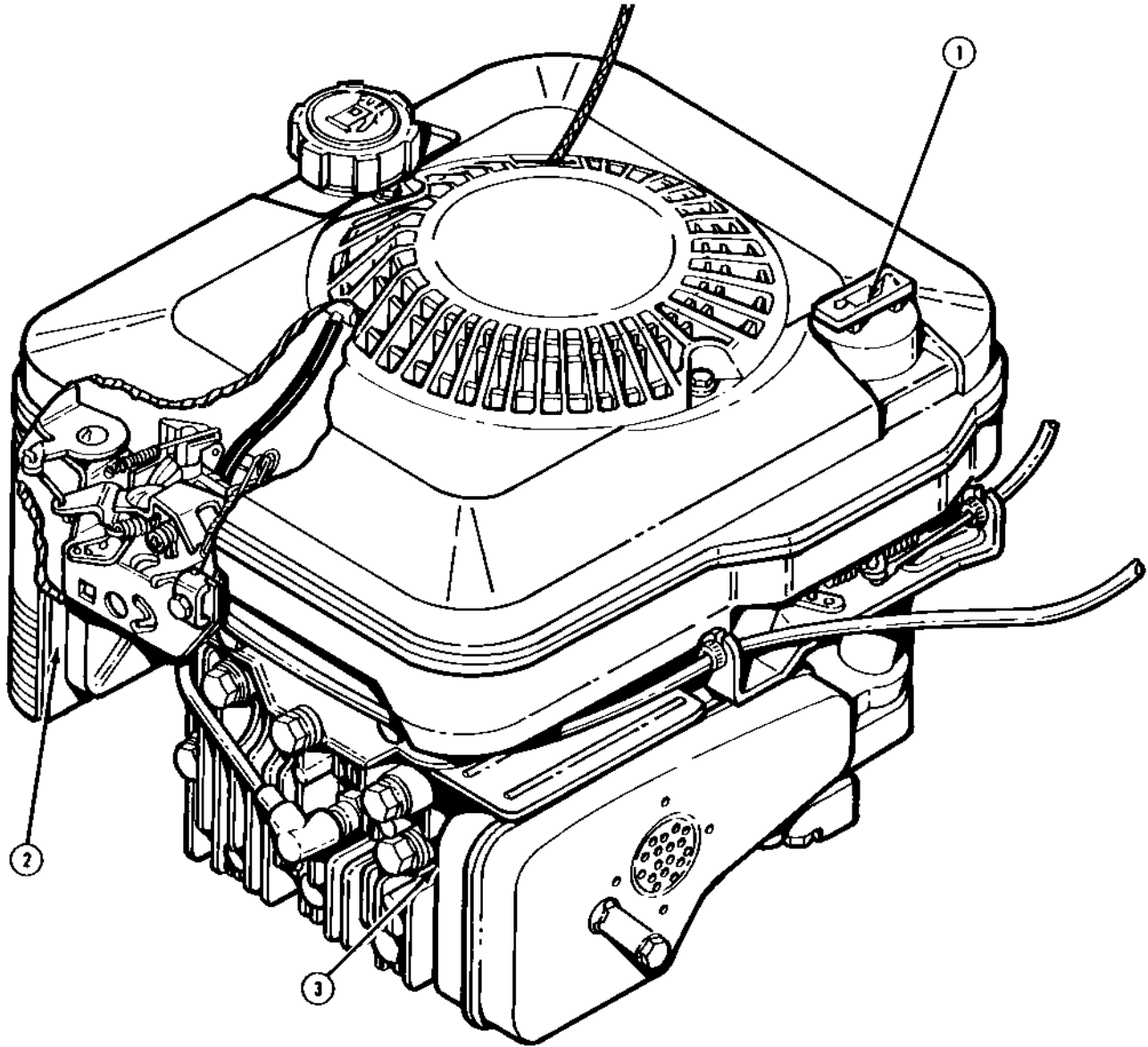
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Proper weight and grade of oil being used.	Change oil.
	Oil level not above full mark on dipstick.	Remove excess oil. Check for fuel contamination of oil, check carburetor.
	Crankcase vacuum of 152 mm (6 in.) of water. (Engine running at 3000 ±100 rpm.)	Check breather operation. Check compression.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Cylinder.	Valve stem to valve guide clearance within specification.	Repair or replace components as needed.

MX,22215BV,10 -19-16JUL96

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**ENGINE HAS BLUE SMOKE
AT START OR DURING OPERATION**

M48747

MX,22215BV,11 -19-16JUL96

M48747 -19-01DEC95

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11

ENGINE HAS EXCESSIVE OIL CONSUMPTION

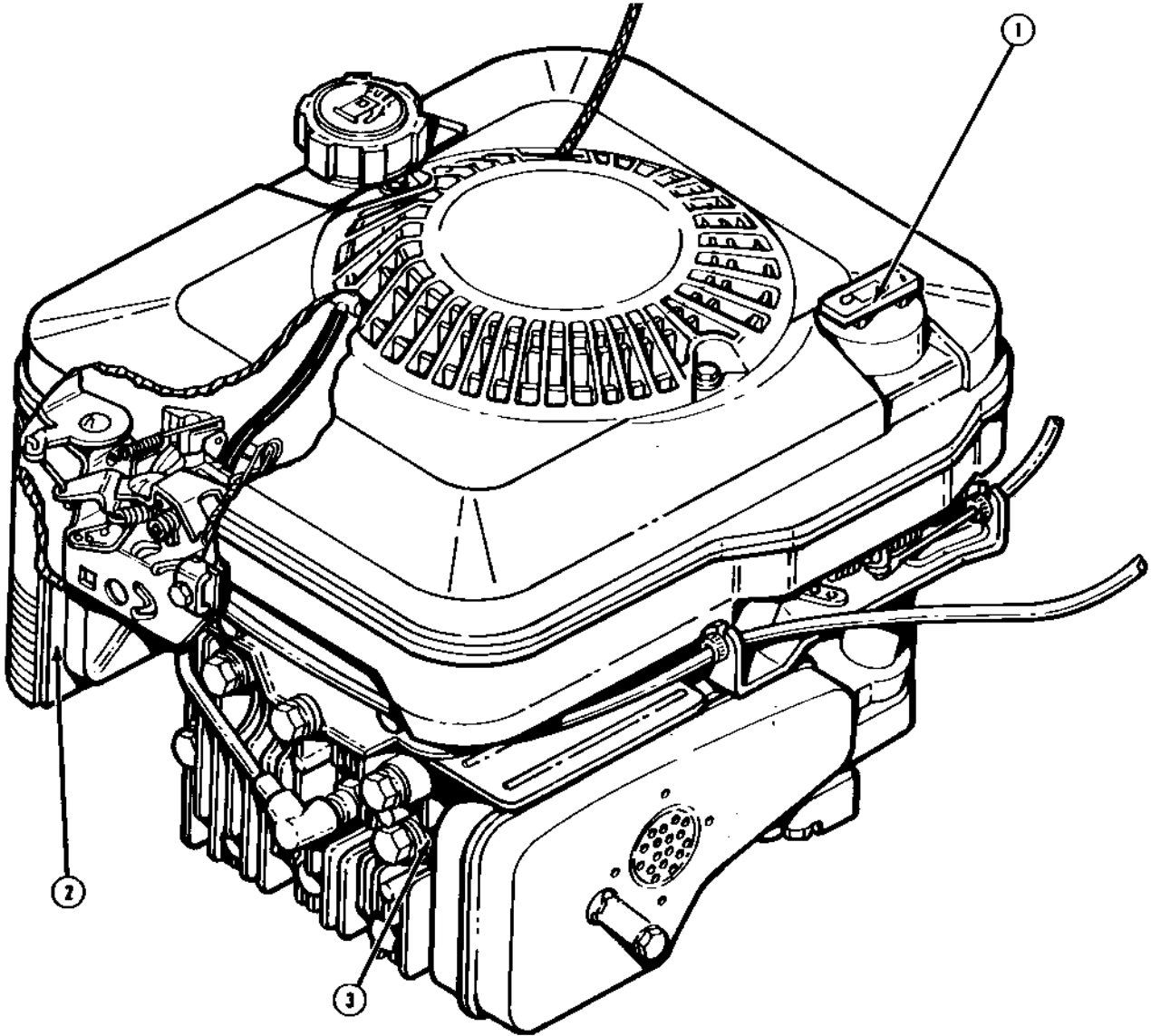
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Proper weight and grade of oil being used.	Change oil.
	Oil level not above full mark on dipstick.	Remove excess oil. Check for fuel contamination of oil. Check for leaking carburetor.
	Crankcase vacuum of 152 mm (6 in.) of water. (Engine running at 3000 ±100 rpm.)	Check breather operation. Check compression.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Cylinder.	Valve stem to valve guide clearance within specification.	Repair or replace components as needed.

MX,22215BV,12 -19-16JUL96

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M48748

ENGINE HAS EXCESSIVE OIL CONSUMPTION

MX,22215BV,13 -19-16JUL96

-19-03JUL90

M48748

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13

ENGINE SURGES

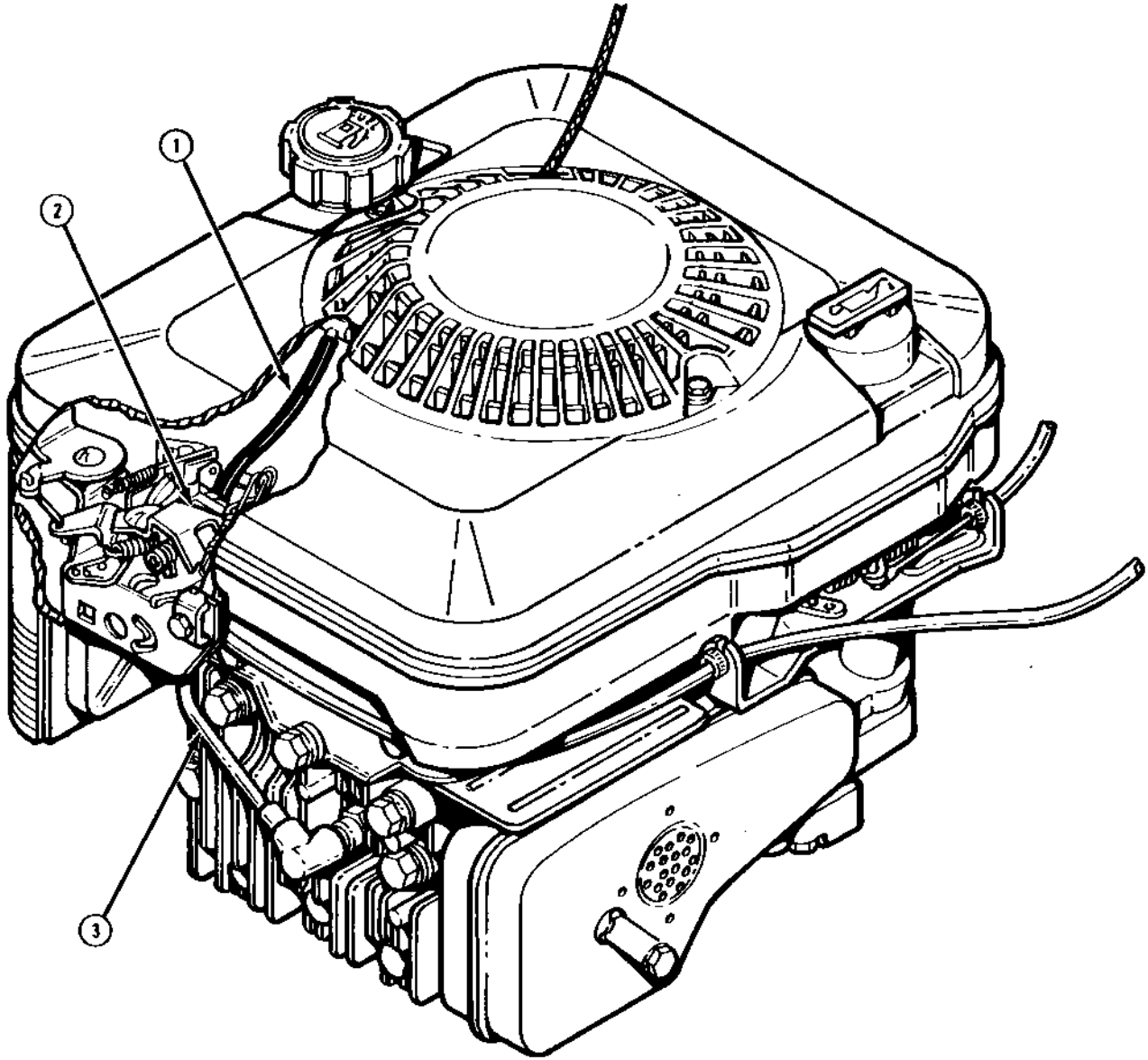
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve ¹ . Check for plugged filter. Check for plugged or pinched hose.
2. Carburetor.	Fuel in float bowl. Choke linkage ² free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
3. Crankcase.	Governor arm tight on governor shaft. Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor and tighten clamp nut. Adjust governor.

¹ Fuel shut-off valve has been eliminated on later models (engines marked 12F702).

² Later model carburetors (S.N. 100001—) use a primer system instead of a choke.



M48749

ENGINE SURGES

MX,22215BV,15 -19-16JUL96

-19-26JUN90

M48749

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ENGINE BACKFIRES AT SHUT-DOWN

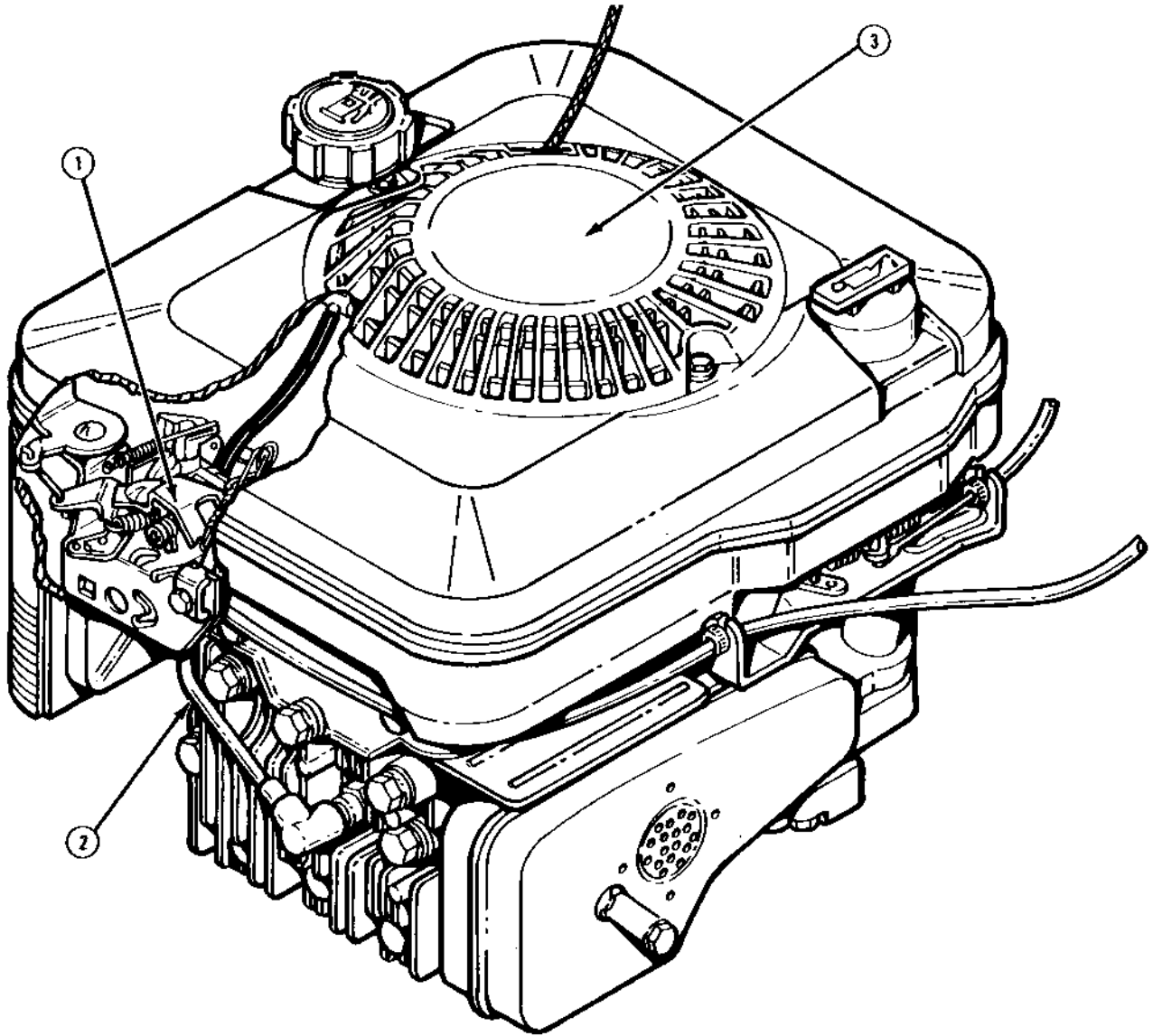
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.

- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 242 Group 15.
- Power train tests found in Section 255 Group 15.

Test Location	Normal	If Not Normal
1. Carburetor.	Carburetor clean.	Clean carburetor.
	Fuel not leaking.	Clean carburetor, check for damaged inlet needle and seat. Check float for leaks. Check idle mixture screw for damage and adjustment. Check for damaged or missing main jet.
	Throttle valve linkage free.	Repair or replace components as needed.
	Choke linkage ¹ free and choke fully open when throttle control not in choke position.	Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
2. Crankcase.	Governor arm tight on governor shaft.	Adjust governor and tighten clamp nut.
	Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor.
3. Flywheel.	Crankshaft flywheel nut tight.	Check for sheared flywheel key.
	Coil air gap 0.15—0.25 mm (0.008—0.016 in.)	Adjust coil air gap.

¹ Later model carburetors (S.N. 100001—) use a primer system instead of a choke.



M48750

ENGINE BACKFIRES AT SHUT-DOWN

MX,22215BV,17 -19-16JUL96

M48750 -19-26JUN90

M48750

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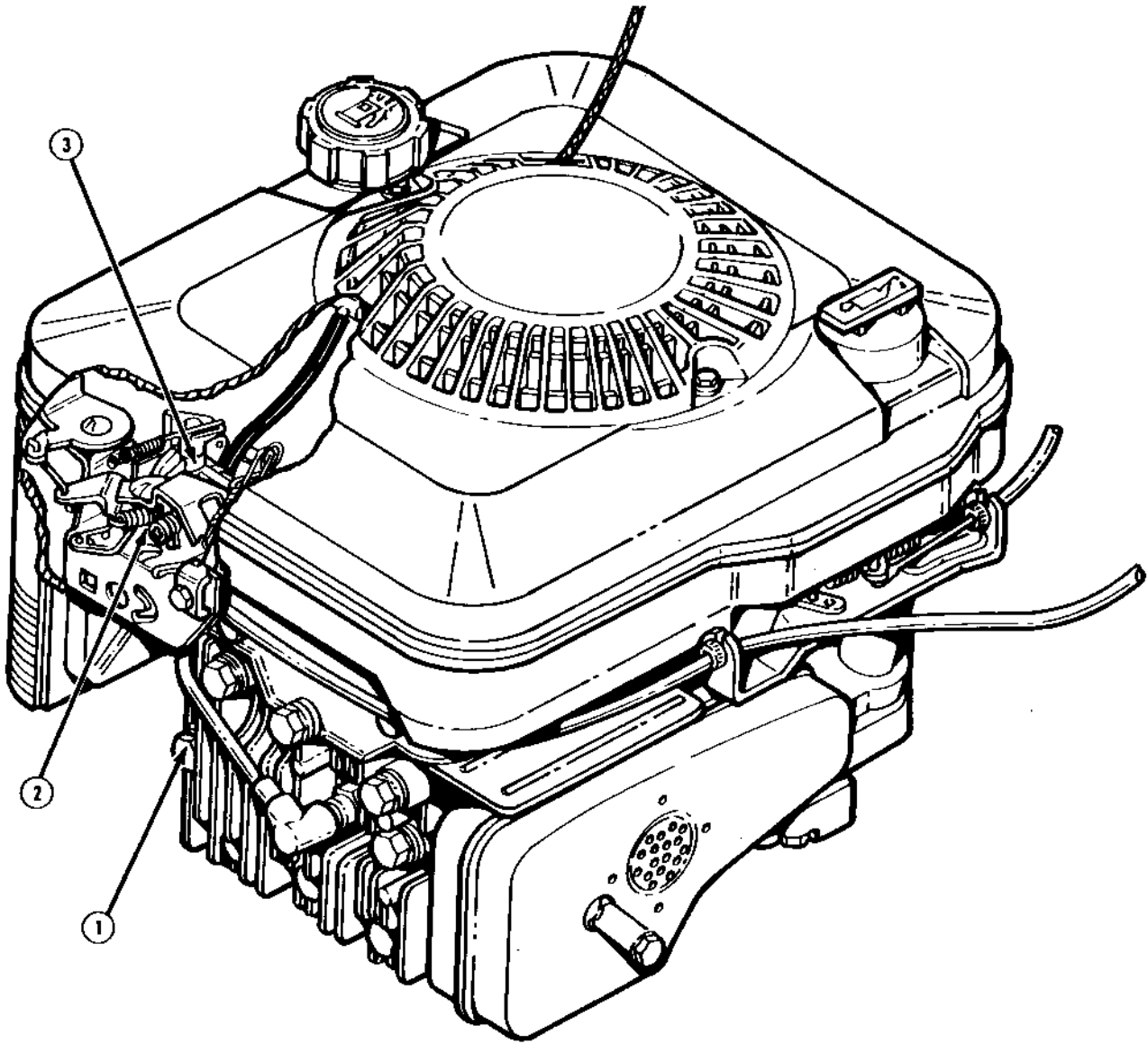
ENGINE HAS UNEVEN OR UNCONTROLLED RPM

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Governor arm tight on governor shaft.	Adjust governor and tighten clamp nut.
	Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor.
	Resistance to movement of governor arm. (Engine running at high idle.)	Disassemble engine and check governor components.
2. Governor control panel.	Linkage not binding or damaged.	Repair or replace components as needed.
	Governor spring installed and not stretched.	Repair or replace spring as needed.
3. Carburetor.	Throttle valve and linkage not binding.	Repair or replace components as needed.
	Low idle stop screw ¹ adjusted correctly.	Adjust low idle.

¹Low idle adjustment has been eliminated from later models (engines marked 12F702).



M48751

ENGINE HAS UNEVEN OR UNCONTROLLED RPM

MX,22215BV,19 -19-16JUL96

M48751 -19-26JUN90

222
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19

ENGINE HAS LOW POWER

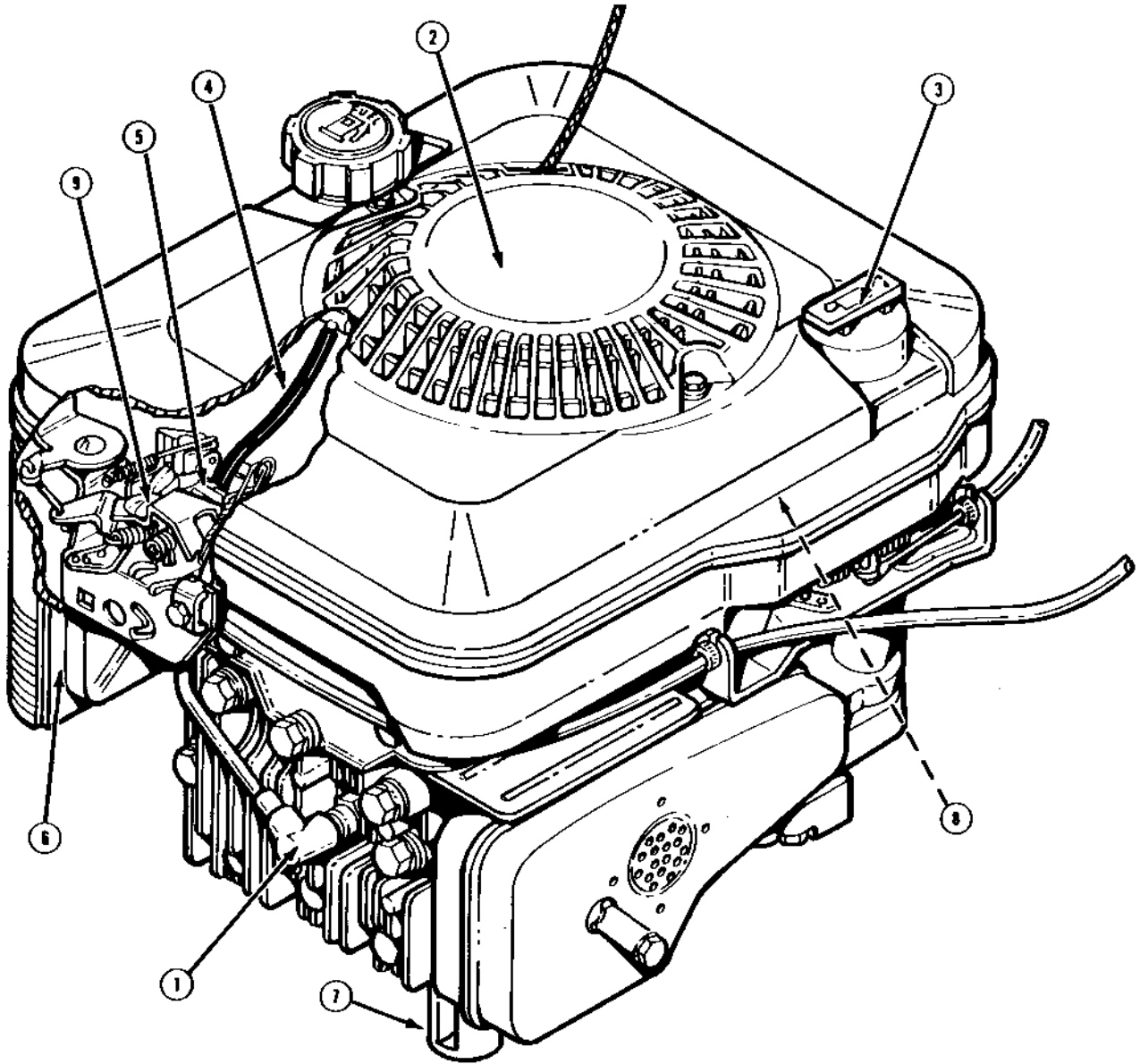
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Zone start disengaged.
- Engine and fuel/air tests found in this group.
- Ignition tests found in Section 242 Group 15.
- Power train tests found in Section 255 Group 15.

Test Location	Normal	If Not Normal
1. Spark Plug.	Plug dry. Steady blue spark. (Throttle not in stop position, zone start bail engaged and spark plug connected.)	Check for inlet needle sealing on carburetor. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Cylinder.	Sharp rebound when crankshaft rotated against direction of operation on compression stroke.	Check condition of rings, piston and cylinder walls. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 152 mm (6 in.) of water. (Engine running at 3000 ±100 rpm).	Check for leaking crankcase seals and gaskets. Check for sticking or damaged breather components. Check condition of rings, piston, cylinder walls and valves.
4. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve ¹ . Check for plugged filter. Check for plugged or pinched hose.
5. Carburetor	Fuel not leaking from float bowl. Choke linkage ² free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.
7. Crankshaft.	Traction drive components free.	Check traction drive cable adjustment.
8. Flywheel.	Zone start brake not contacting flywheel.	Check cable and linkage for binding or damage.
9. Governor control panel.	Engine operating at specified 3000 ±100 rpm.	Adjust governor.

¹ Fuel shut-off valve has been eliminated on later models (engines marked 12F702).

² Later model carburetors (S.N. 100001—) use a primer system instead of a choke.



M48752

ENGINE HAS LOW POWER

MX,22215BV,21 -19-16JUL96

-19-26JUN90

M48752

222
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21

ENGINE VIBRATES EXCESSIVELY—1995 BBC UNITS

NOTE: Some 1995 BBC units may have excessive vibration due to roughness on the end of the crankshaft and BBC fit up.

Products Effected: All 1995 Model year Silver Walk-Behind Mowers with BBC. (Refer to TP PIP 95GX008.)

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged.



M81663 -JUN-20NOV/95

Test Location

Normal

1. Blade.

Total blade deflection reading is equal to or less than 1.03 mm (0.040 in.).

If Not Normal

Repair.
REFER TO TP PIP 95GX008 FOR DETAILED INFORMATION AND REPAIR PROCEDURES.

MX,22215BV,29 -19-16JUL96

222
15
22

COMPRESSION TEST

Reason:

Determine the condition of the rings, piston, valves and cylinder walls.

Connections:

1. Remove spark plug high tension lead from spark plug and ground to engine (A).
2. Remove rewind starter and fan housing.
3. Engage zone start bail.
4. Rotate crankshaft so piston is near bottom of power stroke.

Procedure:

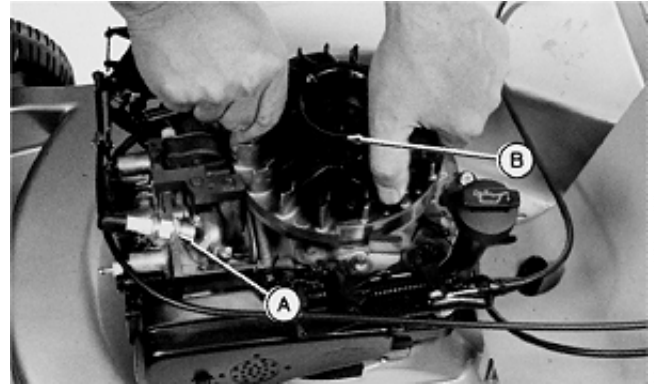
Rapidly rotate flywheel (B) by hand against direction of operation (counterclockwise).

Specifications:

- **Compression Sharp rebound when crankshaft rotated against direction of rotation.**

Results:

- If rebound is weak, go to Section 22 and check condition of rings, piston, valves and cylinder walls.



M49312 -JUN-19JUL90

MX,22215BV,22 -19-16JUL96

222
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23

CRANKCASE VACUUM TEST

Reason:

To determine operation of breather, condition of seals, gaskets, rings, piston and cylinder walls.

Equipment:

- JTO5698 U-Tube Manometer
- 8741-F66 Plug
- JTO5703 Barb Fitting
- JTO5699 Line

Connections:

1. Remove dipstick.
2. Install barb fitting (A) in plug (B) and plug into dipstick tube.

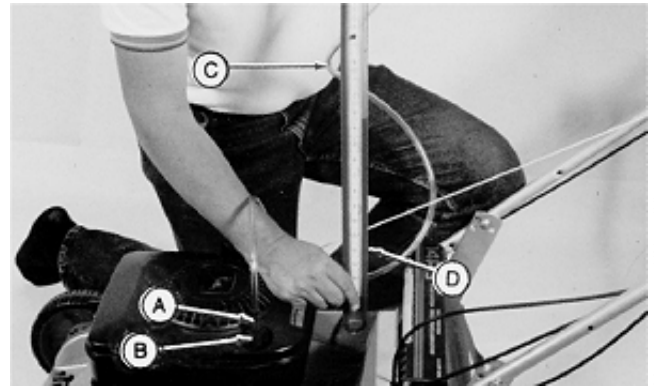
Procedure:

IMPORTANT: Do not make connections between manometer and engine before engine is running or water from the manometer can be drawn into the engine crankcase.

1. Run engine at **fast idle (3000 ±100 rpm)**.
2. Install line (C) between fitting and manometer (D).
3. Record water movement inside manometer. Crankcase vacuum should be a minimum of **152 mm (6 in.) of water at 3000 ±100 rpm**.
4. Remove tube from barb fitting and manometer before stopping engine.

Results:

- If crankcase vacuum is less than specification, check for:
 - Sticky or faulty breather assembly.
 - Leaking crankcase seals or gaskets.
 - Worn rings, piston or cylinder walls.



A—Barb Fitting
B—Plug
C—Line
D—U-Tube Manometer

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CARBURETOR SLOW IDLE TEST AND ADJUSTMENT

Reason:

Check and adjust slow idle fuel/air mixture and rpm.

Equipment:

- JT07270 Digital Pulse Tachometer

Connections:

Turn slow idle mixture screw (A) in until it is lightly seated; back out 1-1/4 turns.

Procedure:

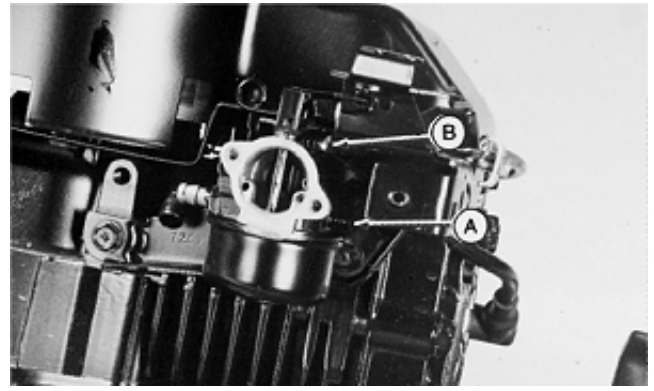
NOTE: Air cleaner assembly removed for photo only, DO NOT remove for adjustment.

1. Start engine, set throttle control to slow idle and warm up for 2 minutes.



CAUTION: Engine will be HOT. Be carefull not to burn hands.

2. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and adjust idle speed screw (B) until engine is running at **1750 ±200 rpm**.
4. Turn idle mixture screw in until rpm starts to drop (engine lean).
5. Turn idle mixture screw out until rpm gain and then start to drop (engine rich).
6. Turn idle mixture screw to midpoint between dropoff points.
7. Set idle speed screw so engine is running at **1750 ±200 rpm**.
8. Move throttle control between slow and fast idle several times. If engine does not accelerate smoothly, adjust idle mixture screw about 1/8 turn richer.



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GOVERNOR TEST AND ADJUSTMENT

Reason:

Check and adjust the fast idle or operating rpm of the engine.

Equipment:

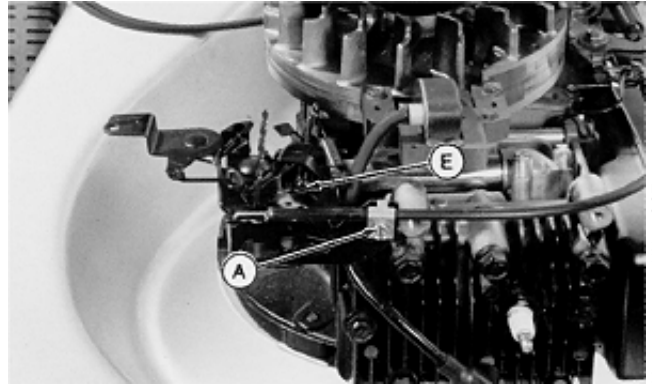
- JT07270 Digital Pulse Tachometer
- Feeler Gauge

Adjustment Procedure:

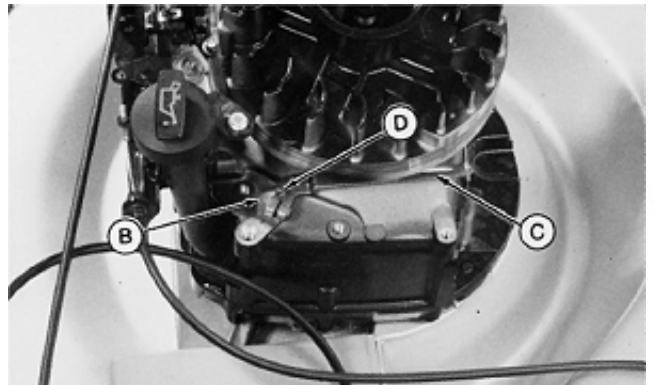
1. Move throttle control to fast idle position and loosen cable clamp screw (A).
2. Shut off fuel valve and remove fuel line at valve.
3. Remove fuel tank assembly and fan shroud for access.
4. Loosen nut (B).
5. Move governor arm (C) to get throttle valve at wide open position.
6. Using a screwdriver, rotate shaft (D) counterclockwise as far as it will go.
7. Tighten nut.
8. Install fan shroud, fuel tank assembly and fuel line. Turn on fuel valve.
9. Adjust throttle cable.

Test Procedure:

1. Start engine, set throttle control at fast idle and warm up for 2 minutes.
2. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and turn screw (E), using a #25 Torx® driver, until engine is running at **3000 ±100 rpm**.



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-JUN-30OCT90

- A—Cable Clamp Screw
- B—Nut
- C—Governor Arm
- D—Shaft
- E—Screw

THROTTLE CABLE ADJUSTMENT

Reason:

Make sure that throttle valve and choke valve are adjusted correctly in relation to throttle control.

Equipment:

- Feeler Gauge Set

Procedure:

1. Move throttle control to fast position.
2. Loosen screw (A).

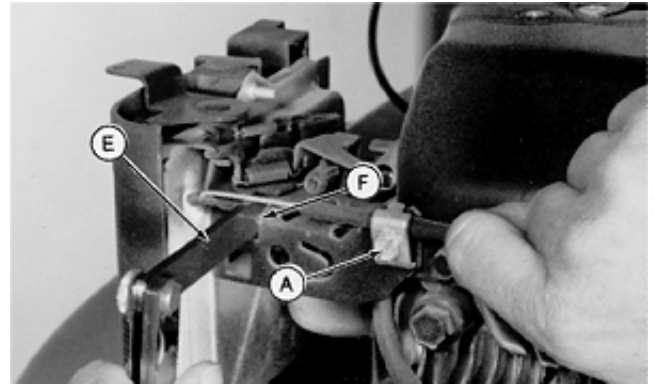
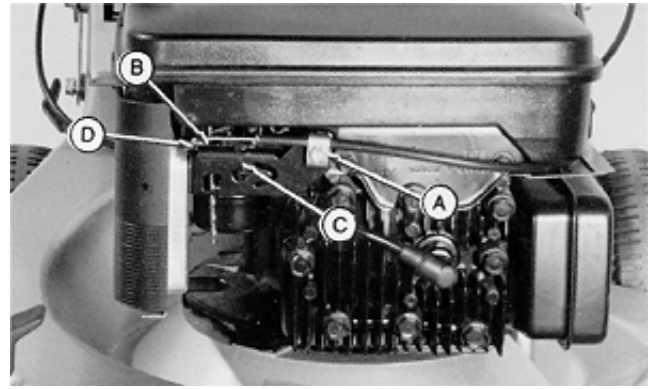
3A. Drill bit method. Insert a 1/8 in. drill bit through holes (B) in carburetor control bracket (C) and arm (D).

NOTE: Use hole in control bracket closest to inlet side of carburetor.

3B. Feeler gauge method. Insert feeler gauge (E) into slot (F) of control bracket.

NOTE: Use enough blades of feeler gauge to fit snugly in slot.

4. Tighten screw and remove drill bit or feeler gauge.



- A—Screw
- B—Holes
- C—Control Bracket
- D—Arm
- E—Feeler Gauge
- F—Slot

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VALVE CLEARANCE TEST AND ADJUSTMENT

Reason:

Check and adjust valve clearance for proper engine operation.

Equipment:

- Feeler Gauge

Procedure:

1. Remove muffler, breather assembly and spark plug.
2. Rotate crankshaft until piston is 1/4 turn past top dead center of compression stroke.
3. Insert feeler gauge (C) between valve stem (A) and tappet (B).

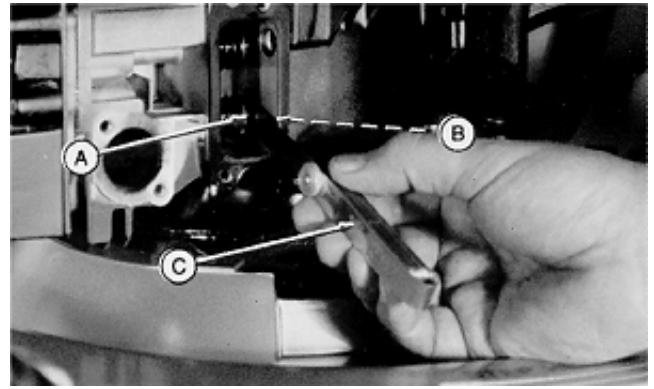
NOTE: Before installing muffler, breather assembly and spark plug, do the compression release operation test.

Specifications:

- **Valve Clearance (cold)**
 - Intake .. 0.12—0.18 mm (0.005—0.007 in.).
 - Exhaust .. 0.18—0.23 mm (0.007—0.009 in.).

Results:

- If valve clearance is less than specification, remove valve from engine and grind end of stem as needed. Take care to keep end of valve stem square.
- If valve clearance is more than specification, remove valve from engine and cut valve seat deeper as needed. Take care to keep valve seat width between **1.19 and 1.59 mm (0.047 and 0.063 in.)**.



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COMPRESSION RELEASE OPERATION TEST

Reason:

Verify operation of compression release.

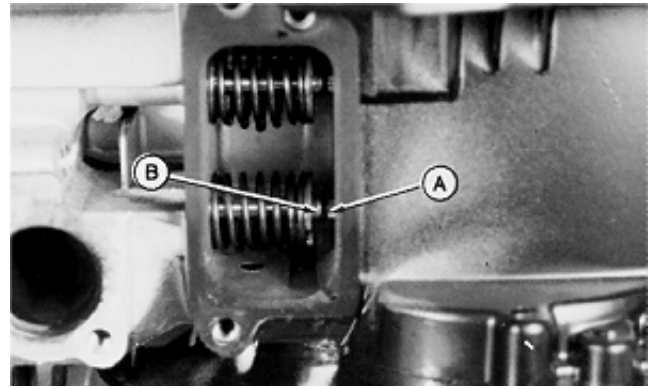
Procedure:

1. Do the valve clearance test and adjustment procedure first.

2. Slowly rotate the crankshaft from bottom dead center to top dead center of the compression stroke and watch the exhaust valve tappet (A). The exhaust valve (B) should lift off its seat about **0.25 mm (0.010 in.)**.

Results:

- If lift is less than specification, intake lobe of camshaft is worn; camshaft will need to be replaced.



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Section 225 ENGINE OPERATION TESTS AND ADJUSTMENTS—KAWASAKI

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COMPONENT LOCATION INFORMATION

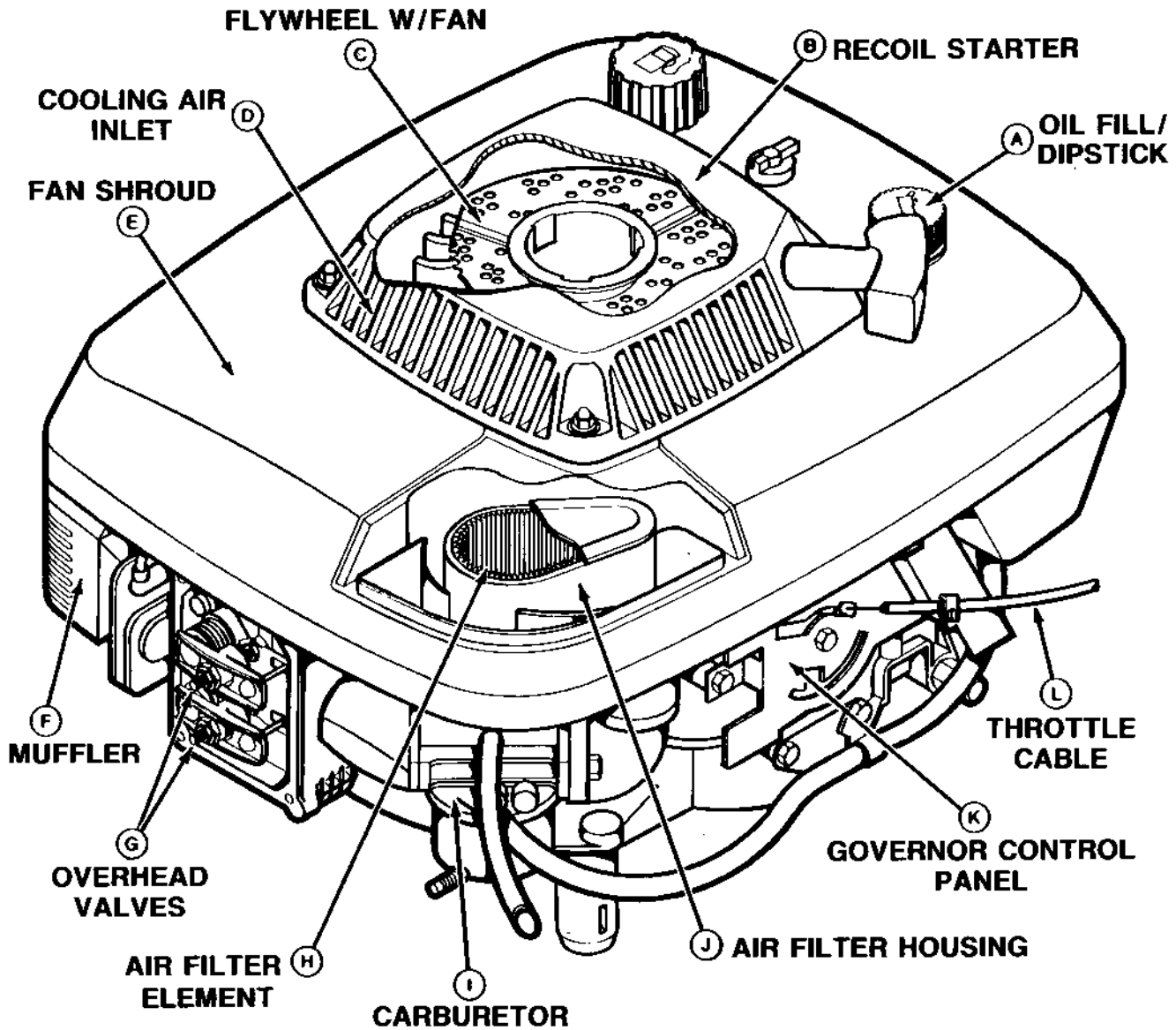
This group contains component location drawings for the following engine system components:

- External Components

Use the drawings when diagnosing an engine problem and to help locate the components to be tested.

MX,22505BV,1 -19-16JUL96

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M48705

EXTERNAL COMPONENTS - KAWASAKI

A—Oil Fill/Dipstick
 B—Recoil Starter
 C—Flywheel w/Fan

D—Cooling Air Inlet
 E—Fan Shroud
 F—Muffler

G—Overhead Valves
 H—Air Filter Element
 I—Carburetor

J—Air Filter Housing
 K—Governor Control Panel
 L—Throttle Cable

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THEORY OF OPERATION INFORMATION

This group divides the engine into individual components or systems by function. The story contains information on function, component identification and theory of operation.

The following systems or components are covered:

- Engine
- Lubrication System

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KAWASAKI ENGINE OPERATION

A—Crankshaft
B—Flywheel w/Fan
C—Fins

D—Fan Shroud
E—Piston
F—Valves

G—Head
H—Rocker Arms
I—Push Rods

J—Tappets
K—Camshaft
L—Counterweights

Function:

Supply power to operate the mower.

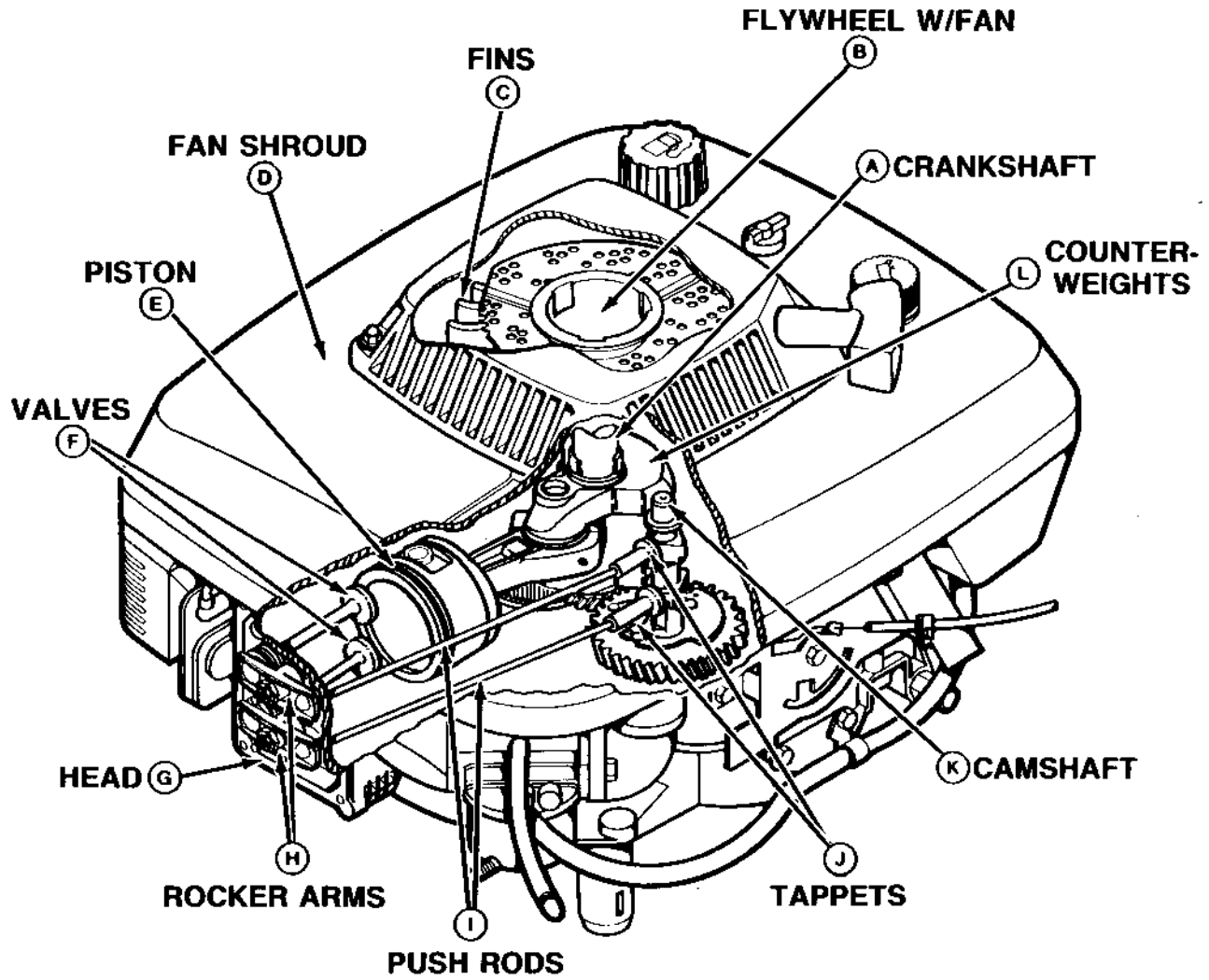
Major Components:

- Crankshaft
- Valve Train
- Flywheel w/Fan

Theory of Operation:

This engine is a 4-cycle using an overhead valve design. This means that the valves (F) are located in the head (G) of the engine. The camshaft (K) pushes on the tappets (J) which operate the push rods (I). The push rods push on one side of the rocker arms (H) and the opposite ends of the rocker arms actuate the valves. This makes the valve train more complex than an engine of a flat head design, but offers higher efficiency. The engine is air cooled with the fins (C) of the fan a part of the flywheel (B). Air is directed around the block and head by the fan shroud (D). There are no separate components for dynamic balancing of the piston (E) other than the counterweights (L) of the crankshaft (A).

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ENGINE OPERATION - KAWASAKI

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3

LUBRICATION SYSTEM OPERATION—KAWASAKI ENGINE (14PB, 14SB, 14SC AND 14SE)

A—Crankshaft

B—Upper Main Bearing

C—Crankshaft Passages

D—Sprayed Oil

E—Piston

F—Lower Main Bearing

G—Pressure Free Oil

H—Pressure Oil

I—Oil Filter Cartridge
(Optional)

J—Gerotor Pump

K—Relief Valve

L—Sump Screen

M—Sump

N—Connecting Rod Journal

Function:

Maintain a film of oil on critical wear and bearing surfaces.

Major Components:

- Pump
- Internal Passages
- Relief Valve
- Filter Cartridge (Optional)

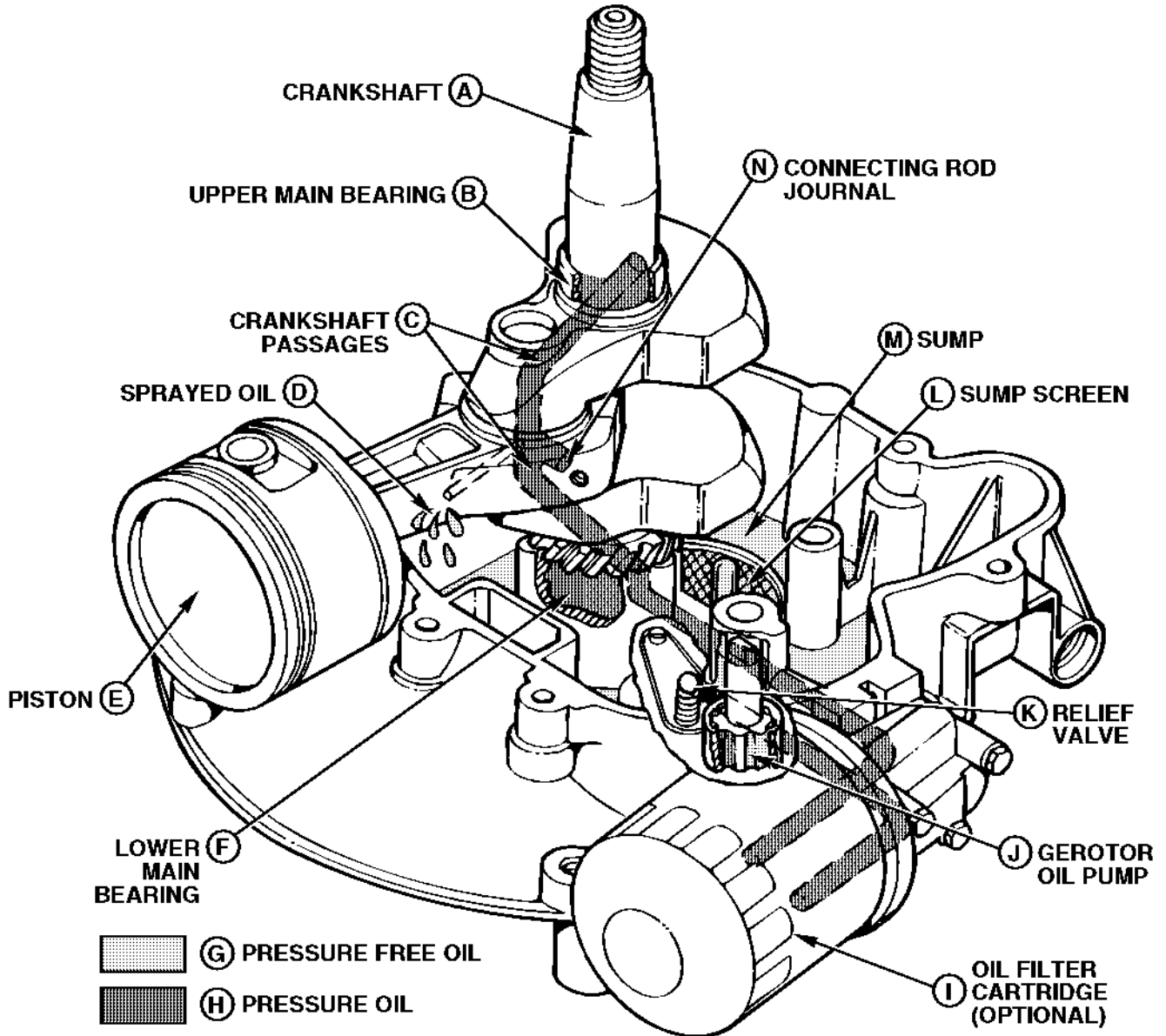
Theory of Operation:

This engine has a pressure lubrication system for main and connecting rod bearings. It uses the oil-laden air of the breather system for the lubrication of the overhead valve components. Oil is drawn from the sump (M) past the sump screen (L) by the internal gerotor pump (J). The oil is then routed past

the relief valve (K), through the optional filter cartridge (if installed) (I) to the lower main bearing (F) of the crankshaft (A). From there it flows through passages (C) in the crankshaft to the connecting rod journal (N). Some oil (D) is sprayed from the connecting rod journal onto the cylinder walls and piston (E). The rest is routed through the crankshaft to the upper main bearing (B).

During operation, the air in the crankcase becomes very oily. This air travels out the breather passage into the head. This oil/air mixture lubricates the rocker arms and valves. Lubrication of the camshaft and tappets of the lower valve train is by splash. There is a by-pass valve in the filter cartridge so the engine will get oil even if the cartridge should become plugged.

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**LUBRICATION SYSTEM OPERATION — KAWASAKI ENGINE
(14PB, 14SB, 14SC AND 14SE)**

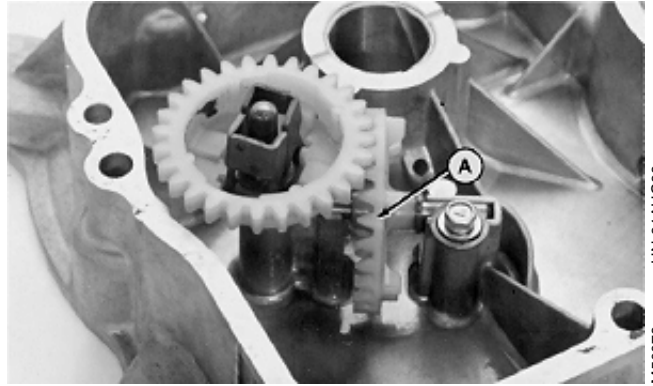
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LUBRICATION SYSTEM OPERATION—KAWASAKI ENGINE (14PT AND 14ST)



Function:

Maintain a film of oil on critical wear and bearing surfaces.

Major Components:

- Oil Slinger Assembly
- Governor Flyweights Assembly
- Crankshaft Governor Drive Gear
- Properly Maintained Crankcase Oil Level

Theory of Operation: This engine has an oil slinger assembly (A) that is driven off the governor flyweights

assembly, which, in turn, is driven off the crankshaft governor drive gear. The oil slinger assembly (A) has slinger tabs that stick out from the back side of the gear. As the engine is running, these slinger tabs splash oil all over the inside of the crankcase, lubricating the critical wear components and bearing surfaces. This slung oil also mixes with the crankcase air and uses the breather system to lubricate the overhead valve components with this oil/air mixture.

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem. Select the appropriate symptom from the list that best matches your problem and follow the test procedures under that heading. The symptom headings are:

- Engine will not start or starts hard
- Engine will not stay running or runs rough
- Engine pulls over hard or recoil snaps back
- Engine has black smoke at start or during operation
- Engine has blue smoke at start or during operation
- Engine has excessive oil consumption
- Engine surges
- Engine backfires at shut-down
- Engine has uneven or uncontrolled rpm
- Engine has low power
- Engine vibrates excessively—1995 BBC units

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the specification or condition that should be obtained when performing the test or check. If the results are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow shows the exact point where the test is to be made.

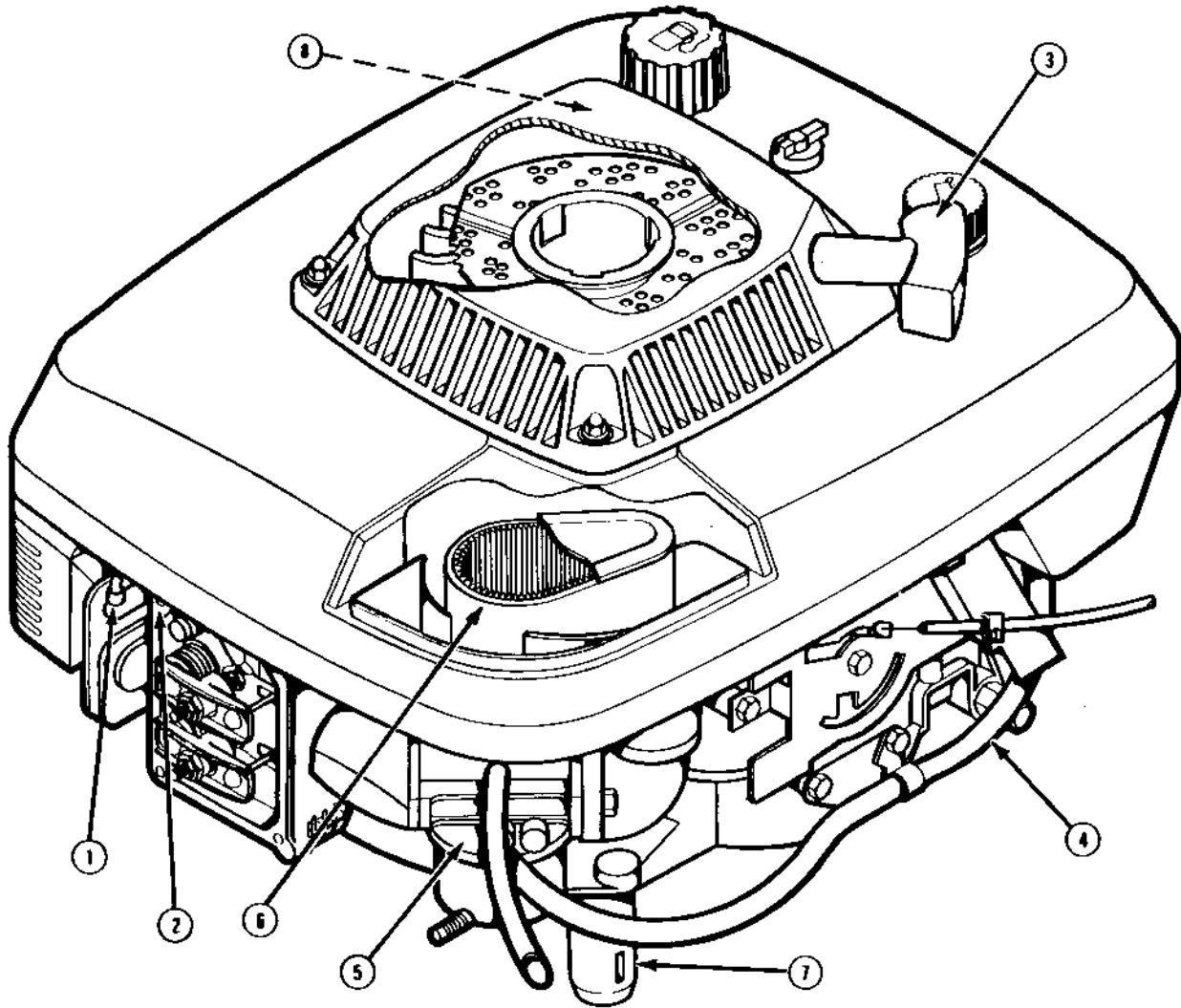
ENGINE WILL NOT START OR STARTS HARD

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Electrical tests found in Section 245 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check carburetor inlet needle sealing. Check for correct adjustment of choke linkage. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Head.	Minimum compression of 155 kPa (22.5 psi).	Check condition of rings, piston and cylinder walls. Check for sticking or damaged compression release components. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 170 mm (6.7 in.) of water. (Engine running at 3075 ±75 rpm.)	Check for leaking crankcase seals and gaskets. Check for sticking or damaged breather components. Check condition of rings, piston, cylinder walls and valves.
4. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hoses.
5. Carburetor.	Fuel not leaking from float bowl. Choke linkage free and choke fully closed when throttle control is in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.
7. Crankshaft.	Traction drive components free. Blade brake clutch not dragging when bail disengaged.	Check traction drive cable adjustment. Check blade brake clutch adjustment. Check for faulty blade brake clutch.
8. Starter motor.	Starter motor turning engine at a minimum of 350 rpm.	Check battery for minimum of 12.5 VDC. Check wiring and key switch contacts. Check for correct weight of engine oil. Check compression release operation.
9. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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**ENGINE WILL NOT START OR
STARTS HARD**

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MX,22515BV,3 -19-16JUL96

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ENGINE WILL NOT STAY RUNNING OR RUNS ROUGH

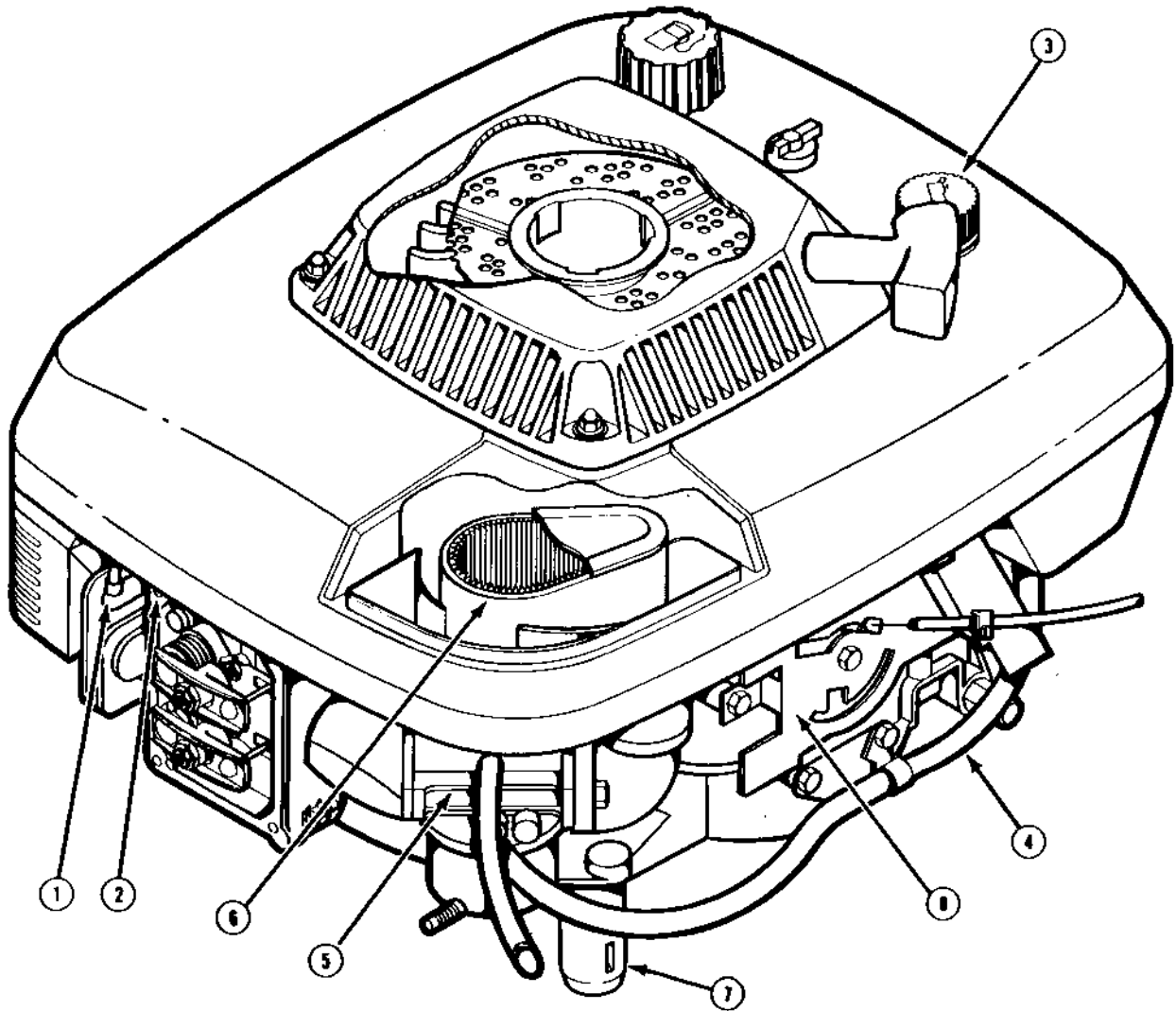
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.

- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Electrical tests found in Section 245 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check for carburetor needle sealing. Check for correct adjustment of choke linkage at carburetor and governor control panel. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Head.	Minimum compression of 155 kPa (22.5 psi).	Check condition of rings, piston and cylinder walls. Check for sticking or damaged compression release components. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 170 mm (6.7 in.) of water. (Engine running at 3075 ±75 rpm.)	Check crankcase seals and gaskets. Check for faulty breather components. Check condition of rings, piston, cylinder walls and valves.
4. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
5. Carburetor.	Fuel not leaking from float bowl. Choke linkage free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check throttle cable adjustment.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace as needed.
7. Crankshaft.	Traction drive components free. Blade brake clutch not dragging when control and bail disengaged.	Check traction drive cable adjustment. Check cable adjustment. Check for faulty blade brake clutch.
8. Governor control panel.	Engine operating at specified 3075 ±75 rpm.	Adjust governor.
9. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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**ENGINE WILL NOT STAY RUNNING
OR RUNS ROUGH**

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M48754 -19-26JUN90

MX,22515BV,5 -19-16JUL96

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ENGINE PULLS OVER HARD OR RECOIL SNAPS BACK

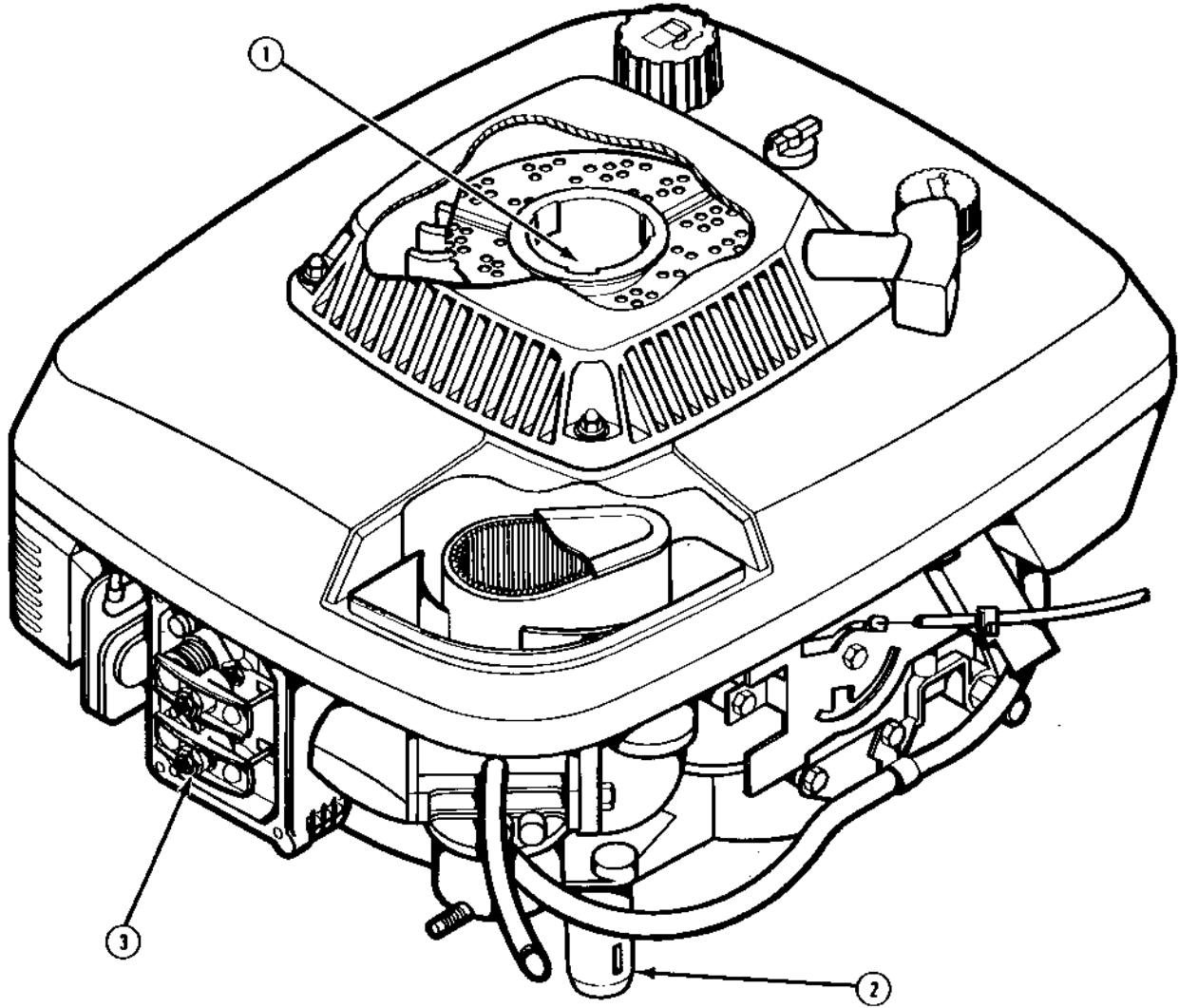
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Electrical tests found in Section 245 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Flywheel.	Crankshaft nut tight. Coil air gap 0.30 mm (0.012 in.)	Check for sheared flywheel key. Adjust coil air gap.
	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.
2. Crankshaft.	Traction drive free when bail not engaged.	Check traction drive cable adjustments. Check for binding or damaged components.
	Blade brake clutch not binding when control and bail not engaged.	Check blade brake clutch cable adjustment. Check for faulty blade brake clutch.
3. Head.	Valve clearance of 0.12 mm (0.005 in.).	Check components for binding or damage. Adjust valve clearance.
	Compression release holding exhaust valve off seat 0.50 mm (0.020 in.) for part of compression stroke.	Adjust valve clearance. Check for sticking or damaged compression release components.
4. Blade (1995 BBC units).	Total blade deflection is less than 1.03 mm (0.040 in.).	Refer to PIP—95GX008.

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**ENGINE PULLS OVER HARD
OR RECOIL SNAPS BACK**

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MX,22515BV,7 -19-16JUL96

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ENGINE HAS BLACK SMOKE AT START OR DURING OPERATION

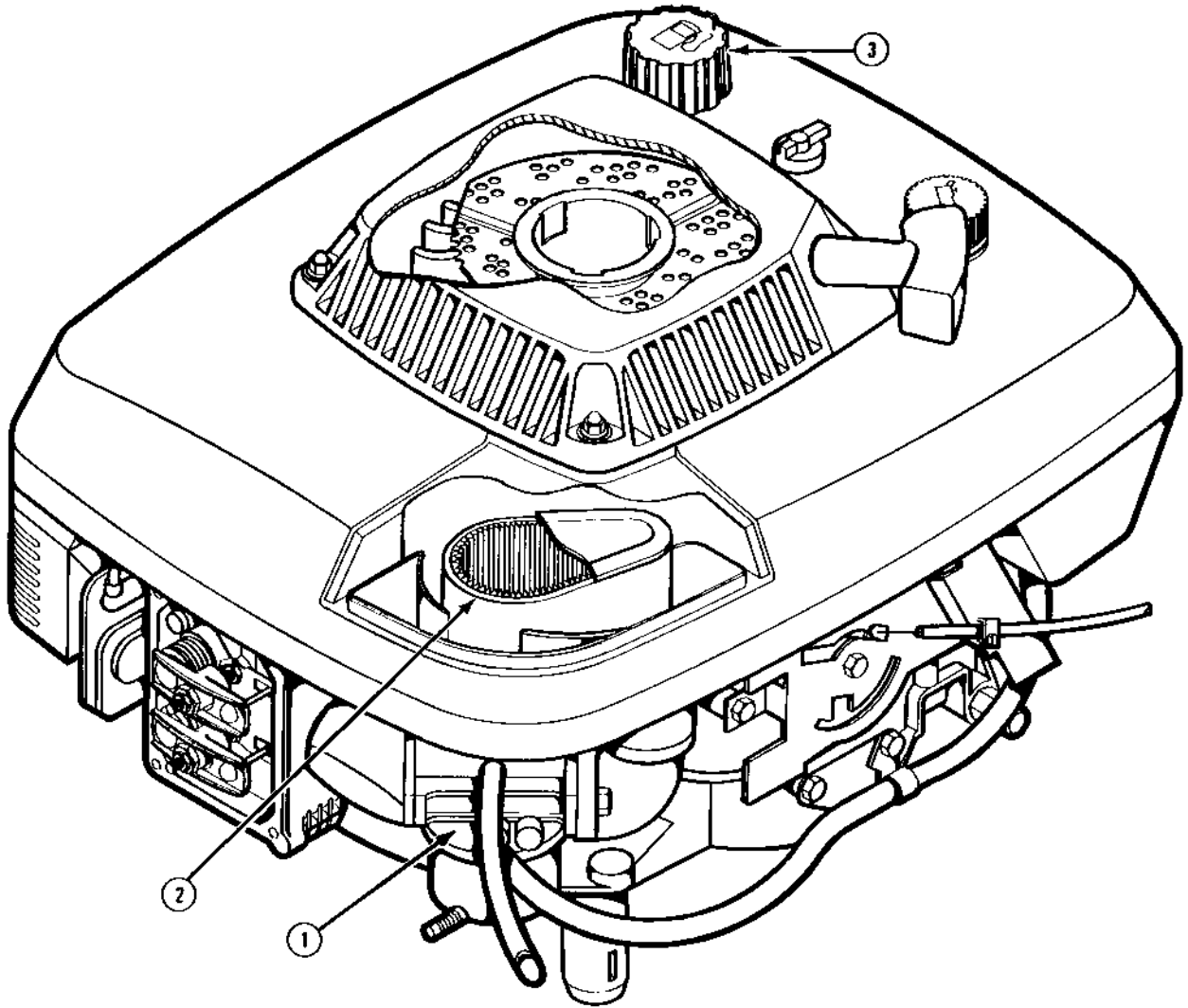
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Carburetor.	Carburetor clean. Fuel not leaking.	Clean carburetor. Clean carburetor; check for damaged inlet needle and seat. Check float for leakage. Check idle mixture screw for damage and adjustment. Check for correct, damaged or missing main jet.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Fuel tank.	No pressure released from tank when cap removed.	Check tank vent; clean and replace faulty components.

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**ENGINE HAS BLACK SMOKE
AT START OR DURING OPERATION**

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M48756 -19-01DEC95

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ENGINE HAS BLUE SMOKE AT START OR DURING OPERATION

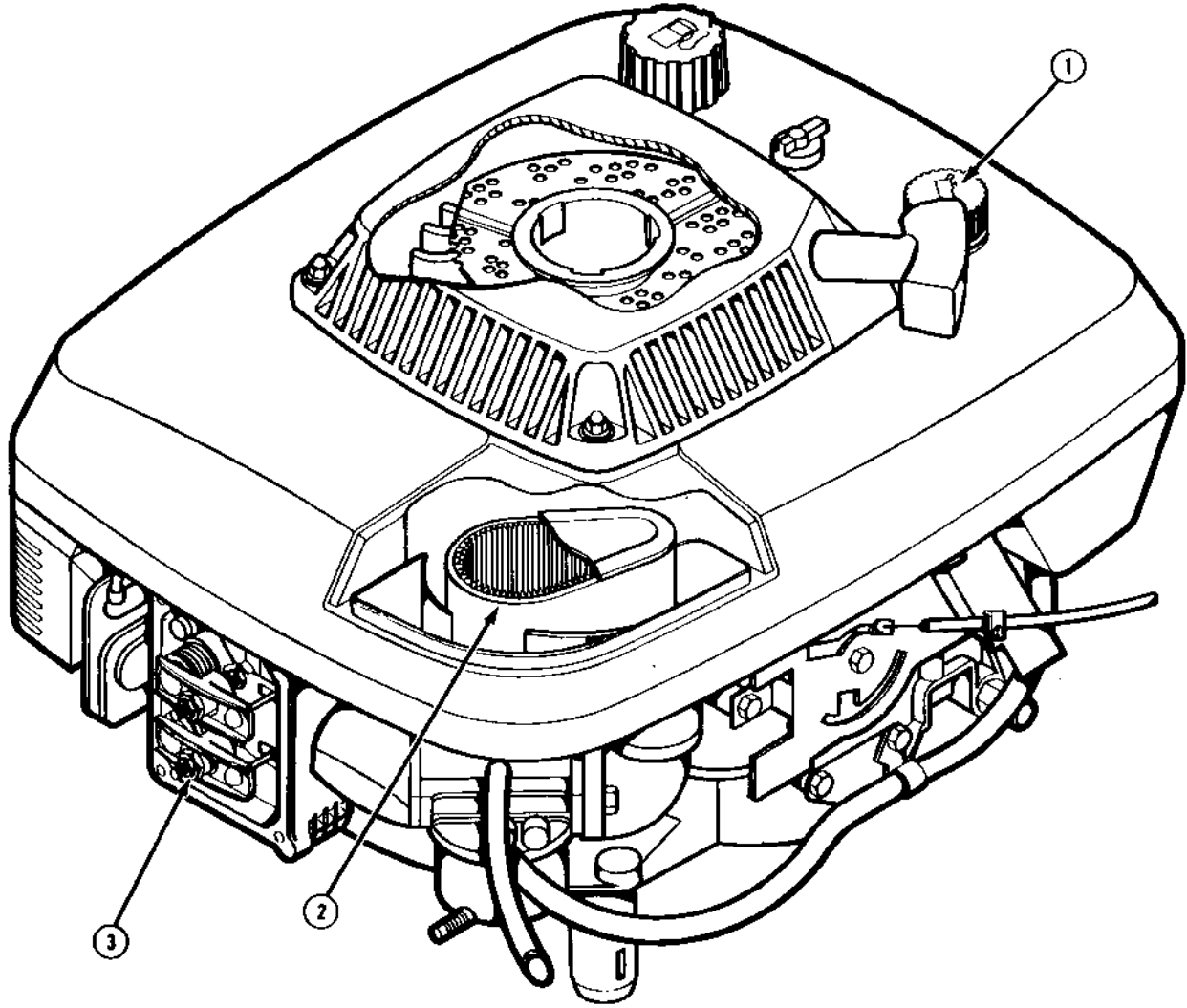
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Proper weight and grade of oil being used.	Change oil.
	Oil level not above full mark on dipstick.	Remove excess oil. Check for fuel contamination of oil; check carburetor.
	Crankcase vacuum of 170 mm (6.7 in.) of water. (Engine running at 3075 ±75 rpm.)	Check breather operation. Check compression.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Head.	Valve stem to valve guide clearance within specifications.	Repair or replace components as needed.

MX,22515BV,10 -19-16JUL96

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**ENGINE HAS BLUE SMOKE
AT START OR DURING OPERATION**

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-19-26JUN90

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MX,22515BV,11 -19-16JUL96

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ENGINE HAS EXCESSIVE OIL CONSUMPTION

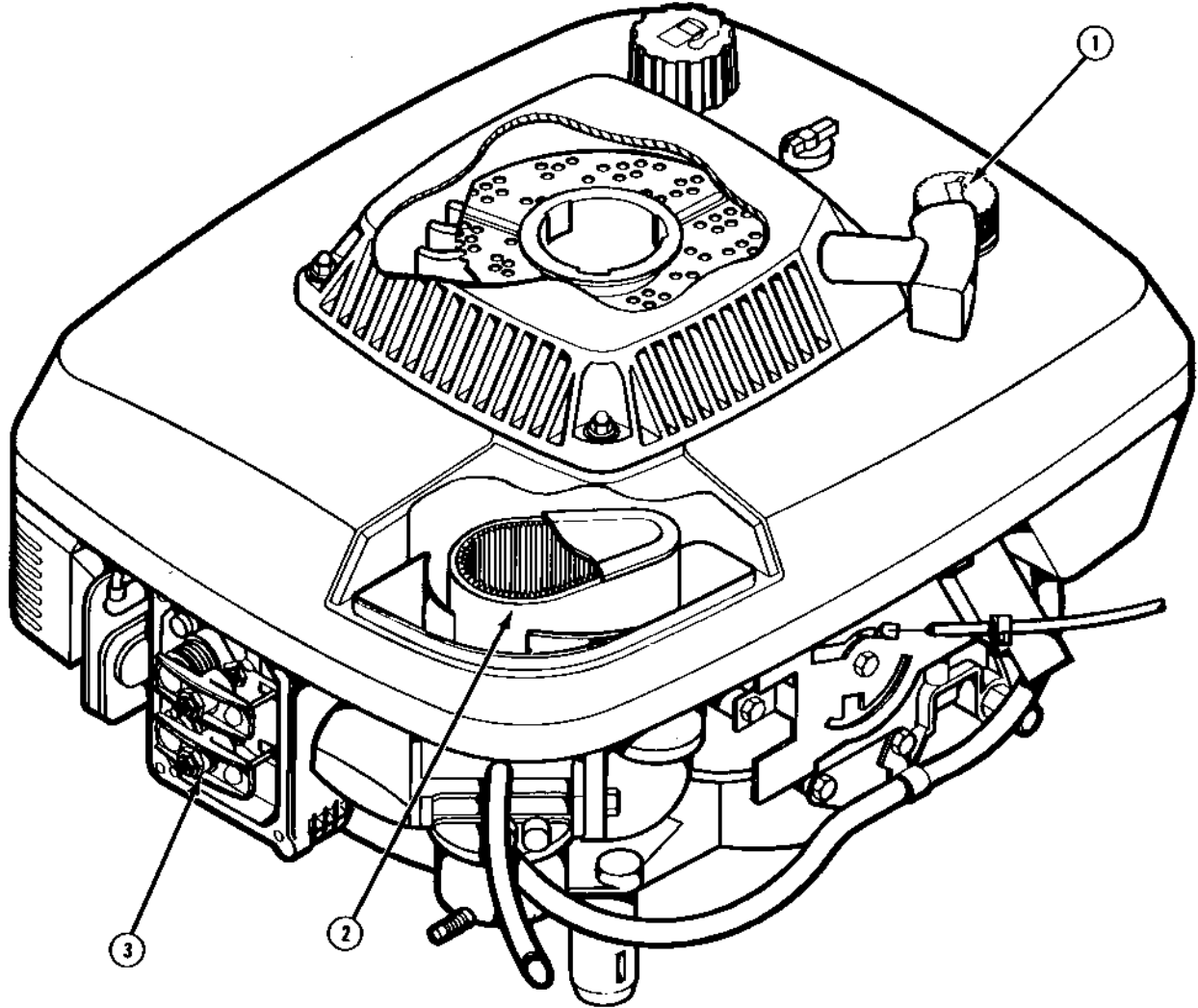
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Proper weight and grade of oil being used.	Change oil.
	Oil level not above full mark on dipstick.	Remove excess oil. Check for fuel contamination of oil; check carburetor.
	Crankcase vacuum of 170 mm (6.7 in.) of water. (Engine running at 3075 ±75 rpm.)	Check breather operation. Check compression.
2. Air filter elements.	Not dirty or oil soaked.	Clean or replace filter elements.
3. Head.	Valve stem to valve guide clearance within specification.	Repair or replace components as needed.

MX,22515BV,12 -19-16JUL96

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M48758

ENGINE HAS EXCESSIVE OIL CONSUMPTION

-19-03JUL90

M48758

MX,22515BV,13 -19-16JUL96

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15
13

ENGINE SURGES

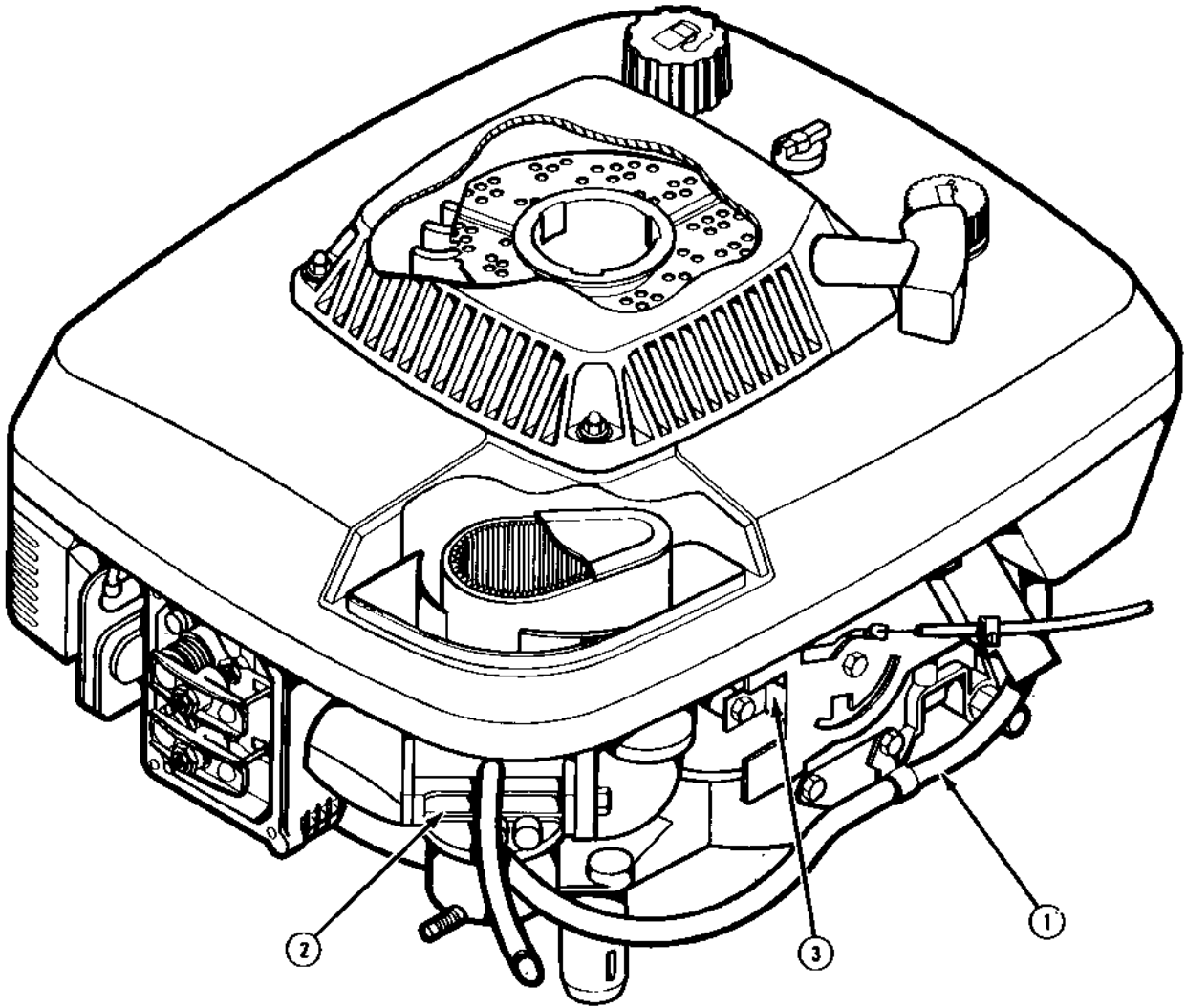
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Carburetor inlet hose.	Free flow of fuel when hose removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
2. Carburetor.	Fuel in float bowl. Choke linkage free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
3. Crankcase.	Governor arm tight on governor shaft. Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor and tighten clamp nut. Adjust governor.

MX,22515BV,14 -19-16JUL96

225
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M48759

ENGINE SURGES

MX,22515BV,15 -19-16JUL96

M48759 -19-26JUN90

225
15
15

ENGINE BACKFIRES AT SHUT-DOWN

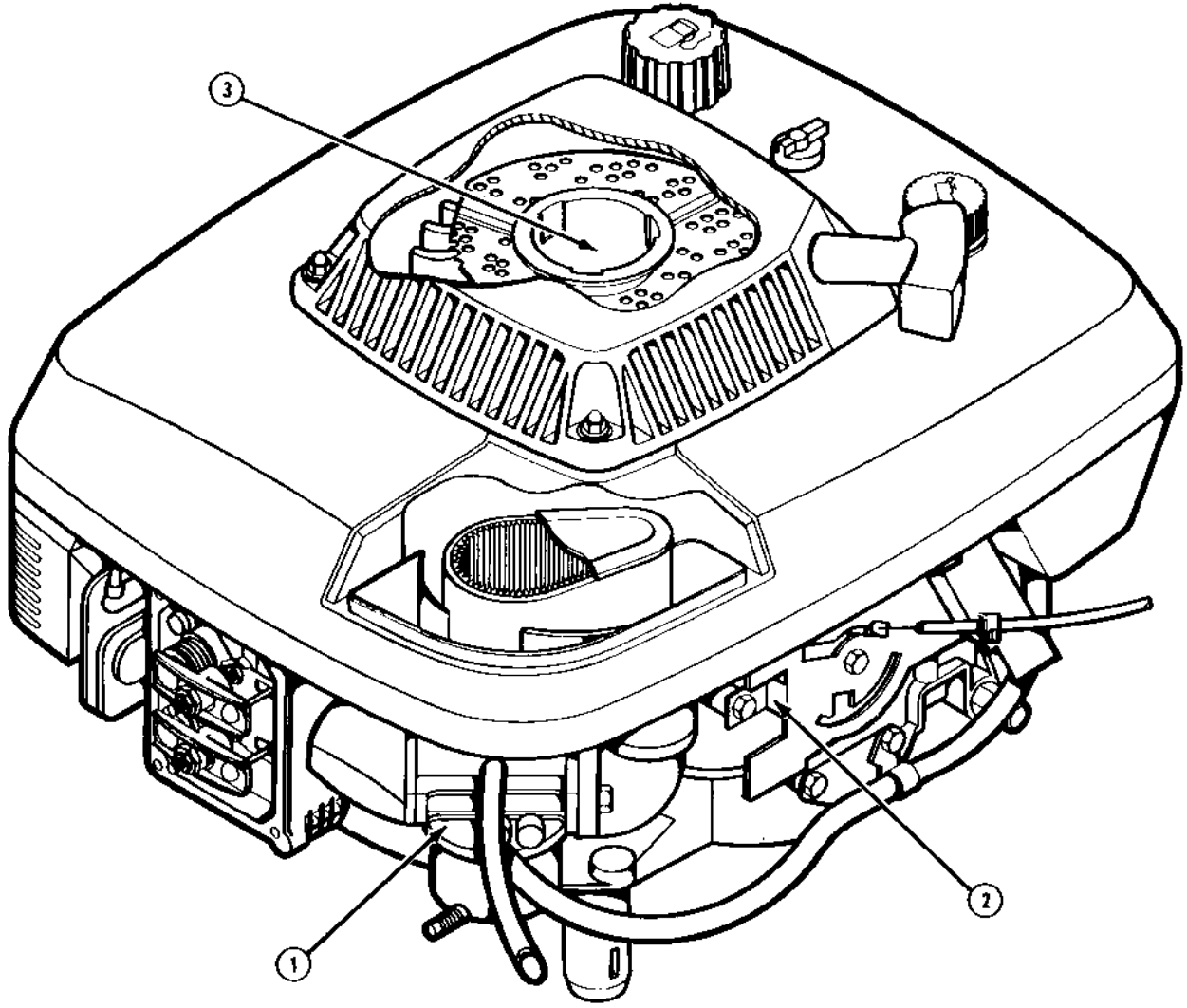
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Ignition and electrical tests found in Section 245 Group 15.

Test Location	Normal	If Not Normal
1. Carburetor.	Carburetor clean.	Clean carburetor.
	Fuel not leaking.	Clean carburetor, check for damaged inlet needle and seat. Check float for leaks. Check idle mixture screw for damage and adjustment. Check for correct, damaged or missing main jet.
	Throttle valve linkage free.	Repair or replace components as needed.
	Choke linkage free and choke fully open when throttle control is not in choke position.	Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
2. Crankcase.	Governor arm tight on governor shaft.	Adjust governor and tighten clamp nut.
	Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor.
3. Flywheel.	Crankshaft flywheel nut tight.	Check for sheared flywheel key.
	Coil air gap 0.30 mm (0.012 in.)	Adjust coil air gap.

MX,22515BV,16 -19-16JUL96

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M48760

ENGINE BACKFIRES AT SHUT-DOWN

MX,22515BV,17 -19-16JUL96

-19-26JUN90

M48760

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ENGINE HAS UNEVEN OR UNCONTROLLED RPM

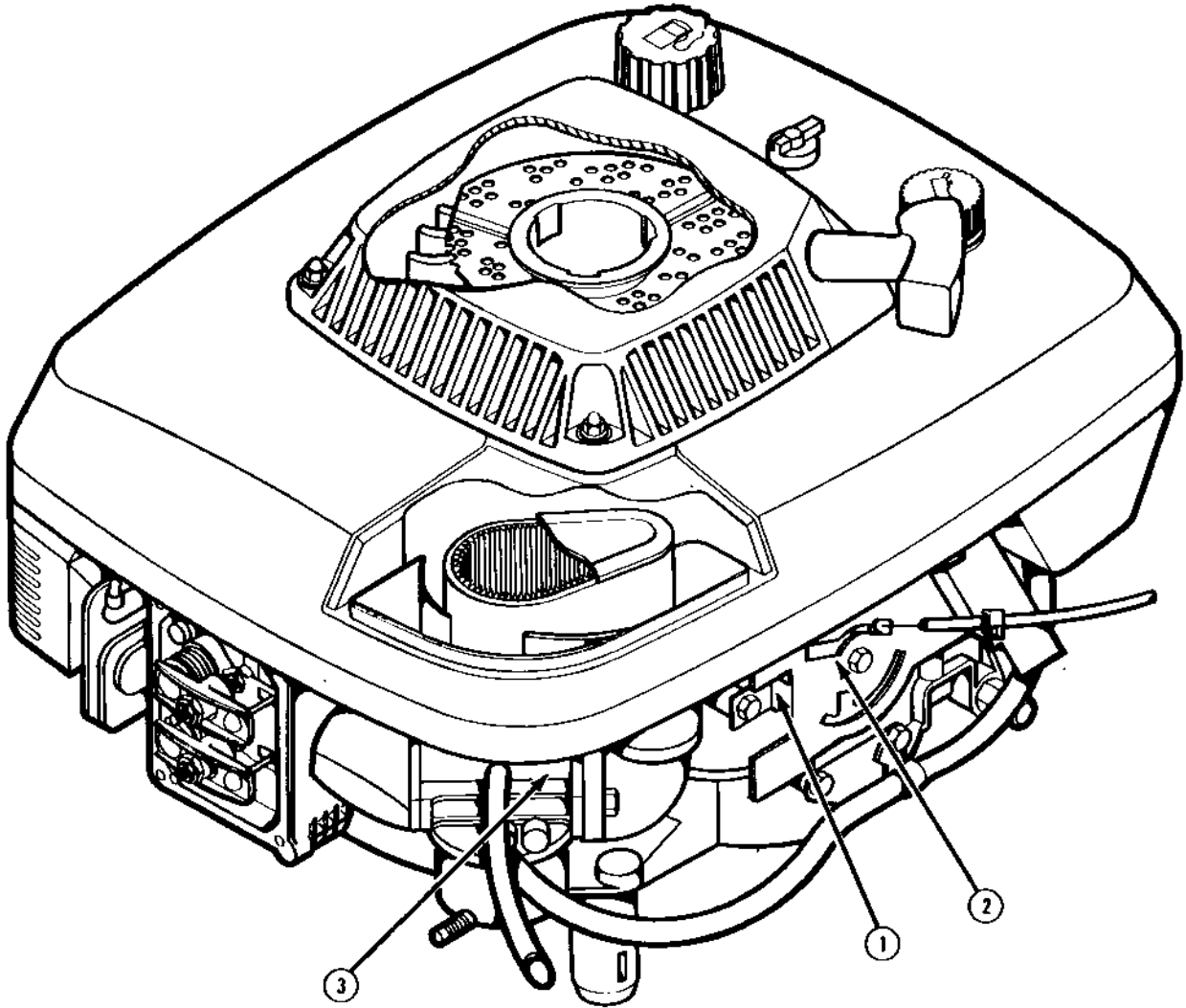
Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.

Test Location	Normal	If Not Normal
1. Crankcase.	Governor arm tight on governor shaft.	Adjust governor and tighten clamp nut.
	Governor arm and governor shaft both rotated as far counterclockwise as possible.	Adjust governor.
	Resistance to movement of governor arm. (Engine running at high idle.)	Disassemble engine and check governor components.
2. Governor control panel.	Linkage not binding or damaged.	Repair or replace components as needed.
	Governor spring installed and not stretched.	Repair or replace spring as needed.
3. Carburetor.	Throttle valve and linkage not binding.	Repair or replace components as needed.
	Low idle stop screw adjusted correctly.	Adjust low idle.

MX,22515BV,18 -19-16JUL96

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**ENGINE HAS UNEVEN OR
UNCONTROLLED RPM**

M48761

M48761 -19-26JUN90

MX,22515BV,19 -19-16JUL96

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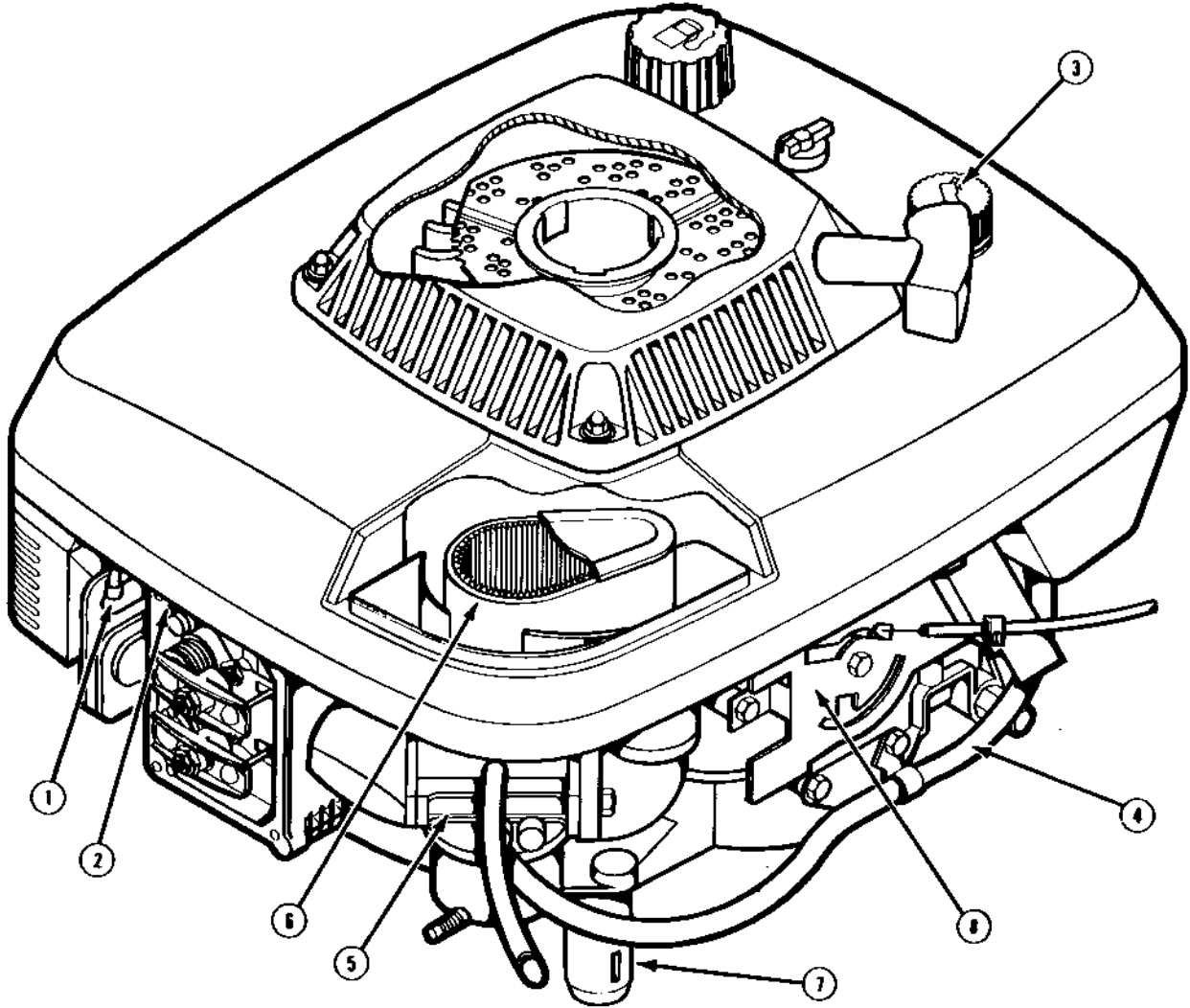
ENGINE HAS LOW POWER

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Engine and fuel/air tests found in this group.
- Electrical tests found in Section 245 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Spark Plug.	Plug dry. Steady blue spark. (Throttle in run position and spark plug connected.)	Check carburetor inlet needle sealing. Check for correct adjustment of choke linkage. Check for faulty safety switch. Check for faulty coil and/or trigger. Check for shorted kill wire or high tension lead.
2. Head.	Minimum compression of 155 kPa (22.5 psi).	Check condition of rings, piston and cylinder walls. Check for sticking or damaged compression release components. Check for sticking or damaged valve. Check for misadjusted valves.
3. Crankcase.	Crankcase vacuum of 170 mm (6.7 in.) of water. (Engine running at 3075 ±75 rpm.)	Check for leaking crankcase seals and gaskets. Check for sticking or damaged breather components. Check condition of rings, piston, cylinder walls and valves.
4. Carburetor inlet hose.	Free flow of fuel when hose is removed from carburetor inlet fitting.	Check for plugged tank vent. Check for open fuel shut-off valve. Check for plugged filter. Check for plugged or pinched hose.
5. Carburetor.	Fuel not leaking from float bowl. Choke linkage free and choke fully open when throttle control is not in choke position.	Check for dirty or sticking inlet needle. Check for binding linkage at carburetor and governor panel. Check for correct adjustment of throttle cable.
6. Air filter elements.	Not dirty or oil soaked.	Clean or replace elements as needed.
7. Crankshaft.	Traction drive components free. Blade brake clutch not binding when disengaged.	Check traction drive cable adjustment. Check cable adjustment. Check linkage for binding or damage.
8. Governor control panel.	Engine operating at specified 3075 ±75 rpm.	Adjust governor.
9. Flywheel.	Zone start brake not dragging and safety switch open when bail engaged.	Check cable and linkage for binding or damage.

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M48762

ENGINE HAS LOW POWER

MX,22515BV,21 -19-16JUL96

-19-26JUN90

M48762

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ENGINE VIBRATES EXCESSIVELY—1995 BBC UNITS

NOTE: Some 1995 BBC units may have excessive vibration due to roughness on the end of the crankshaft and BBC fit up.

Products Affected: All 1995 Model year Silver Walk-Behind Mowers with BBC. (Refer to TP PIP 95GX008.)

Conditions:

- Throttle control at off position.
- Spark plug wire removed and grounded.
- Traction drive disengaged, self-propelled units.
- Blade brake clutch disengaged.



MS1663 -JUN-20NOV/95

Test Location

Normal

If Not Normal

1. Blade.

Total blade deflection reading is equal to or less than 1.03 mm (0.040 in.).

Repair.
REFER TO TP PIPGX008 FOR DETAILED INFORMATION AND REPAIR PROCEDURES

MX,22515BV,30 -19-16JUL96

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COMPRESSION AND CYLINDER LEAKAGE TEST

Reason:

Determine the condition of the rings, piston, valves and cylinder walls.

Equipment:

- JDM-59 Compression Gauge

Connections:

1. Remove spark plug (A) and ground high tension lead to engine (B).
3. Install compression gauge (C) in spark plug hole.
4. Set throttle control to fast idle position.
5. On zone start units, engage zone start bail.

Procedure:

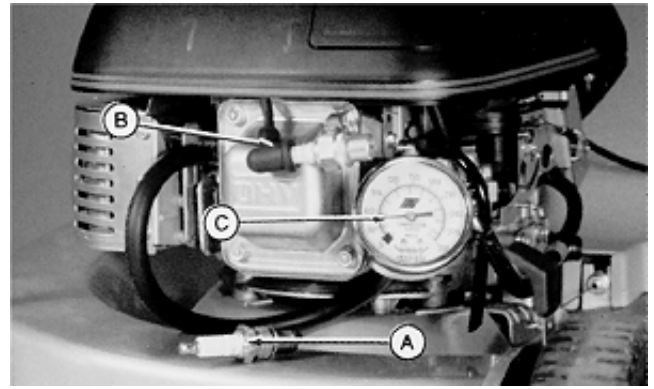
1. On manual start units, rapidly pull recoil starter 5 or 6 times.

On electric start units, spin engine with starter for 5 seconds.

2. Record compression reading. Compression should be a minimum of **155 kPa (22.5 psi)**, with a maximum of **621 kPa (90 psi)**.

Results:

- If compression is low, remove gauge and squirt a small amount of engine oil into spark plug hole of engine. Repeat compression test.
- If compression improves with oil in cylinder, rings, piston or cylinder walls are faulty. Go to Section 22, Group 10 and service as needed.
- If compression remains low with oil in cylinder, valves are faulty. Go to Section 22, Group 10 and service as needed.
- If compression is high, check compression release mechanism.



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CRANKCASE VACUUM TEST

Reason:

To determine operation of breather, condition of seals, gaskets, rings, piston and cylinder walls.

Equipment:

- JTO5698 U-Tube Manometer
- 8741-F66 Plug
- JTO5703 Barb Fitting
- JTO5699 Line

Connections:

1. Remove dipstick.
2. Install barb fitting (A) in plug (B) and plug into dipstick tube.

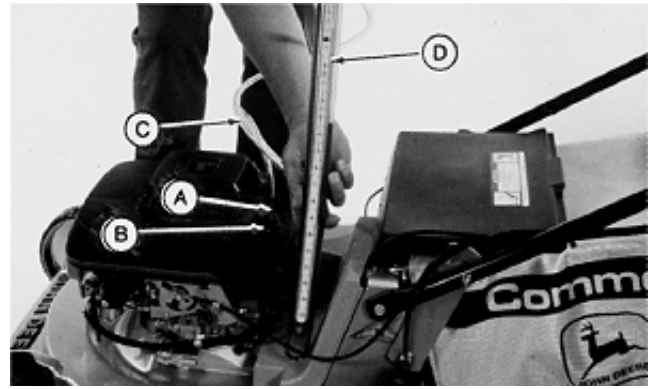
Procedure:

IMPORTANT: Do not make connections between manometer and engine before engine is running or water from the manometer can be drawn into the engine crankcase.

1. Run engine at **fast idle (3075 ±75 rpm)**.
2. Install line (C) between fitting and Manometer (D).
3. Record water movement inside Manometer. Crankcase vacuum should be a minimum of **170 mm (6.7 in.) of water at 3075 ±75 rpm**.
4. Remove line from barb fitting and Manometer before stopping engine.

Results:

- If crankcase vacuum is less than specification, check for:
 - Sticky or faulty breather assembly.
 - Leaking crankcase seals or gaskets.
 - Worn rings, piston or cylinder walls.



A—Barb Fitting
B—Plug
C—Line
D—U-Tube Manometer

M49318 -JUN-19JUL90

CARBURETOR SLOW IDLE TEST AND ADJUSTMENT

Attention! DO NOT attempt to adjust the carburetor unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions Carburetors.

Reason:

Check and adjust slow idle fuel/air mixture and rpm.

Equipment:

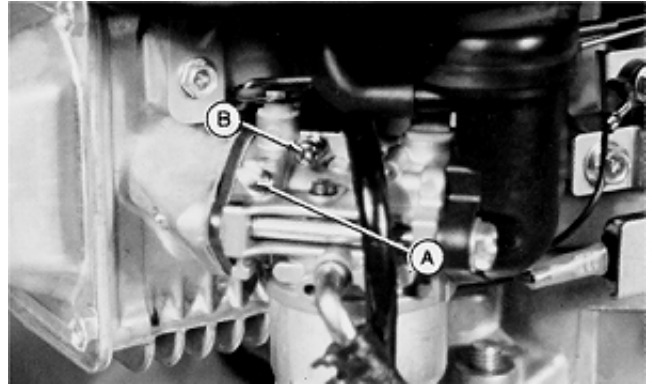
- JT07270 Digital Pulse Tachometer

Connections:

Turn slow idle mixture screw (A) in until it is lightly seated, back out 1 turn.

Procedure:

1. Start engine, set throttle control to fast idle position and warm up for 2 minutes.
2. Set throttle control to slow idle position.
3. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and turn idle speed screw (B) until engine is running at **1500 rpm**.
4. Turn idle mixture screw (A) in and out until rpm are at maximum.
5. Turn idle mixture screw out an additional 1/4 turn.
6. Set idle speed screw so engine is running at **1500 ±200 rpm**.
7. Move throttle control between slow and fast idle several times. If engine does not accelerate smoothly, adjust idle mixture screw about 1/8 turn richer.



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M49292

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GOVERNOR AND FAST IDLE TEST AND ADJUSTMENT

Attention! DO NOT attempt to adjust the carburetor unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions Carburetors.

Reason:

Check and adjust the fast idle or operating rpm of the engine.

Equipment:

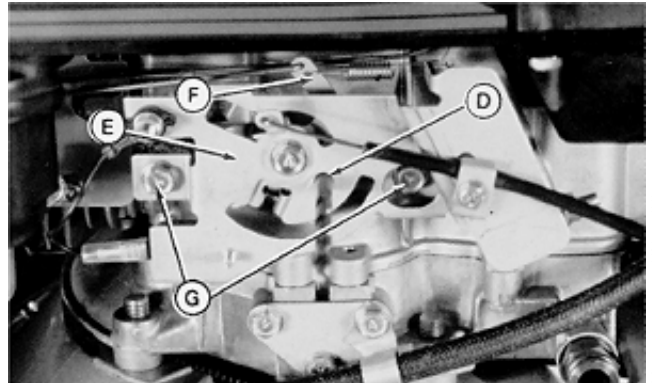
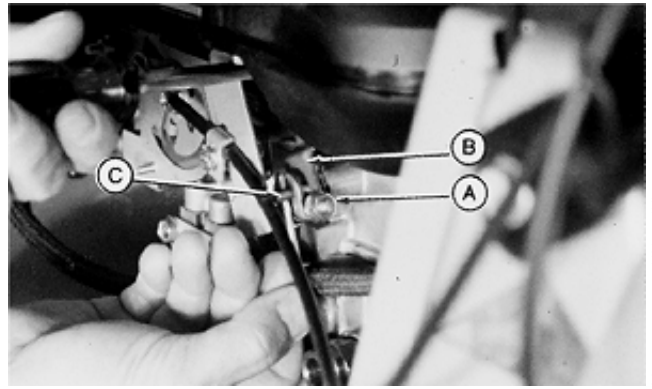
- JT07270 Digital Pulse Tachometer
- 6 mm (15/64 in.) Drill Bit or 45M7036 Pin

Adjustment Procedure:

1. Adjust throttle cable.
2. Move throttle control to fast position.
3. Loosen nut (A).
4. Hold governor arm (B) fully counterclockwise.
5. Using a small pin, rotate shaft (C) counterclockwise as far as it will go.
6. Tighten nut.

Test Procedure:

1. Start engine, set throttle control at fast idle and warm up for 2 minutes.
2. Insert a 6 mm (15/64 in.) drill bit or 45M7036 Pin through holes (D) in governor control plate (E) and throttle arm (F).
3. Loosen bolts (G) of governor control plate.
4. Hold a JT07270 Digital Pulse Tachometer at spark plug wire, and move governor control plate to get engine fast idle to **3075 ±75 rpm**.
5. Tighten governor control plate bolts.
6. Remove drill bit/pin.
7. Adjust choke.



- A—Nut
- B—Governor Arm
- C—Shaft
- D—Holes
- E—Governor Control Plate
- F—Throttle Arm
- G—Bolts

THROTTLE CABLE AND CHOKE ADJUSTMENT

Attention! DO NOT attempt to adjust the carburetor unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions Carburetors.

Reason:

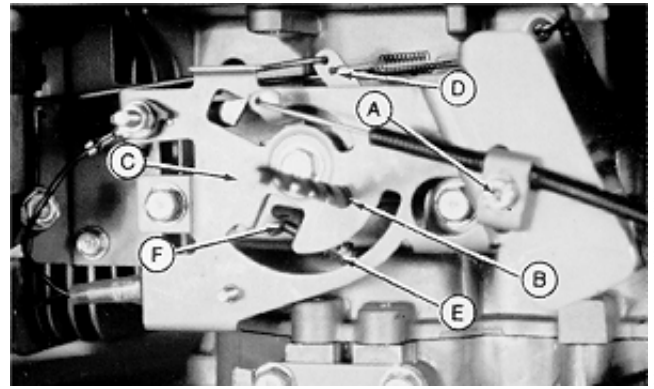
Make sure that throttle valve and choke valve are adjusted correctly in relation to throttle control.

Equipment:

- 6 mm (15/64 in.) Drill Bit or 45M7036 Pin

Procedure:

1. Move throttle control to full choke and then to fast idle position.
2. Loosen screw (A).
3. Insert a 6 mm (15/64 in.) drill bit or 45M7036 Pin through holes (B) in governor control plate (C) and throttle arm (D).
4. Tighten screw (A).
5. Turn screw (E) out until it does not contact tang (F) of throttle arm.
6. Move choke linkage to check for free operation and that choke is fully open.
7. Turn screw (E) in until it just contacts tang (F).
8. Remove drill bit/pin.
9. Operate throttle control linkage through full travel several times and check that choke is fully closed in choke position and that it is fully open in all non-choke positions.



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VALVE CLEARANCE TEST AND ADJUSTMENT

Reason:

Check and adjust valve clearance for proper engine operation.

Equipment:

- Feeler Gauge

Procedure:

1. Remove rocker cover and spark plug.
2. Rotate crankshaft until piston is slightly past top dead center of compression stroke.
3. Insert feeler gauge (A) between valve stem (B) and rocker arm (C).

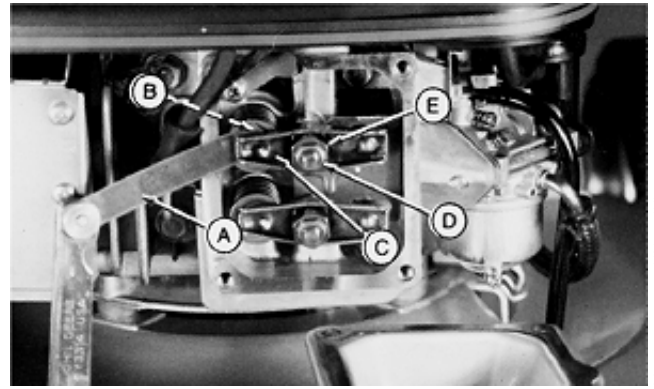
NOTE: Before installing rocker cover and spark plug, do the compression release operation test.

Specifications:

- **Valve clearance (cold)**
 - Intake .. 0.12 mm (0.005 in.)
 - Exhaust .. 0.12 mm (0.005 in.)

Results:

- If valve clearance is not to specification, loosen lock nut (D) and turn rocker arm pivot (E) as needed. Tighten lock nut to **7 N·m (62 lb-in.)**.



A—Feeler Gauge
B—Valve Stem
C—Rocker Arm
D—Lock Nut
E—Rocker Arm Pivot

MX,22515BV,27 -19-16JUL96

COMPRESSION RELEASE OPERATION TEST

Reason:

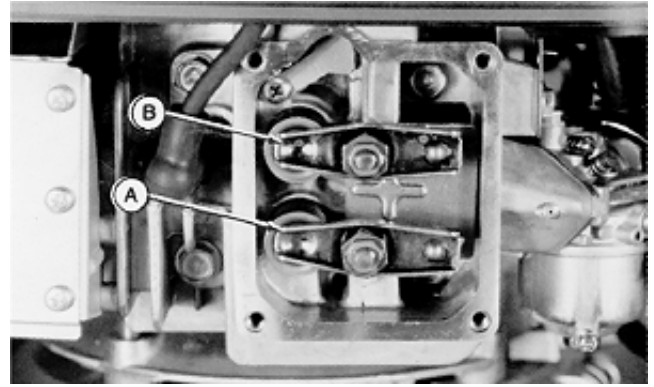
Verify operation of compression release.

Procedure:

1. Do the valve clearance test and adjustment procedure first.
2. Slowly rotate crankshaft and watch valves. Exhaust valve (A) should lift briefly just as intake valve (B) closes.
3. Use a feeler gauge to measure exhaust valve movement. Movement should be **0.50 mm (0.020 in.)**.

Results:

- If lift is less than specification, or not at all, compression release is not operating. Disassemble engine and repair or replace as needed.



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Section 230

FUEL/AIR OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON 2-CYCLE

Contents

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Theory Information 230-10-1

Fuel/Air Supply System Operation 230-10-2

Group 15—Diagnosis, Tests and Adjustments

Diagnostic Information 230-15-1

Go To Section 220, Group 15 230-15-1

THEORY OF OPERATION INFORMATION

This group divides the fuel/air system into individual components or sub-systems by function. The story contains information on function, component or sub-system identification and theory of operation.

The following system is covered:

- Fuel/Air Supply System

MX,23010BV,1 -19-16JUL96

FUEL/AIR SUPPLY SYSTEM OPERATION—BRIGGS & STRATTON 2-CYCLE ENGINE

A—Fuel Tank
B—Tank Vent
C—Tank Cap

D—Fan
E—Fan Shroud
F—Air Filter Housing

G—Carburetor
H—Air Filter Element
I—Fuel Line

J—Shut-Off Valve
K—Fuel Filter

Function:

Under a variety of conditions, supply the correct amount of fuel and air to the engine to allow it to run.

Major Components:

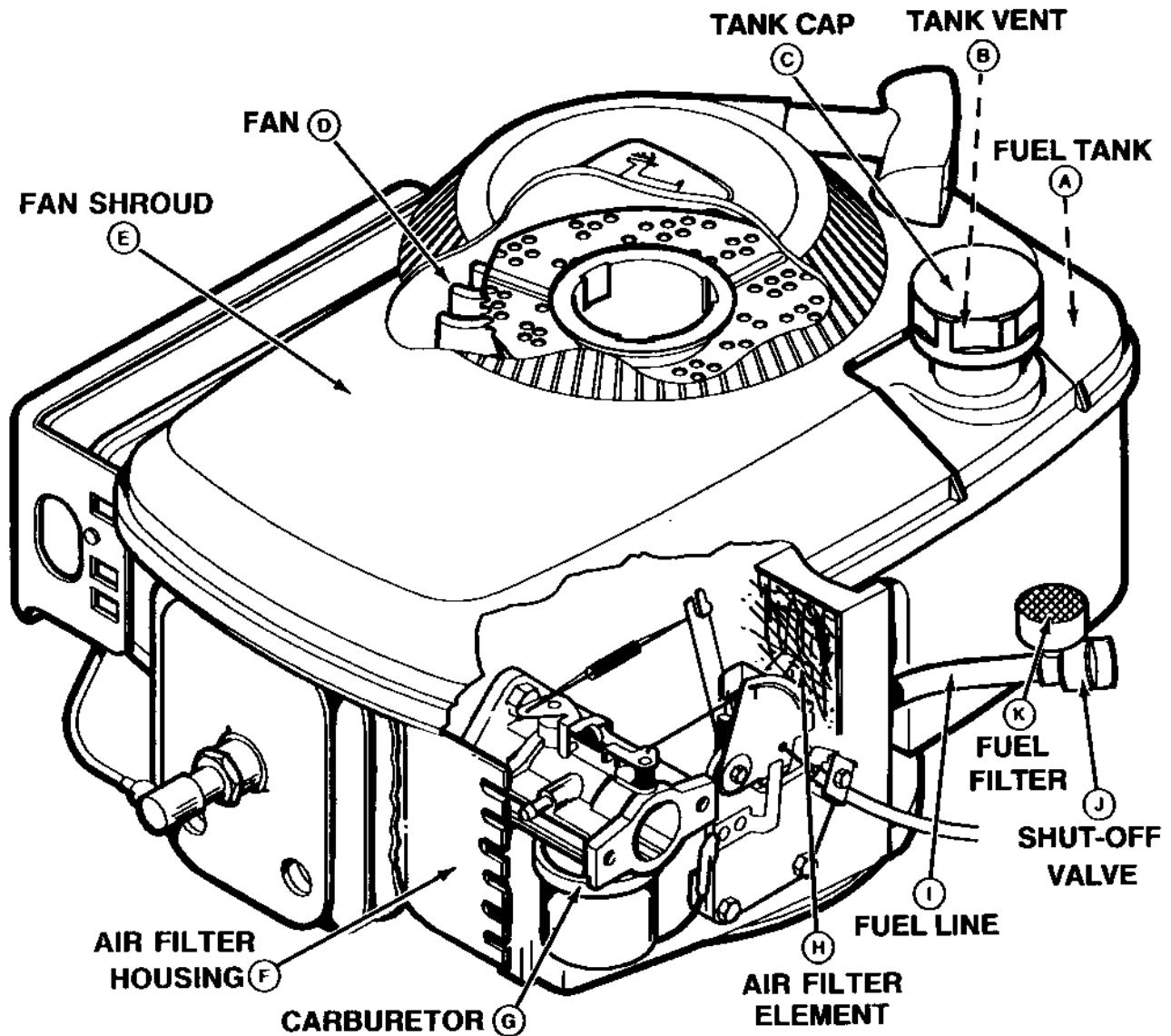
- Tank
- Shut-Off Valve
- Fuel Filter
- Air Filter
- Air Filter Housing

Theory of Operation:

The fuel supply for this engine is a gravity-feed type. Fuel flows from the tank (A) through the fuel filter (K) and fuel shut-off valve (J) to the carburetor (G) where it is metered to supply the correct amount for the various operating conditions. The vent (B) for the fuel tank is a notch in the threads of the fuel tank cap (C).

The air supply is drawn into the air filter housing (F) through the air filter element (H). This filter is a two stage design consisting of a paper element and a foam element. The air inlet to the filter housing is not connected to the engine fan shroud (E) so the air supplied to the carburetor does not come from the cooling fan (D).

MX,23010BV,2 -19-16JUL96



M48719

FUEL/AIR SYSTEM-BRIGGS & STRATTON 2-CYCLE ENGINE

MX,23010BV,3 -19-16JUL96

M48719 -19-06JUL90

DIAGNOSTIC INFORMATION

The diagnostic information is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point the test is to be made.

MX,23015BV,1 -19-16JUL96

For this product, all diagnosis, tests and adjustments for the fuel/air system are addressed in SECTION 220, GROUP 15. This is done since many engine complaints can be caused by the fuel/air system and diagnosing them separately is difficult.

Section 232

FUEL/AIR OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON

4-CYCLE

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Group 15—Diagnosis, Tests and Adjustments

Diagnostic Information 232-15-1

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THEORY OF OPERATION INFORMATION

This group divides the fuel/air system into individual components or sub-systems by function. The story contains information on function, component or sub-system identification and theory of operation.

The following systems or components are covered:

- Fuel Supply System
- Float and Main Jet Circuits
- Low and High Idle Circuits
- Choke Circuit¹

¹Later model carburetors (S.N. 100001—) use a primer system instead of a choke.

MX,23210BV,1 -19-16JUL96

FUEL/AIR SUPPLY SYSTEM OPERATION—BRIGGS & STRATTON 4-CYCLE ENGINE

A—Fan Shroud
B—Fan
C—Fuel Tank

D—Tank Vent
E—Tank Cap
F—Fuel Filter

G—Shut-Off Valve
H—Carburetor
I—Air Filter Element

J—Air Filter Housing
K—Fuel Line

Function:

Under a variety of conditions, supply the correct amount of fuel and air to the engine to allow it to run.

Major Components:

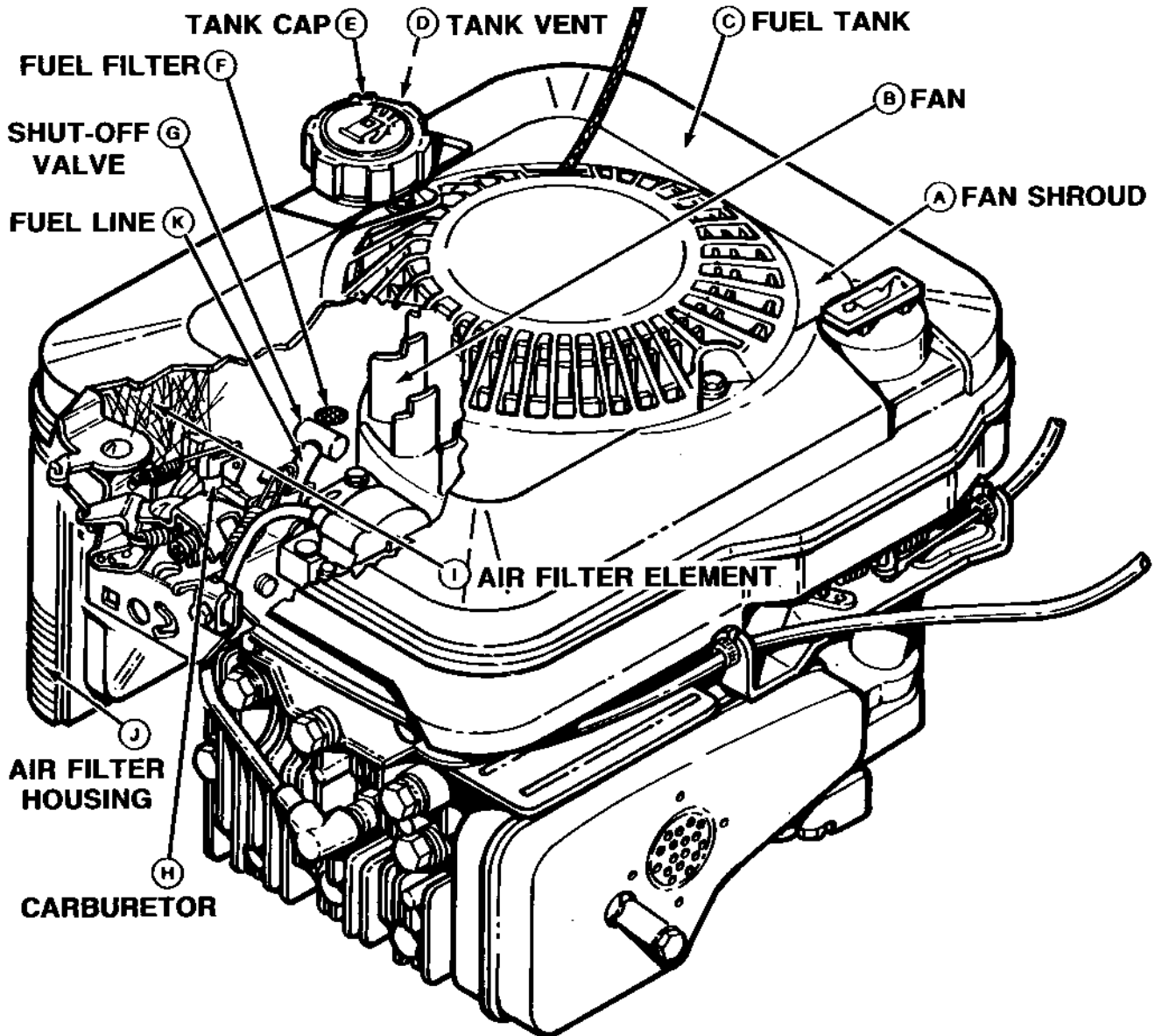
- Tank
- Shut-Off Valve¹
- Fuel Filter
- Air Filter
- Air Filter Housing

Theory of Operation:

The fuel supply for this engine is a gravity-feed type. Fuel flows from the tank (C) through the fuel filter (F) and the fuel shut-off valve¹ (G) to the carburetor (H) where it is metered to supply the correct amount for the various operating conditions. The vent (D) for the fuel tank is a notch in the threads of the fuel tank cap (E).

The air supply is drawn into the air filter housing (J) and then through the air filter element (I). This filter is a two-stage design consisting of a paper element and a foam element. The air inlet to the filter housing is not connected to the engine fan shroud (A) so the carburetor air supply is not supplied by the cooling fan (B).

¹The fuel shut-off valve has been eliminated on later models (engines marked 12F702).



M48728 FUEL/AIR SYSTEM BRIGGS & STRATTON 4-CYCLE ENGINE

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-19-03JUL90

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DIAGNOSTIC INFORMATION

The diagnostic information is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point the test is to be made.

MX,23215BV,1 -19-16JUL96

For this product, all diagnosis, tests and adjustments for the fuel/air system are addressed in SECTION 222, GROUP 15. This is done since many engine complaints can be caused by the fuel/air system and diagnosing them separately is difficult.

MX,23215BV,2 -19-16JUL96

Section 235

FUEL/AIR OPERATION TESTS AND ADJUSTMENTS—KAWASAKI

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THEORY OF OPERATION INFORMATION

This group divides the fuel/air system into individual components or sub-systems by function. The story contains information on function, component or sub-system identification and theory of operation.

The following systems or components are covered:

- Fuel Supply System
- Float and Main Jet Circuits
- Low and High Idle Circuits
- Choke Circuit

MX,23510BV,1 -19-16JUL96

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1

FUEL/AIR SUPPLY SYSTEM OPERATION—KAWASAKI ENGINE

A—Fuel Tank
B—Fuel Filter
C—Shut-Off Valve

D—Tank Vent
E—Tank Cap
F—Fan

G—Fan Shroud
H—Air Inlet
I—Air Filter Element

J—Carburetor
K—Fuel Line
L—Air Filter Housing

Function:

Under a variety of conditions, supply the correct amount of fuel and air to the engine to allow it to run.

Major Components:

- Tank
- Shut-Off Valve
- Fuel Filter
- Air Filter
- Air Filter Housing

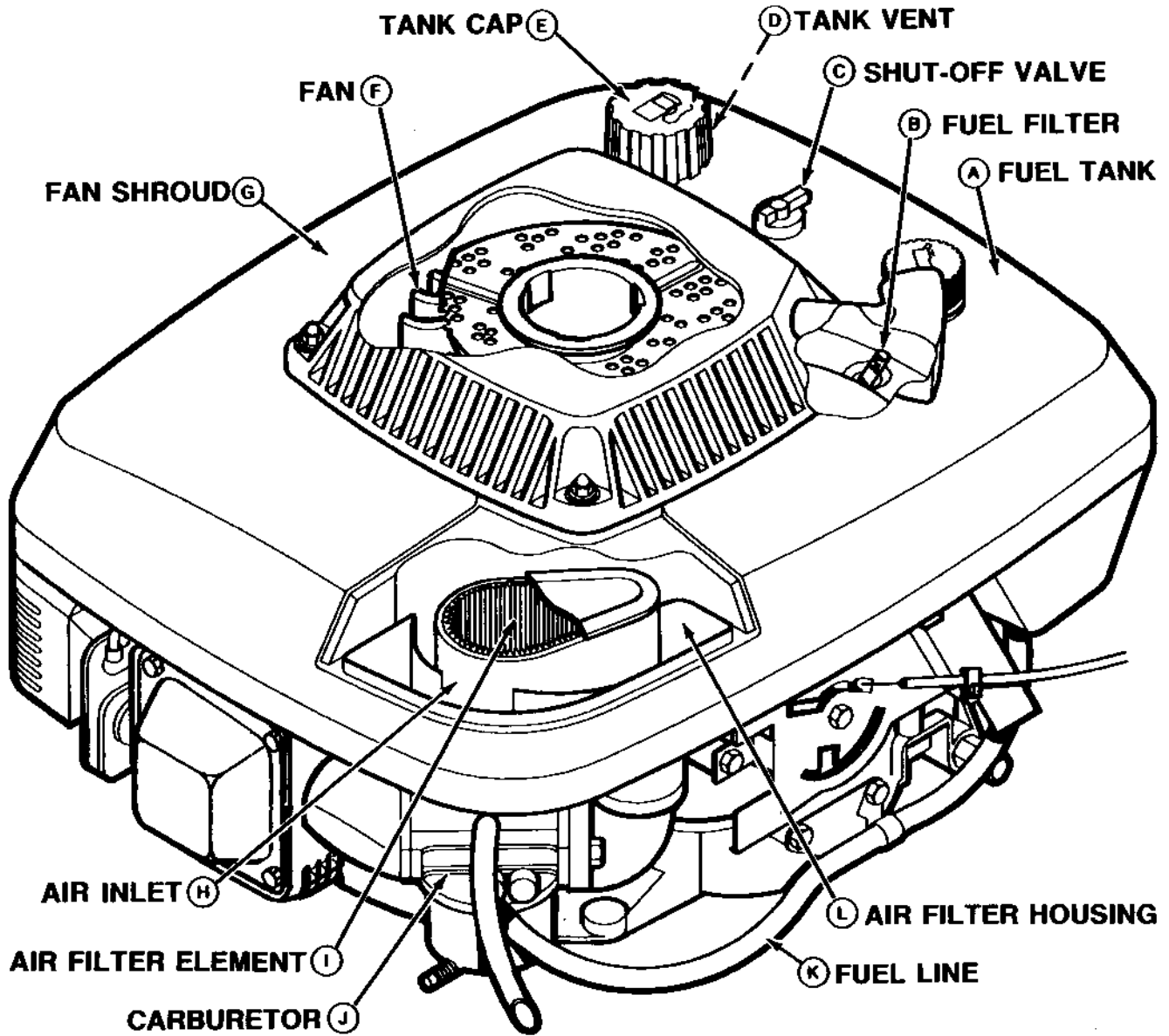
Theory of Operation:

The fuel supply for this engine is a gravity-feed type. Fuel flows from the tank (A) through the fuel filter (B) and the fuel shut-off valve (C) to the carburetor (J) where it is metered to supply the correct amount for the various operating conditions. The vent (D) for the fuel tank is a notch in the threads of the fuel tank cap (E).

The air supply is drawn into the air filter housing (L) through the air filter element (I). This filter is a two-stage design consisting of a paper element and a foam element. The air for the filter system is supplied by the cooling fan (F) of the engine. Air from the engine fan shroud (G) is supplied to the air filter housing through air inlet (H).

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MX,23510BV,2 -19-16JUL96



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-19-03JUL90

M48706

M48706

FUEL/AIR SYSTEM-KAWASAKI ENGINE

MX.23510BV.3 -19-16JUL96

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DIAGNOSTIC INFORMATION

The diagnostic information is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point the test is to be made.

MX,23515BV,1 -19-16JUL96

For this product, all diagnosis, tests and adjustments for the fuel/air system are addressed in SECTION 225, GROUP 15. This is done since many engine complaints can be caused by the fuel/air system and diagnosing them separately is difficult.

MX,23515BV,2 -19-16JUL96

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Section 240

ELECTRICAL OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON 2-CYCLE

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Group 10—Theory of Operation

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following electrical system components:

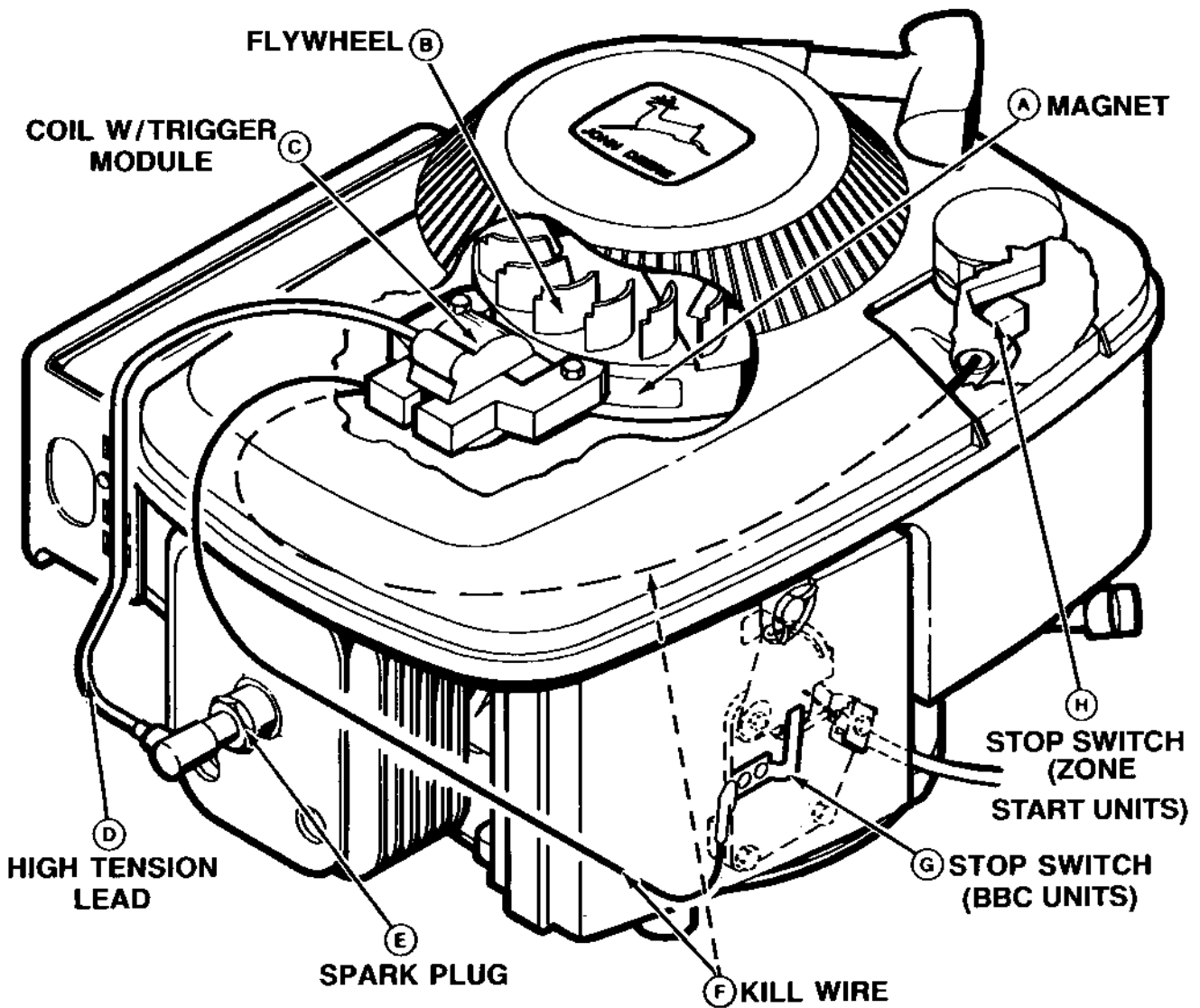
- Ignition System

Use the drawings when diagnosing an electrical problem and to help locate the components to be tested.

MX,24005BV,1 -19-16JUL96

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M48725 IGNITION SYSTEM-BRIGGS & STRATTON 2 CYCLE ENGINE

- | | | | |
|-------------------------|---------------------|---------------------------|----------------------------------|
| A—Magnet | D—High Tension Lead | F—Kill Wire | H—Stop Switch (Zone Start Units) |
| B—Flywheel | E—Spark Plug | G—Stop Switch (BBC Units) | |
| C—Coil W/Trigger Module | | | |

M48725 -19-29OCT90

MX,24005BV,2 -19-16JUL96

THEORY OF OPERATION INFORMATION

This group divides the electrical system into individual components or circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, component or circuit identification and theory of operation.

The following systems or components are covered:

- Ignition System

MX,24010BV,1 -19-16JUL96

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IGNITION SYSTEM OPERATION—BRIGGS & STRATTON 2-CYCLE ENGINE

A—Magnet
B—Flywheel
C—Coil w/Trigger Module

D—High Tension Lead
E—Spark Plug

F—Kill Wire
G—Stop Switch (BBC Units)

H—Stop Switch (Zone Start Units)

Function:

At the correct time, supplies a high voltage at the spark plug to ignite a fuel/air mixture.

Major Components:

- Ignition Coil w/Trigger Module
- Safety Switch
- Flywheel w/Magnet

Theory of Operation:

This engine is equipped with a solid-state, transistorized, magneto ignition system. There are no moving parts and there is no need for an external power source (battery). The power and the triggering signal are both generated as the permanent magnet (A) on the outside edge of the flywheel (B) moves past the ignition coil and trigger module (C). The ignition coil consists of an iron core with 2 sets of wires wound around it. The primary winding connects to the trigger. The secondary winding connects to the spark plug (E) with the high tension lead (D). The trigger module is a switch that opens and closes the

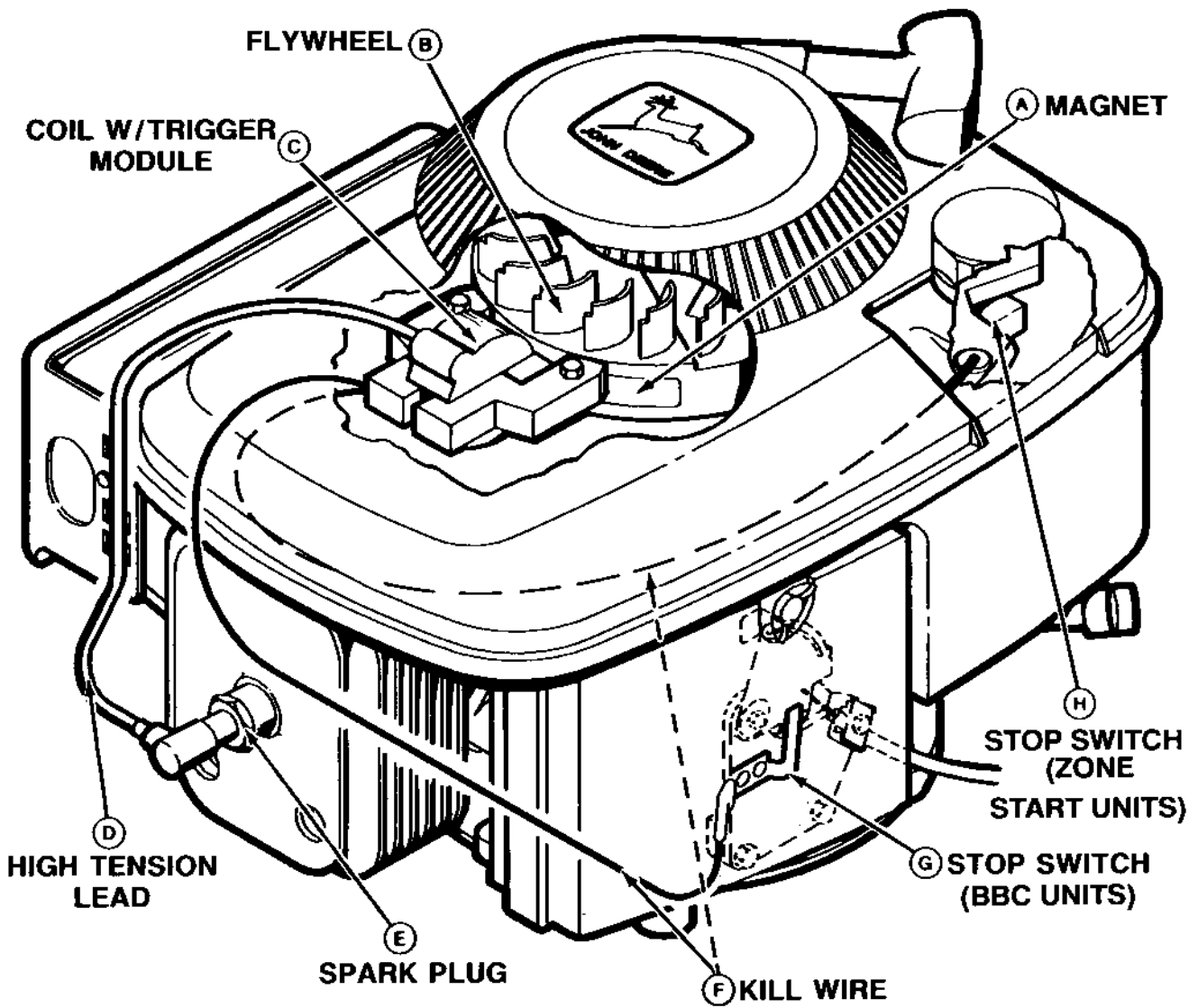
ground circuit of the primary winding of the coil (think of it as a non-moving set of points).

As the magnet nears the coil, a magnetic field passes through the core of the coil. This builds up a voltage in the primary windings of the coil. As the flywheel continues to turn, the magnetic field in the core of the coil reverses. Also, a voltage is generated in a small coil in the trigger. The voltage in the trigger closes the ground circuit of the primary winding of the coil. The field reversal and the closed ground of the primary winding cause a very rapid drop in voltage in the primary winding. This causes a very high voltage in the secondary winding of the coil. The high voltage of the secondary winding creates the spark at the spark plug.

The stop switch (G) or (H) is also a ground for the primary winding of the coil. When it is closed, a voltage cannot build up in the primary winding so no spark is generated. It is connected to the coil by the kill wire (F).

MX,24010BV,2 -19-16JUL96

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M48725 IGNITION SYSTEM-BRIGGS & STRATTON 2 CYCLE ENGINE

MX,24010BV,3 -19-16JUL96

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M48725
-19-29OCT90

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Ignition System

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point at which the test is to be made.

MX,24015BV,1 -19-16JUL96

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IGNITION SYSTEM—BRIGGS & STRATTON 2-CYCLE ENGINE

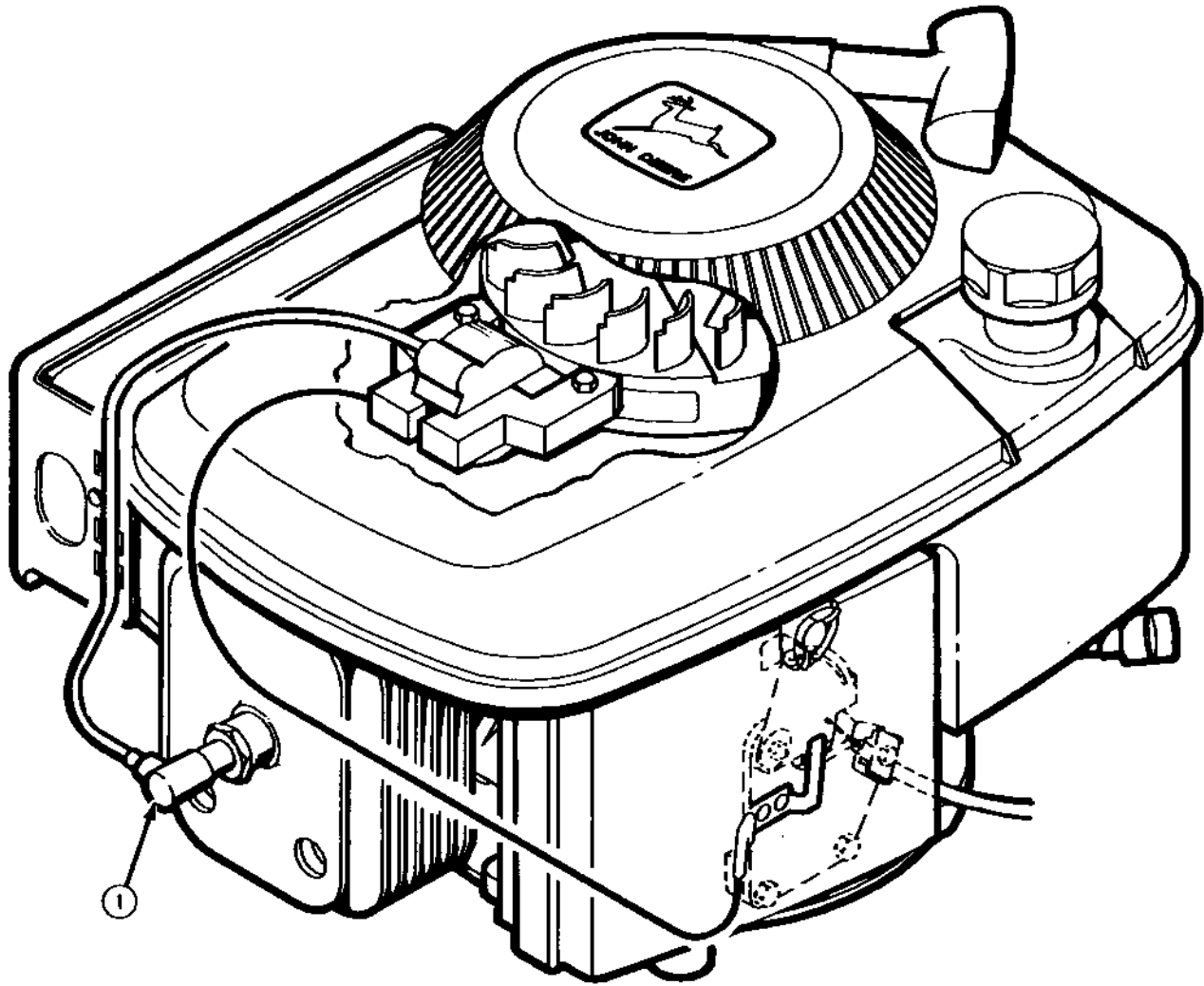
Conditions:

- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Traction drive disengaged, self-propelled units.
- Ignition tests found in this group.

Test Location	Normal	If Not Normal
1. Spark plug.	No spark when engine spun over. (Throttle control in stop position or zone start bail not engaged.)	Check for broken wire between ignition trigger and safety switch. Check for misadjusted or faulty stop switch.
	Steady spark when engine spun over. (Throttle control not in stop position or zone start bail engaged.)	Check for faulty spark plug. Check for shorted or broken high tension lead. Check for shorted wire between ignition trigger and safety switch. Check for faulty or misadjusted stop switch. Check for faulty coil. Check for faulty trigger.

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MX,24015BV,2 -19-16JUL96



M48763

IGNITION SYSTEM-BRIGGS & STRATTON 2 CYCLE ENGINE

MX,24015BV,3 -19-16JUL96

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-19-26JUN90

M48763

SPARK TEST

Reason:

Check overall condition of ignition system.

Equipment:

- D-5351ST Spark Tester

Connections:

1. Remove high tension lead (A) from spark plug.
2. Connect spark tester (B) to spark plug.
3. Connect high tension lead to spark tester.
4. Adjust spark tester gap to 0.76 mm (0.030 in.) with screw (C).

NOTE: Do not adjust spark tester gap beyond 4.0 mm (0.160 in.) as damage to ignition system components could occur.

5. Set throttle control to fast idle position.
6. On zone start units, engage zone start bail.

Procedure:

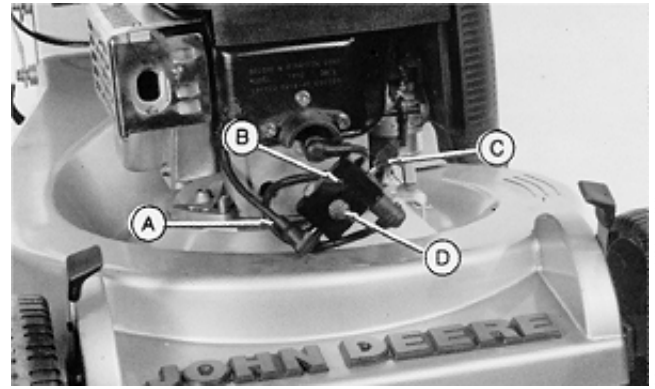
Pull recoil starter and watch spark (D) at spark tester. If engine will start, watch spark with engine running.

Specifications:

- **Steady, strong spark.**

Results:

- If spark is weak, or if no spark, install a new spark plug and test again.
- If spark is still weak, or still no spark, run the tests on individual components to find cause of malfunction.



A—High Tension Lead
B—Spark Tester
C—Screw
D—Spark

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M49319
-JUN-19JUL90

MX,24015BV,4 -19-16JUL96

STOP SWITCH TEST AND ADJUSTMENT

Reason:

Determine proper operation of stop switch.

Equipment:

- Ohmmeter

Connections:

NOTE: Air cleaner assembly removed for photo, DO NOT remove for test or adjustment.

1. Disconnect wire (A) from stop switch (B).
2. Set ohmmeter for 1X Ohms resistance.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

3. Connect one lead of meter to stop switch tang (C) and other lead of meter to engine block (D).

Procedure:

1. On blade brake clutch units, move throttle through full range from stop to choke.
2. On zone start units, engage and disengage zone bail.

Specifications:

• Blade Brake Clutch units:

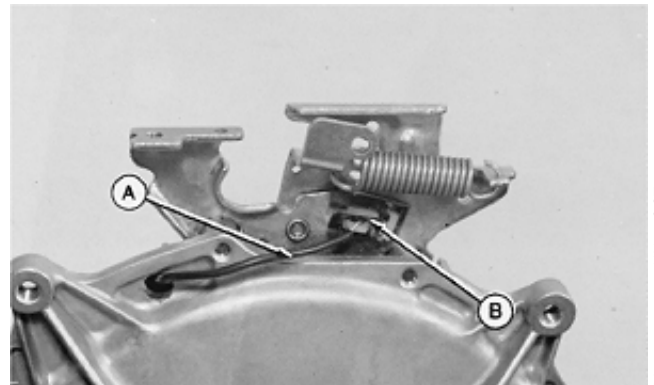
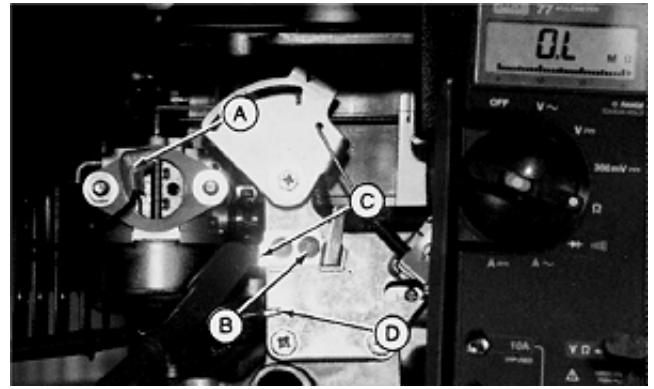
- Continuity to ground, throttle in stop position.
- No continuity to ground, throttle in other positions.

• Zone Start units:

- Continuity to ground, zone start bail in disengaged.
- No continuity to ground, zone start bail in engaged.

Results:

- If there is no continuity to ground with throttle in stop position, or when zone start bail not engaged, check for:
 - Dirt or rust on stop switch tang or control arm — clean arm and tang.
 - Arm not contacting stop switch tang — adjust arm or tang as needed.
 - Faulty stop switch — replace switch.
- If there is continuity to ground with throttle in other than stop position or with zone start bail engaged, check for:
 - Control arm contacting stop switch tang — adjust arm or tang as needed.
 - Faulty stop switch — replace switch.



- A—Wire
- B—Stop Switch
- C—Stop Switch Tang
- D—Engine Block

M49320 -JUN-19JUL90

M49778 -JUN-29OCT90

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COIL AIR GAP ADJUSTMENT

Reason:

Set correct coil to flywheel air gap for proper ignition operation.

Equipment:

- Feeler Gauge

Connections:

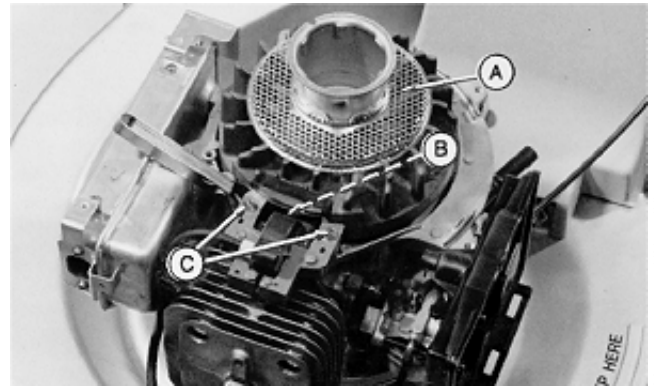
1. Remove fuel tank, muffler guard and fan housing. (See Section 30, Group 15.)
2. Set throttle control to stop position.
3. Remove spark plug high tension lead and ground to engine.
4. Rotate flywheel (A) until magnets (B) align with coil.
5. Loosen coil screws (C).

Procedure:

1. Place a 0.2 to 0.4 mm (0.008 to 0.016 in.) feeler gauge between coil and flywheel.
2. Push coil toward flywheel.
3. Tighten coil screws.

Specifications:

- **Coil air gap .. 0.2 to 0.4 mm (0.008 to 0.016 in.).**



M49321 -JUN-19JUL90

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MX,24015BV,6 -19-16JUL96

FLYWHEEL MAGNET TEST

Reason:

Check strength of flywheel magnet.

NOTE: This is a rough test and should only be used to determine flywheel magnet strength only if no other cause for weak or no spark is found.

Connections:

1. Remove fuel tank, muffler guard and fan housing.
(See Section 30, Group 15.)

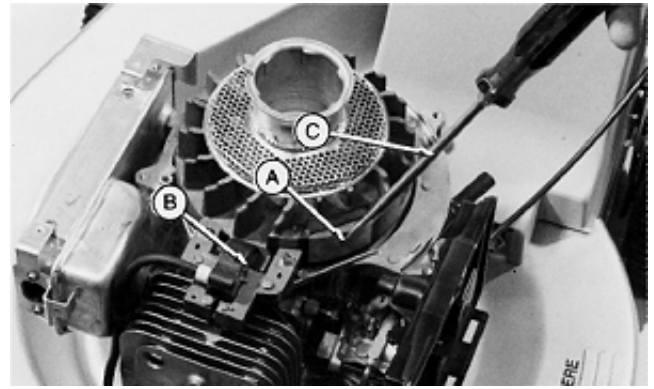
2. Rotate flywheel so magnet (A) is away from coil (B).

Procedure:

Loosely hold handle of steel shaft screwdriver (C) so that shaft is about 25 mm (1 in.) away from magnet.

Results:

- If screwdriver shank is not pulled into magnets, flywheel will need to be replaced.



M49322 -JUN-19JUL90

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MX,24015BV,7 -19-16JUL96

IGNITION COIL RESISTANCE TEST

Reason:

Check primary and secondary windings of ignition coil.

Equipment:

- Ohmmeter

Connections:

NOTE: Air cleaner assembly removed for photo; does not need to be removed for tests.

1. Disconnect wire at stop switch (A).

NOTE: Blade brake clutch switch shown in photo, follow the same procedure for zone start switch.

2. Remove high tension lead from spark plug (B).

3A. For primary winding test, set Ohmmeter to 1X scale.

3B. For secondary winding test, set Ohmmeter to 100X, 1KX or 10KX scale.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

Procedure:

1. Place one lead of meter on engine block (C).

2A. For primary winding test, place other lead of meter on wire (D).

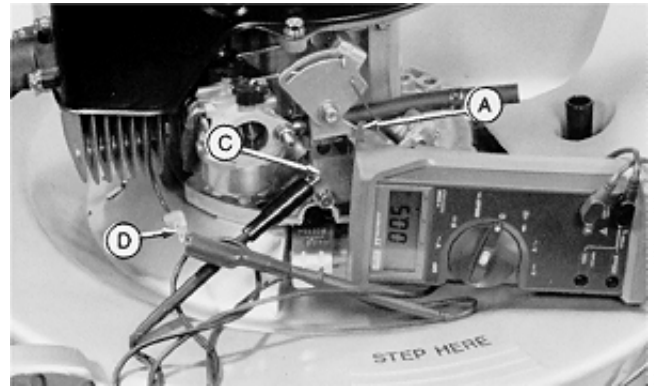
2B. For secondary winding test, place other lead of meter in spark plug cap (E).

Specifications:

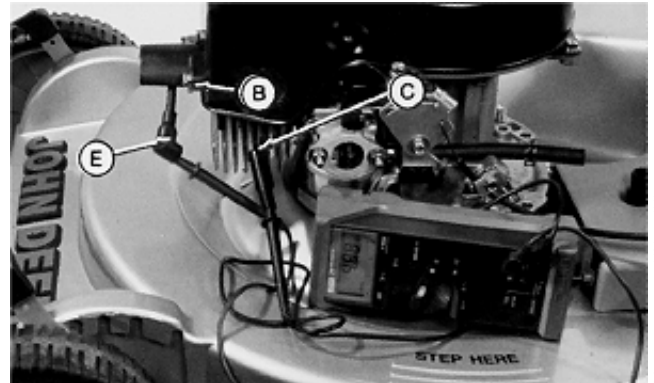
- **Coil primary winding resistance .. 0.2 to 0.6 Ohms.**
- **Coil secondary winding resistance .. 2500 to 5500 Ohms.**

Results:

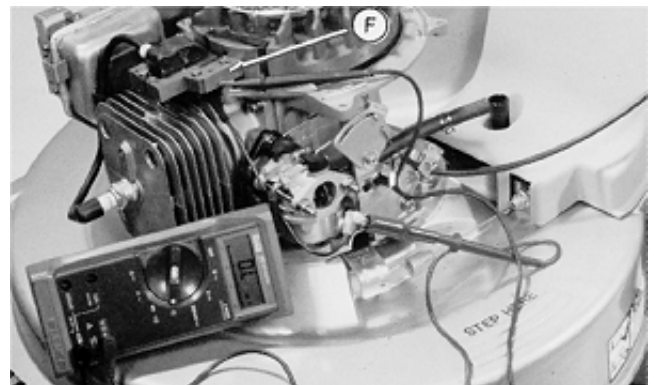
- If either winding of the coil is not within specification, remove fuel tank, muffler guard and fan housing and retest with one lead of meter grounded to side of coil laminations (F).
- If coil tests good with ground at coil, check for poor contact of coil with block.
- If either winding of the coil is still not within specification, replace coil.



M49323 -JUN-19JUL90



M49324 -JUN-19JUL90



M49325 -JUN-19JUL90

- A—Stop Switch
- B—Spark Plug
- C—Engine Block
- D—Wire
- E—Spark Plug Cap
- F—Coil Laminations

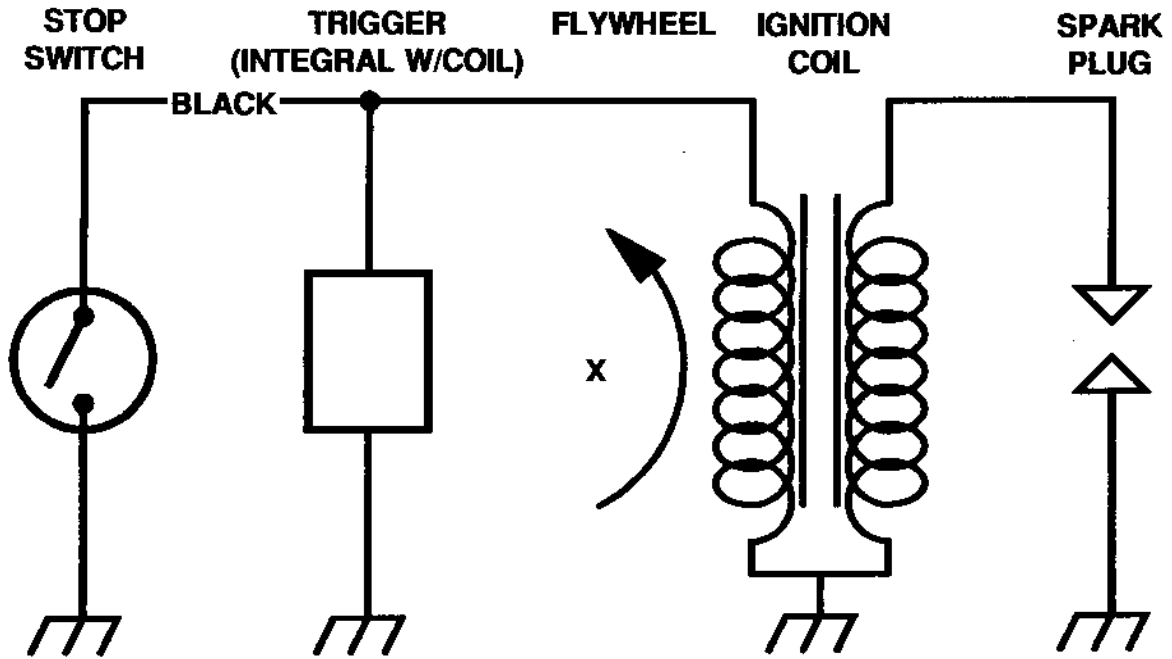
SCHEMATICS INFORMATION

The wiring schematics are drawn with the power in, or battery positive, circuit across the top and the ground, or battery negative, circuit across the bottom. The flow is then, as much as possible, from top to bottom through each circuit and component. All components are shown in the off position.

MX,24020BV,1 -19-16JUL96

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**WIRING DIAGRAM -
IGNITION BRIGGS & STRATTON 2 - CYCLE ENGINE**

M48972

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M48972 -19-03-JUL90

MX,24020BV,2 -19-16JUL96

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Section 242

ELECTRICAL OPERATION TESTS AND ADJUSTMENTS—BRIGGS & STRATTON 4-CYCLE

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Group 20—Wiring Schematics

Schematics Information	242-20-1
Ignition System Schematic	242-20-1

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COMPONENT LOCATION INFORMATION

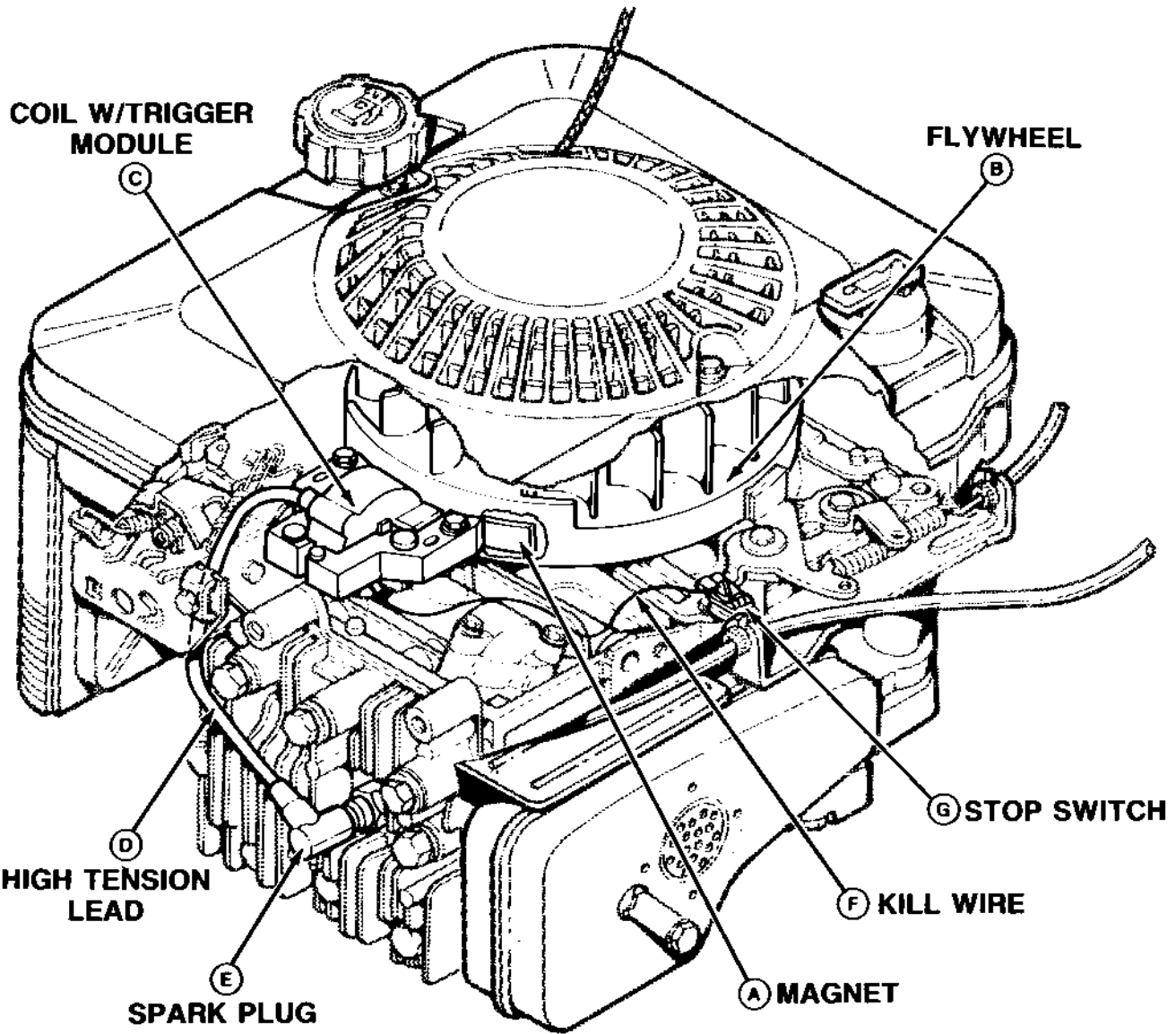
This group contains component location drawings for the following electrical system components:

- Ignition System

Use the drawings when diagnosing an electrical problem and to help locate the components to be tested.

MX,24205BV,1 -19-16JUL96

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M48736 IGNITION SYSTEM - BRIGGS & STRATTON 4 - CYCLE ENGINE

A—Magnet
B—Flywheel

C—Coil w/Trigger Module
D—High Tension Lead

E—Spark Plug
F—Kill Wire

G—Stop Switch

M48736
-19-30OCT90

MX,24205BV,2 -19-16JUL96

THEORY OF OPERATION INFORMATION

This group divides the electrical system into individual components or circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, component or circuit identification and theory of operation.

The following systems or components are covered:

- Ignition System

MX,24210BV,1 -19-16JUL96

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IGNITION SYSTEM OPERATION—BRIGGS & STRATTON 4-CYCLE ENGINE

A—Magnet
B—Flywheel

C—Coil w/Trigger Module
D—High Tension Lead

E—Spark Plug
F—Kill Wire

G—Stop Switch

Function:

At the correct time, supplies a high voltage at the spark plug to ignite a fuel/air mixture.

Major Components:

- Ignition Coil w/Trigger Module
- Stop Switch
- Flywheel W/Magnet

Theory of Operation:

This engine is equipped with a solid state, transistorized, magneto ignition system. There are no moving parts and there is no need for an external power source (battery). The power and the triggering signal are both generated as the permanent magnet (A) on the outside edge of the flywheel (B) moves past the ignition coil and trigger module (C). The ignition coil consists of an iron core with 2 sets of wires wound around it. The primary winding connects to the trigger, the secondary winding connects to the spark plug (E) with the high tension lead (D). The trigger module is a switch that opens and closes the

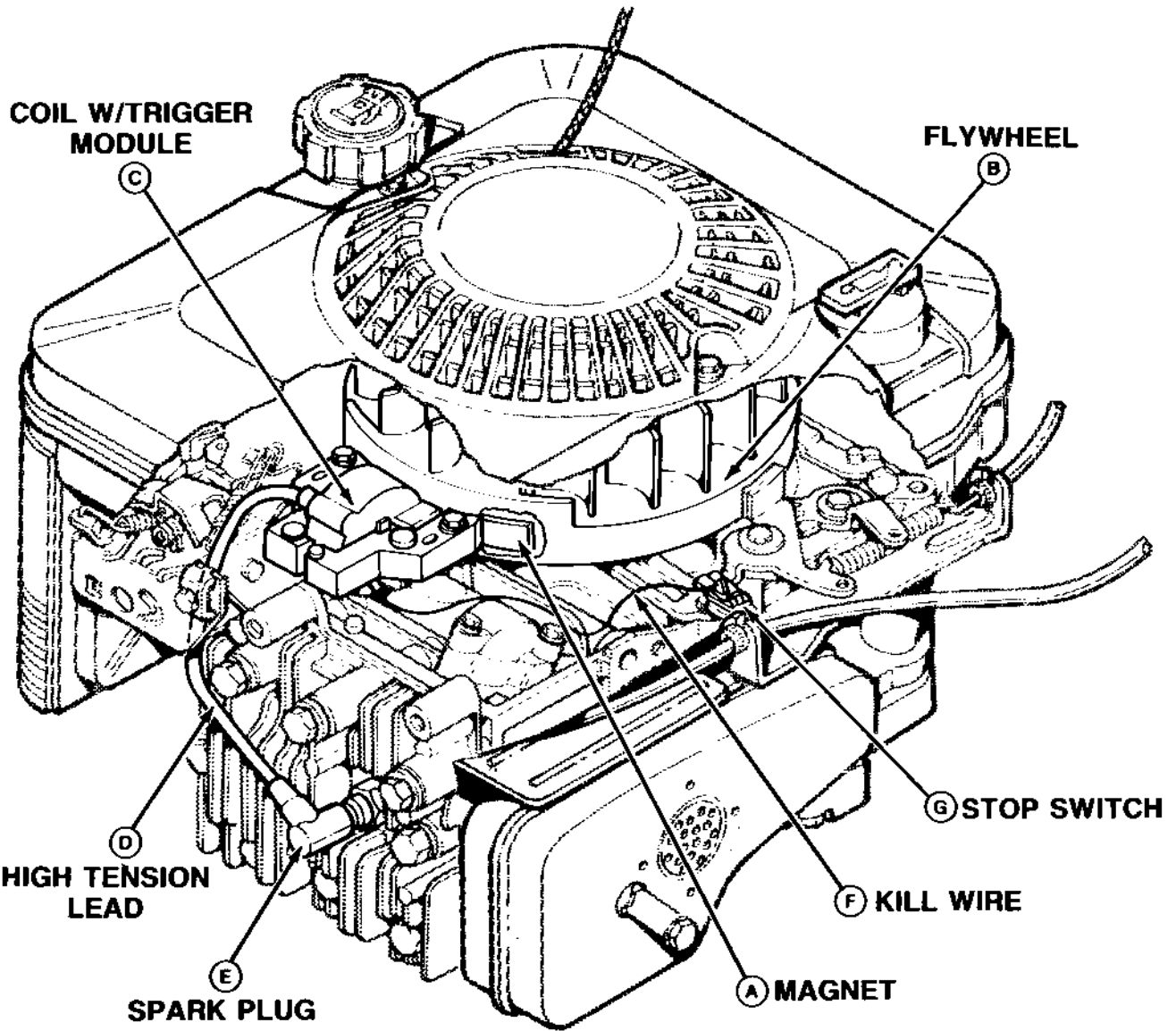
ground circuit of the primary winding of the coil (think of it as a non-moving set of points).

As the magnet nears the coil, a magnetic field passes through the core of the coil. This builds up a voltage in the primary windings of the coil. As the flywheel continues to turn, the magnetic field in the core of the coil reverses. Also, a voltage is generated in a small coil in the trigger. The voltage in the trigger closes the ground circuit of the primary winding of the coil. The field reversal and the closed ground of the primary winding cause a very rapid drop in voltage in the primary winding. This causes a very high voltage in the secondary winding of the coil. The high voltage of the secondary winding creates the spark at the spark plug.

The stop switch (G) is also a ground for the primary winding of the coil. When it is closed, a voltage cannot build up in the primary winding so no spark is generated. The safety switch is connected to the coil by the kill wire (F).

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MX,24210BV,2 -19-16JUL96



M48736

IGNITION SYSTEM - BRIGGS & STRATTON 4 - CYCLE ENGINE

MX,24210BV,3 -19-16JUL96

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M48736
-19-30OCT90

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Ignition System

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point at which the test is to be made.

MX,24215BV,1 -19-16JUL96

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IGNITION SYSTEM—BRIGGS & STRATTON 4-CYCLE ENGINE

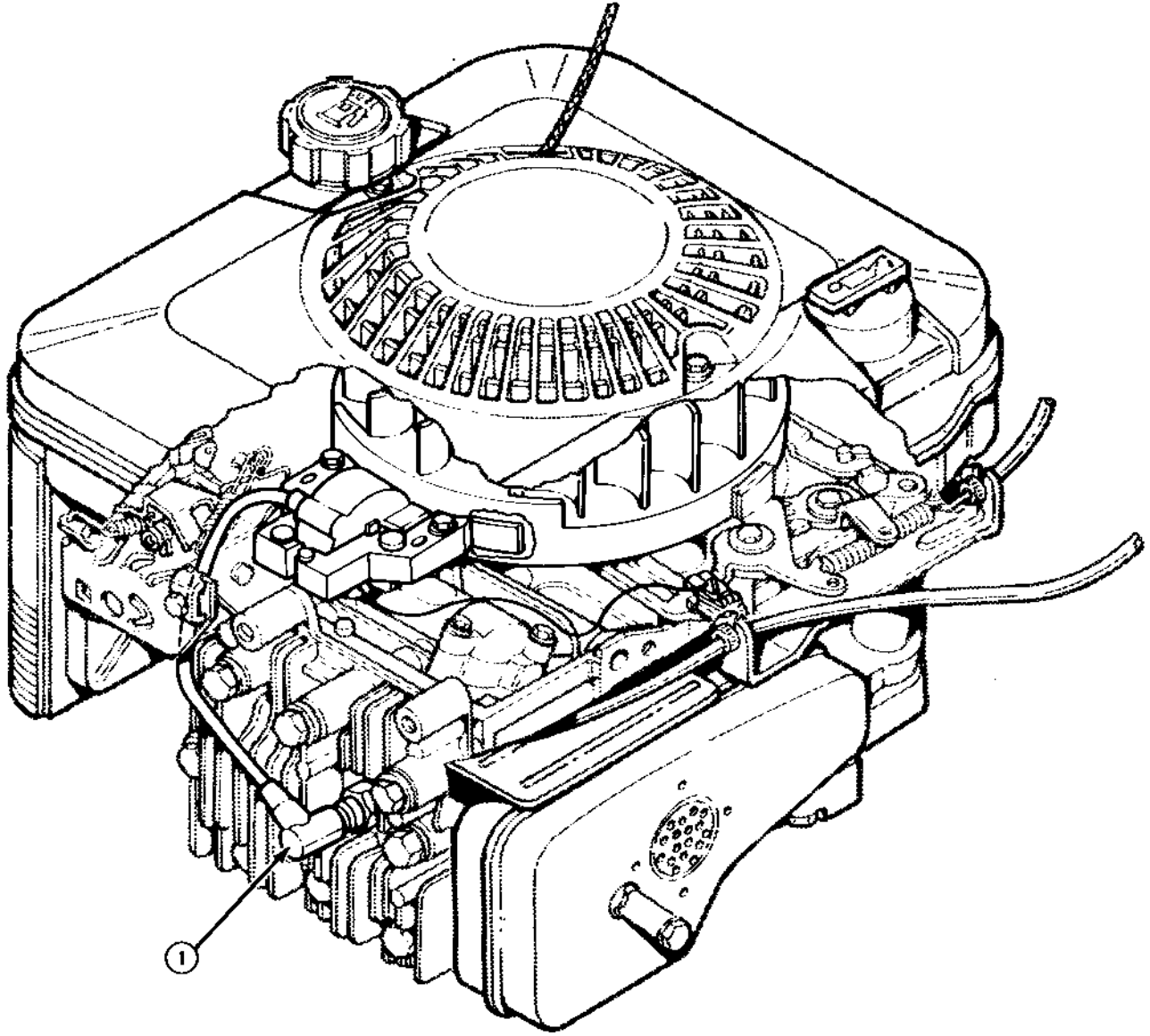
Conditions:

- Zone start engaged.
- Traction drive disengaged, self-propelled units.
- Ignition tests found in this group.

Test Location	Normal	If Not Normal
1. Spark plug.	Steady spark when engine is spun over.	Check for faulty spark plug. Check for shorted or broken high tension lead. Check for shorted wire between ignition trigger and safety switch. Check for misadjusted or faulty stop switch. Check for faulty coil/trigger.

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MX,24215BV,2 -19-16JUL96



M48764

IGNITION SYSTEM - BRIGGS & STRATTON 4 - CYCLE ENGINE

MX,24215BV,3 -19-16JUL96

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M48764
-19-30OCT90

SPARK TEST

Reason:

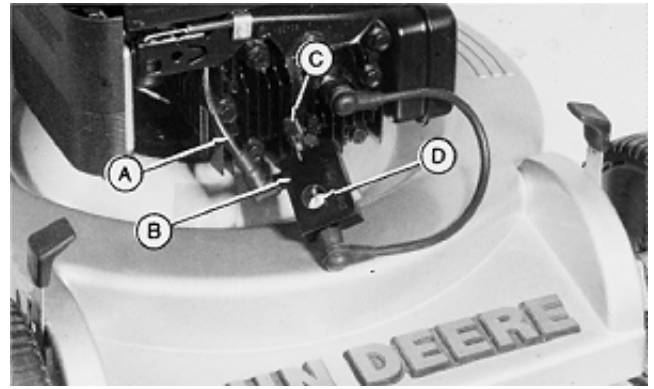
Check overall condition of ignition system.

Equipment:

- D-05351ST Spark Tester

Connections:

1. Remove high tension lead (A) from spark plug.
2. Connect spark tester (B) to spark plug.
3. Connect high tension lead to spark tester.
4. Adjust spark tester gap to 0.76 mm (0.030 in.) with screw (C).



- A—High Tension Lead
- B—Spark Tester
- C—Screw
- D—Spark

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NOTE: Do not adjust spark tester gap beyond 4.0 mm (0.160 in.) as damage to ignition system components could occur.

5. Set throttle control to fast idle position.

Procedure:

Pull recoil starter and watch spark (D) at spark tester. If engine will start, watch spark with engine running.

Specifications:

- **Steady, strong spark.**

Results:

- If spark is weak, or if no spark, install a new spark plug and test again.
- If spark is still weak, or still no spark, run the tests on individual components to find cause of malfunction.

MX,24215BV,4 -19-16JUL96

STOP SWITCH TEST AND ADJUSTMENT

Reason:

Determine proper operation of safety switch.

Equipment:

- Ohmmeter

Connections:

1. Remove fuel tank. (See Section 31, Group 15.)
2. Disconnect wire (A) from stop switch (B).
3. Set ohmmeter for 1X Ohms resistance.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

4. Connect one lead of meter to stop switch (B).
5. Connect other lead of meter to engine block (C).

Procedure:

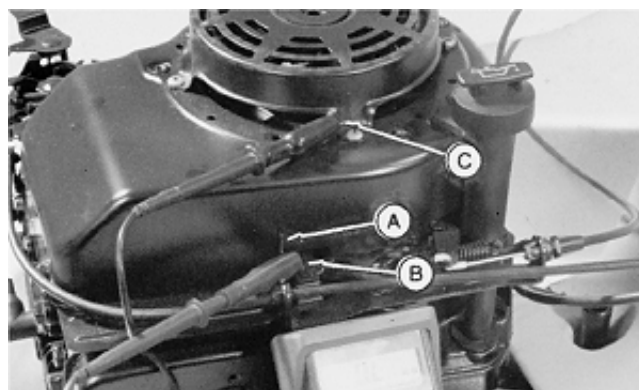
Engage and disengage zone start bail.

Specifications:

- **Continuity to ground when zone start bail disengaged.**
- **No continuity to ground when zone start bail engaged.**

Results:

- If there is no continuity to ground with zone start bail disengaged, check for:
 - Dirt or rust on stop switch tang or zone start linkage finger—clean tang and finger.
 - Zone start linkage finger not contacting stop switch tang—adjust linkage or tang as needed.
 - Faulty stop switch—replace switch.
- If there is continuity to ground with zone start bail engaged, check for:
 - Zone start linkage finger contacting stop switch tang—adjust linkage or tang as needed.
 - Faulty stop switch—replace switch.



M49327 -JUN-19JUL90

242
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5

COIL AIR GAP ADJUSTMENT

Reason:

Set correct coil to flywheel air gap for proper ignition operation.

Equipment:

- Feeler Gauge

Connections:

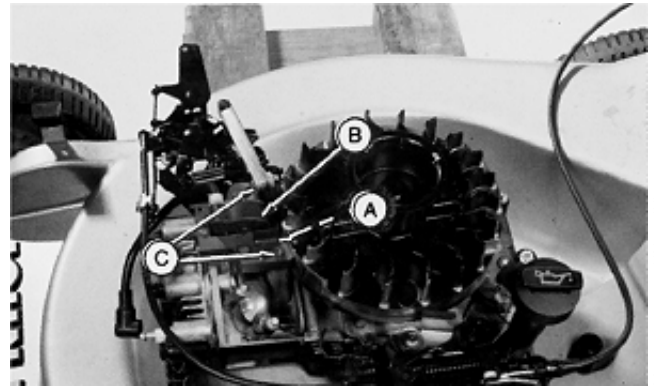
1. Make sure that zone start bail is disengaged.
2. Remove fuel tank and engine fan shroud. (See Section 31, Group 05.)
3. Remove spark plug high tension lead and ground to engine.
4. Rotate flywheel until magnets (A) align with coil (B).
5. Loosen screws (C).

Procedure:

1. Place a 0.2 to 0.4 mm (0.008 to 0.016 in.) feeler gauge between coil and flywheel.
2. Push coil toward flywheel.
3. Tighten screws.

Specifications:

- Coil air gap .. 0.2—0.4 mm (0.008—0.016 in.).



M49328 -JUN-19JUL90

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MX,24215BV,6 -19-16JUL96

FLYWHEEL MAGNET TEST

Reason:

Check strength of flywheel magnets.

NOTE: This is a rough test and should only be used to determine flywheel magnet strength only if no other cause for weak or no spark is found.

Connections:

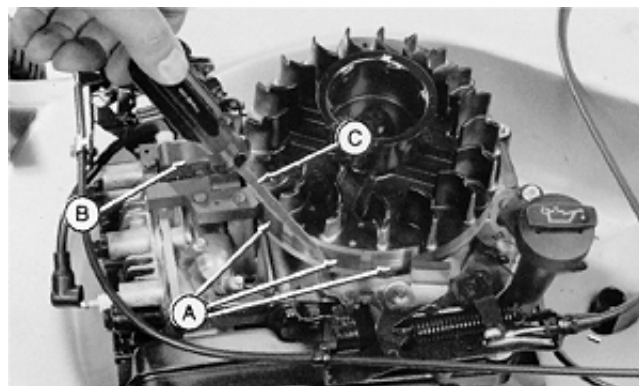
1. Make sure that zone start bail is disengaged.
2. Remove fuel tank and fan housing. (See Section 31, Group 05.)
3. Rotate flywheel so magnets (A) are away from coil (B).

Procedure:

Loosely hold handle of steel shaft screwdriver (C) so that shaft is about 25 mm (1 in.) away from magnets.

Results:

- If screwdriver shank is not pulled into magnets, flywheel will need to be replaced.



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MX,24215BV,7 -19-16JUL96

IGNITION COIL RESISTANCE TEST

Reason:

Check primary and secondary windings of ignition coil.

Equipment:

- Ohmmeter

Connections:

1. Remove fuel tank. (See Section 31, Group 15.)
2. Disconnect wire at stop switch (A).
3. Remove high tension lead (B) from spark plug.
- 4A. For primary winding test, set Ohmmeter to 1X scale.
- 4B. For secondary winding test, set Ohmmeter to 100X, 1KX or 10KX scale.

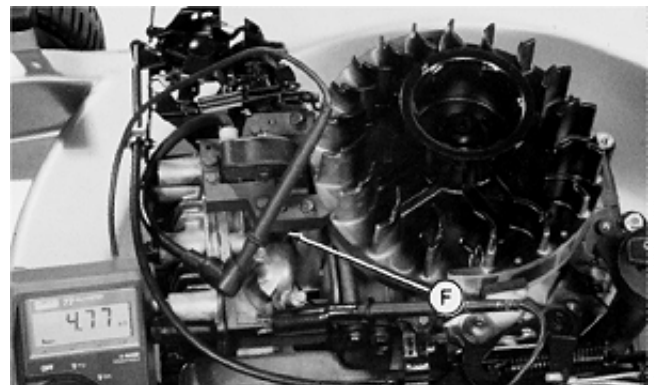
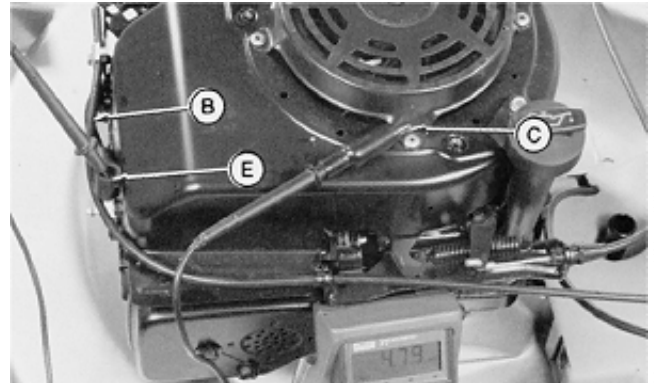
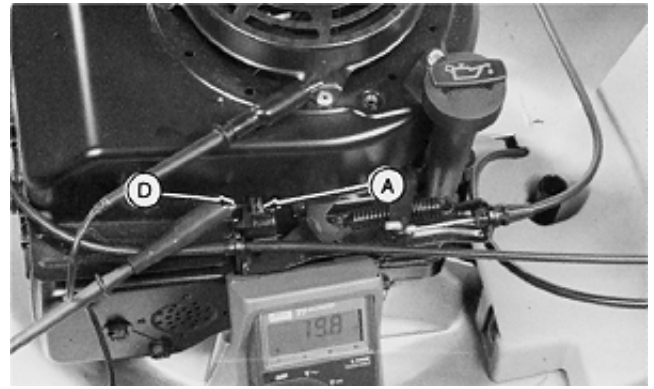
NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

Procedure:

1. Place one lead of meter on engine block (C).
- 2A. For primary winding test, place other lead of meter on wire (D). Resistance should be **0.2—0.6 ohms**.
- 2B. For secondary winding test, place other lead of meter in spark plug cap (E). Resistance should be **2500—5500 ohms**.

Results:

- If either winding of the coil is not within specification, remove muffler guard and fan housing and retest with one lead of meter grounded to side of coil laminations (F).
- If coil tests good with ground at coil, check for poor contact of coil with block.
- If either winding of the coil is still not within specification, replace coil.



- A—Stop Switch
- B—High Tension Lead
- C—Engine Block
- D—Wire
- E—Spark Plug Cap
- F—Coil Laminations

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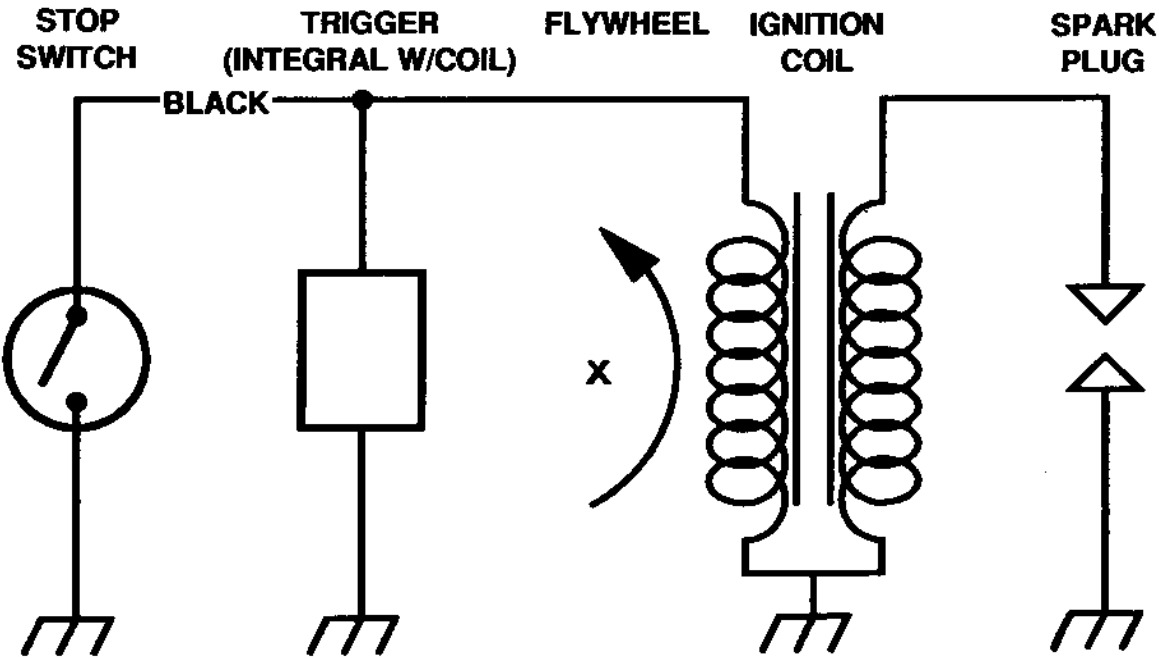
M49331 -JUN-19JUL90

M49332 -JUN-19JUL90

SCHEMATICS INFORMATION

The wiring schematics are drawn with the power in, or battery positive, circuit across the top and the ground, or battery negative, circuit across the bottom. The flow is then, as much as possible, from top to bottom through each circuit and component. All components are shown in the off position.

MX,24220BV,1 -19-16JUL96



**WIRING DIAGRAM -
IGNITION BRIGGS & STRATTON 4 - CYCLE ENGINE**

M48973

M48973 -19-03JUL90

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Section 245 ELECTRICAL OPERATION TESTS AND ADJUSTMENTS—KAWASAKI ENGINE

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COMPONENT LOCATION INFORMATION

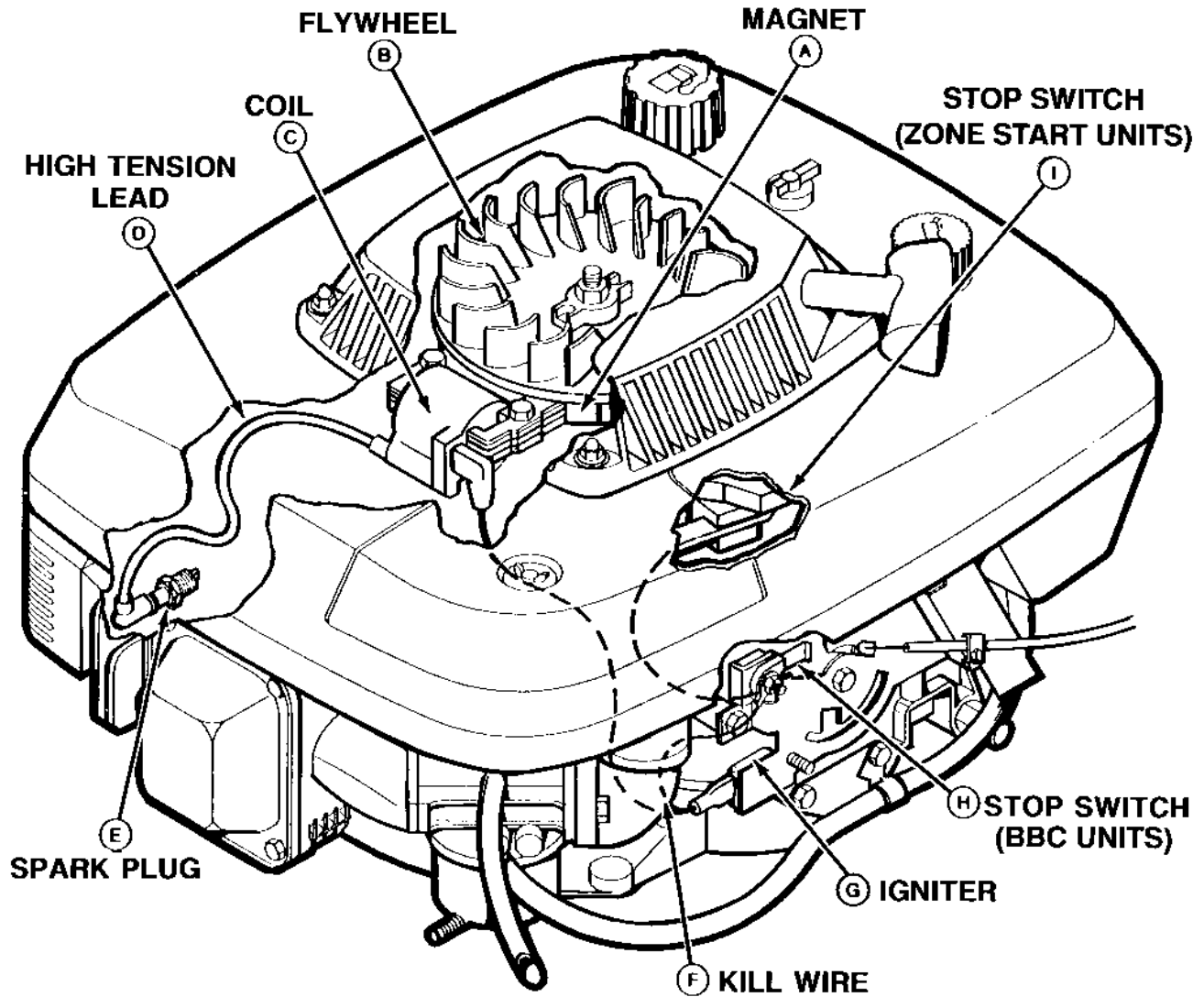
This group contains component location drawings for the following electrical system components:

- Ignition System
- Electrical System

Use the drawings when diagnosing an electrical problem and to help locate the components to be tested.

MX,24505BV,1 -19-16JUL96

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M48714

IGNITION SYSTEM - KAWASAKI ENGINE

A—Magnet
B—Flywheel
C—Coil

D—High Tension Lead
E—Spark Plug
F—Kill Wire

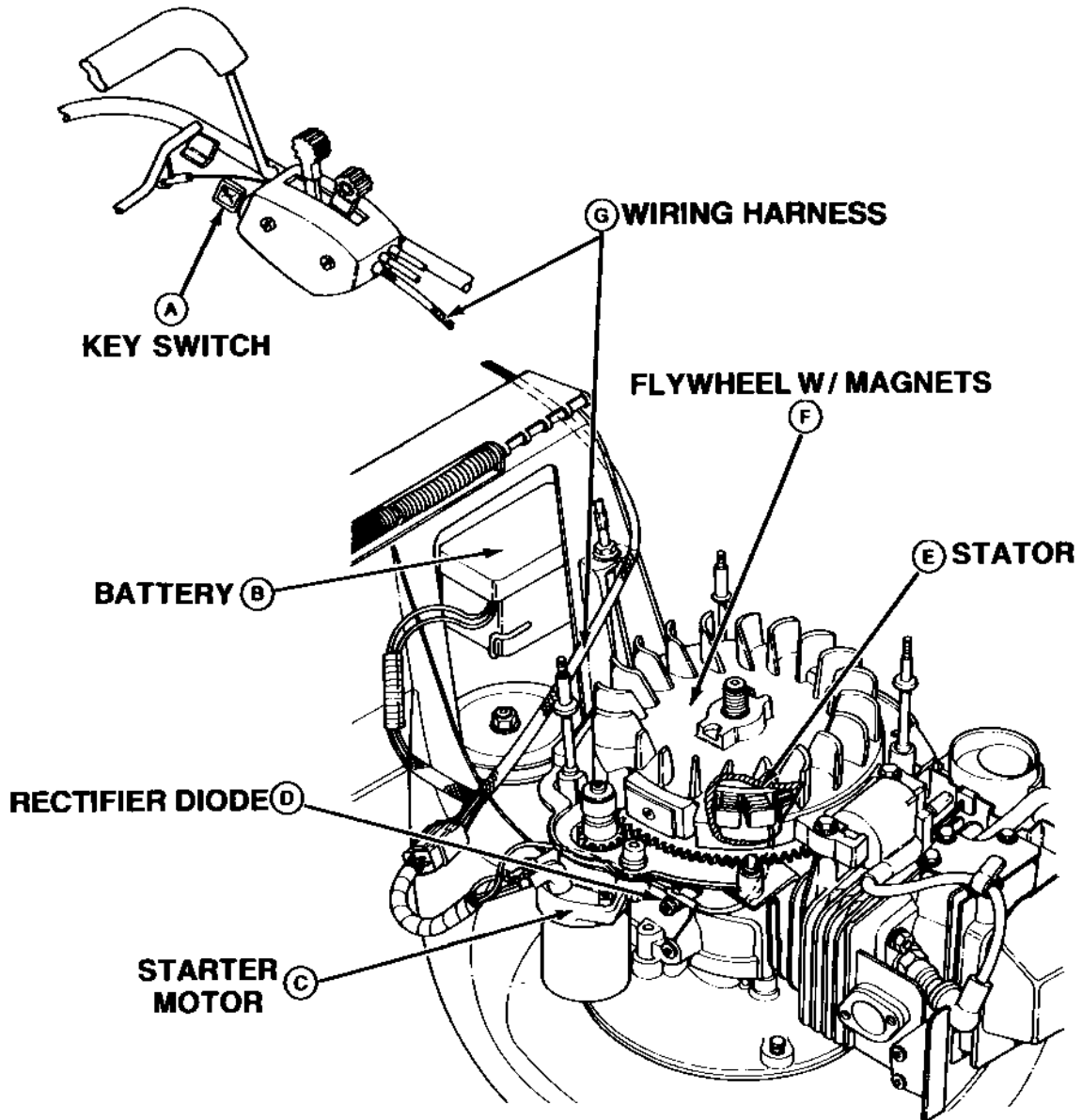
G—Igniter
H—Stop Switch (BBC Units)

I—Stop Switch (Zone Start Units)

-19-02NOV95

M48714

MX,24505BV,2 -19-16JUL96



M48715

ELECTRICAL SYSTEM - KAWASAKI ENGINE

A—Key Switch
B—Battery

C—Starter Motor
D—Rectifier Diode

E—Stator
F—Flywheel w/Magnets

G—Wiring Harness

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THEORY OF OPERATION INFORMATION

This group divides the electrical system into individual components or circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, component or circuit identification and theory of operation.

The following systems or components are covered:

- Ignition System
- Electrical System

MX,24510BV,1 -19-16JUL96

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IGNITION SYSTEM OPERATION—KAWASAKI ENGINE

A—Magnet
B—Flywheel
C—Coil

D—High Tension Lead
E—Spark Plug
F—Kill Wire

G—Igniter¹
H—Stop Switch (BBC Units)

I—Stop Switch (Zone Start Units)

Function:

At the correct time, supply a high voltage at the spark plug to ignite a fuel/air mixture.

Major Components:

- Ignition Coil
- Igniter
- Safety Switch
- Flywheel w/Magnet

Theory of Operation:

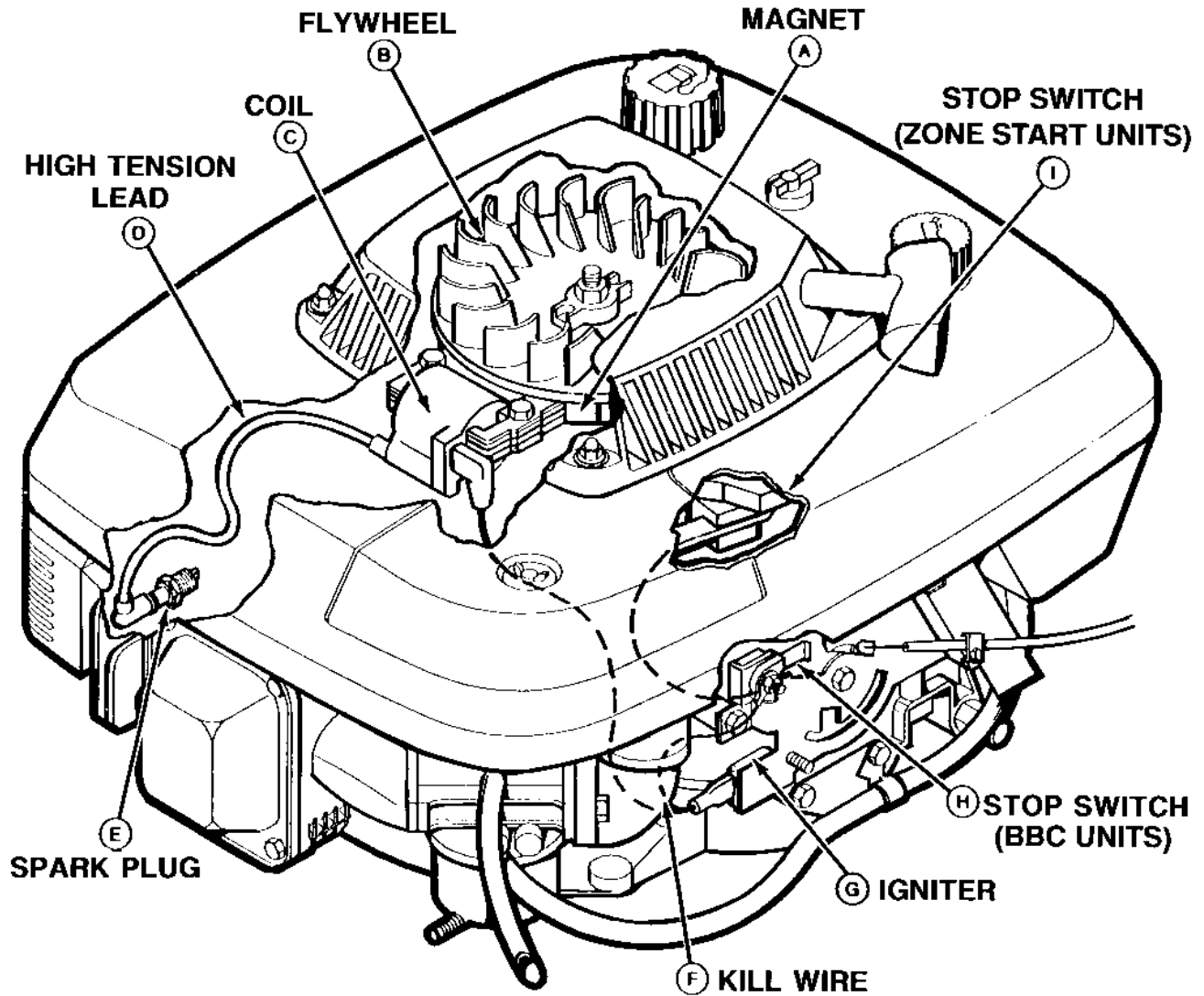
This engine is equipped with a solid-state, transistorized, magneto ignition system. There are no moving parts and there is no need for an external power source (battery). The power and the triggering signal are both generated as the permanent magnet (A) on the outside edge of the flywheel (B) moves past the ignition coil (C). The ignition coil consists of an iron core with 2 sets of wires wound around it. The primary winding connects to the trigger. The secondary winding connects to the spark plug (E) with the high tension lead (D). The igniter (G) is a

switch that opens and closes the ground circuit of the primary winding of the coil (think of it as a non-moving set of points).

As the magnet nears the coil, a magnetic field passes through the core of the coil. This builds up a voltage in the primary windings of the coil. As the flywheel continues to turn, the magnetic field in the core of the coil reverses. The field reversal sends a signal to the igniter which closes the ground circuit of the primary winding of the coil. The field reversal and the closed ground of the primary winding cause a very rapid drop in voltage in the primary winding. This causes a very high voltage in the secondary winding of the coil. The high voltage of the secondary winding creates the spark at the spark plug.

The stop switch (H) or (I) is also a ground for the primary winding of the coil. When it is closed, a voltage cannot build up in the primary winding so no spark is generated. The safety switch is connected to the igniter/coil by the kill wire (F).

¹14SB, 14SE and 14SX units (engine S.N. FC150VF67581—) have the igniter integrated with the ignition coil.



M48714

IGNITION SYSTEM - KAWASAKI ENGINE

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ELECTRICAL SYSTEM OPERATION—KAWASAKI ENGINE

A—Key Switch
B—Battery

C—Starter Motor
D—Rectifier Diode

E—Stator
F—Flywheel w/Magnets

G—Wiring Harness

Function:

Offer a non-manual method of starting the engine and a means of keeping the battery charged.

Major Components:

- Battery
- Starter Motor
- Key Switch
- Stator

Theory of Operation:

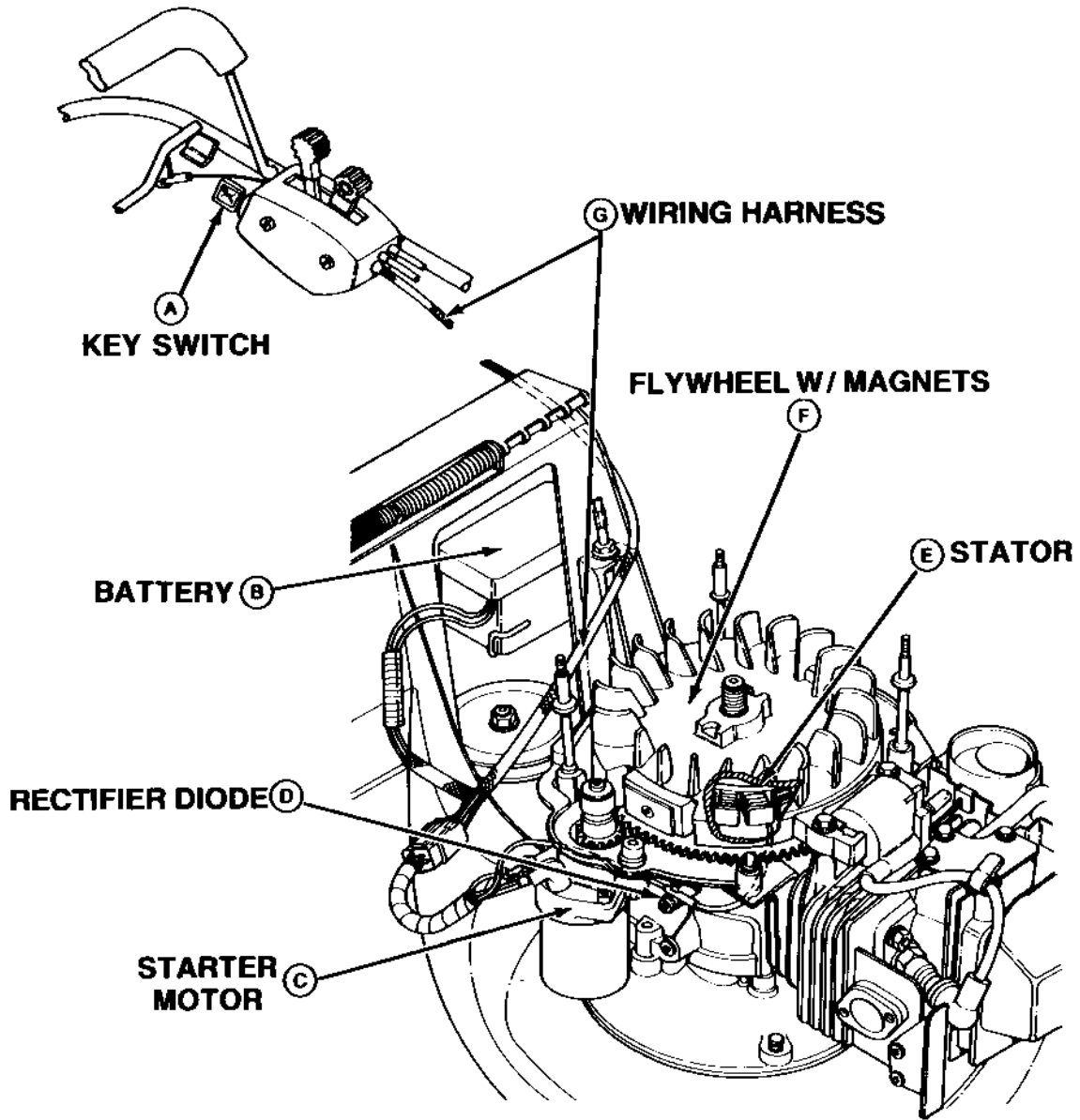
The electrical system on this mower can be broken down into the starting components and the charging components. The starting components consist of the starter motor (C), key switch (A) and battery (B). The charging components consist of the stator (E), flywheel w/magnets (F) and rectifier diode (D). The starting and charging systems DO NOT connect in any way with the ignition system.

The starting system on this unit is quite simple. The power for the starter motor goes from the battery through the wiring (G) directly to the key switch. When the key switch is turned on the power goes directly to the starter motor. There are no solenoids or relays in the system.

The charging system for the battery is working whenever the engine is running. An AC voltage is created as the flywheel magnets pass the stator. This AC voltage is converted to the DC voltage needed by the battery at the rectifier diode. There is no voltage regulator since the output of the system is only about 0.5 amperes at 3000 rpm. The battery can accept this charge without any problem.

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ELECTRICAL SYSTEM - KAWASAKI ENGINE

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Ignition System
- Electrical System

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point at which the test is to be made.

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IGNITION SYSTEM—KAWASAKI ENGINE

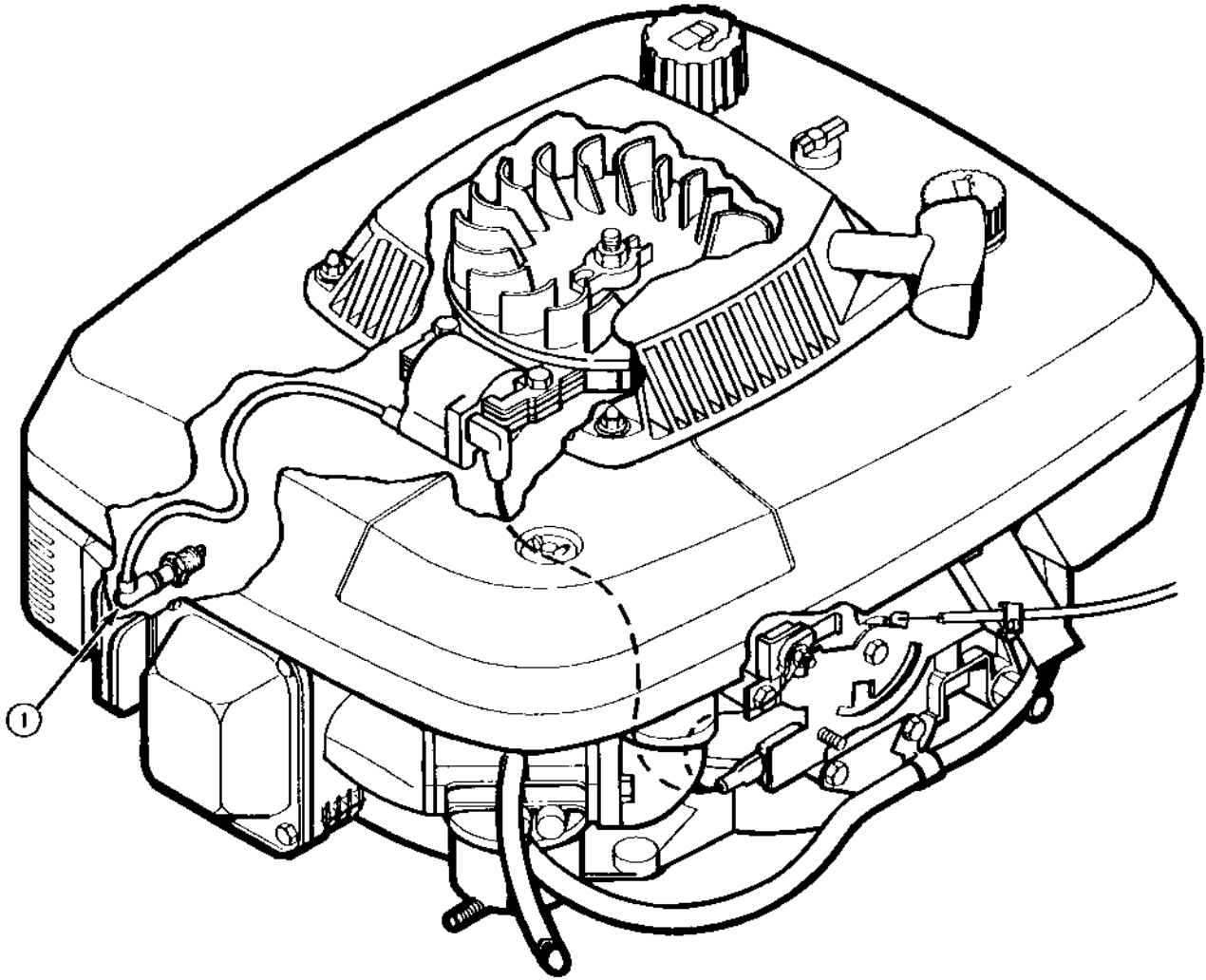
Conditions:

- Blade brake clutch disengaged on BBC units.
- Zone start bail engaged on zone start units.
- Traction drive disengaged, self-propelled units.
- Ignition tests found in this group.

Test Location	Normal	If Not Normal
1. Spark plug.	No spark when engine spun over. (Throttle control in stop position or zone start bail not engaged.) Steady spark when engine spun over (Throttle control not in stop position or zone start bail engaged.)	Check for broken wire between ignition trigger and safety switch. Check for misadjusted or faulty stop switch. Check for faulty spark plug. Check for shorted or broken high tension lead. Check for shorted wire between ignition trigger and safety switch. Check for misadjusted or faulty stop switch. Check for faulty coil. Check for faulty trigger.

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IGNITION SYSTEM - KAWASAKI ENGINE

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ELECTRICAL SYSTEM—KAWASAKI ENGINE

Conditions:

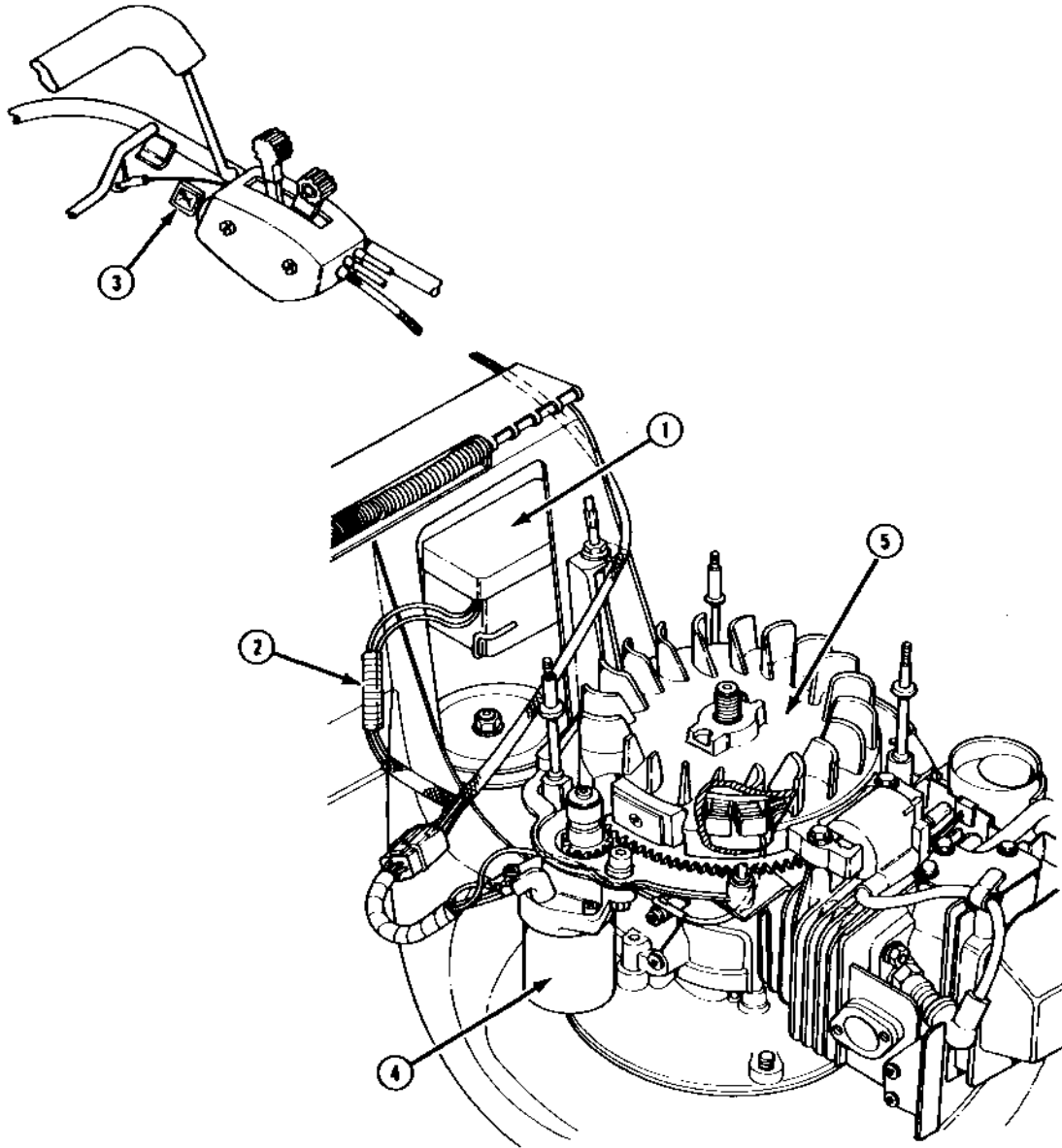
- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Electrical tests found in this group.

- Engine tests found in Section 225 Group 15.
- Power train tests found in Section 250 Group 15.

Test Location	Normal	If Not Normal
1. Battery.	Minimum of 12.5 VDC.	Charge and test battery.
2. Battery connector.	Minimum of 0.50 Amps charge. (Engine running at 3000 to 3150 rpm.)	Check for faulty stator or flywheel magnets.
3. Key switch.	Minimum of 12.5 VDC at red wire. (Key switch in rest position.)	Charge and check battery. Check for broken wire in harness. Check for corroded connectors in harness.
	Minimum of 12.5 VDC at yellow wire. (Key switch turned clockwise as far as it will go. Red/white wire disconnected from starter motor.)	Charge and check battery. Check for faulty key switch.
4. Starter motor.	Minimum of 12.5 VDC at red/white wire. (Key switch turned clockwise as far as it will go. Red/white wire disconnected from starter motor.)	Check and charge battery. Check for broken wires in harness. Check for corroded connectors in harness.
5. Flywheel.	Engine being turned at a minimum of 350 rpm by the starter motor.	Check for a discharged or faulty battery. Check for poor connections or faulty wiring. Check for a faulty starter motor.

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M48978

ELECTRICAL SYSTEM - KAWASAKI ENGINE

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SPARK TEST

Reason:

Check overall condition of ignition system.

Equipment:

- D-05351ST Spark Tester

Connections:

1. Remove high tension lead (A) from spark plug.
2. Connect spark tester (B) to spark plug.
3. Connect high tension lead to spark tester.
4. Adjust spark tester gap to 0.76 mm (0.030 in.) with screw (C).

NOTE: Do not adjust spark tester gap beyond 4.0 mm (0.160 in.) as damage to ignition system components could occur.

5. Set throttle control to fast idle position.
6. On zone start units, engage zone start bail.

Procedure:

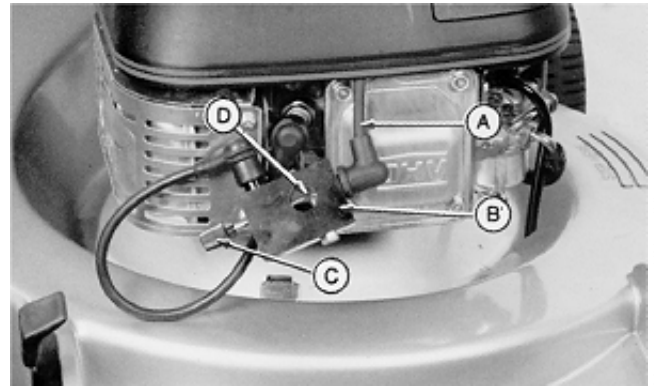
Pull recoil starter and watch spark (D) at spark tester. If engine will start, watch spark with engine running.

Specifications:

- **Steady, strong spark.**

Results:

- If spark is weak, or if no spark, install a new spark plug and test again.
- If spark is still weak, or still no spark, run tests on individual components to find cause of malfunction.



A—High Tension Lead
B—Spark Tester
C—Screw
D—Spark

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STOP SWITCH TEST AND ADJUSTMENT

Reason:

Determine proper operation of stop switch.

Equipment:

- Ohmmeter

Connections:

1. Disconnect wire (A) from stop switch terminal (B).
2. Set Ohmmeter to 1X Ohms scale.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

3. Connect one lead of meter to stop switch terminal.
4. Connect other lead of meter to engine block (C).

Procedure:

1. On blade brake clutch units, move throttle control through full range from stop to choke.
2. On zone start units, engage and disengage zone start bail.

Specifications:

• Blade Brake Clutch Units:

- Continuity to ground when throttle control in stop position.
- No continuity to ground when throttle control in any other position.

• Zone Start Units:

- Continuity to ground when throttle zone start bail not engaged.
- No continuity to ground when zone start bail engaged.

Results:

- If there is no continuity to ground with throttle control in stop position or when zone start bail not engaged, check for:

Dirt or rust on safety stop tang or control arm
—clean arm and tang.

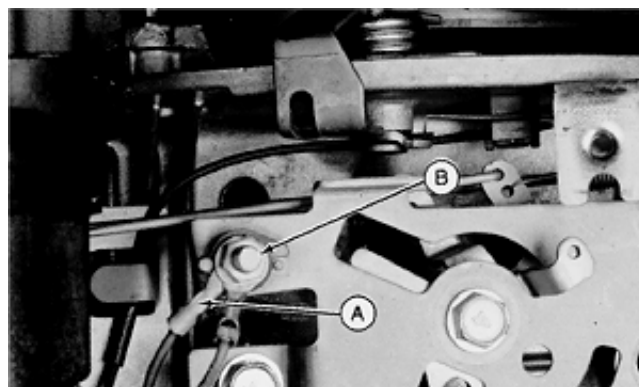
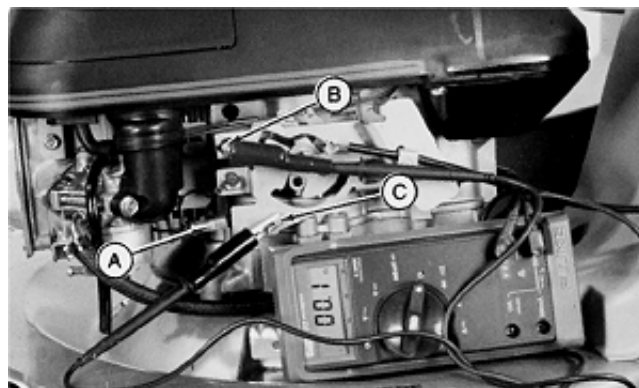
Control arm not contacting stop switch
tang—adjust arm or tang as needed.

Faulty stop switch—replace switch.

- If there is continuity to ground with throttle control in other than stop position or when zone start bail is engaged, check for:

Control arm contacting stop switch tang
—adjust arm or tang as needed.

Faulty stop switch—replace switch.



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COIL AIR GAP ADJUSTMENT

Reason:

Set correct coil to flywheel air gap for proper ignition operation.

Equipment:

- Feeler Gauge

Connections:

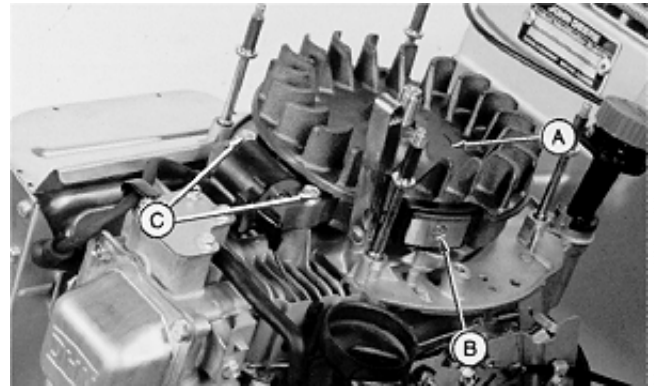
1. Remove recoil starter and fuel tank/fan housing. (See Section 32, Group 10.)
2. Set throttle control to stop position.
3. Remove spark plug high tension lead and ground to engine.
4. Rotate flywheel (A) until magnet (B) is not aligned with coil.
5. Loosen screws (C).

Procedure:

1. Place a 0.3 mm (0.012 in.) feeler gauge between coil and flywheel.
2. Push coil toward flywheel.
3. Tighten screws.

Specifications:

- **Coil air gap .. 0.3 mm (0.012 in.).**



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FLYWHEEL MAGNET TEST

Reason:

Check strength of flywheel magnets.

NOTE: This is a rough test and should only be used to determine flywheel magnet strength only if no other cause for weak or no spark is found.

Connections:

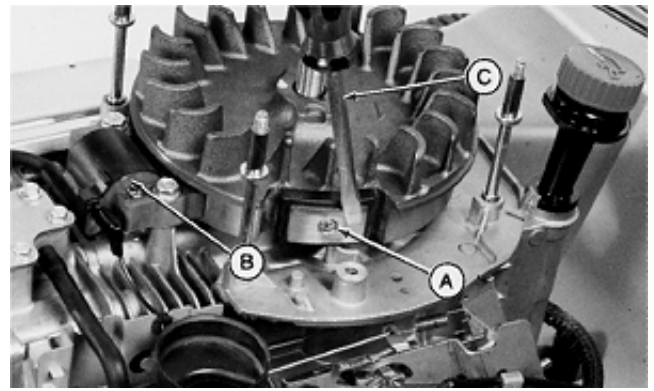
1. Remove recoil starter and fuel tank/fan housing. (See Section 32, group 10.)
2. Rotate flywheel so magnet (A) is away from coil (B).

Procedure:

Loosely hold handle of steel shaft screwdriver (C) so that shaft is about 25 mm (1 in.) away from magnet.

Results:

- If screwdriver shank is not pulled into magnet, flywheel will need to be replaced.



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IGNITION COIL RESISTANCE TEST

Reason:

Check primary and secondary windings of ignition coil.

Equipment:

- Ohmmeter

Connections:

1. Disconnect wire (A) at igniter.
- 2A. On blade brake clutch units, set throttle control in any position except stop position.
- 2B. On zone start units, engage zone start bail.
3. Remove high tension lead (B) from spark plug.
- 4A. For primary winding test, set Ohmmeter to 1X Ohms scale.
- 4B. For secondary winding test, set Ohmmeter to 1000X or 1KX Ohms scale.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

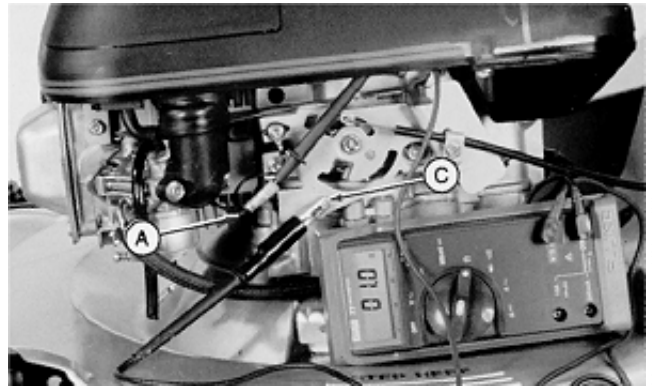
Procedure:

1. Place one lead of meter on engine block (C).
- 2A. For primary winding test, place other lead of meter on wire (A). Resistance should be **0.67—1.10 ohms**.
- 2B. For secondary winding test, place other lead of meter in spark plug cap (D). Resistance should be **6000—10,000 ohms**.

Results:

If either winding of the coil is not within specification, remove fuel tank/fan housing assembly and retest with one lead of meter grounded to side of coil laminations (E).

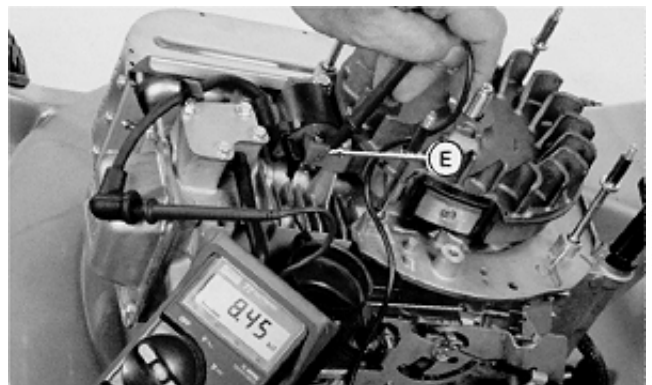
- If coil checks good with meter lead on coil, check for poor ground of coil to block.
- If either winding of the coil is still not within specification, replace coil.



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- A—Igniter Wire
- B—High Tension Lead
- C—Engine Block
- D—Spark Plug Cap
- E—Coil Laminations

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IGNITER TEST

Reason:

Check if igniter is good.

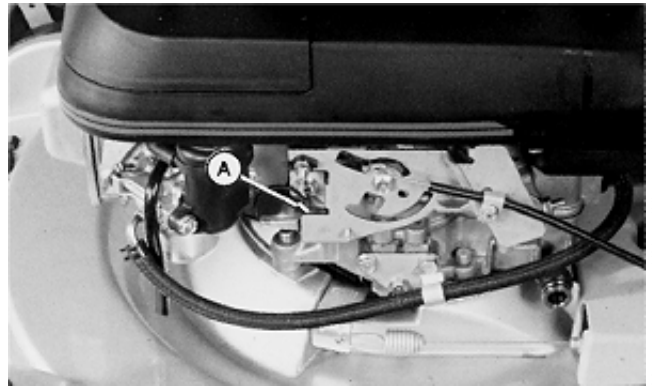
NOTE: Later model engines have a combined igniter/coil assembly. Igniters on these engines cannot be replaced separately.

Procedure:

Due to variations in meters, that the igniter is very sensitive to the type of meter used and that the possible tests DO NOT cover all malfunctions, the best way to determine if the igniter is good is to replace the questionable igniter (A) with a known good igniter.

Results:

- If the new igniter does not solve the problem, check the other ignition components for the cause of the malfunction.



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M49340

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BATTERY TEST

Reason:

Determine if the battery is good or bad.

Equipment:

- AM32792 Battery Charger
- Voltmeter

Connections:

1. Disconnect battery from wiring harness and charge for 24 to 48 hours using AM32792 battery charger.

2. Set voltmeter on a DC scale capable of reading 13 VDC.

3. Connect red meter lead to red wire (A) of battery connector.

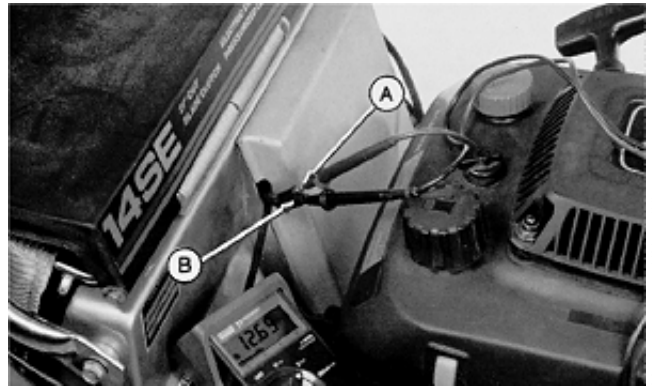
4. Connect black meter lead to black wire (B) of battery connector.

Procedure:

Read meter. Voltage should read a **minimum of 12.5 VDC**.

Results:

- If voltage is to specification, connect battery to harness. Then with throttle control in stop position, spin engine over with electric starter for 5 seconds. Disconnect battery and retest.
- If battery passes both tests, it is good.
- If battery fails either test, it is bad and needs to be replaced.



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STARTER TEST

Reason:

Check starter performance.

Equipment:

- JT05719 Photo Tachometer

Connections:

1. Charge and test battery before testing starter.
2. Test key switch and wiring before testing starter.
3. Remove recoil starter.
4. Place photo tachometer reflective tape (A) on flywheel (B).
5. Set throttle control in stop position to keep engine from starting.

Procedure:

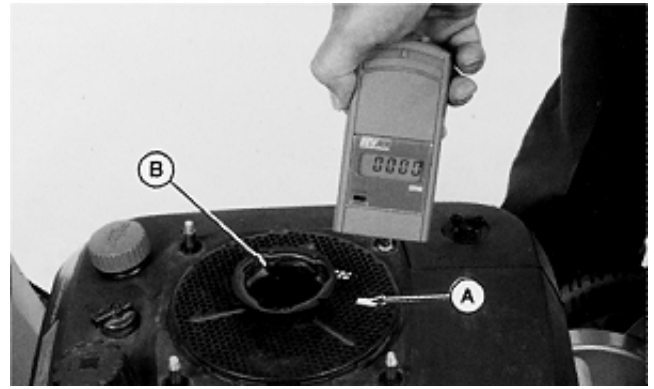
Spin engine with electric starter and note engine rpm.

Specifications:

- **Engine speed with electric starter .. minimum 350 rpm.**

Results:

- If engine starting rpm is below specification, check compression and compression release operation and retest rpm.
- If engine starting rpm is still below specification, repair or replace starter as needed.



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STATOR TEST

Reason:

Check output of stator.

Equipment:

- Ammeter

Connections:

1. Separate battery-to-wiring harness connector.
2. Put negative connection (black wires) (A) of battery-to-harness connector back together but DO NOT connect positive connection (red wires).
3. Set ammeter to 10 Amp scale.
4. Put red meter lead into male harness connector (B).
5. Put black meter lead into female battery connector (C).

Procedure:

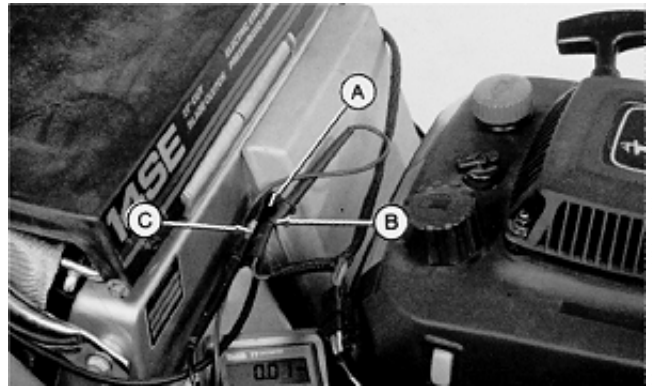
1. Start engine with recoil starter.
2. Set throttle control to fast idle position.

Specifications:

- **Stator output .. minimum 0.5 Amps at 3000 rpm.**

Results:

- If there is no output, check for broken wire between connector and stator and retest.
- If there is still no output after checking wire, or output is low, replace stator.



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KEY SWITCH TEST

Reason:

Check key switch operation.

Equipment:

- Ohmmeter

Connections:

1. Separate wiring harness at 4-pin connector (A).
2. Separate battery connector.
3. Set Ohmmeter to 1X Ohms scale.

NOTE: On analog (swing needle) ammeters, set zero point before every test.

4. Put one lead of ohmmeter on red wire terminal (B) of key switch side of harness connector.
5. Put other lead of ohmmeter on yellow wire terminal (C) of key switch side of harness connector.

Procedure:

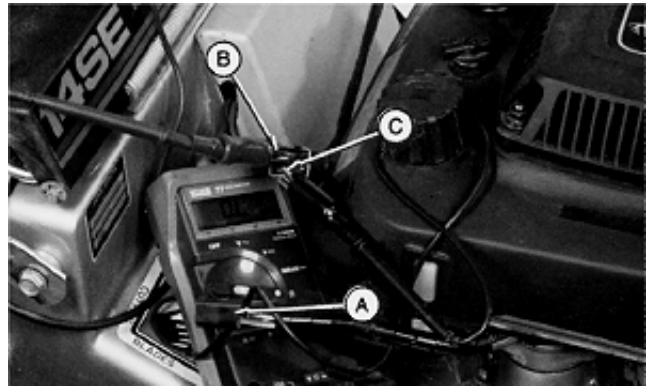
1. Turn key switch clockwise as far as it will go.
2. Release key switch.

Specifications:

- Continuity when key switch turned clockwise.
- No continuity when key switch at rest position.

Results:

- If key switch does not pass both tests, replace key switch.



M49344 -JUN-19JUL90

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MX,24515BV,15 -19-16JUL96

WIRING INSPECTION

Reason:

Check for corrosion in wiring harness connectors.

Procedure:

1. Separate wiring harness at connectors and from components and clean all terminals.
2. Coat all terminals with dielectric grease before reconnecting.



M49345 -JUN-19JUL90

MX,24515BV,16 -19-16JUL96

TEST BATTERY CHARGER VOLTAGE OUTPUT

Reason:

Determine if battery charger is working.

Equipment:

- Voltmeter

Connections:

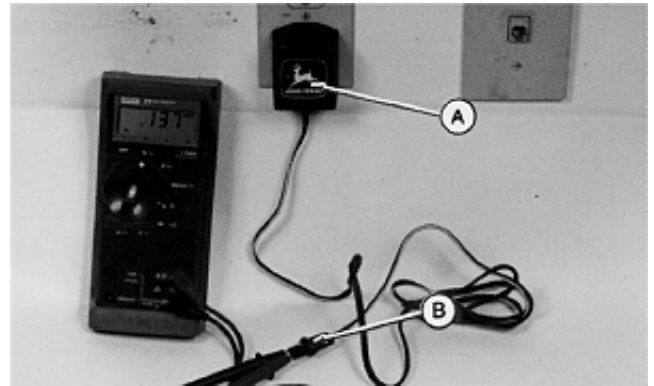
1. Plug charger (A) into power source.
2. Set voltmeter to AC voltage scale.

Procedure:

1. Connect voltmeter leads to battery connector (B) of charger.
2. Read voltmeter. Charger voltage output should read a minimum of **9 VAC**.

Results:

- If AC voltage is below minimum specification, replace charger.
- If AC voltage is above minimum specification, do the amperage output test before assuming that the charger is good.



M49346 -JUN-19JUL90

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MX,24515BV,17 -19-16JUL96

TEST BATTERY CHARGER AMPERAGE OUTPUT

Reason:

Determine if battery charger is working.

Equipment:

- Ammeter

Connections:

1. Set ammeter to DC amperage scale.
2. Set wires on meter for measuring milli-amperes.

NOTE: Ammeter must be able to read a minimum of 200 mA.

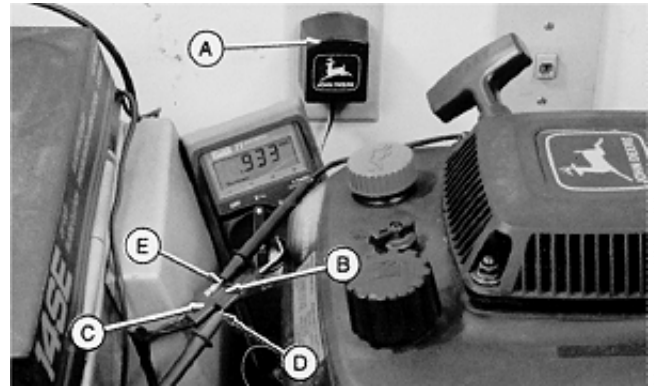
3. Plug battery charger (A) into power source.
4. Plug battery charger negative connector (B) into battery negative connector (C). Have connectors rotated so that positive charger connector and positive battery connector are not plugged in.

Procedure:

1. Hold positive (red) meter lead (D) on positive charger connector.
2. Hold negative (black) meter lead (E) on positive battery connector.
3. Read meter. Charger amperage output should read a minimum of **80 mA DC**.

Results:

- If amperage output is below minimum specification, replace charger.
- If amperage output is above minimum specification, do the voltage output test before assuming that the charger is good.



A—Battery Charger
B—Charger Negative Connector
C—Battery Negative Connector
D—Positive Meter Lead
E—Negative Meter Lead

M49347 -JUN-19JUL90

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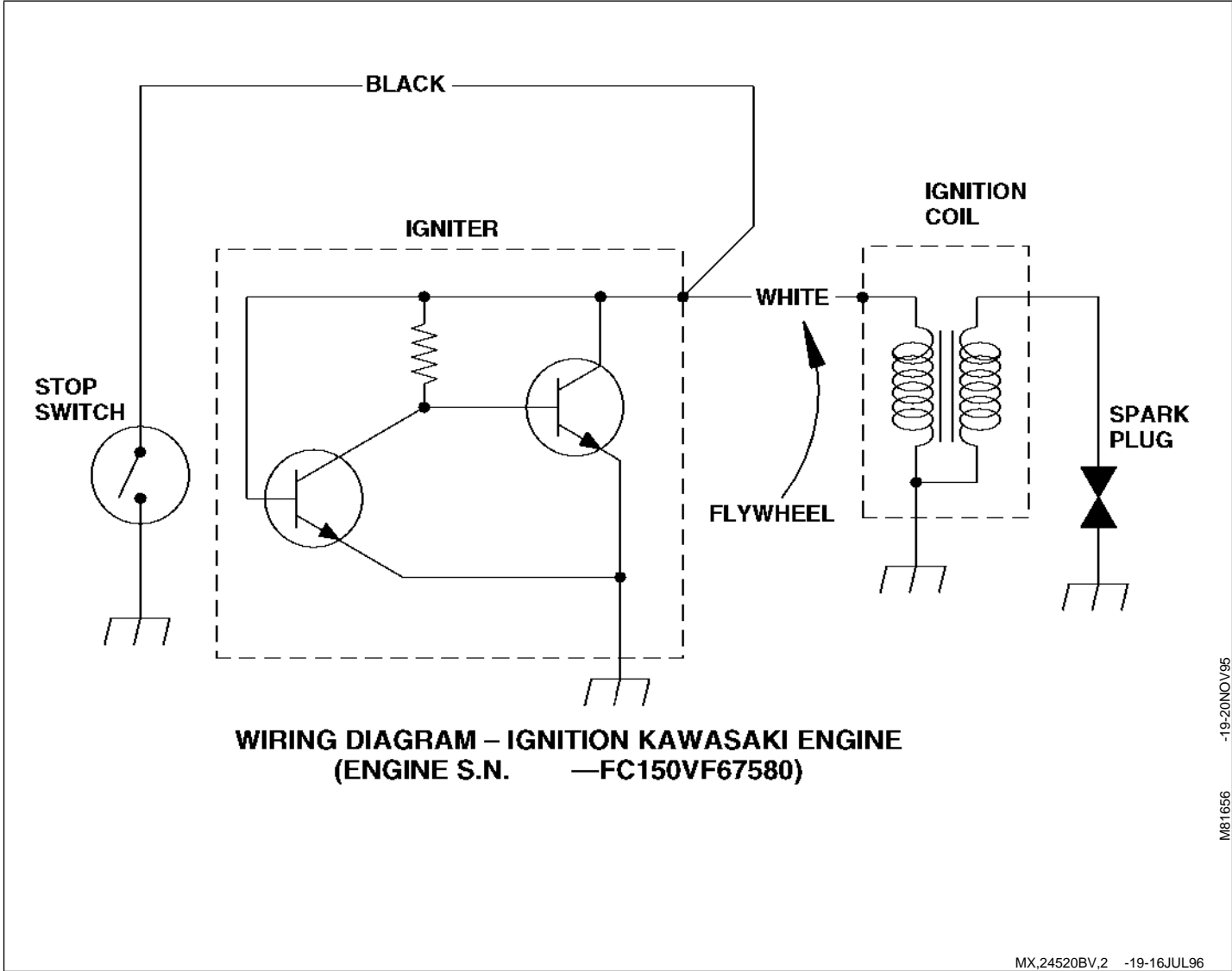
MX,24515BV,18 -19-16JUL96

245
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18

SCHEMATICS INFORMATION

The wiring schematics are drawn with the power in, or battery positive, circuit across the top and the ground, or battery negative, circuit across the bottom. The flow is then, as much as possible, from top to bottom through each circuit and component. All components are shown in the off position.

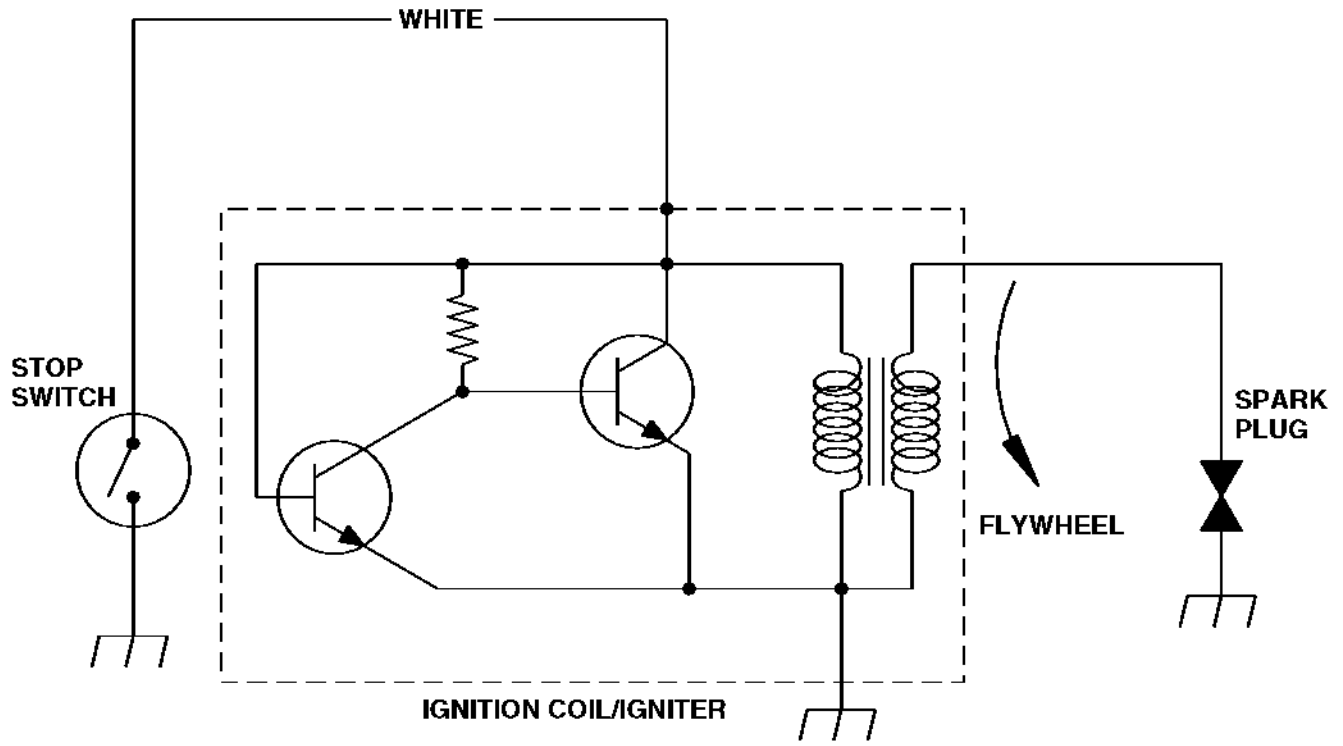
MX,24520BV,1 -19-16JUL96



MX,24520BV,2 -19-16JUL96

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M81656 -19-20NOV95

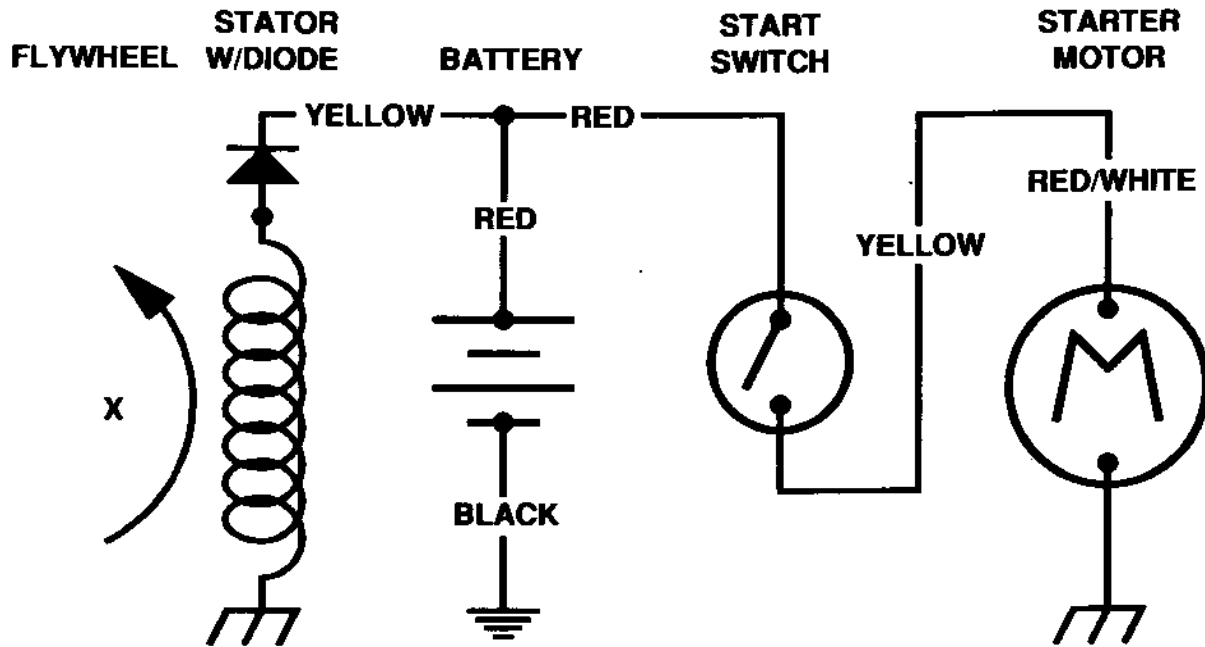


**WIRING DIAGRAM – IGNITION KAWASAKI ENGINE
(ENGINE S.N. FC150VF67581—)**

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MB1655 -19-20NOV/95

MX,24520BV,4 -19-16JUL96



M48975

WIRING DIAGRAM - ELECTRIC START KAWASAKI

MX,24520BV,3 -19-16JUL96

M48975 -19-03JUL90

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245
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4

Section 250

POWER TRAIN OPERATION TESTS AND ADJUSTMENTS (12PB/12SB/14PB/14SB/14SE)

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**COMPONENT LOCATION
INFORMATION—BLADE BRAKE CLUTCH
(BBC) UNITS**

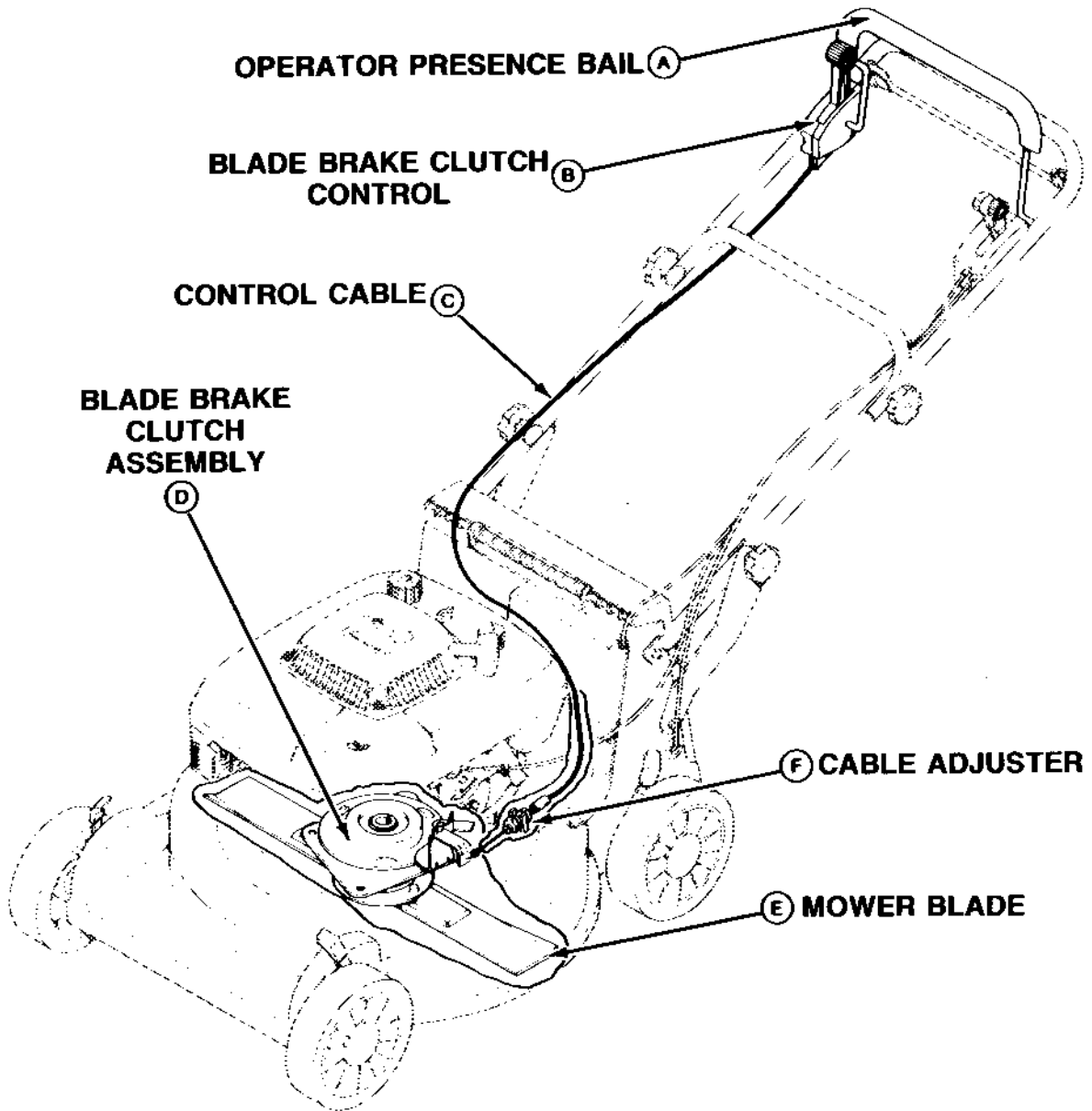
This group contains component location drawings for the following power train components:

- Blade Drive
- Traction Drive

Use the drawings when diagnosing a power train problem and to help locate the components to be tested.

MX,25005BV,1 -19-16JUL96

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M48828 BLADE DRIVE COMPONENTS-BLADE BRAKE CLUTCH UNITS

A—Operator Presence Bail
B—Blade Brake Clutch Control

C—Control Cable
D—Blade Brake Clutch Assembly

E—Mower Blade

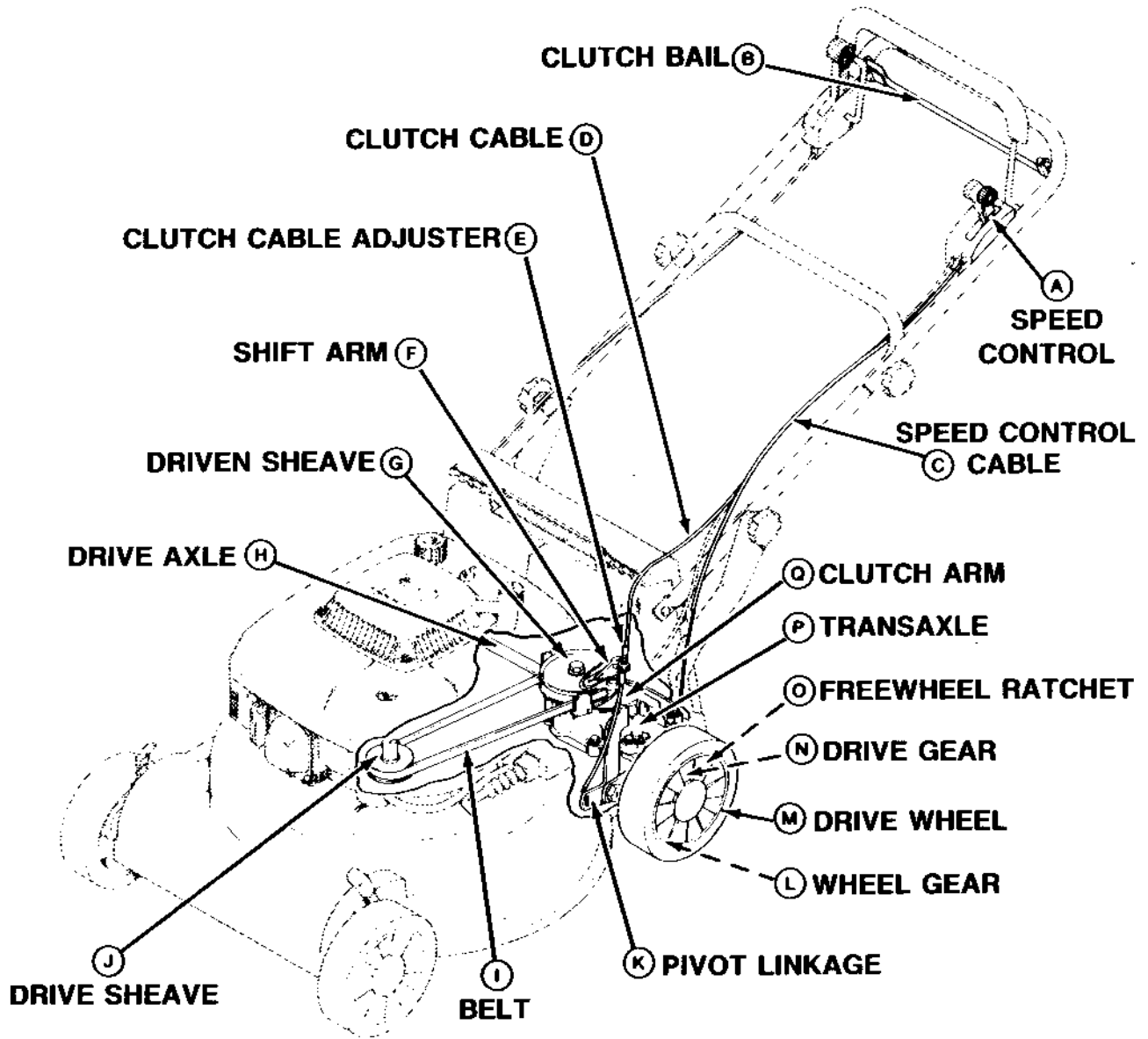
F—Cable Adjuster

250
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-19-26JUN90

M48828

MX,25005BV,2 -19-16JUL96



M48829

TRACTION DRIVE-5 SPEED TRANSAXLE

A—Speed Control
 B—Clutch Bail
 C—Speed Control Cable
 D—Clutch Cable
 E—Clutch Cable Adjuster

F—Shift Arm
 G—Driven Sheave
 H—Drive Axle
 I—Belt

J—Drive Sheave
 K—Pivot Linkage
 L—Wheel Gear
 M—Drive Wheel

N—Drive Gear
 O—Freewheel Ratchet
 P—Transaxle
 Q—Clutch Arm

MX,25005BV,3 -19-16JUL96

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-19-26JUN90

M48829

Component Location/Traction Drive Components

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4

THEORY OF OPERATION INFORMATION

This group divides the power train into individual components or systems by function. The story contains information on function, component or system identification and theory of operation.

The following systems or components are covered:

- Blade Brake Clutch
- Traction Drive System
- 5-Speed Transaxle

MX,25010BV,1 -19-16JUL96

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1

BLADE BRAKE CLUTCH OPERATION—OGURA BBC

A—Operator Presence Bail
 B—Blade Brake Clutch Control
 C—Clutch Release Spring
 D—Drive Hub

E—Brake Plate Spring
 F—Brake Plate
 G—Pad
 H—Pad Spring

I—Blade Hub
 J—Mower Blade
 K—Clutch Arm
 L—Clutch Control Cable

M—Lower Ramp
 N—Ball
 O—Upper Ramp
 P—Handle Bars

Function:

Offers a means of controlling mower engagement and disengagement while the engine is running.

Major Components:

- Pad
- Brake Plate
- Drive Disk
- Engagement Mechanism

Theory of Operation:

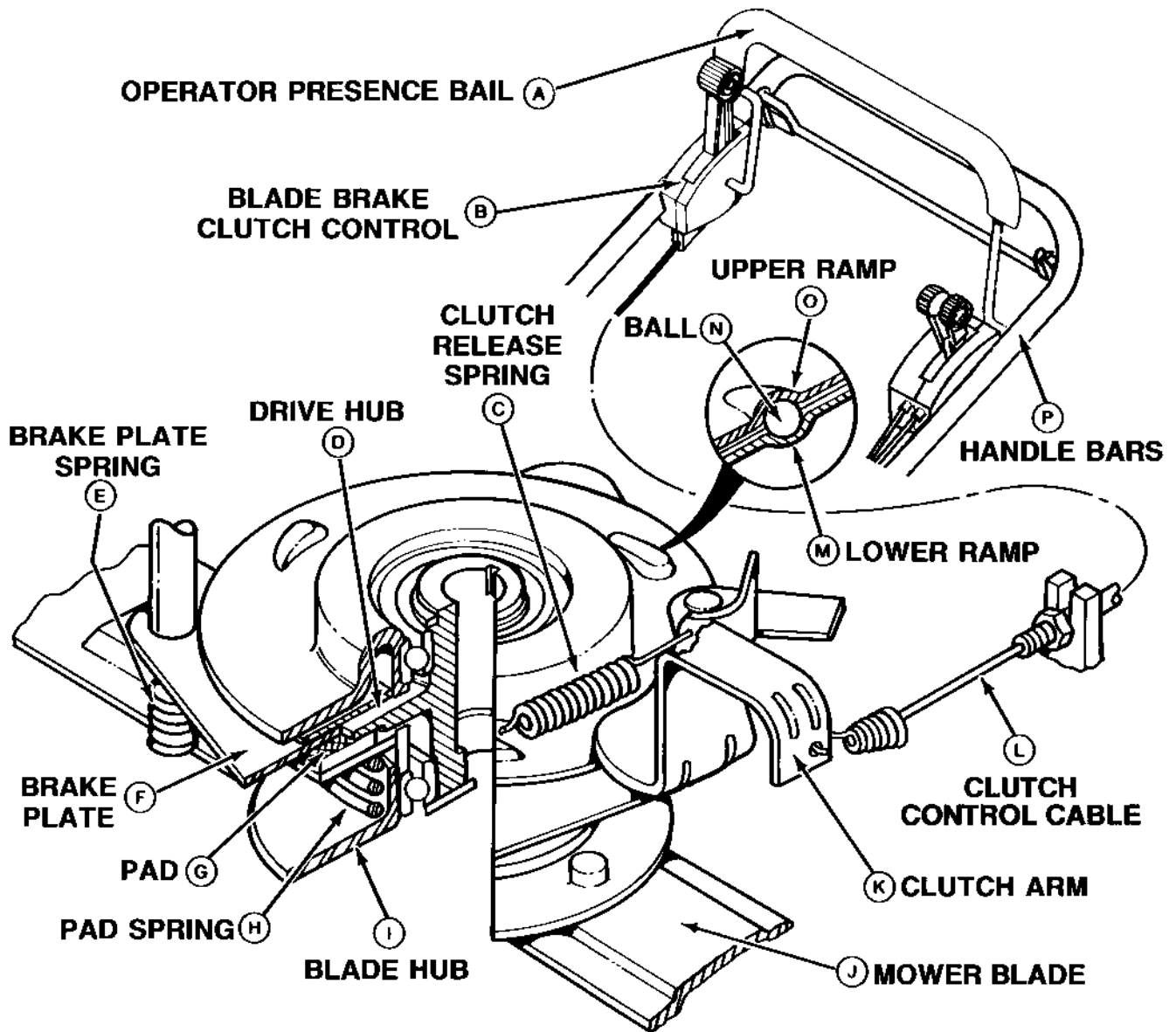
The blade brake clutch (BBC) operates by engaging brake pad (G) with either the outer brake plate (F) or the inner drive hub (D). Blade hub pad spring (H) maintains the pressure to hold brake pad (G) against one or the other at all times. The drive hub (D) is keyed to the crankshaft of the engine. The brake pad (G) is attached to blade hub (I) with the mower blade (J) bolted to the hub.

When the operator presence bail (A) and the BBC control lever (B) are engaged, the BBC brake pad (G) becomes engaged with the drive hub (D), causing blade hub (I) and blade (J) to rotate. This is accomplished by clutch arm (K) being pulled by control cable (L) and held in place by the operator's sustained grip of operator presence bail (A). This

causes the balls (N) to move up the upper ramps (O) and lower ramps (M). As the balls move up the ramps, the brake plate (F) is pressed up by brake plate springs (E) and away from the outer surface of the brake pad (G). Spring tension of the pad spring (H) in the blade hub (I) forces the inner surface of the brake pad (G) against the drive hub (D), causing it to turn with the drive hub, causing the blade hub and blade to rotate.

When the operator presence bail (A) and the BBC control lever (B) are disengaged (this happens simultaneously), the BBC brake pad (G) becomes engaged with the brake plate (F) and stops the blade from rotating. This is accomplished via tension in the clutch release spring (C) which causes the balls (N) to move down the upper ramps (O) and lower ramps (M). As the balls move down the ramps, the brake plate (F) is forced down against the outer surface of the brake pad (G), compressing the brake plate springs (E). At the same time, the brake plate forces the inner surface of the brake pad (G) away from the drive hub (D), compressing the blade hub pad spring (H) to assist in stopping blade hub (I) and blade (J) rotation. The BBC is held in the disengaged position by tension in the clutch release spring (C) and the blade hub pad spring (H).

MX,25010BV,2A -19-16JUL96



M48831

BLADE BRAKE CLUTCH OPERATION — OGURA BBC

MX,25010BV,2B -19-16JUL96

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M48831 -19-04DEC95

BLADE BRAKE CLUTCH OPERATION—WARNER BBC

A—Operator Presence Bail
 B—Blade Brake Clutch Control
 C—Clutch Release Spring
 D—Drive Hub

E—Brake Plate Spring¹
 F—Brake Plate
 G—Pad
 H—Pad Spring

I—Blade Hub
 J—Mower Blade
 K—Clutch Control Arm
 L—Clutch Control Cable

M—Lower Ramp
 N—Ball
 O—Upper Ramp
 P—Handle Bars

Function:

Offers a means of controlling mower engagement and disengagement while the engine is running.

Major Components:

- Pad
- Brake Plate
- Drive Disk
- Engagement Mechanism

Theory of Operation:

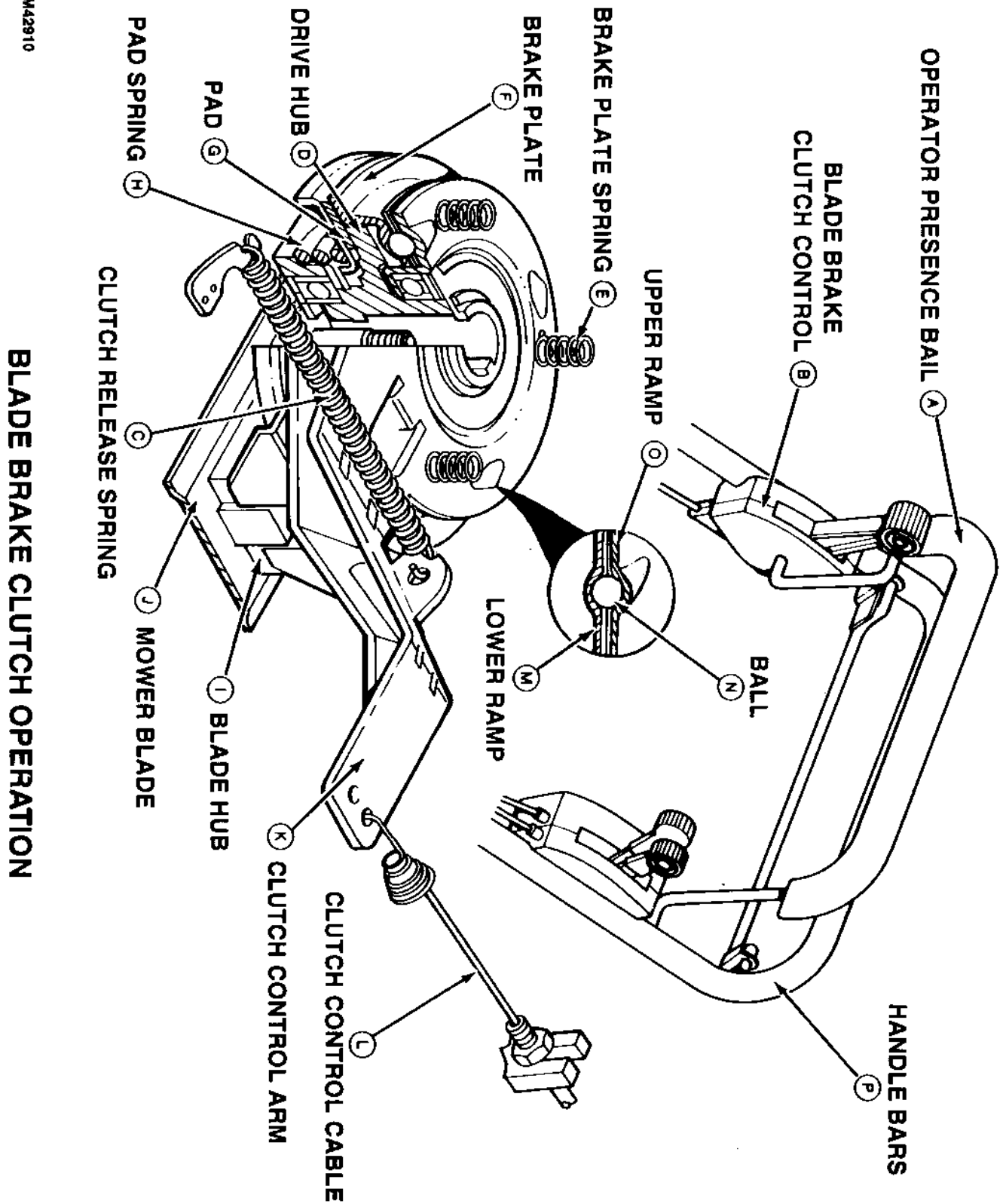
The blade brake clutch (BBC) operates by engaging brake pad (G) with either the outer brake plate (F) or the inner drive hub (D). Blade hub pad spring (H) maintains the pressure to hold brake pad (G) against one or the other at all times. The drive hub (D) is keyed to the crankshaft of the engine. The brake pad (G) is attached to blade hub (I) with the mower blade (J) bolted to the hub.

When the operator presence bail (A) and the BBC control lever (B) are engaged, the BBC brake pad (G) becomes engaged with the drive hub (D), causing blade hub (I) and blade (J) to rotate. This is accomplished by clutch control arm (K) being pulled by control cable (L) and held in place by the operator's sustained grip of operator presence bail

(A). This causes the balls (N) to move up the upper ramps (O) and lower ramps (M). As the balls move up the ramps, the brake plate (F) is pulled up by brake plate springs (E) and away from the outer surface of the brake pad (G). Spring tension of the pad spring (H) in the blade hub (I) forces the inner surface of the brake pad (G) against the drive hub (D), causing it to turn with the drive hub, causing the blade hub and blade to rotate.

When the operator presence bail (A) and the BBC control lever (B) are disengaged (this happens simultaneously), the BBC brake pad (G) becomes engaged with the brake plate (F) and stops the blade from rotating. This is accomplished via tension in the clutch release spring (C) which causes the balls (N) to move down the upper ramps (O) and lower ramps (M). As the balls move down the ramps, the brake plate (F) is forced down against the outer surface of the brake pad (G), compressing the brake plate springs¹ (E). At the same time, the brake plate forces the inner surface of the brake pad (G) away from the drive hub (D), compressing the blade hub pad spring (H) to assist in stopping blade hub (I) and blade (J) rotation. The BBC is held in the disengaged position by tension in the clutch release spring (C) and the blade hub pad spring (H).

¹Later versions of Warner Blade Brake Clutches have internally mounted blade plate springs.



MA2910

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MA2910 -19-16SEP92

MX,25010BV,3B -19-01OCT92

TRACTION DRIVE OPERATION—5-SPEED TRANSAXLE

A—Speed Control
B—Clutch Bail
C—Speed Control Cable
D—Clutch Cable
E—Clutch Cable Adjuster

F—Shift Arm
G—Driven Sheave
H—Drive Axle
I—Belt

J—Drive Sheave
K—Pivot Linkage
L—Wheel Gear
M—Drive Wheel

N—Drive Gear
O—Freewheel Ratchet
P—Transaxle
Q—Clutch Arm

Function:

Propel the mower using power from the engine and offer a variety of ground speeds for different conditions.

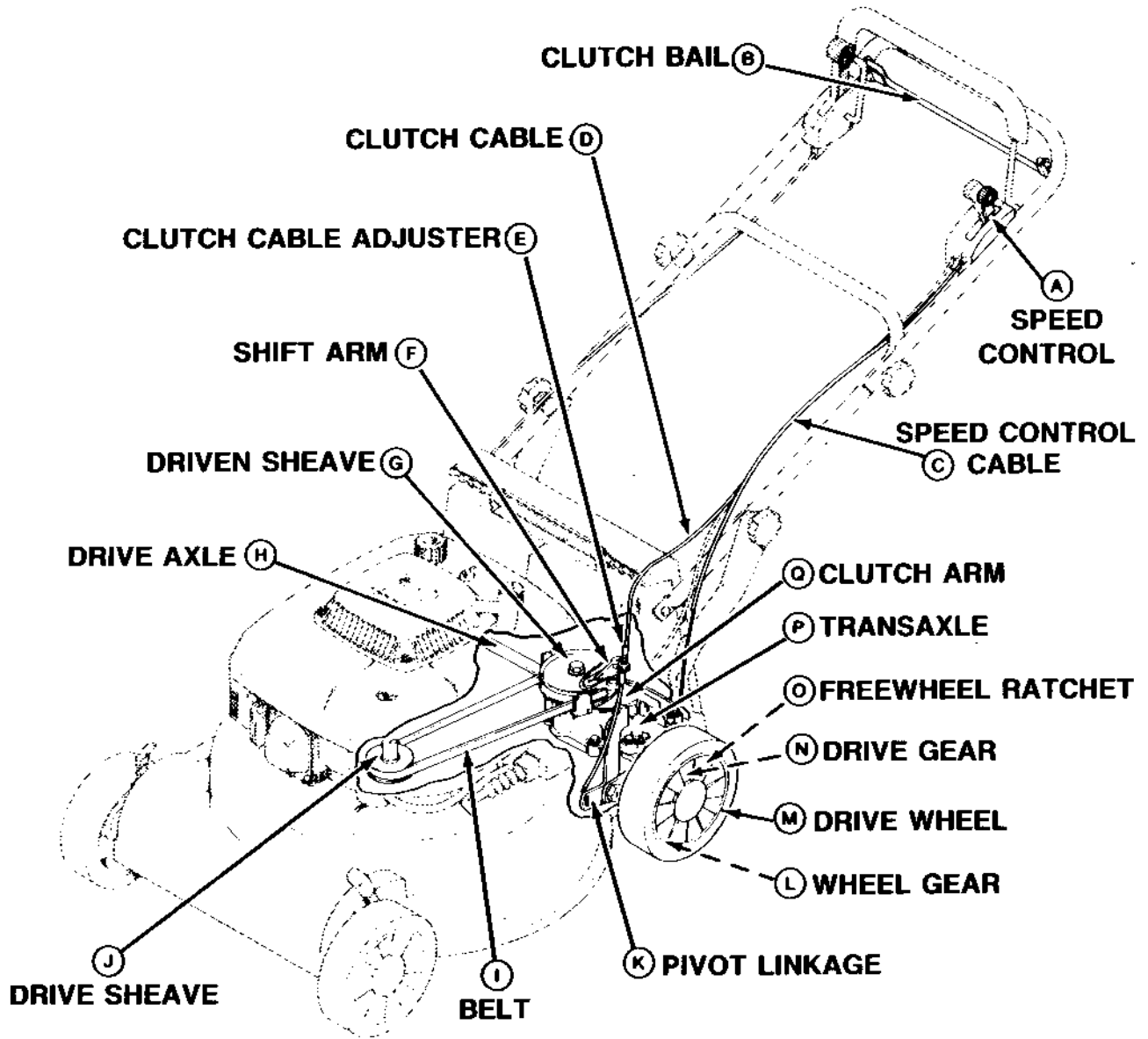
Major Components:

- Drive Sheave
- Drive Belt
- 5-Speed Transaxle
- Drive Wheels

Theory of Operation:

The power to the transaxle (P) comes from the crankshaft at the drive sheave (J) through belt (I). The belt, along with the clutch mechanism inside the transaxle, acts as the clutch for the drive. When the

drive is not engaged, the belt is loose. As the clutch bail (B) is engaged, clutch cable (D) pulls on pivot linkage (K) which rotates the transaxle on the drive axle (H). At the same time, the linkage pushes clutch arm (Q) which rotates and engages the transaxle internal clutch. The axle transmits the power to the drive gears (N) which mesh with the wheel gears (L). The drive gears have freewheel ratchets (O), comprised of a spring loaded woodruff key working inside the axle keyway with the pinion gears internal series of three ramps and traction flats, that allow the mower to be pushed around easily and help during turning. The ground speeds are adjusted by speed control (A) which is connected to the shift arm (F) of the transaxle by speed control cable (C).



M48829

TRACTION DRIVE-5 SPEED TRANSAXLE

MX,25010BV,5 -19-16JUL96

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M48829 -19-26JUN90

5-SPEED TRANSAXLE OPERATION

A—Shift Key
B—Shift Hub
C—Shift Fork
D—Shift Collar

E—Input Shaft w/Pinion Gear
F—Ring Gear
G—Drive Shaft
H—Drive Gears

I—Clutch Fork
J—Drive Axle
K—Clutch Hub

L—Clutch Collar
M—Clutch Ball
N—Driven Gears

Function:

Offer 5 ground speeds independent of engine rpm.

Major Components:

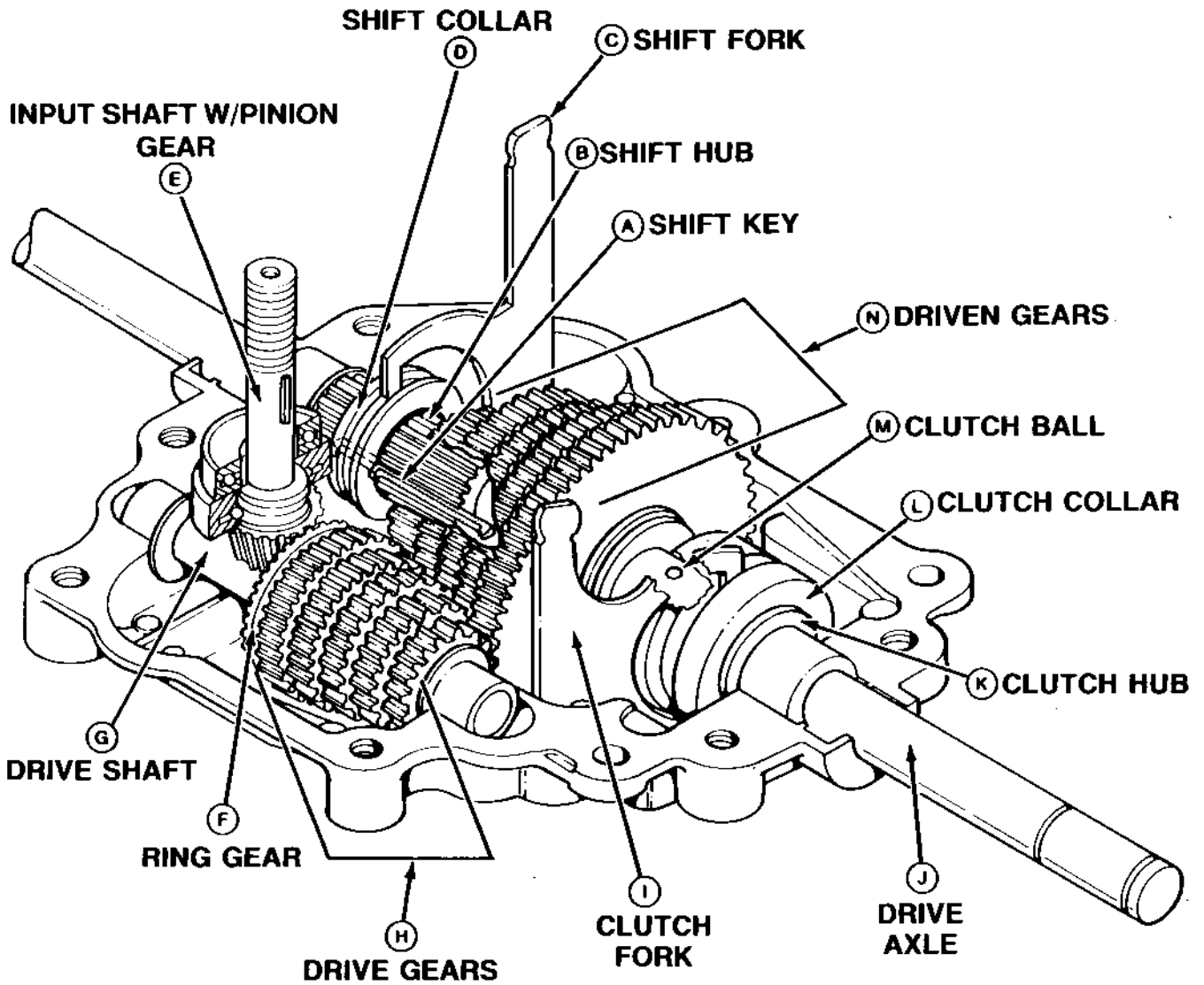
- Drive Gears
- Driven Gears
- Shift Mechanism

Theory of Operation:

The power comes into the transaxle at the input shaft with pinion gear (E). This drives ring gear (F) which is splined to the drive shaft (G). The drive gears (H) are also splined to the drive shaft. The driven gears

(N) are in constant mesh with the drive gears and connect to the drive axle (J) through shift keys (A) and shift hub (B). Projections on the shift keys engage in notches on the inside diameter of the driven gears. The shift arm rotates the shift fork (C) which moves the shift collar (D) which slides the shift keys to engage the gears. Different speed ratios are chosen when different gears are engaged. The clutch arm rotates the clutch fork (I) when it is pushed by the external linkage. This slides the clutch collar (L) along the clutch hub (K) and forces balls (M) into holes on the drive axle (J) and the power from the driven gears is transmitted to the drive axle.

MX,25010BV,6 -19-16JUL96



M48830

5-SPEED TRANSAXLE OPERATION

MX,25010BV,7 -19-16JUL96

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M48830
-19-30OCT90

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Mower blade will not spin.
- Mower blade will not stop in 3 seconds.
- Noise when engaging blade brake clutch.
- Blade brake clutch control will not stay engaged.
- No traction drive.
- Traction drive will not release.
- Do not have all ground speeds.
- Traction drive ratchets at engagement.
- Traction Drive will not freewheel.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point at which the test is to be made.

MX,25015BV,1 -19-16JUL96

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MOWER BLADE WILL NOT SPIN

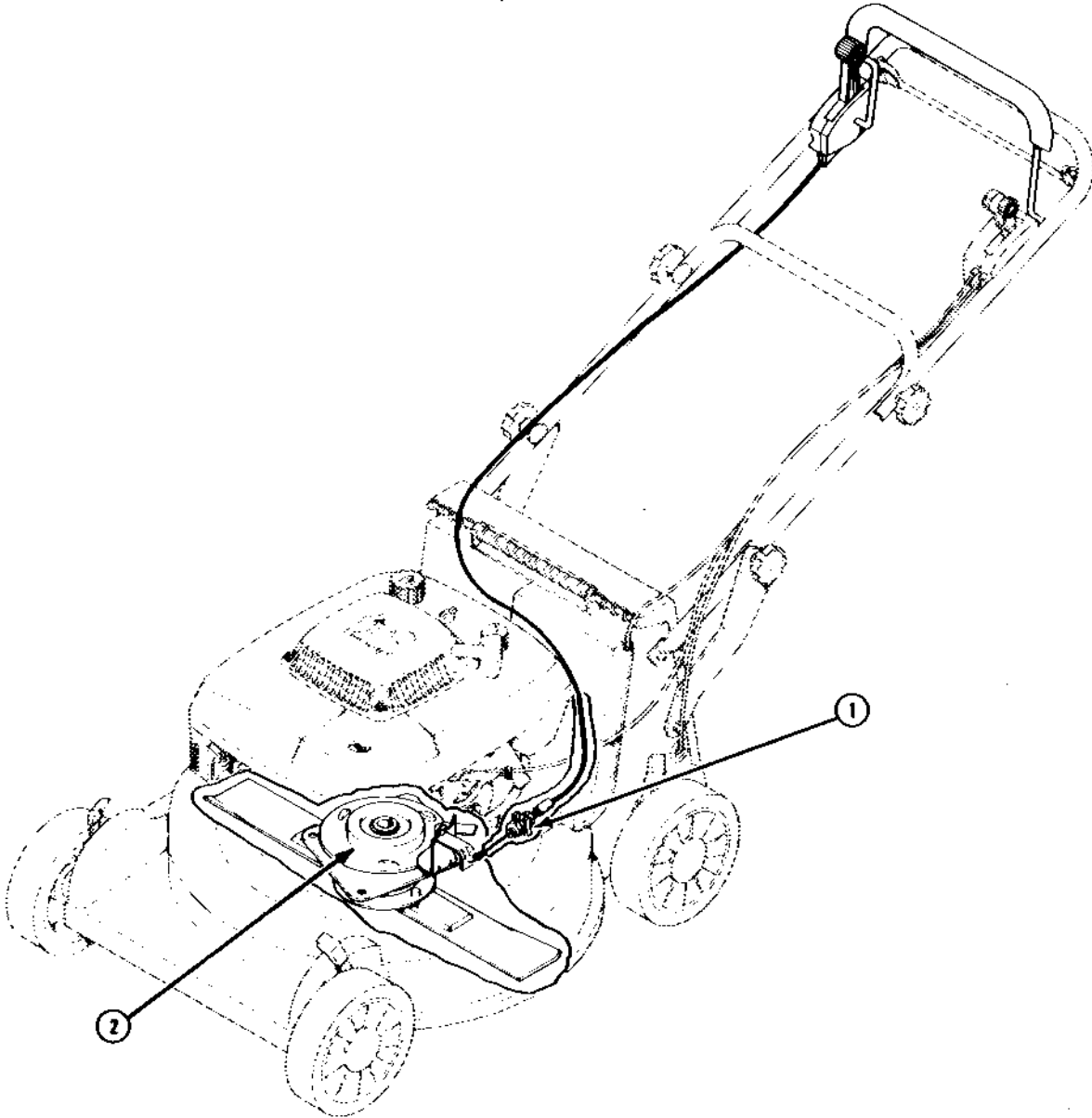
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Blade brake clutch control cable.	Less than 25 mm (1 in.) side movement in cable.	Adjust cable.
	Cable not sticking or damaged.	Clean or replace.
2. Blade brake clutch.	Clean and not corroded.	Clean.
	Drive spring not failed.	
	Ramps and balls not worn or damaged. Pad material minimum thickness 0.76 mm (0.030 in.).	
	Bearings not seized.	Replace blade brake clutch.
	Brake springs not failed.	Replace springs.

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MX,25015BV,2 -19-16JUL96



M48980

MOWER BLADE WILL NOT SPIN.

MX,25015BV,3 -19-16JUL96

M48980 -19-26JUN90

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MOWER BLADE WILL NOT STOP IN 3 SECONDS

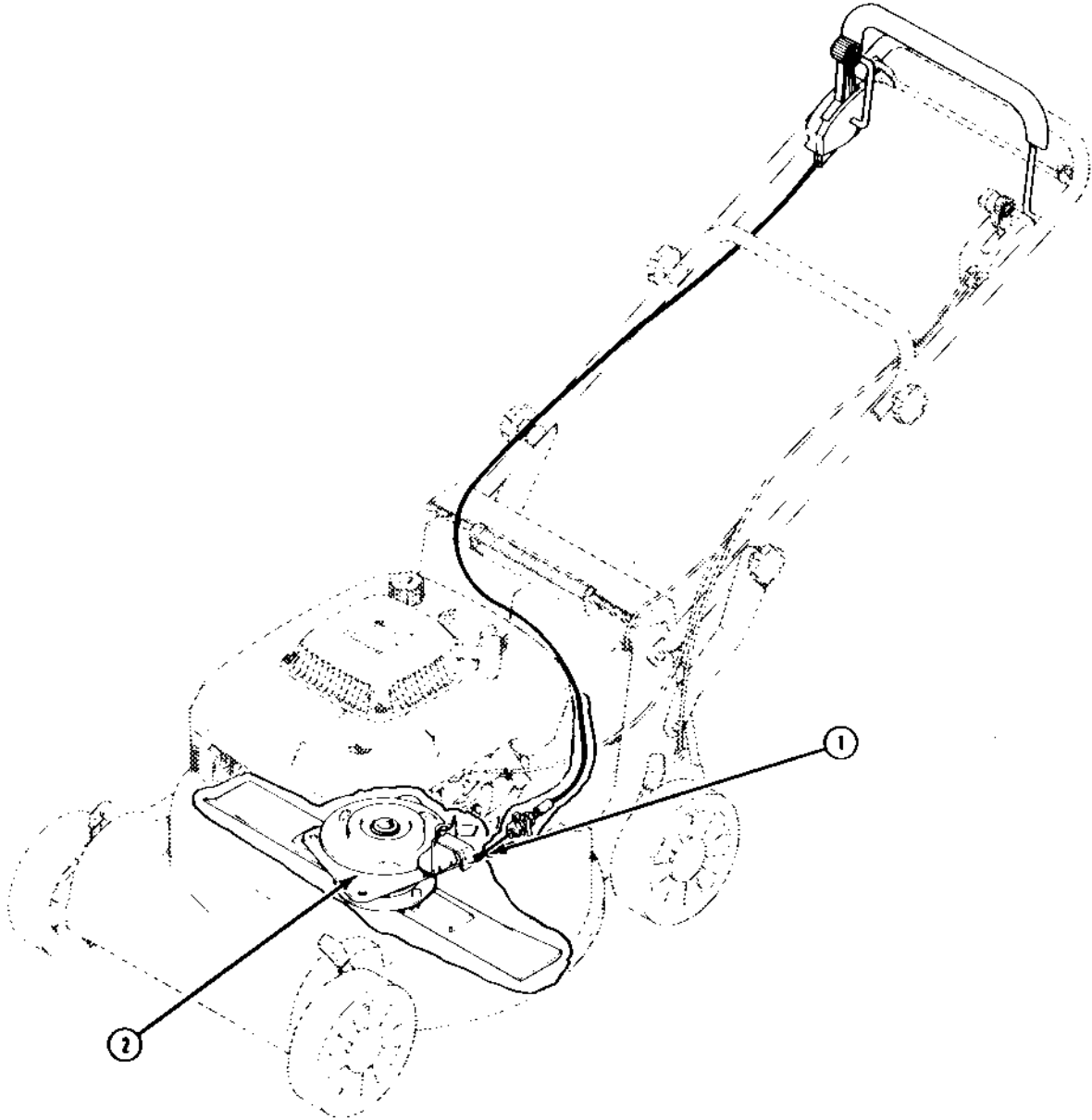
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Blade brake clutch control cable.	Cable spring not tight.	Adjust cable.
	Cable not sticking or damaged.	Clean or replace cable as needed.
2. Blade brake clutch.	Clean and not corroded.	Clean.
	Drive spring not failed.	Replace blade brake clutch.
	Ramps and balls not worn or damaged.	
	Pad material minimum thickness 0.76 mm (0.030 in.).	
	Bearings not seized.	
	Brake spring not failed.	

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MX,25015BV,4 -19-16JUL96



M48981

MOWER BLADE WILL NOT STOP IN 3 SECONDS

MX,25015BV,5 -19-16JUL96

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-19-26JUN90

M48981

NOISE WHEN ENGAGING BLADE BRAKE CLUTCH

Conditions:

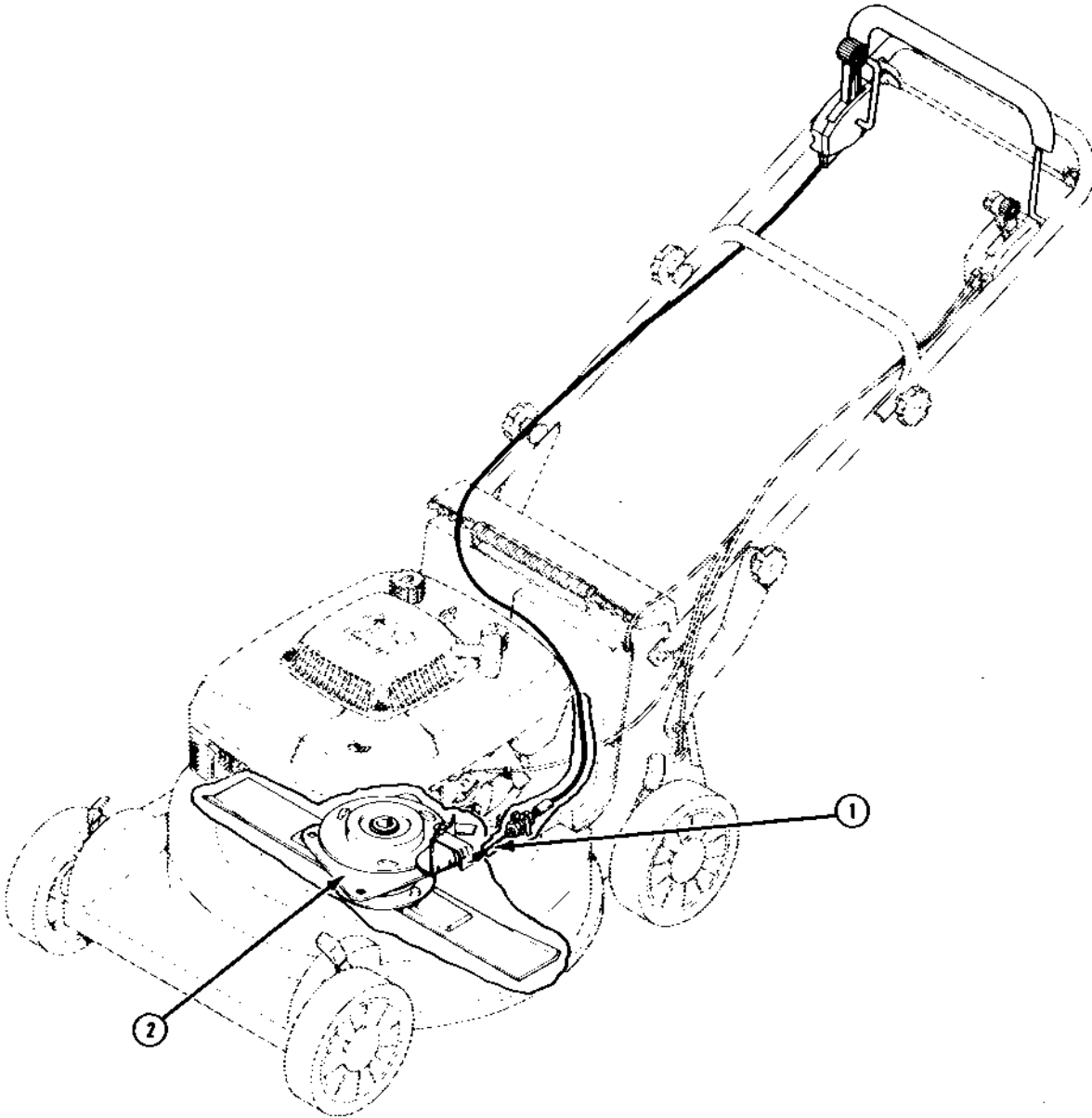
- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Blade brake clutch control cable.	Less than 25 mm (1 in.) side movement in cable. Cable spring not tight.	Adjust cable.
2. Blade brake clutch.	Clean and not corroded.	Clean or replace as needed.

NOTE: Some noise during engagement of the blade brake clutch is normal because both brake and clutch can be engaged slightly at the same time. This can be minimized by rapid engagement of the blade brake clutch control.

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MX,25015BV,6 -19-16JUL96



M48982

NOISE WHEN ENGAGING BLADE BRAKE CLUTCH

MX,25015BV,7 -19-16JUL96

M48982 -19-26JUN90

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7

BLADE BRAKE CLUTCH CONTROL WILL NOT STAY ENGAGED

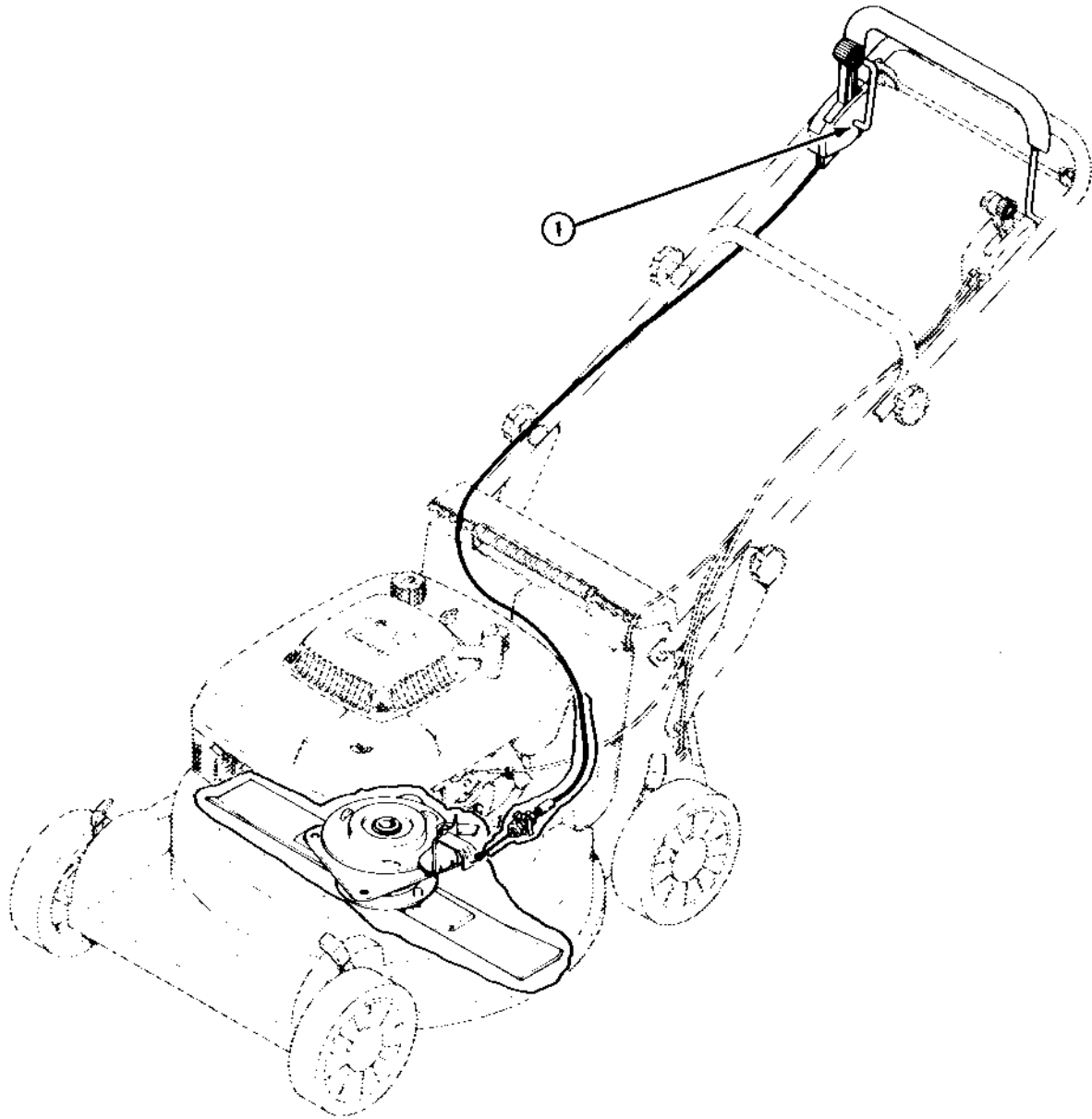
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Blade brake clutch control.	Interlock tab in control not rounded.	Replace blade brake clutch control.

MX,25015BV,8 -19-16JUL96

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M48983

BLADE BRAKE CLUTCH WILL NOT STAY ENGAGED

MX,25015BV,9 -19-16JUL96

M48983 -19-26JUN90

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9

NO TRACTION DRIVE

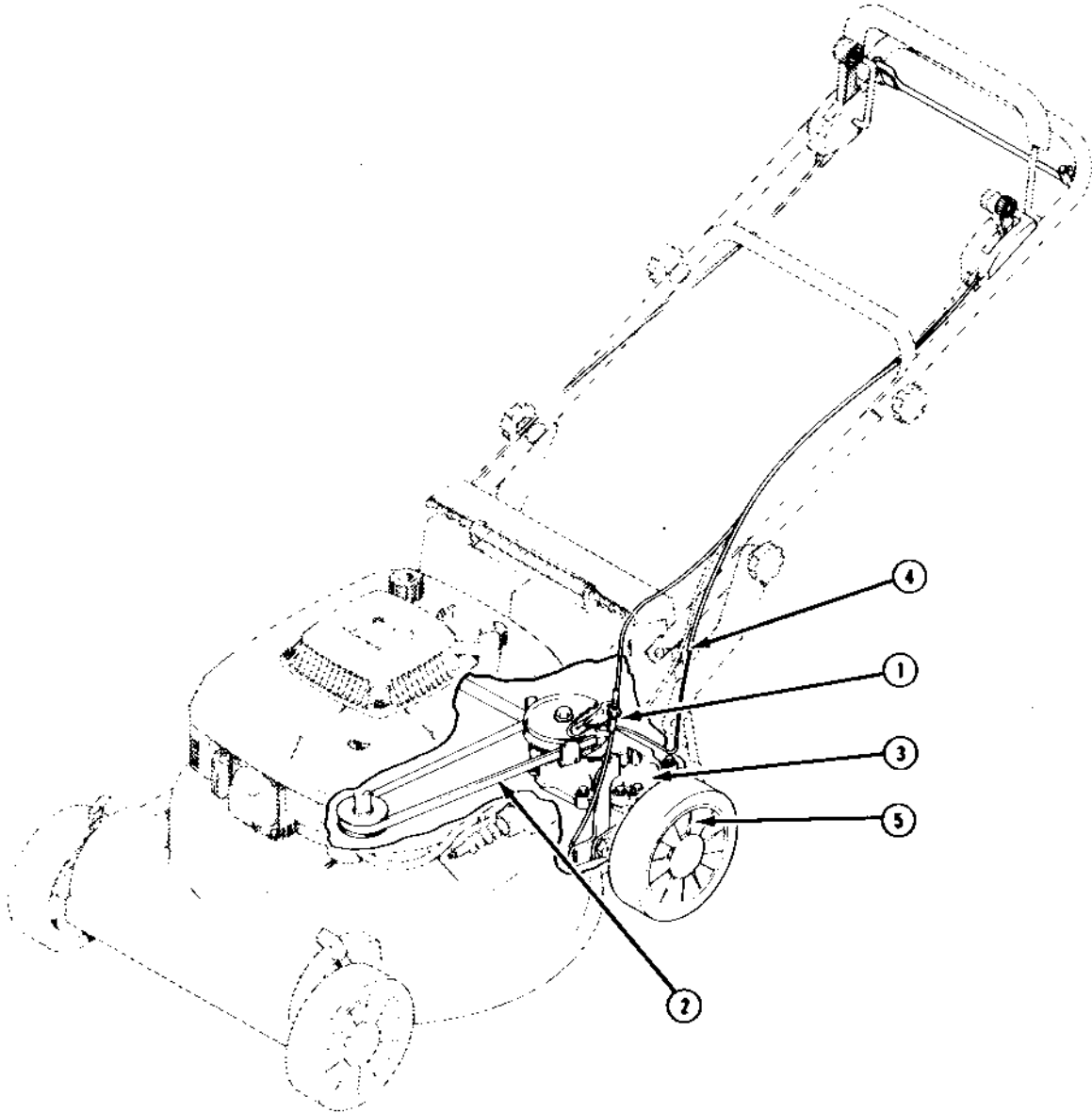
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
2. Drive belt and sheaves.	Drive sheave tight on crankshaft.	Check key and set screw.
	Belt not worn or stretched.	Replace belt.
	Belt guides correctly adjusted.	Adjust belt guides.
	Driven sheave tight on transaxle.	Repair or replace as needed.
3. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
4. Speed control cable.	Correctly adjusted.	Adjust.
	Not sticking or damaged.	Clean or replace cable as needed.
5. Rear wheels.	Drive gears correctly installed.	Reverse gear so freewheel ratchet works.
	Drive or wheel gears not failed.	Replace failed gears.

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MX,25015BV,10 -19-16JUL96



M48984

NO TRACTION DRIVE

MX,25015BV,11 -19-16JUL96

M48984 -19-26JUN90

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11

TRACTION DRIVE WILL NOT RELEASE

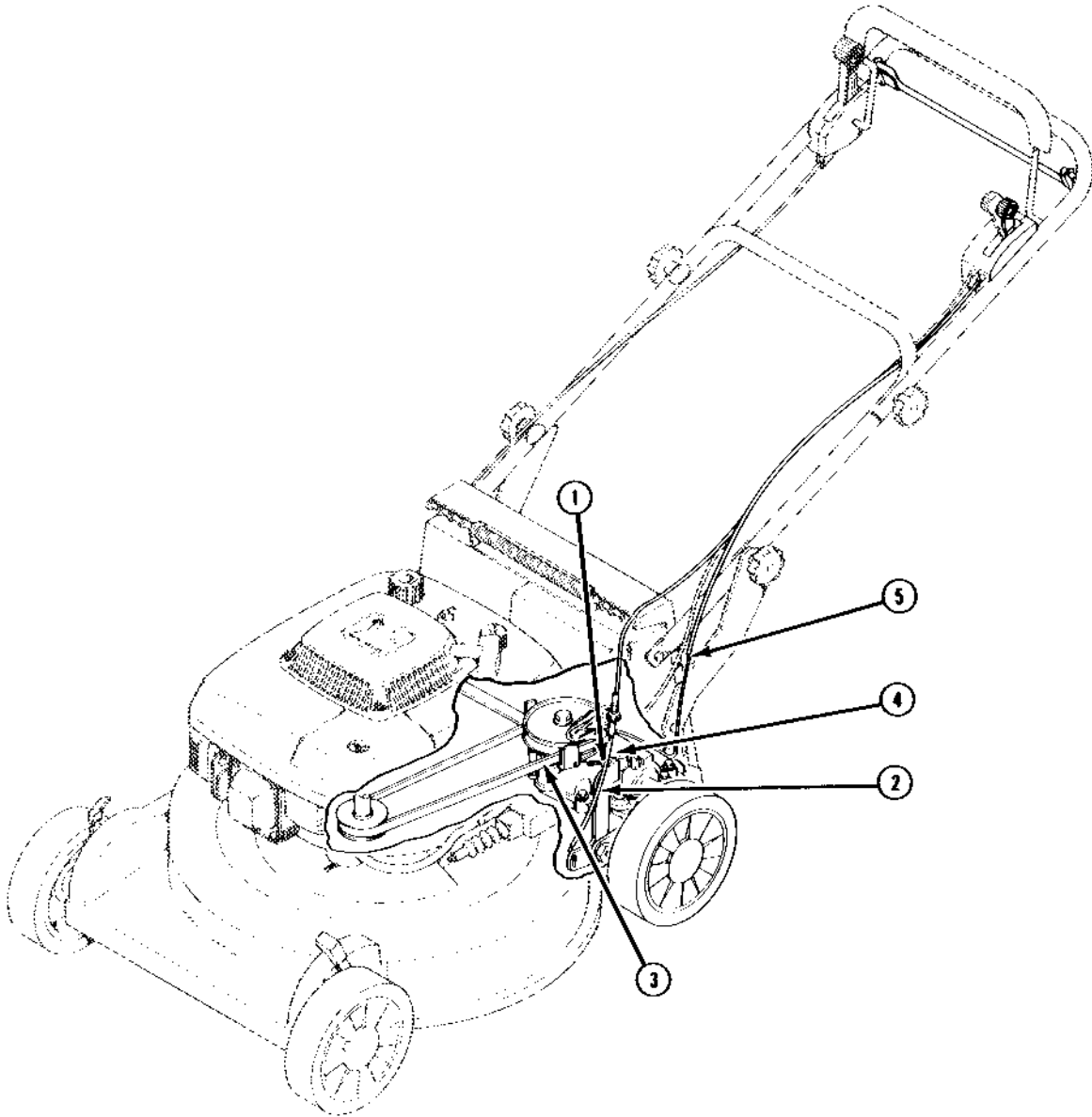
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Clutch arm return spring.	Spring returns clutch arm into neutral. Spring not over-stretched, broken, or missing.	Carefully replace spring.
2. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
3. Drive belt and guides.	Correct length belt installed.	Replace belt.
	Belt guides correctly adjusted.	Adjust belt guides.
4. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal clutch and shift components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
5. Speed control cable.	Correctly adjusted.	Adjust.
	Not sticking or damaged.	Clean or replace cable as needed.

250
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12

MX,25015BV,12 -19-16JUL96



M48985

TRACTION DRIVE WILL NOT RELEASE

MX,25015BV,13 -19-16JUL96

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M48985 -19-04DEC95

DO NOT HAVE ALL GROUND SPEEDS

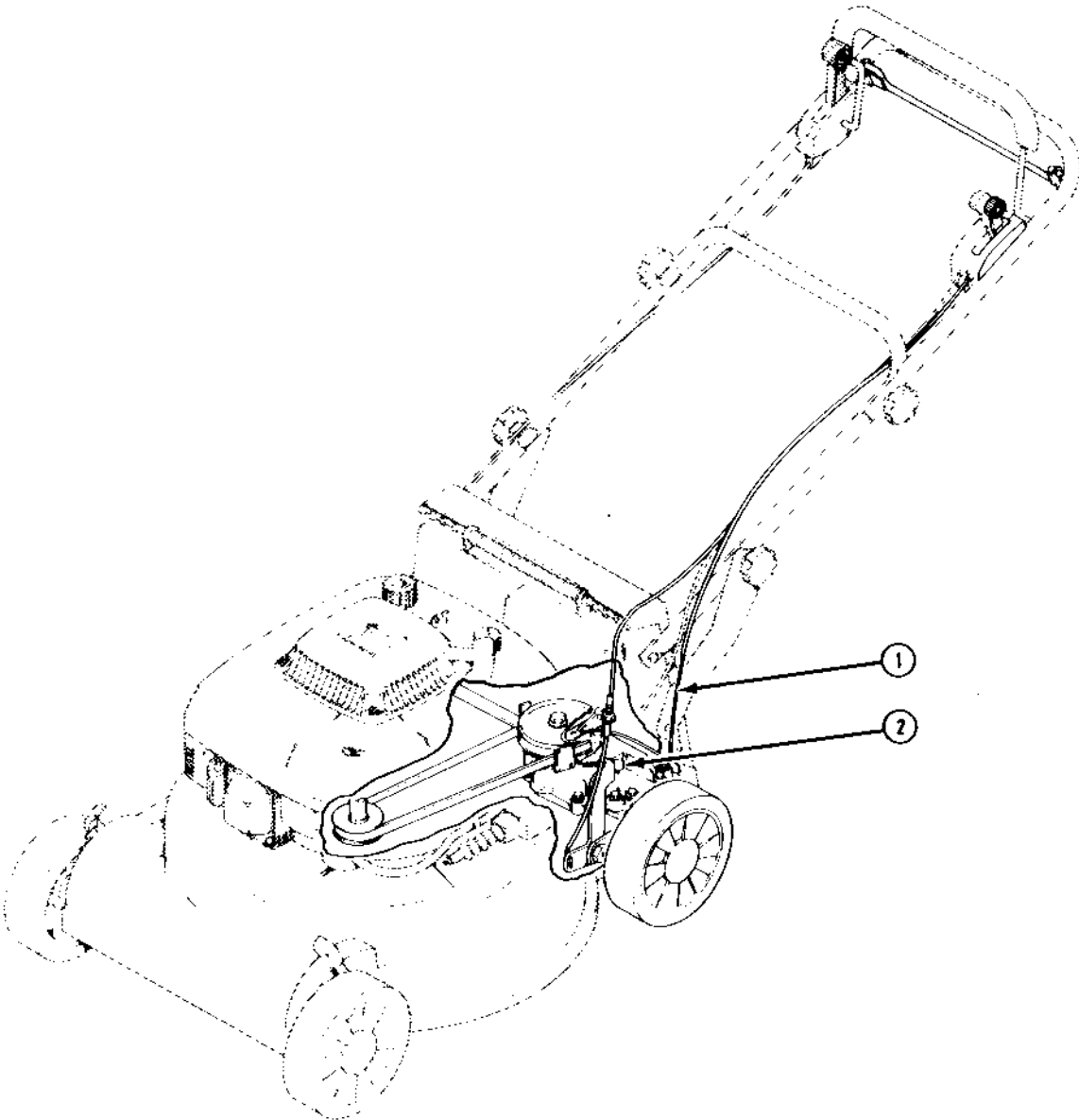
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Spark plug wire disengaged and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Speed control cable.	Correctly adjusted. Not sticking or damaged.	Adjust. Clean or replace cable as needed.
2. Transaxle.	Internal components not sticking or damaged.	Disassemble and repair or replace as needed.

MX,25015BV,14 -19-16JUL96

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M48986

DO NOT HAVE ALL GROUND SPEEDS

MX,25015BV,15 -19-16JUL96

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TRACTION DRIVE RATCHETS AT ENGAGEMENT

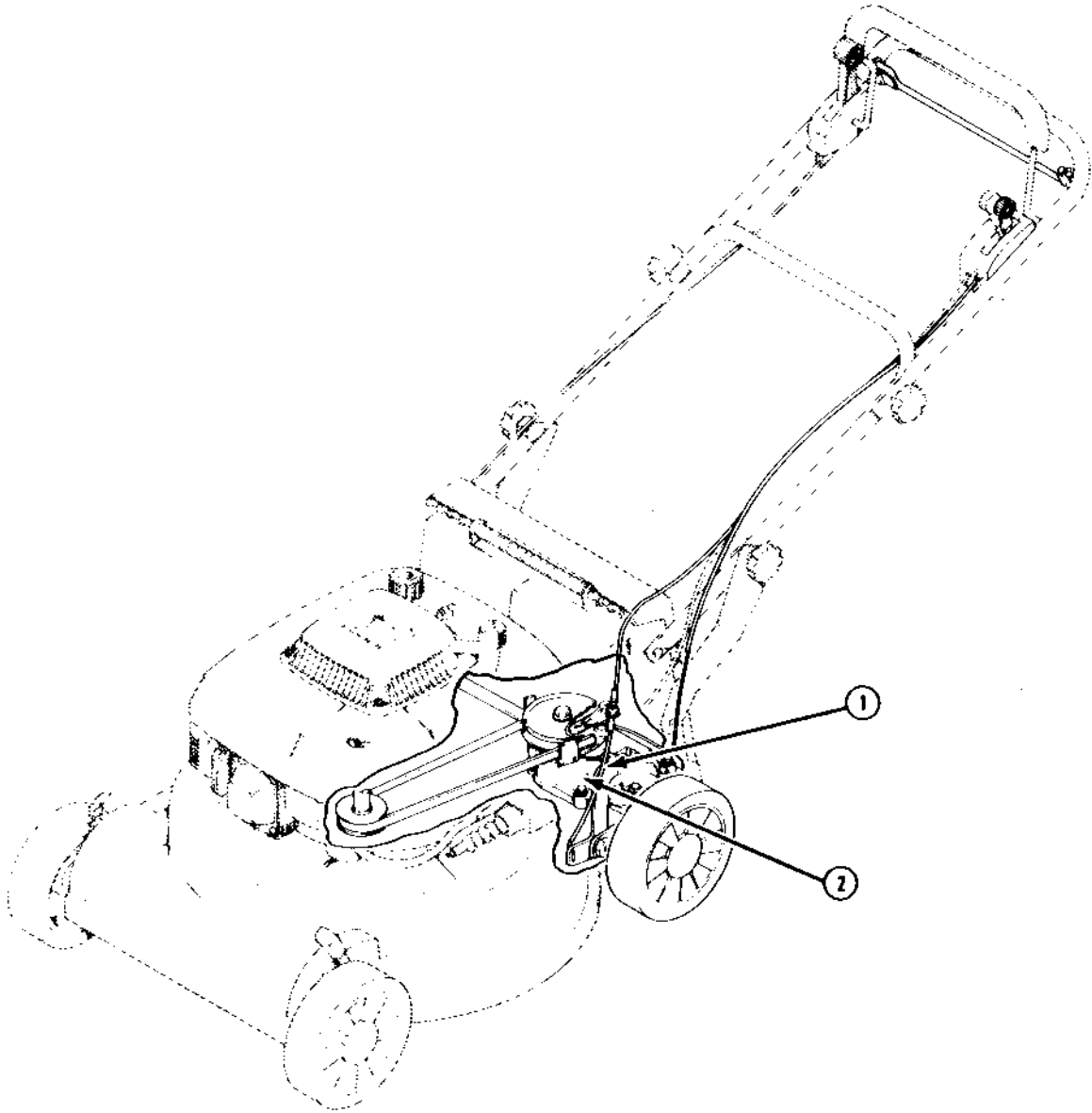
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
2. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal clutch components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
3. Axle pinion gears.	Clean and greased internally with proper grease.	Disassemble, clean, and grease internally with proper grease.
	Installed correctly, not binding, and drives properly.	Remove and install correctly.

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MX,25015BV,16 -19-16JUL96



M48987

TRACTION DRIVE RATCHETS AT ENGAGEMENT

MX,25015BV,17 -19-16JUL96

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-19-26JUN90

M48987

TRACTION DRIVE WILL NOT FREEWHEEL

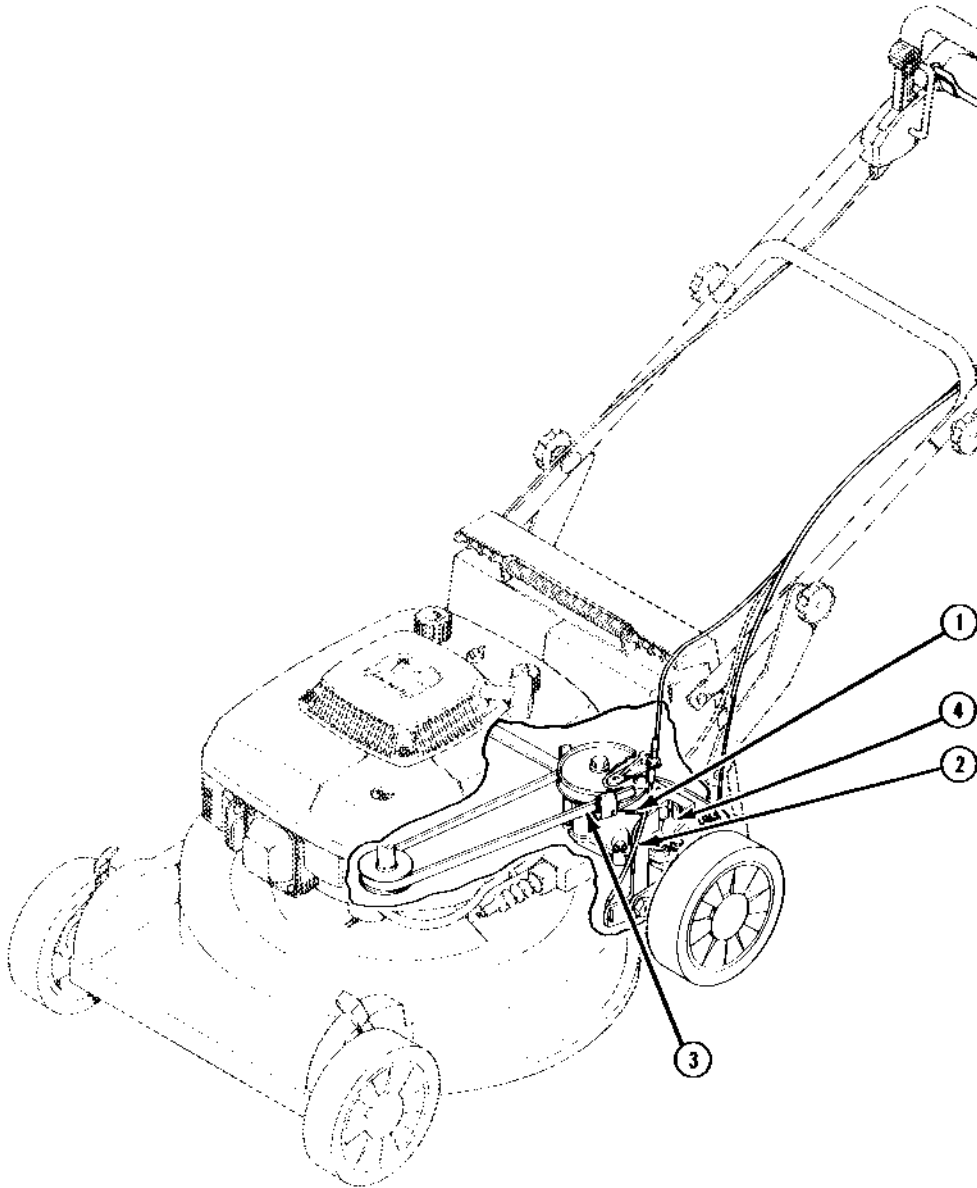
Conditions:

- Throttle control in stop position.
- Blade brake clutch disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Clutch arm return spring.	Spring returns clutch arm into neutral. Spring not over-stretched, broken, or missing.	Carefully replace spring.
2. Traction drive cable.	Correctly adjusted. Not sticking or damaged.	Adjust cable. Clean or replace cable as needed.
3. Drive belt and guides.	Correct length belt installed. Belt guides correctly adjusted.	Replace belt. Adjust belt guides.
4. Transaxle.	Linkage not binding or damaged. Rotates on axle. Internal clutch components not sticking or damaged.	Clean or replace as needed. Disassemble transaxle and clean or repair as needed.
5. Axle pinion gears.	Pinion gears correctly installed. Pinion gears clean and lubricated inside with proper grease.	Reverse gear so freewheel ratchet works. Clean axle, pinion gears, and internal components and lubricate with proper grease.

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MX,25015BV,18 -19-16JUL96



M48988

TRACTION DRIVE WILL NOT FREEWHEEL

MX,25015BV,19 -19-16JUL96

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M48988
-19-04DEC95

BLADE BRAKE CLUTCH TEST AND ADJUSTMENT

NOTE: This procedure and specifications apply to both Warner and Ogura BBC.

Reason:

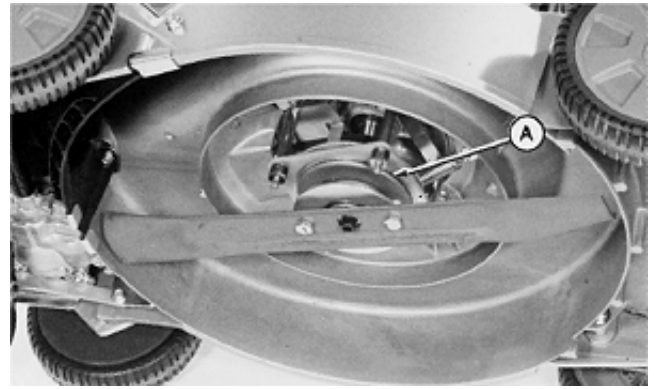
Check and adjust blade brake clutch for correct operation.

Equipment:

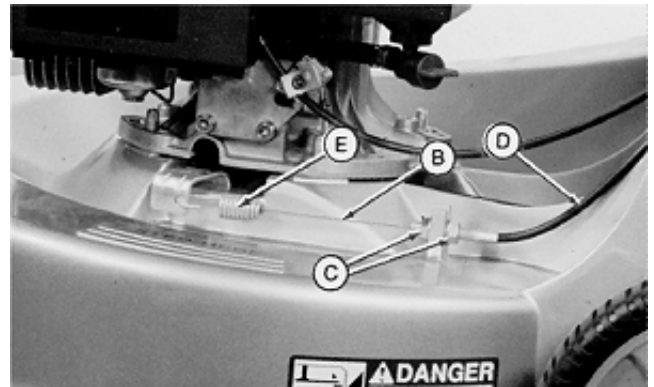
- Ruler
- Vernier Calipers

Procedure:

1. Set throttle control to stop position.
2. Remove high tension lead from spark plug and ground to engine.
3. Tip mower to access blade brake clutch assembly and measure thickness of pad material (A). If less than **0.76 mm (0.030 in.)** blade brake clutch should be replaced.
4. Set mower on wheels.
5. Make sure that blade brake clutch control is completely disengaged.
6. On units where installed, move boot to access blade brake clutch cable (B).
7. Remove traction drive components cover.
8. Loosen nuts (C) on cable housing (D).
9. Adjust cable housing so that with blade brake clutch control disengaged:
 - A. Cable has less than **25 mm (1.0 in.)** freeplay.
 - B. Cable spring (E) is not tight at lever.
10. Tighten nuts.
11. Install cover.



Ogura BBC Shown



Ogura BBC Shown

- A—Pad Material
- B—Blade Brake Clutch Cable
- C—Nuts
- D—Cable Housing

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MX,25015BV,20 -19-16JUL96

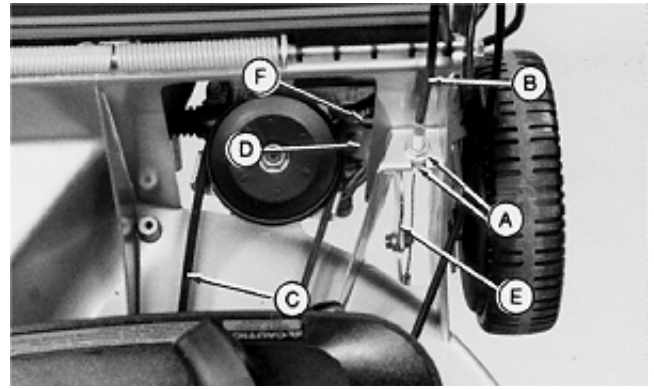
TRACTION DRIVE TEST AND ADJUSTMENT (12SB, 14SB AND 14SE)

Reason:

Check and adjust cable for proper traction drive operation.

Procedure:

NOTE: The photo shows the newer version clutch control cable that does not include a spring. The test and adjustment procedure for the early version that included the spring is the same.



M49351 -JUN-19JUL90

1. Set throttle control to stop position.
2. Remove high tension lead from spark plug and ground to engine.
3. Remove mower deck cover.
4. Loosen nuts (A) on cable housing (B).
5. Adjust cable housing so that:
 - A. Belt (C) is loose and clutch arm (D) is not depressed by lever (E) when traction drive bail is not engaged.
 - B. Belt is tight and clutch arm is contacting boss (F) on transaxle case when traction drive bail is engaged.

A—Nuts
B—Cable Housing
C—Belt
D—Clutch Arm
E—Lever
F—Boss

NOTE: Roll the mower backward and forward to insure that the internal clutch engages or disengages properly. If mower does not freewheel backwards, the clutch arm (D) neutral return spring is most likely over-stretched and no longer returns clutch arm completely into neutral position.

6. Tighten nuts.
7. Install mower deck cover.

MX,25015BV,21 -19-16JUL96

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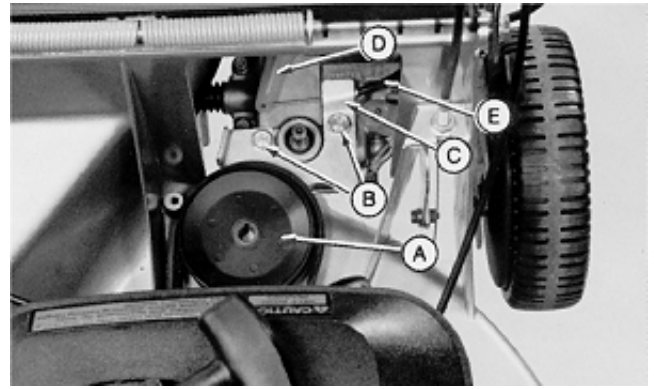
TRANSAXLE TEST AND ADJUSTMENT (12SB, 14SB AND 14SE)

Reason:

Check and adjust speed control to insure that all speeds of transaxle are useable.

Procedure:

1. Remove mower deck cover.
2. Remove driven sheave (A).
3. Loosen cap screws (B) that hold cable clamp/belt guide (C).
4. Move speed control lever to high-gear speed position.
5. Move shift arm (D) as far right as possible, as viewed from the operator's station.
6. Push cable housing (E) toward shift arm to remove slack.
7. It may be necessary to adjust the ridge position of cable housing (E) in transaxle case grooves, then clamp in place by tightening belt guide bracket cap screws.
8. Move shift control lever from high-gear to low-gear to ensure all gears can be obtained. Repeat adjustment if necessary.
9. Install driven sheave.
10. Install mower deck cover.



A—Driven Sheave
B—Cap Screws
C—Cable Clamp/Belt Guide
D—Shift Arm
E—Cable Housing

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POWER TRAIN TESTS AND ADJUSTMENTS (12PC/14PT/14PZ/14SC/14SX/14ST/14SZ)

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**COMPONENT LOCATION
INFORMATION—ZONE START UNITS**

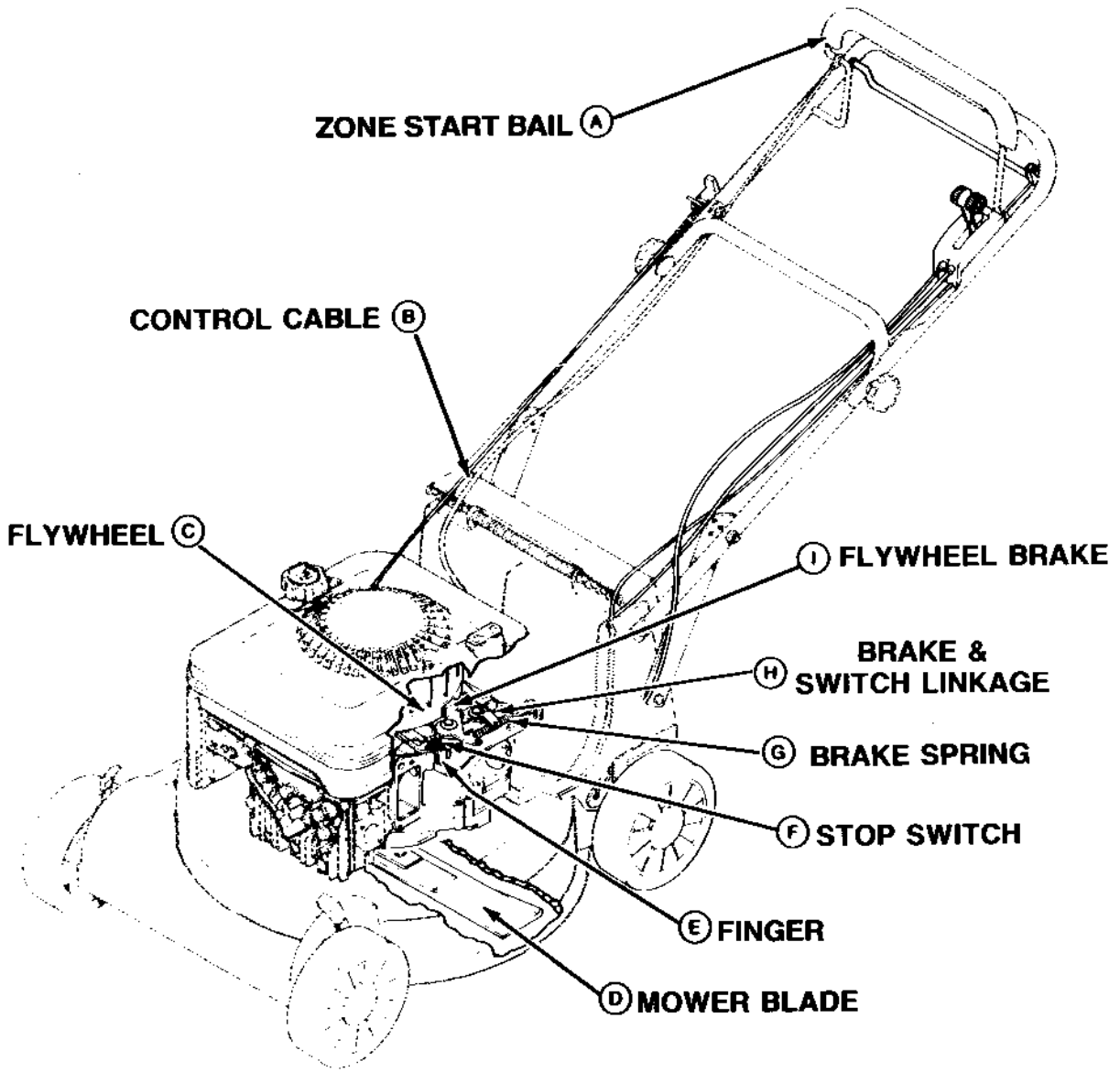
This group contains component location drawings for the following power train components:

- Blade Drive and Brake
- Traction Drive

Use the drawings when diagnosing a power train problem and to help locate the components to be tested.

MX,25505BV,1 -19-16JUL96

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BLADE DRIVE-ZONE START UNITS

M48833

A—Zone Start Bail
B—Control Cable
C—Flywheel

D—Mower Blade
E—Finger

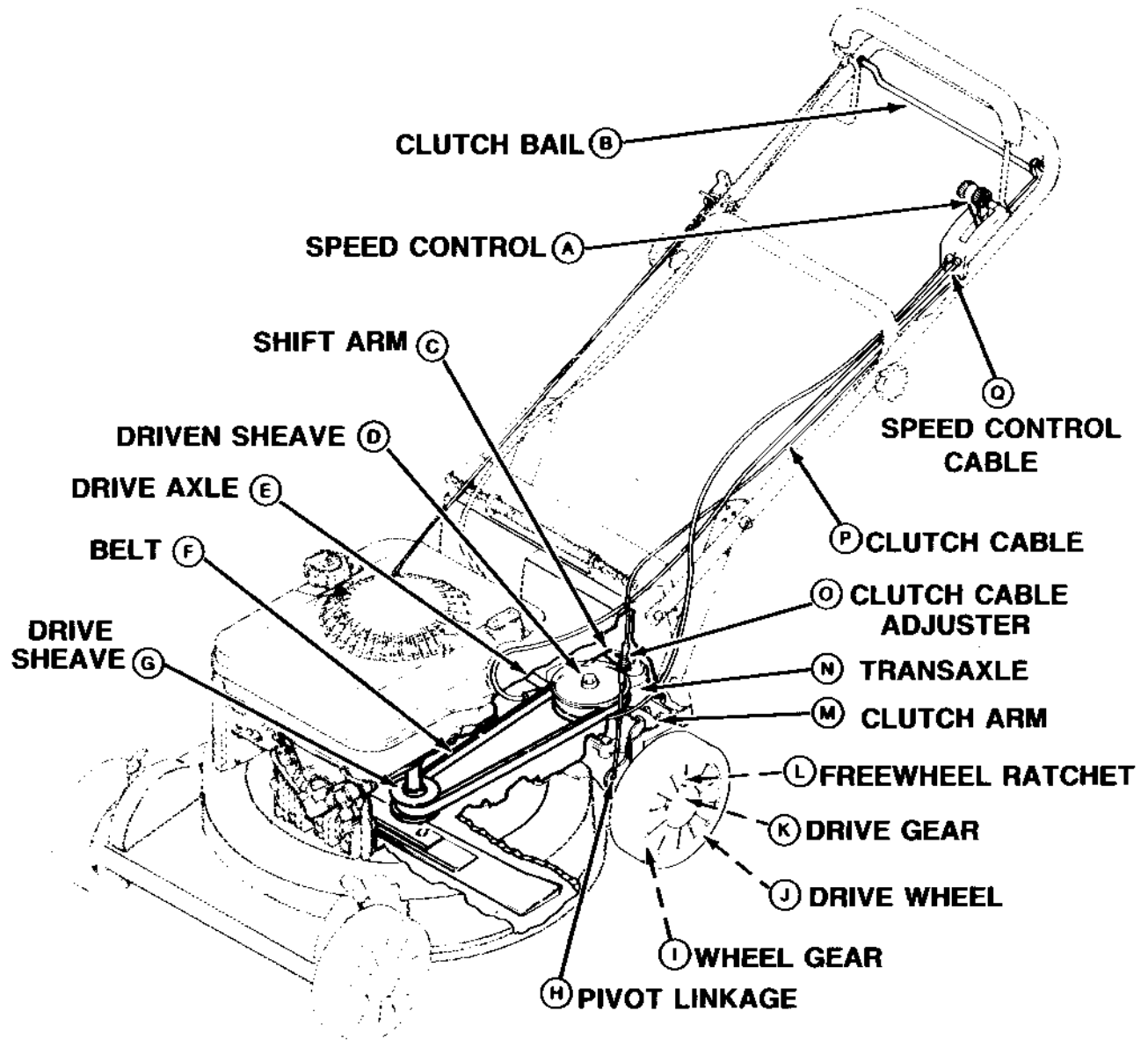
F—Stop Switch
G—Brake Spring

H—Brake and Switch Linkage
I—Flywheel Brake

NOTE: The drawing shows the Briggs & Stratton 4-cycle engine version zone start. Briggs & Stratton 2-cycle engine and Kawasaki engine zone start units are similar except for engine type.

M48833 -19-06JUL90

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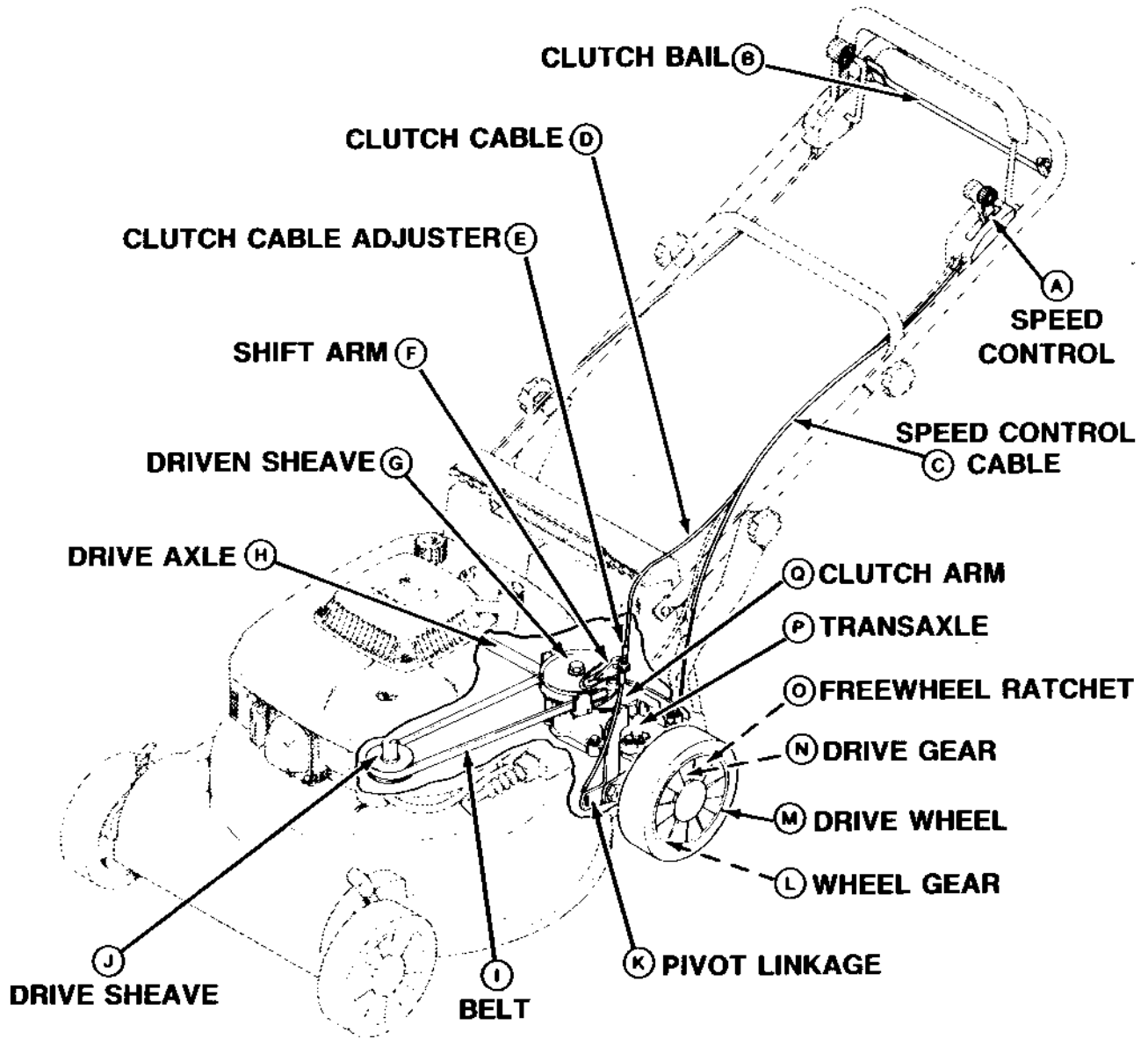
M48834

TRACTION DRIVE-2-SPEED TRANSAXLE

- | | | | |
|-----------------|-----------------|---------------------|-------------------------|
| A—Speed Control | F—Belt | J—Drive Wheel | N—Transaxle |
| B—Clutch Bail | G—Drive Sheave | K—Drive Gear | O—Clutch Cable Adjuster |
| C—Shift Arm | H—Pivot Linkage | L—Freewheel Ratchet | P—Clutch Cable |
| D—Driven Sheave | I—Wheel Gear | M—Clutch Arm | Q—Speed Control Cable |
| E—Drive Axle | | | |

NOTE: The drawing shows the Briggs & Stratton 4-cycle engine, 2-speed transaxle version zone start.

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M48829

TRACTION DRIVE-5 SPEED TRANSAXLE

- | | | | |
|-------------------------|-----------------|-----------------|---------------------|
| A—Speed Control | F—Shift Arm | J—Drive Sheave | N—Drive Gear |
| B—Clutch Bail | G—Driven Sheave | K—Pivot Linkage | O—Freewheel Ratchet |
| C—Speed Control Cable | H—Drive Axle | L—Wheel Gear | P—Transaxle |
| D—Clutch Cable | I—Belt | M—Drive Wheel | Q—Clutch Arm |
| E—Clutch Cable Adjuster | | | |

NOTE: The 14SC is the only model that has the Kawasaki zone start, 4-cycle engine with the 5-speed transaxle.

M48829 -19-26JUN90

THEORY OF OPERATION INFORMATION

This group divides the power train into individual components or systems by function. The story contains information on function, component or system identification and theory of operation.

The following systems or components are covered:

- Blade Drive and Brake
- Traction Drive
- 2-Speed Transaxle
- 5-Speed Transaxle

MX,25510BV,1 -19-16JUL96

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BLADE DRIVE AND BRAKE OPERATION—ZONE START UNITS

A—Zone Start Bail
B—Control Cable
C—Flywheel

D—Mower Blade
E—Finger

F—Stop Switch
G—Brake Spring

H—Brake and Switch Linkage
I—Flywheel Brake

Function:

To stop mower blade and engine when operator leaves handle bars.

Major Components:

- Brake Pad
- Flywheel
- Stop Switch

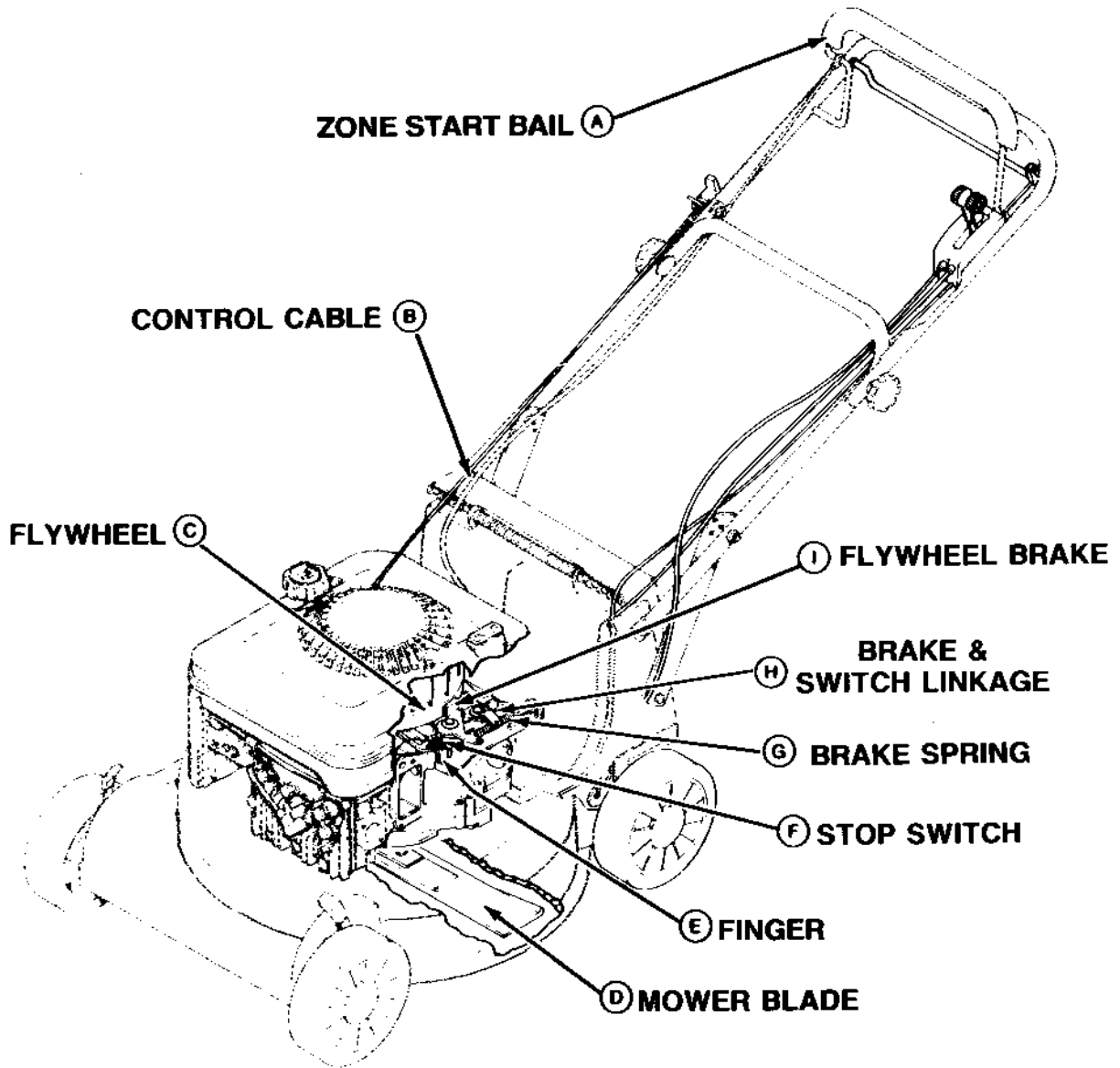
Theory of Operation:

The zone start system is designed to ground the ignition system and stop the engine when the operator releases the zone start bail (A). When the bail is engaged, the control cable (B) pulls on the brake and switch linkage (H). This holds the brake (I)

away from the flywheel (C) and opens stop switch (F). When the bail is released, the brake spring (G) pulls the brake pad against the flywheel. At the same time, finger (E) grounds the ignition at the kill switch. The engine and the mower blade (D) then stop quickly. The mower will need to be restarted every time the bail is released and the bail must be held down for the engine to start.

NOTE: The drawing shows the Briggs & Stratton 4-cycle engine version zone start. Briggs & Stratton 2-cycle engine and Kawasaki engine zone start units are similar except for engine type.

MX,25510BV,2 -19-16JUL96



M48833

BLADE DRIVE-ZONE START UNITS

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TRACTION DRIVE OPERATION—ZONE START UNITS

A—Speed Control
B—Clutch Bail
C—Shift Arm
D—Driven Sheave
E—Drive Axle

F—Belt
G—Drive Sheave
H—Pivot Linkage
I—Wheel Gear

J—Drive Wheel
K—Drive Gear
L—Freewheel Ratchet
M—Clutch Arm

N—Transaxle
O—Clutch Cable Adjuster
P—Clutch Cable
Q—Speed Control Cable

Function:

Propel the mower using power from the engine and offer a variety of ground speeds for different conditions.

Major Components:

- Drive Sheave
- Drive Belt
- 2-Speed Transaxle
- Drive Wheels

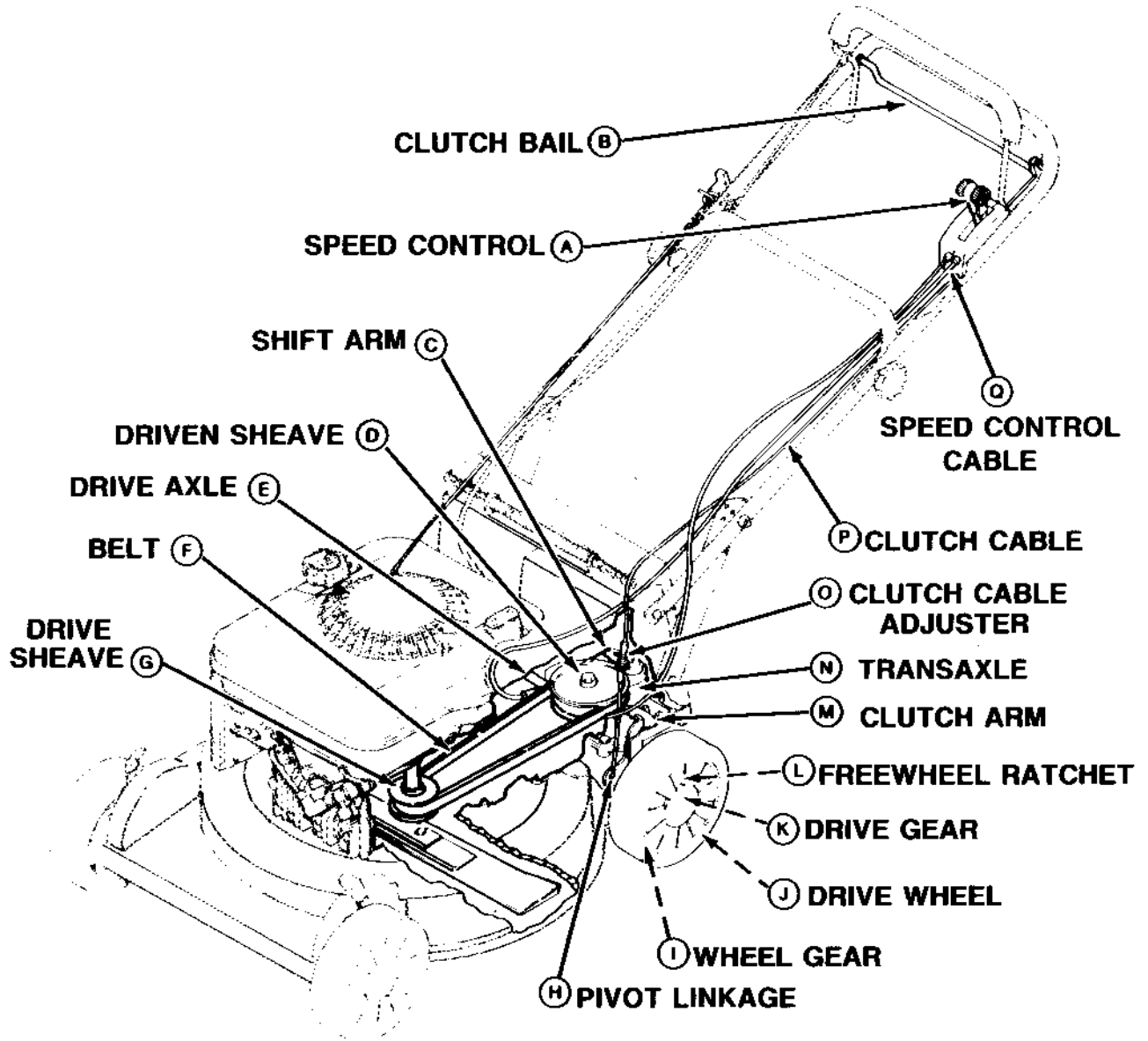
Theory of Operation:

The power to the transaxle (N) comes from the crankshaft at drive sheave (G) through belt (F). The belt, along with the mechanism inside the transaxle, act as the clutch for the drive. When the drive is not engaged, the belt is loose. As the clutch bail (B) is engaged, cable (P) pulls on pivot linkage (H) which rotates the transaxle on the drive axle (E). At the

same time, the linkage pushes clutch arm (M) which rotates and engages the internal clutch. The axle transmits the power to the drive gears (K) which mesh with the wheel gears (I). The drive gears have freewheel ratchets (L), comprised of a spring loaded woodruff key working inside the axle keyway with the pinion gears internal series of three ramps and traction flats, that allow the mower to be pushed around more easily and help in turning. The ground speeds are adjusted by speed control lever (A) which is connected to the shift arm (C) of the transaxle by speed control cable (Q).

NOTE: The drawing shows the Briggs & Stratton 4-cycle engine, 2-speed transaxle version zone start. Kawasaki engine, 5-speed transaxle version zone start units are identical except for engine and transaxle type.

MX,25510BV,4 -19-16JUL96



M48834

TRACTION DRIVE-2-SPEED TRANSAXLE

MX,25510BV,5 -19-16JUL96

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2-SPEED TRANSAXLE OPERATION—ZONE START UNITS

A—Shift Key
B—Shift Hub
C—Shift Fork
D—Shift Collar

E—Input Shaft w/Pinion Gear
F—Ring Gear
G—Drive Shaft
H—Drive Gears

I—Clutch Fork
J—Drive Axle
K—Clutch Hub

L—Clutch Collar
M—Clutch Ball
N—Driven Gears

Function:

Offer 2 ground speeds independent of engine rpm.

Major Components:

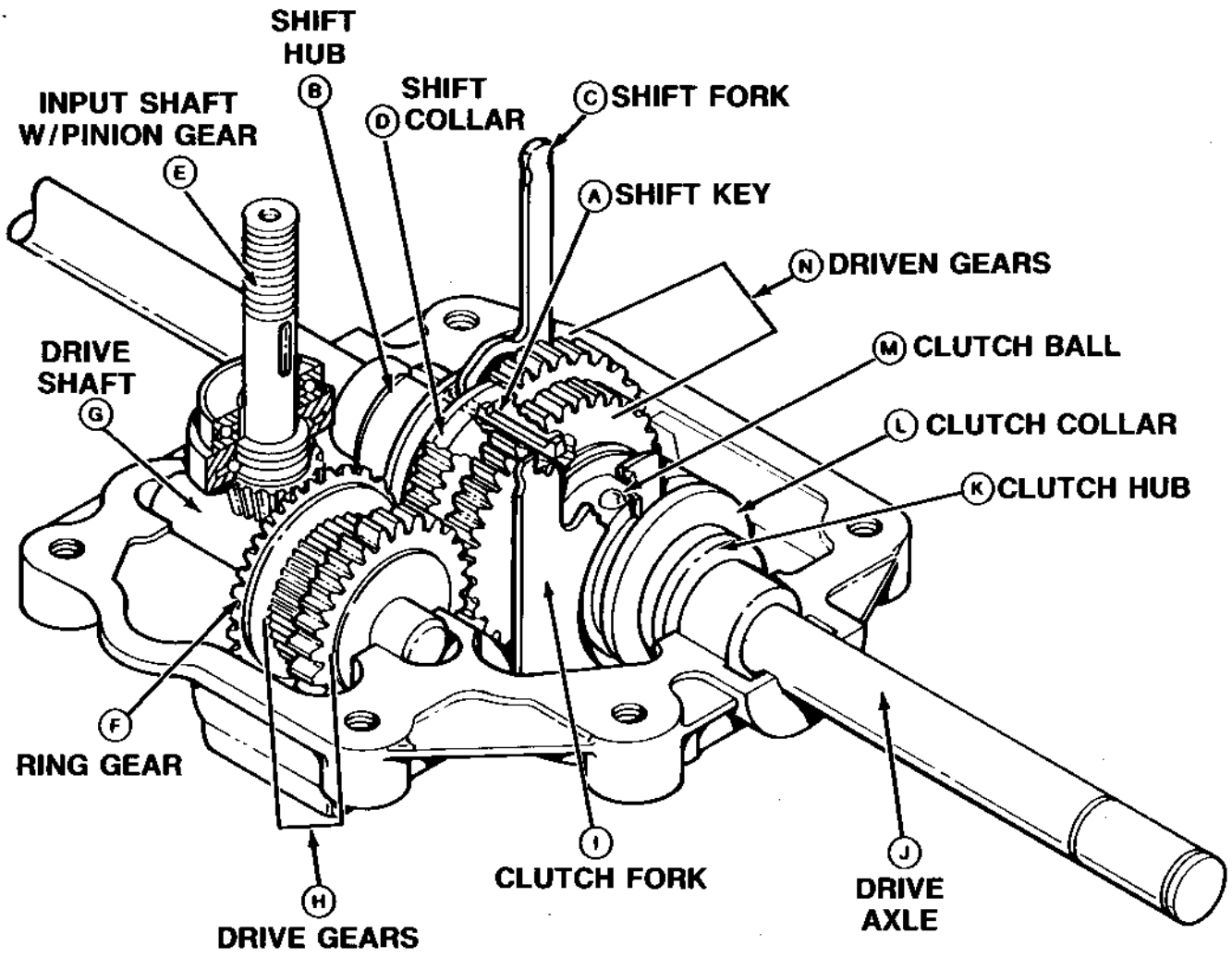
- Drive Gears
- Driven Gears
- Shift Mechanism

Theory of Operation:

The power comes into the transaxle at the input shaft with pinion gear (E). This drives ring gear (F) which is splined to the drive shaft (G). The drive gears (H) are also splined to the drive shaft. The driven gears

(N) are in constant mesh with the drive gears and connect to the drive axle (J) through shift keys (A) and shift hub (B). Projections on the shift keys engage in notches on the inside diameter of the driven gears. The shift arm rotates the shift fork (C) which moves the shift collar (D) which slides the shift keys to engage the gears. Different speed ratios are chosen when different gears are engaged. The clutch arm rotates the clutch fork (I) when it is pushed by the external linkage. This slides the clutch collar (L) along the clutch hub (K) and forces balls (M) into holes on the drive axle (J) and the power from the driven gears is transmitted to the drive axle.

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M48835

2 SPEED TRANSAXLE OPERATION

MX,25510BV,7 -19-16JUL96

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-19-26JUN90

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5-SPEED TRANSAXLE OPERATION—ZONE START UNIT (14SC ONLY)

A—Shift Key
B—Shift Hub
C—Shift Fork
D—Shift Collar

E—Input Shaft w/Pinion Gear
F—Ring Gear
G—Drive Shaft
H—Drive Gears

I—Clutch Fork
J—Drive Axle
K—Clutch Hub

L—Clutch Collar
M—Clutch Ball
N—Driven Gears

Function:

Offer 5 ground speeds independent of engine rpm.

Major Components:

- Drive Gears
- Driven Gears
- Shift Mechanism

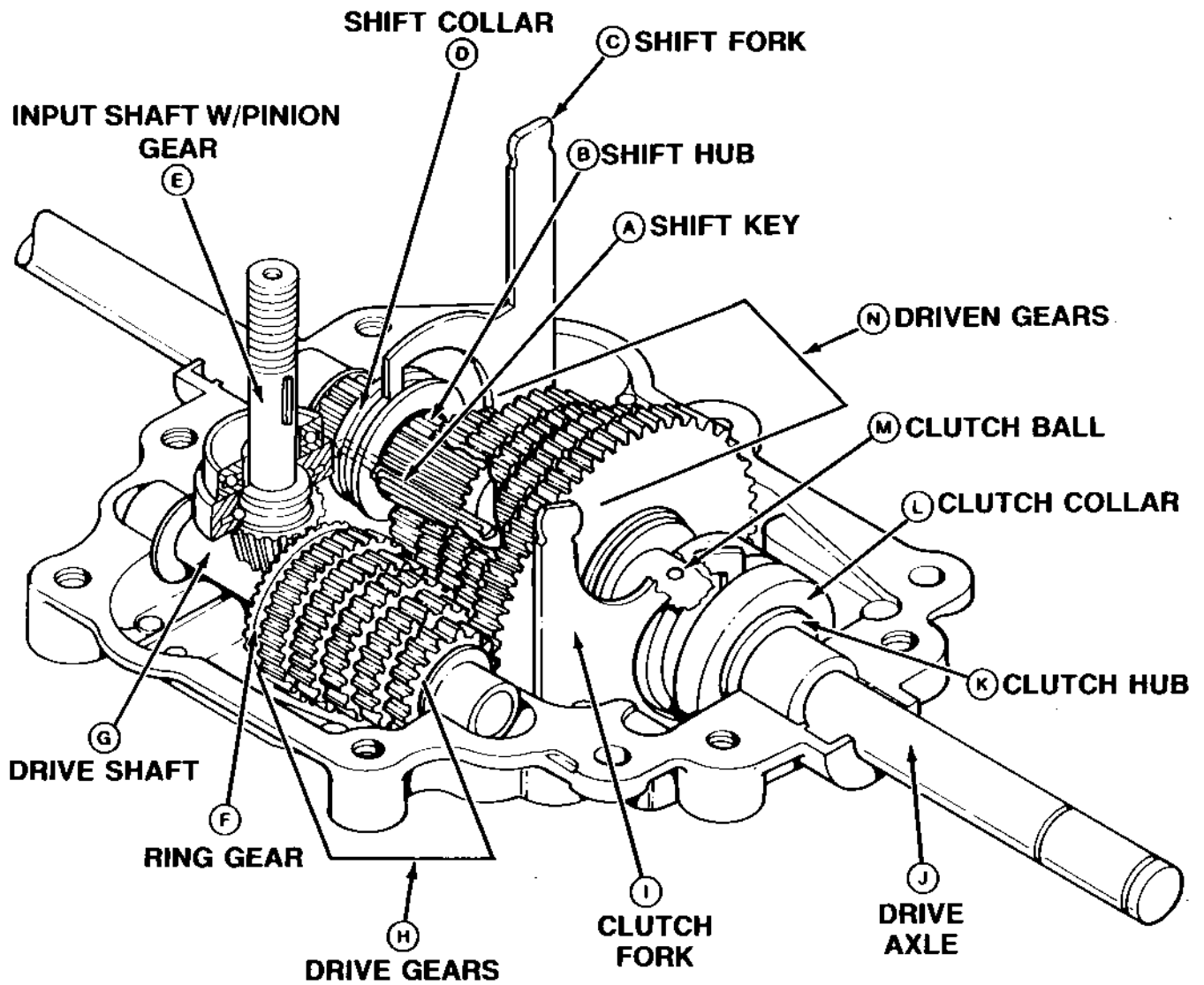
Theory of Operation:

The power comes into the transaxle at the input shaft with pinion gear (E). This drives ring gear (F) which is splined to the drive shaft (G). The drive gears (H) are also splined to the drive shaft. The driven gears

(N) are in constant mesh with the drive gears and connect to the drive axle (J) through shift keys (A) and shift hub (B). Projections on the shift keys engage in notches on the inside diameter of the driven gears. The shift arm rotates the shift fork (C) which moves the shift collar (D) which slides the shift keys to engage the gears. Different speed ratios are chosen when different gears are engaged. The clutch arm rotates the clutch fork (I) when it is pushed by the external linkage. This slides the clutch collar (L) along the clutch hub (K) and forces balls (M) into holes on the drive axle (J) and the power from the driven gears is transmitted to the drive axle.

MX,25510BV,8 -19-16JUL96

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M48830

5-SPEED TRANSAXLE OPERATION

MX,25510BV,9 -19-16JUL96

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Mower blade and engine will not spin or start.
- Mower blade and engine will not stop in 3 seconds.
- No traction drive.
- Traction drive will not release.
- Do not have all ground speeds.
- Traction drive ratchets at engagement.
- Traction drive will not freewheel.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle "Normal" column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third "If Not Normal" column to repair the malfunction. The detailed tests or adjustments referred to in the "If Not Normal" column are located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the "Test Location" column and the arrow points to the exact point at which the test is to be made.

MX,25515BV,1 -19-16JUL96

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1

MOWER BLADE AND ENGINE WILL NOT SPIN OR START

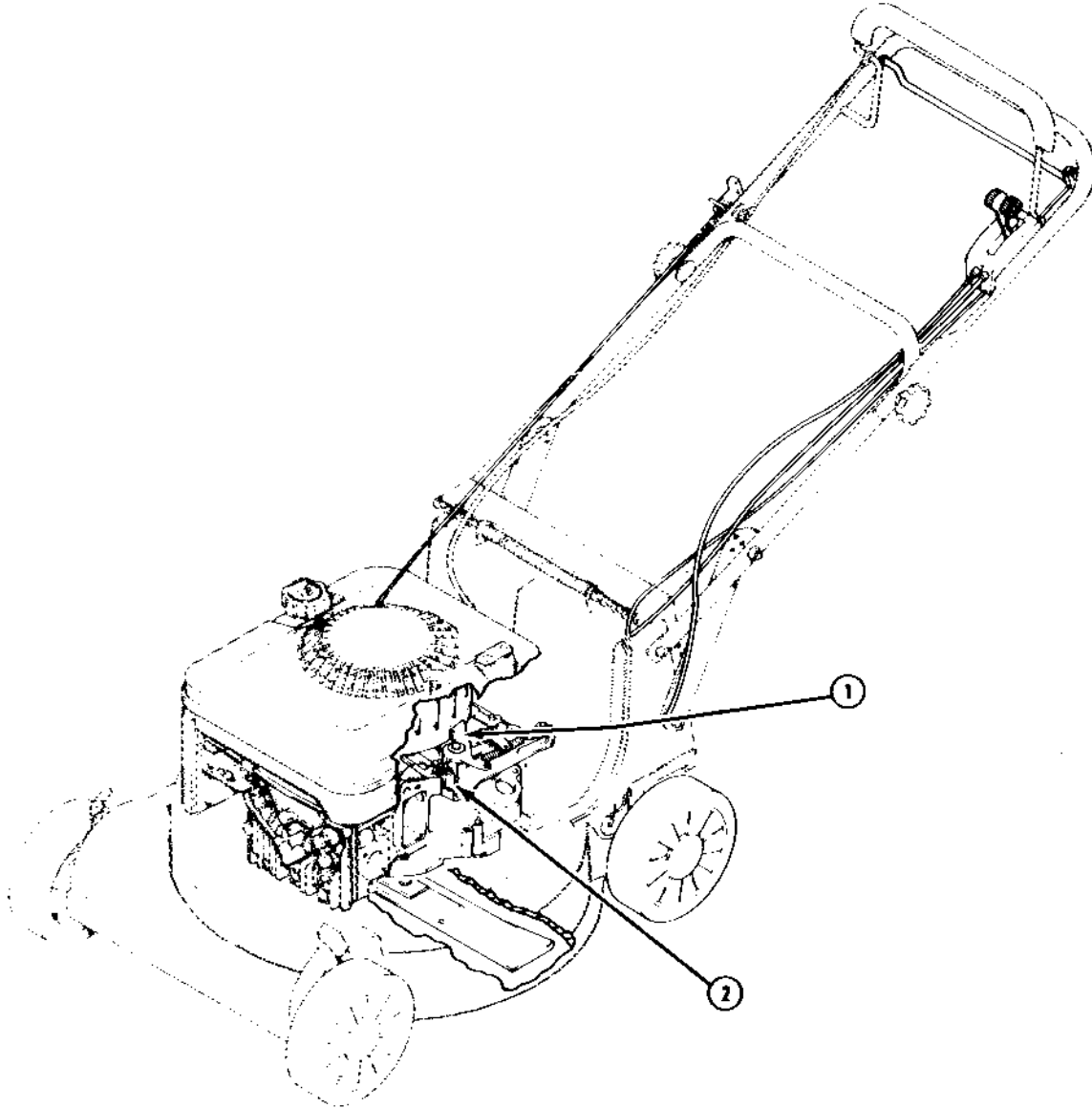
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.
- Briggs & Stratton 2-cycle engine ignition tests found in Section 220 Group 15.
- Briggs & Stratton 4-cycle engine ignition tests found in Section 222 Group 15.
- Kawasaki engine ignition tests found in Section 222 Group 15.

Test Location	Normal	If Not Normal
1. Flywheel brake.	Brake pad not contacting flywheel. (Zone start bail completely engaged.)	Check for sticking, stretched or damaged cable. Check for binding or damaged linkage.
2. Stop switch.	No continuity to ground. (Zone start bail completely engaged.)	Check for shorted or misadjusted stop switch.

MX,25515BV,2 -19-16JUL96

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2



MOWER BLADE & ENGINE WILL NOT SPIN OR START

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3

MOWER BLADE AND ENGINE WILL NOT STOP IN 3 SECONDS

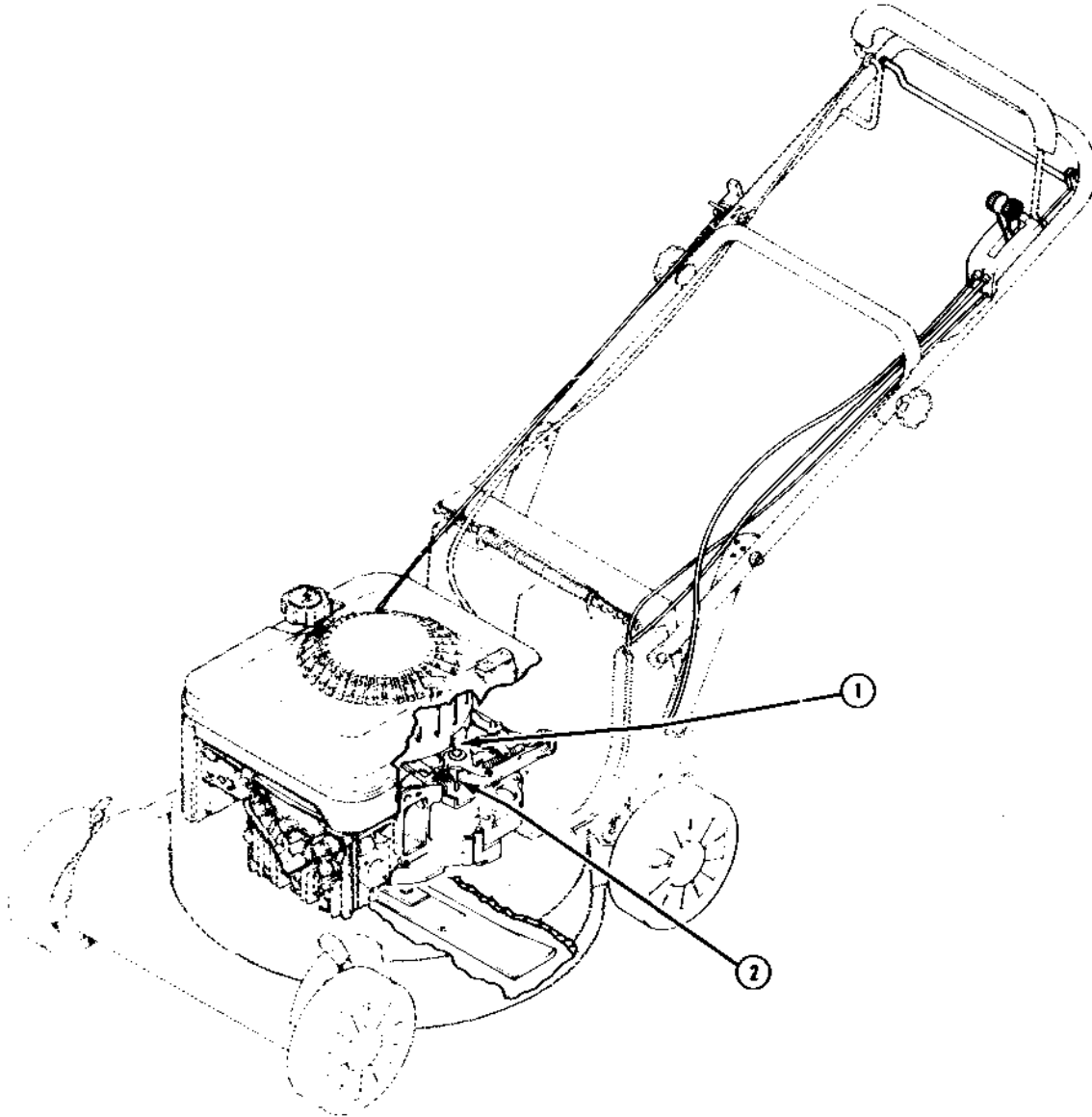
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged, self-propelled units.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.
- Briggs & Stratton 2-cycle engine ignition tests found in Section 220 Group 15.
- Briggs & Stratton 4-cycle engine ignition tests found in Section 222 Group 15.
- Kawasaki engine ignition tests found in Section 225 Group 15.

Test Location	Normal	If Not Normal
1. Flywheel brake.	Brake pad contacting flywheel completely.	Check for weak or damaged brake spring. Check for sticking or damaged cable. Check for binding or damaged linkage.
2. Stop switch.	Linkage finger contacting tang of stop switch. Continuity to ground of wire from ignition.	Check for binding or damaged linkage. Adjust stop switch. Check for corrosion or dirt on tang or finger.

MX,25515BV,4 -19-16JUL96

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**MOWER BLADE & ENGINE WILL NOT
STOP IN 3 SECONDS**

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MX,25515BV,5 -19-16JUL96

M48990 -19-06JUL90

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NO TRACTION DRIVE

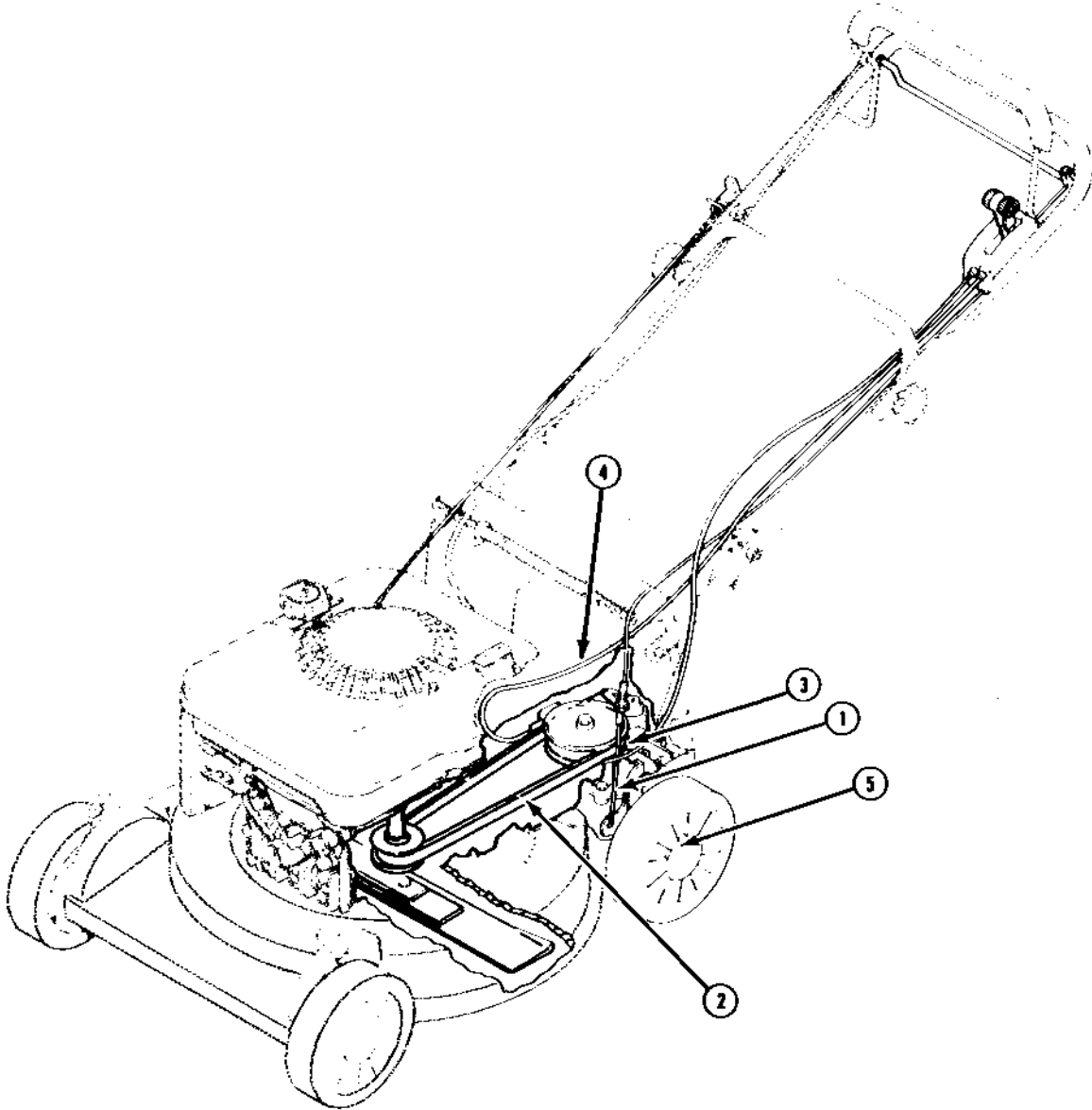
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
2. Drive belt and sheaves.	Drive sheave tight on crankshaft.	Check key and set screw.
	Belt not worn or stretched.	Replace belt.
	Belt guides correctly adjusted.	Adjust belt guides.
	Driven sheave tight on transaxle.	Repair or replace as needed.
3. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
4. Speed control cable.	Not sticking or damaged.	Clean or replace cable as needed.
	Correctly adjusted. (5-speed transaxle only.)	Adjust cable.
5. Rear wheels.	Drive gears correctly installed.	Reverse gear so freewheel ratchet works.
	Drive or wheel gears not failed.	Replace failed gears.

MX,25515BV,6 -19-16JUL96

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M48991

NO TRACTION DRIVE

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7

TRACTION DRIVE WILL NOT RELEASE

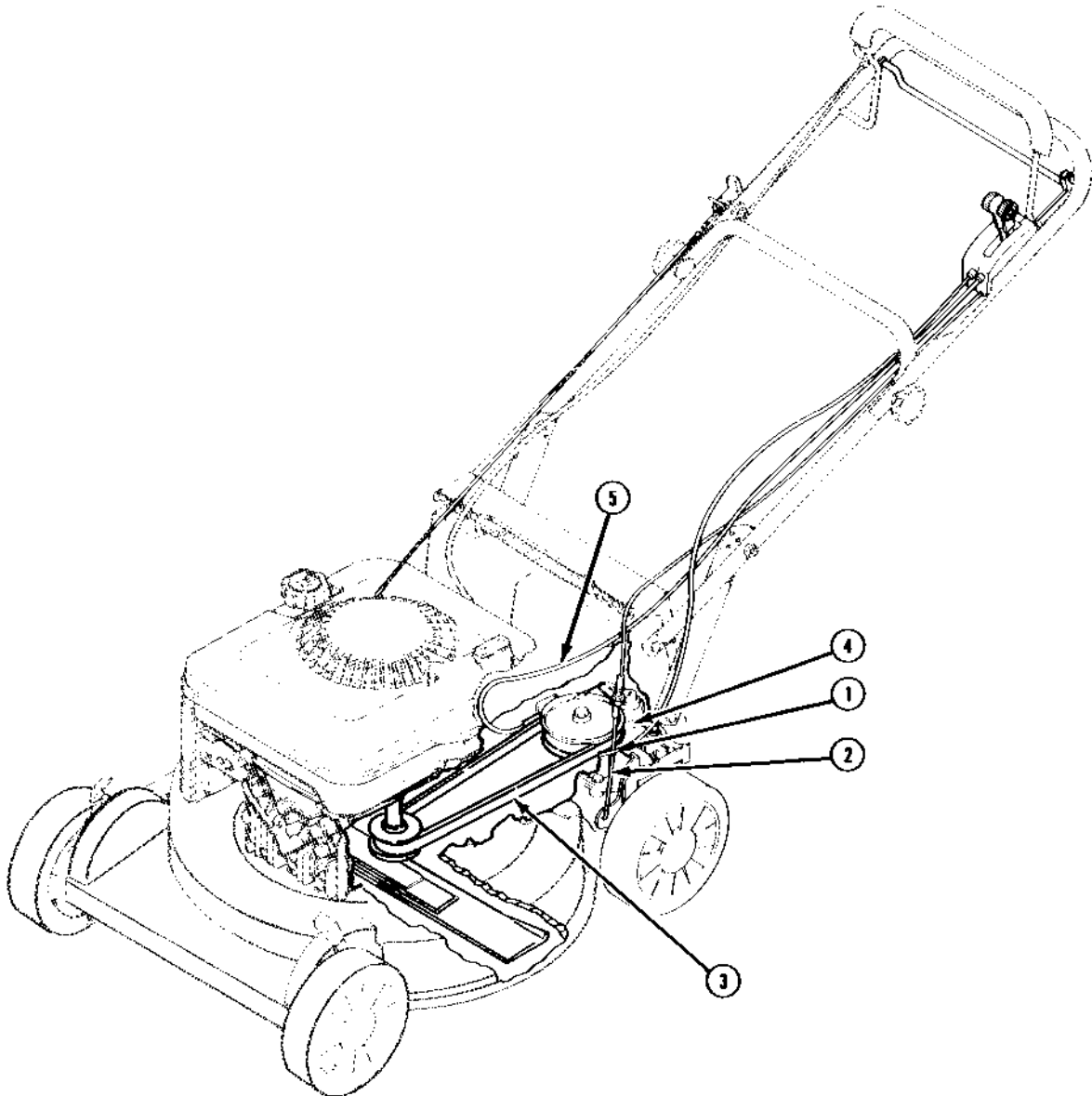
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Clutch arm return Spring.	Spring returns clutch arm into neutral. Spring not over-stretched, broken, or missing.	Carefully replace spring.
2. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
3. Drive belt and guides.	Correct length belt installed.	Replace belt.
	Belt guides correctly adjusted.	Adjust belt guides.
4. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal clutch and shift components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
5. Speed control cable.	Correctly adjusted.	Adjust.
	Not sticking or damaged.	Clean or replace cable as needed.

255
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8

MX,25515BV,8 -19-16JUL96



M48992

TRACTION DRIVE WILL NOT RELEASE

MX,25515BV,9 -19-16JUL96

M48992 -19-04DEC95

255
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9

DO NOT HAVE ALL GROUND SPEEDS

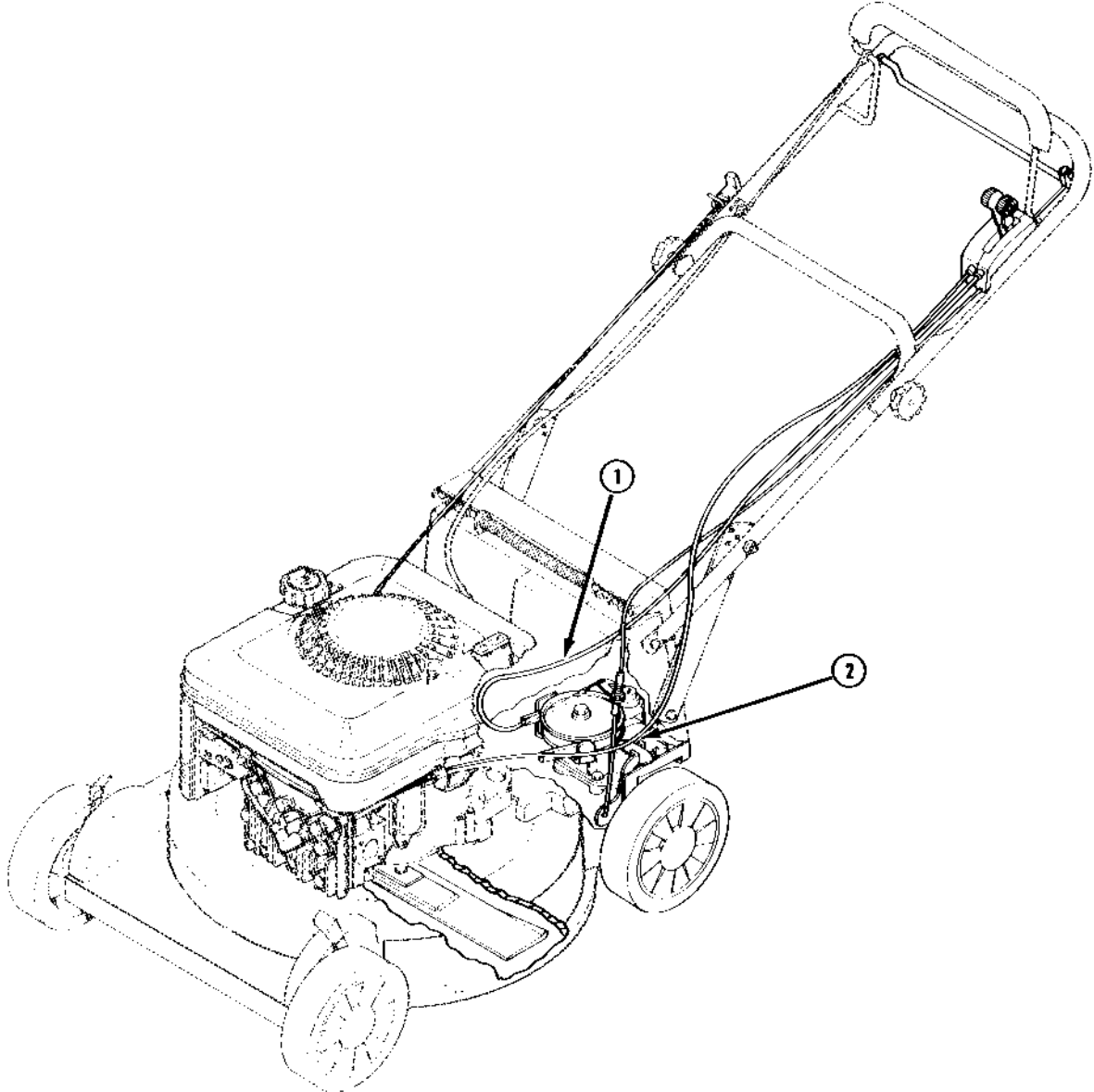
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Speed control cable.	Not sticking or damaged. Correctly adjusted. (5-speed transaxle only.)	Clean or replace cable as needed. Adjust cable.
2. Transaxle.	Internal components not sticking or damaged.	Disassemble and repair or replace as needed.

MX,25515BV,10 -19-16JUL96

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M48993

DO NOT HAVE ALL GROUND SPEEDS

MX,25515BV,11 -19-16JUL96

M48993
-19-04DEC95

255
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11

TRACTION DRIVE RATCHETS AT ENGAGEMENT

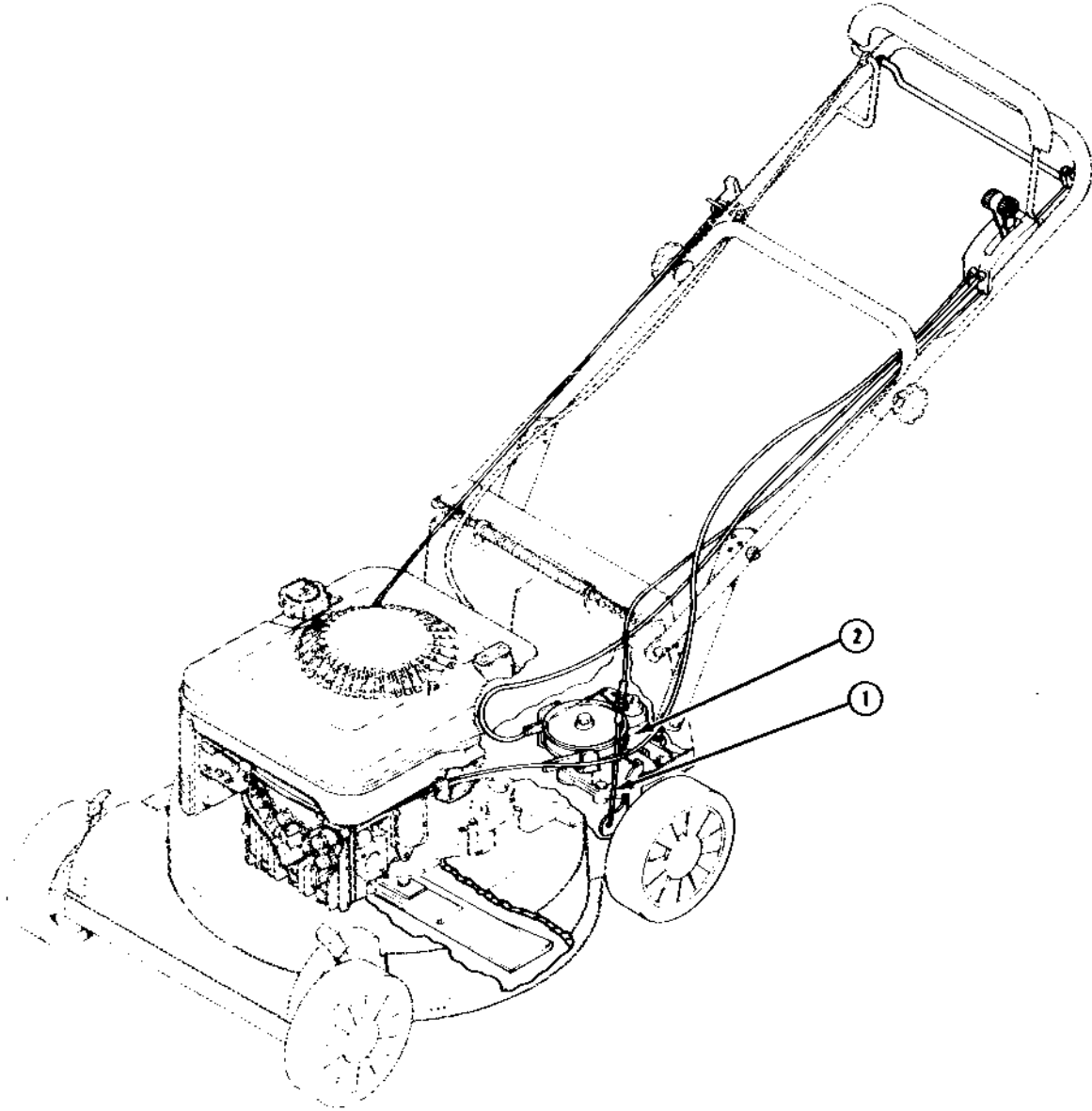
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Traction drive cable.	Correctly adjusted.	Adjust cable.
	Not sticking or damaged.	Clean or replace cable as needed.
2. Transaxle.	Linkage not binding or damaged. Rotates on axle.	Clean or replace as needed.
	Clutch arm rotates far enough.	Check linkage. Modify arm. (See SIB-89-11-10-6.)
	Internal clutch components not sticking or damaged.	Disassemble transaxle and clean or repair as needed.
3. Axle pinion gears.	Clean and greased internally with proper grease.	Disassemble, clean, and grease internally with proper grease.
	Installed correctly, not binding, and drives properly.	Remove and install correctly.

255
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12

MX,25515BV,12 -19-16JUL96



M48994

TRACTION DRIVE RATCHETS AT ENGAGEMENT

MX,25515BV,13 -19-16JUL96

M48994 -19-26JUN90

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13

TRACTION DRIVE WILL NOT FREEWHEEL

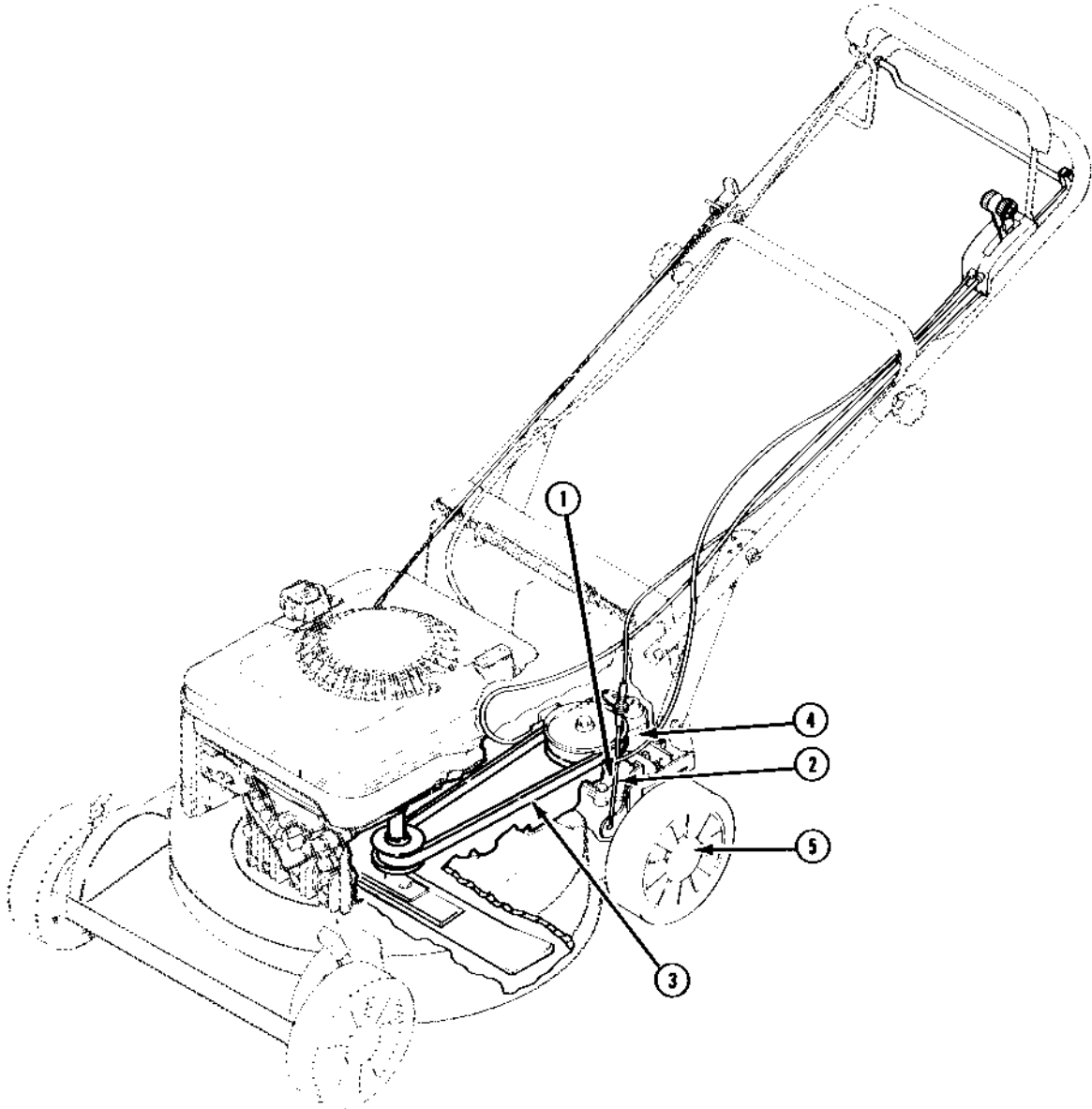
Conditions:

- Throttle control in stop position.
- Zone start disengaged.
- Traction drive disengaged.
- Spark plug wire disconnected and grounded.
- Power train tests found in this group.

Test Location	Normal	If Not Normal
1. Clutch arm return spring.	Spring returns clutch arm into neutral. Spring not over-stretched, broken, or missing.	Carefully replace spring.
2. Traction drive cable.	Correctly adjusted. Not sticking or damaged.	Adjust cable. Clean or replace cable as needed.
3. Drive belt and guides.	Correct length belt installed. Belt guides correctly adjusted.	Replace belt. Adjust belt guides.
4. Transaxle.	Linkage not binding or damaged. Rotates on axle. Internal clutch components not sticking or damaged.	Clean or replace as needed. Disassemble transaxle and clean or repair as needed.
5. Axle pinion gears.	Pinion gears correctly installed. Pinion gears clean and lubricated inside with proper grease.	Reverse gear so freewheel ratchet works. Clean axle, pinion gears, and internal components and lubricate with proper grease.

255
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14

MX,25515BV,14 -19-16JUL96



M48995

TRACTION DRIVE WILL NOT FREEWHEEL

MX,25515BV,15 -19-16JUL96

M48995 -19-04DEC95

255
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15

ZONE START TESTS—BRIGGS & STRATTON 2-CYCLE ENGINE (12PC ONLY)

Reason:

Check zone start linkage to insure proper operation.

Equipment:

- Torque Wrench

Test Procedure:

1. Remove high tension lead and ground. Remove spark plug. Remove fuel tank and fan shroud.
2. Make sure that zone start bail is disengaged.
3. Set torque wrench and socket (A) on flywheel nut (B).
4. Slowly rotate flywheel clockwise, read torque wrench.
5. Engage zone start bail completely and check for clearance between brake band (C) and flywheel (D).

Adjustment Procedure:

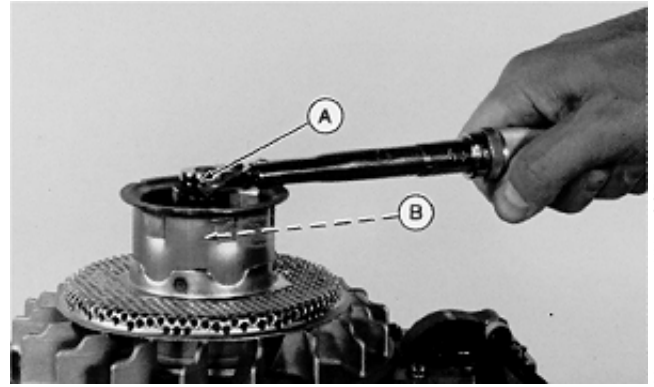
1. Loosen screws (E).
2. Pry brake plate (F) toward the left until spring (G) is slightly stretched.
3. Tighten screws.
4. Conduct torque test.
5. Move plate further toward left if torque is below minimum specification.

Specifications:

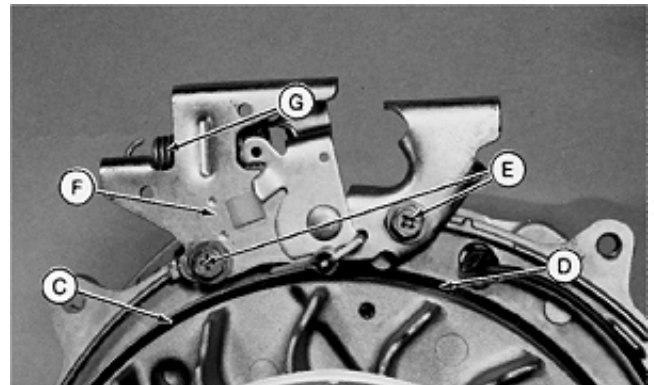
- **Blade stop time .. maximum 3 seconds from fast idle.**
- **Flywheel brake slip torque .. minimum 5.1 N-m (45 lb-in.).**

Results:

- If brake slip torque is below specification, adjust flywheel brake and check for:
 - Weak or damaged brake spring.
 - Sticking or damaged cable.
 - Binding or damaged linkage.
 - Worn or damaged brake pad.
- If brake pad contacts flywheel with bail engaged, adjust flywheel brake and check for:
 - Sticking, stretched or damaged cable.
 - Binding or damaged linkage.



M49781 -JUN-29OCT90



M49782 -JUN-29OCT90

- A—Torque Wrench
- B—Flywheel Nut
- C—Brake Band
- D—Flywheel
- E—Screws
- F—Brake Plate
- G—Spring

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16

ZONE START TESTS—BRIGGS & STRATTON 4-CYCLE ENGINE

Reason:

Check zone start linkage to insure proper operation.

Equipment:

- Torque Wrench

Procedure:

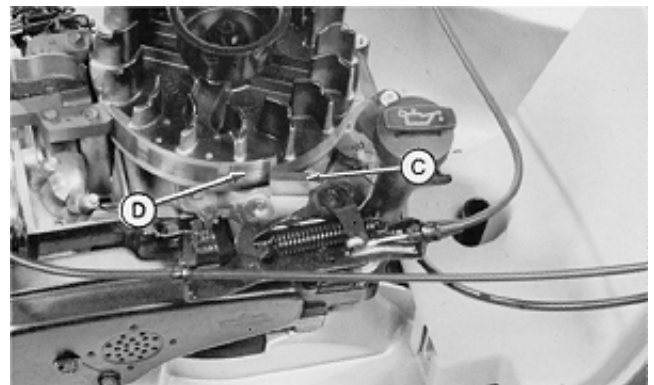
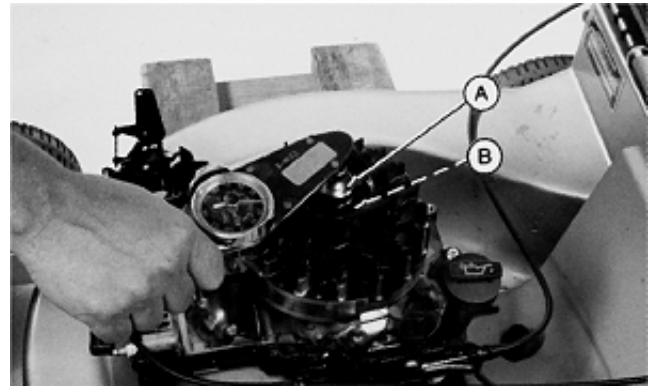
1. Set throttle control to stop position.
2. Remove high tension lead from spark plug and ground to engine.
3. Remove spark plug.
4. Remove fuel tank and fan shroud.
5. Make sure that zone start bail is completely disengaged.
6. Install torque wrench with socket (A) on flywheel nut (B).
7. Slowly rotate flywheel in a clockwise direction and read torque wrench.
8. Engage zone start bail completely. There MUST be clearance between brake pad (C) and flywheel (D).

Specifications:

- **Blade stop time .. maximum 3 seconds from fast idle.**
- **Flywheel brake slip torque .. minimum 5.1 N·m (45 lb-in.).**

Results:

- If brake slip torque is below specification, check for:
 - Weak or damaged brake spring.
 - Sticking or damaged cable.
 - Binding or damaged linkage.
 - Worn or damaged brake pad.
- If brake pad contacts flywheel with bail engaged, check for:
 - Sticking, stretched or damaged cable.
 - Binding or damaged linkage.



A—Torque Wrench
B—Flywheel Nut
C—Brake Pad
D—Flywheel

M49353 -JUN-19JUL90

M49354 -JUN-19JUL90

255
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17

ZONE START TEST AND CABLE ADJUSTMENT—KAWASAKI 4-CYCLE ENGINE (14SC ONLY)

Reason:

Adjust cable to insure proper brake operation.

Test Procedure:

1. Start engine and run at fast idle.
2. Release zone start bail.
3. Check that blade stops within 3 seconds after releasing zone start bail.

Adjustment Procedure:

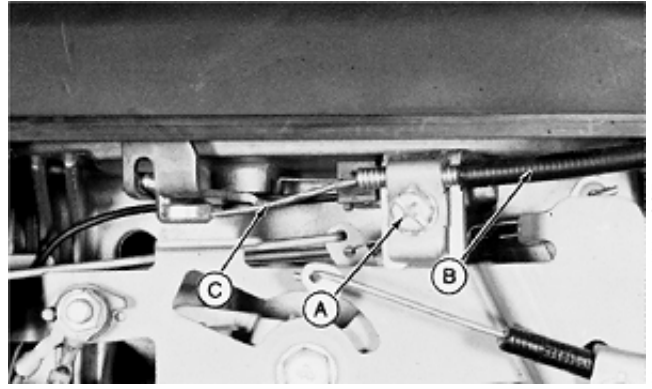
1. Loosen screw (A).
2. Slide housing (B) to remove slack in wire (C).
3. Tighten screw.

Specifications:

- **Blade stopping time .. Maximum 3 seconds.**

Results:

- If blade does not stop within specified time, check the following and retest;
 - Cable adjustment.
 - Stop switch operation.
 - Condition of brake band.
 - Linkage for binding.
 - Weak brake spring.



M49780 -JUN-29OCT90

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MX,25515BV,18 -19-16JUL96

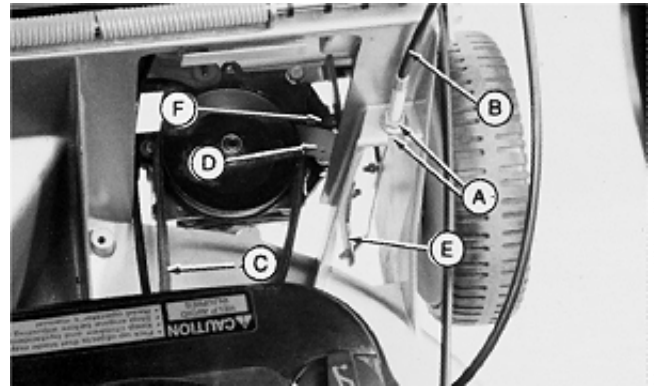
TRACTION DRIVE TEST AND ADJUSTMENT (14SC/14SX, 14ST AND 14SZ)

Reason:

Check and adjust cable for proper traction drive operation.

Procedure:

1. Set throttle control to stop position.
2. Remove high tension lead from spark plug and ground to engine.
3. Remove mower deck cover.
4. Loosen nuts (A) of cable housing (B).
5. Check that clutch arm (D) neutral return spring is not over-stretched—replace as necessary.
6. Adjust cable housing so that:
 - A. Belt (C) is loose and clutch arm (D) is not depressed by lever (E) when traction drive bail is not engaged.
 - B. Belt is tight and clutch arm is contacting boss (F) on transaxle case when traction drive bail is engaged.
7. Tighten nuts.
8. Install mower deck cover.



A—Nuts
B—Cable Housing
C—Belt
D—Clutch Arm
E—Lever
F—Boss

NOTE: Roll the mower backward and forward to insure that the internal clutch is properly engaged or disengaged. If mower does not freewheel backwards, most likely the clutch arm (D) neutral return spring is over-stretched and no longer returns clutch arm into neutral completely.

M49355 -JUN-19JUL90

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MX,25515BV,19 -19-16JUL96

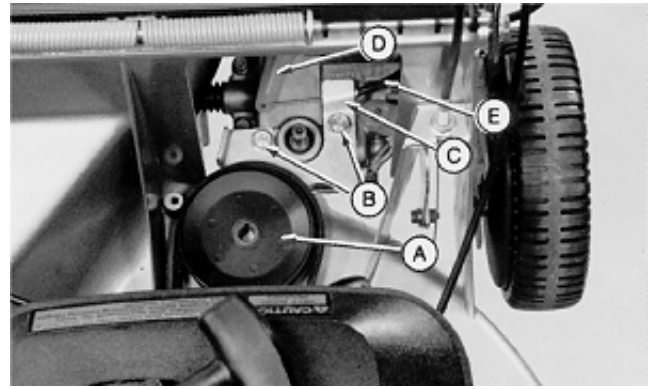
TRANSAXLE TEST AND ADJUSTMENT (14SC/14SX, 14ST AND 14SZ)

Reason:

Check and adjust speed control to insure that all speeds of transaxle are useable.

Procedure:

1. Remove mower deck cover.
2. Remove driven sheave (A).
3. On 5-speed transaxle, loosen cap screws (B) that hold cable clamp/belt guide (C).
4. Move speed control lever to high-gear speed position.
5. Move shift arm (D) as far right as possible, as viewed from the operator's station.
6. Push cable housing (E) toward shift arm to remove slack. On 2-speed transaxle, hold shift cable position with tie strap where most effective.
7. On 5-speed transaxle, you may have to adjust the ridge position of the cable housing (E) in the transaxle case grooves, then clamp in place by tightening belt guide bracket cap screws.
8. Move shift control lever from high-gear to low-gear to ensure all gears can be obtained. Adjust again if necessary.
9. Install drive sheave.
10. Install mower deck cover.



A—Driven Sheave
B—Cap Screws
C—Cable Clamp/Belt Guide
D—Shift Arm
E—Cable Housing

M49352 -JUN-19JUL90

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MX,25515BV,20 -19-16JUL96

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