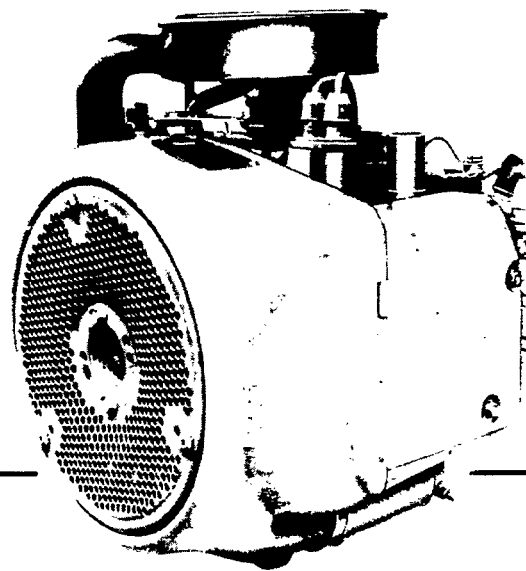


Onan

Service and Parts Manual

BF Engine



965-0250
12-87 (SPEC A-F)
Printed in USA

Safety Precautions

It is recommended that you read your engine manual and become thoroughly acquainted with your equipment before you start the engine.

WARNING *This symbol is used throughout this manual to warn of possible serious personal injury.*

CAUTION *This symbol refers to possible equipment damage.*

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

Safety Codes

- All local, state and federal codes should be consulted and complied with.
- This engine is not designed or intended for use in aircraft. Any such use is at the owner's sole risk.

General

- Provide appropriate fire extinguishers and install them in convenient locations. Use an extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the engine are secure and accurately torqued. Keep guards in position over fans, driving belts, etc.
- If it is necessary to make adjustments while the engine is running, use extreme caution when close to hot exhausts, moving parts, etc.

Protect Against Moving Parts

- Do not wear loose clothing in the vicinity of moving parts, such as PTO shafts, flywheels, blowers, couplings, fans, belts, etc.
- Keep your hands away from moving parts.

Batteries

- Before starting work on the engine, disconnect batteries to prevent inadvertent starting of the engine.
- **DO NOT SMOKE** while servicing batteries. Lead acid batteries give off a highly explosive hydrogen gas which can be ignited by flame, electrical arcing or by smoking.
- Verify battery polarity before connecting battery cables. Connect negative cable last.

Fuel System

- **DO NOT** fill fuel tanks while engine is running.

- **DO NOT** smoke or use an open flame in the vicinity of the engine or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping for flexible lines as copper will work harden and become brittle enough to break.
- Be sure all fuel supplies have a positive shutoff valve.

Exhaust System

- Exhaust products of any internal combustion engine are toxic and can cause injury, or death if inhaled. All engine applications, especially those within a confined area, should be equipped with an exhaust system to discharge gases to the outside atmosphere.
- Do not use exhaust gases to heat a compartment.
- Make sure that your exhaust system is free of leaks. Ensure that exhaust manifolds are secure and are not warped by bolts unevenly torqued.

Exhaust Gas is Deadly!

Exhaust gases contain carbon monoxide, a poisonous gas that might cause unconsciousness and death. It is an odorless and colorless gas formed during combustion of hydrocarbon fuels. Symptoms of carbon monoxide poisoning are:

- Dizziness
- Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of these symptoms, get out into fresh air immediately, shut down the unit and do not use until it has been inspected.

The best protection against carbon monoxide inhalation is proper installation and regular, frequent inspections of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

Cooling System

- Coolants under pressure have a higher boiling point than water. **DO NOT** open a radiator pressure cap when coolant temperature is above 212°F (100°C) or while engine is running.

Keep the Unit and Surrounding Area Clean

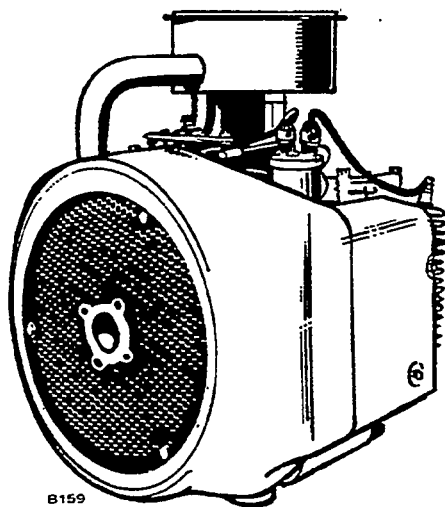
- Make sure that oily rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and present a potential fire hazard.

SERVICE MANUAL

FOR

BF

GARDEN TRACTOR ENGINES



WE SUGGEST THIS BOOK BE KEPT HANDY FOR READY REFERENCE, EITHER FOR ORDERING PARTS OR MAKING ADJUSTMENTS.

TABLE OF CONTENTS

GENERAL INFORMATION	2
SPECIFICATIONS	3
DIMENSIONS AND CLEARANCES	4
ASSEMBLY TORQUES	4
ENGINE TROUBLE SHOOTING	5
OIL SYSTEM	6
FUEL SYSTEM	8
IGNITION AND BATTERY CHARGING	12
STARTING SYSTEM	15
ENGINE DISASSEMBLY	18
PARTS CATALOG	29
ENGINE WIRING DIAGRAM	47

GENERAL INFORMATION

This manual contains proper information for the servicing and overhaul of your Onan engine. Use the parts catalog in the rear portion of this book to help you with disassembly and assembly procedures.

NOTE: *Flywheel end of engine is considered the front. Left and right sides are determined looking at front of engine.*

If it is necessary to contact your dealer or the factory about this engine, always supply the complete Model and Spec Number as well as the Serial Number shown on the engine nameplate. The engine nameplate is located on left side of blower housing (end opposite oil filter).

Refer to the *Troubleshooting Guide* for assistance in locating and correcting troubles which may occur. If a major repair or overhaul becomes necessary, the engine should be carefully checked and necessary repairs made by a competent mechanic. Maintain factory limits and clearances as shown, replacing worn parts when necessary.

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM ALL SERVICE.

ENGINE MODEL REFERENCE

Identify your model by referring to the MODEL and SPEC (specification) NO. as shown on the unit nameplate. Always use this number and the engine serial number when making reference to your engine.

How to interpret MODEL and SPEC NO.

BF - MS/0123 A
| | | |
1 2 3 4

1. Factory code for general identification purposes.
2. Specific Type:
 S - MANUAL STARTING
 MS - ELECTRIC STARTING
3. Factory code for optional equipment supplied.
4. Specification (Spec Letter) advances with factory production modification.

SPECIFICATIONS

Engine Manufacturer	Onan
Engine Design	Four Cycle, Air-Cooled, Two Cylinder
Horsepower at 3600 rpm	16
Displacement	40.3 cu. in.
Bore	3-1/8 inch
Stroke	2-5/8 inch
Compression Ratio	7 to 1
Crankshaft	Horizontal, Ductile Iron
Valves	Mechanical, Poppet
Bearings (Main and Rod)	Sleeve
Oil Capacity	4 pints w/o filter
Battery Charging System	12 volt, 15 amp Flywheel Alternator

TUNE-UP SPECIFICATIONS

Tappets (Cold) Intake005
Exhaust013
Breaker Point Gap (Full Separation and Engine Cold)025 "
Spark Plug Gap025
Ignition Timing (Engine Not Running, Cold Setting)	* 25° BTC

* - Preferred setting.

DIMENSIONS AND CLEARANCES

All dimensions and clearances given at room temperature of 70°F.
All values in inches unless otherwise specified.

	Minimum	Maximum
CAMSHAFT AND CRANKSHAFT		
Crankshaft Main Bearing Journal to Bearing Clearance	0.0025	0.0038
*Crankshaft End Play	0.006	0.012
Camshaft Bearing to Camshaft	0.0015	0.0030
Camshaft End Play	0.003	
*Crankshaft Rod Journal to Rod Bearing	0.0020	0.0033
Connecting Rod End Play	0.002	0.016
Timing Gear Backlash	0.002	0.003
Oil Pump Gear Backlash	0.002	0.005
PISTON AND CYLINDER		
Piston Pin in Piston	0.0002	0.0004
Piston Pin in Rod	0.0002	0.0007
*Piston Ring Gap in Cylinder	0.010	0.020
Piston Clearance in Cylinder-Measured .10 Below Oil		
Control Ring, 90° from Pin	0.001	0.003
Cylinder Bore - Standard Size	3.1245	3.1255
Crankshaft Main Bearing Journal - Standard Size	1.9992	2.0000
Crankshaft Rod Bearing Journal - Standard Size	1.6252	1.6260
TAPPETS AND VALVES		
*Valve Seat Width	1/32	1/8
*Valve Face Angle		44°
*Valve Seat Angle		45°
Valve Stem to Guide - Intake	0.0010	0.0025
Valve Stem to Guide - Exhaust	0.0035	0.0040
Tappet to Cylinder Block Clearance	0.0015	0.0030
Tappet Adjustment (Cold)		
* Intake		0.005
* Exhaust		0.013

* - Frequently used overhaul values.

ASSEMBLY TORQUES AND SPECIAL TOOLS

BOLT TORQUE	FT.-LB.
Gearcase Cover	8 - 10
Cylinder Head Stud Nuts (Cold)	14 - 16
Rear Bearing Plate Screws	25 - 27
Starter Mounting Bolts	18 - 20
Connecting Rod Bolt	14 - 16
Flywheel Cap Screw	50 - 55
Other 5/16" Cylinder Block	
Stud and Nuts	8 - 10
Oil Base	18 - 23
Manifold Mounting Screws	6 - 10
Oil Pump	7 - 9

The following special tools are available from Onan, for further information see Tool Catalog 900-0019.

- Valve Seat Driver
- Valve Guide Driver
- Oil Guide and Driver
- Combination Bearing Remover (Main and Cam)
- Combination Bearing Driver (Main and Cam)
- Flywheel Puller

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the Complete Manual
Thank you very much!**