Onan

Service Manual

RV GenSets

BF (Spec a-b)
BFA (Spec a-c)
NH (Spec j-p)
BGA (Spec a-c)

900-0337
1-83
Printed in U.S.A.

Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER This symbol warns of immediate hazards which will result in severe personal injury or death.

⚠ WARNING This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

⚠ CAUTION This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

FUEL AND FUMES ARE FLAMMABLE. Fire, explosion, and personal injury can result from improper practices.

- DO NOT fill fuel tanks while engine is running. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible, non–conductive line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

GASOLINE AND LPG FUEL MAY BE ACCIDENTALLY IGNITED BY ELECTRICAL SPARKS, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

- Do not tie electrical wiring to fuel lines.
- Do not run electrical lines and fuel lines through the same compartment openings.
- Keep electrical and fuel lines as far apart as possible.
- Place a physical barrier between fuel lines and electrical lines wherever possible.
- If electrical and fuel lines must pass through the same compartment opening, make certain that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

- Never sleep in the vehicle with the generator set running unless vehicle is equipped with an operating carbon monoxide detector.
- Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator set, disconnect batteries. This will prevent accidental arcing.
- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry while working on generator sets. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Have a fire extinguisher nearby. Maintain extinguisher properly and become familiar with its use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.
- Hot coolants under pressure can cause severe personal injury. DO NOT open a radiator pressure cap while the engine is running. Stop the engine and carefully bleed the system pressure.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which presents a potential fire hazard.
- DO NOT store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Table of Contents

TITLE	PAGE
SAFETY PRECAUTIONS	Inside Cover
INTRODUCTION	2
About this Manual	2
Model Identification	2
SPECIFICATIONS	3
DIMENSIONS AND CLEARANCES	4
TORQUE SPECIFICATIONS	7
PREPARING TO SERVICE	8
Troubleshooting	8
Special Tools	8
Safety Considerations	8
Set Removal	9
ENGINE-PRIMARY SYSTEMS	10
General	10
Engine Troubleshooting Guide	10
Exhaust System	11
Cooling System	13
Fuel System,	14
Ignition System	24
Crankcase Ventilation System	26
CONTROL	28
General	28
Operation Description for BF and NH (Spec J) Control	28
Troubleshooting the BF and NH (Spec J) Control	29
Operation Description for BFA, BGA, and NH (Spec K-P) Control	35
Troubleshooting the BFA, BGA, and NH (Spec K-P) Control	36
GENERATOR	41
Generator Troubleshooting	41
Generator Disassembly	41
Generator Service Procedures	43
Generator Assembly	47
Load Wire Connections	48
ENGINE-BLOCK ASSEMBLY	49
General	49
Oil Filter and Adapter	49
Cylinder Heads	49
Valve System	50
Gear Cover	53
Governor Cup	54
Timing Gears and Camshaft	54
Lubrication System	54
Piston Assembly	55
Crankshaft	59
Cylinder Block	60
Bearings	61
Oil Seals	61
SERVICE CHECKLIST	63
Mounting	63
Lubrication	63
Wiring	63
Initial Start Adjustments	63
Output Check	63
Exhaust System	63
Fuel System	64
Control	64
Mechanical	64

Introduction

ABOUT THIS MANUAL

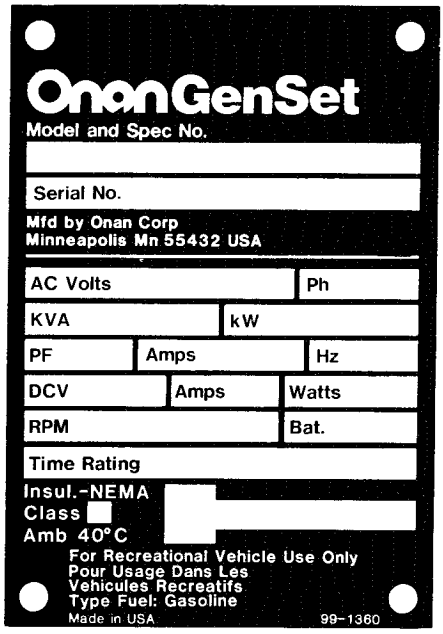
This manual provides service information for Onan B and N series recreational vehicle generator sets. This is a complete service manual for the experienced serviceperson covering troubleshooting, disassembly, repair, reassembly, and adjustments for the engine, generator, and control. It is recommended that the serviceperson be thoroughly familiar with the principles of gasoline engine operation and have a basic knowledge of electrical fundamentals. Other Onan publications such as Electrical/Mechanical Fundamentals (932-0408), Onan Generator Training Manual (932-0404), and Electric Generating Set Training Manual For Recreational Vehicles (932-0402) are recommended as additional sources of information.

Read all service procedures completely before beginning any repair work and observe all cautions and warnings. It is extremely important that the generator set installation maintain compliance with applicable codes and standards for RV installations (see Installation Guide). The most critical areas of concern include the exhaust system, fuel system, electrical wiring, compartment construction, and ventilation system. Improper servicing can create an unsafe installation that might result in damage to the vehicle and equipment or might cause serious personal injury or death to the user.

MODEL IDENTIFICATION

When contacting an Onan Dealer or Distributor, always supply the complete Model No. and Serial No. as shown on the set nameplate. This information is necessary to identify your set when ordering replacement parts.

Always use genuine Onan replacement parts obtained from an authorized Onan Dealer or Distributor. Universal replacement type parts (usually intended for automotive use) often look similar but might not perform to Onan specifications. Only genuine Onan replacement parts are designed and tested for the application to ensure reliable service and dependable operation.



ONAN NAMEPLATE

WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS MIGHT RESULT IN SEVERE PERSONAL INJURY AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

Specifications

MODELS	BF (Spec A-B)	BFA (Spec A-C)	BGA (Spec A-C)	NH (Spec J-P)
GENERAL				
Engine Design	Four Cycle, Air Cooled, Two Cylinder			
Generator Design	Revolving Armature, Four Pole			
Output Ratings	Unity Power Factor			
Starting System	Exciter Cranked, 12 volts			
Engine Speed	1800 r/min			
Weight	217 lbs (99 Kg)	235 lbs (107 Kg)	285 lbs (129 Kg)	305 lbs (138 Kg)
ENGINE DETAILS				
Horsepower	8.5	8.5	10	14.0
Displacement	40.25 in^3 (700 cm^3)	43.3 in^3 (710 cm^3)	47.4 in^3 (782 cm^3)	60.0 in^3 (984 cm^3)
Compression Ratio	7:1	7:1	6.9:1	7.1
Bore	3.125 in (79.38 mm)	3.25 in (82.55 mm)	3.25 in (82.55 mm)	3.56 in (90.42 mm)
Stroke	2.625 in (66.68 mm)	2.625 in (66.68 mm)	2.87 in (72.90 mm)	3.0 in (76.20)
Oil Capacity (with filter)	4 qts (3.8 L)	3.5 qts (3.3 L)	3.5 qts (3.3 L)	3.5 qts (3.3 L)
Fuel	Lead-Free Or Regular Grade Gasoline			
Ventilation	80 in^2 (516 cm^2)	80 in^2 (516 cm^2)	100 in^2 (645 cm^2)	120 in^2 (774 cm^2)
GENERATOR DETAILS				
Watts	4,000	4,000	5,000	6,500
Volts	120/240	120	120/240	120/240
Amps At 120 Volts	33.3	33.3	41.6	54.2
Frequency (Hertz)	60	60	60	60
Phase	Single	Single	Single	Single
Wires	4	2	4	4
Battery Charge Rate	1-1.5 Amps	1-1.5 Amps	1-1.5 Amps	1-1.5 Amps
TUNE UP SPECS				
Spark Plug Gap	0.025 in (0.64 mm)	0.025 in (0.64 mm)	0.025 in (0.64 mm)	0.025 in (0.64 mm)
Ignition Points	0.25 in (0.64 mm)	0.021 in (0.53 mm)	0.021 in (0.53 mm)	0.020 in (0.51 mm)
Ignition Timing (cold)	21°-25° BTC	21° BTC	21° BTC	21° BTC
Valve Lash (cold)				
Intake	0.005 in (0.127 mm)	0.005 in (0.127 mm)	0.005 in (0.127 mm)	0.005 in (0.127 mm)
Exhaust	0.013 in (0.330 mm)	0.013 in (0.330 mm)	0.013 in (0.330 mm)	0.013 in (0.330 mm)

Dimensions And Clearances

Dimensions not in parentheses are INCHES.

MODELS	BF (Spec A-B)	BFA (Spec A-C)	BGA (Spec A-C)	NH (Spec J-P)
CYLINDERS AND PISTON ASSEMBLY				
Cylinder Bore (std size honed)	3.1245-3.1255 (79.362-79.388mm)	3.2490-3.2500 (82.525-82.550mm)		3.5625-3.5635 (90.488-90.513mm)
Cylinder Taper (Max)	0.005 (0.127mm)			
Cylinder Out Of Round (Max)	0.002 (0.051mm)			
Piston Diameter	3.122-3.123 (79.31-79.34mm)	3.243-3.244 (82.37-82.40mm)		3.5600-3.5610 (90.424-90.449mm)
Clearance In Cylinder	0.001-0.003 (.025-.080mm)	0.004-0.006 (0.10-0.15mm)		0.0015-0.0035 (0.038-0.089mm)
Ring Gap	0.0100-0.0200 (0.254-0.508mm)			
Piston Ring #1 (top) Groove Width	0.080-0.081 (2.03-2.06mm)			0.0955-0.0965 (2.426-2.451mm)
Piston Ring #2 Groove Width	0.080-0.081 (2.03-2.06mm)			0.0955-0.0965 (2.426-2.451mm)
Piston Ring #3 Groove Width	0.188-0.189 (4.78-4.80mm)			0.1880-0.1890 (4.775-4.800mm)
Piston Ring #1 (top) Side Clearance	0.002-0.008 (0.051-0.203mm)			
Piston Pin Diameter	0.687-0.688 (17.46-17.47mm)			0.7500-0.7502 (19.050-19.055mm)
Piston Pin Fit In Rod	0.0002-0.0007 (0.005-0.018mm)			
Connecting Rod Side Clearance	0.0020-0.0160 (0.051-0.406mm)			
Connecting Rod Bearing Clearance	0.0020-0.0033 (0.051-0.084mm)			0.0005-0.0023 (0.013-0.058mm)

MODELS	BF (Spec A-B)	BFA (Spec A-C)	BGA (Spec A-C)	NH (Spec J-P)
CRANKSHAFT AND CAMSHAFT				
Crankshaft Main Bearing Journal Diameter	1.9992-2.0000 (50.780-50.800mm)			
Crankshaft Rod Journal Bearing Diameter	1.6252-1.6260 (41.280-41.300mm)			
Crankshaft Main Bearing Diameter (Assembled)	2.0015-2.0040 (50.838-50.902mm)			
Crankshaft Main Bearing Clearance	0.0025-0.0038 (0.064-0.097mm)			
Crankshaft End Play	0.006-0.012 (0.15-0.30mm)			0.0050-0.0090 (0.127-0.229mm)
Camshaft Journal Diameter	1.3740-1.3745 (34.900-34.912mm)			
Camshaft Bearing Diameter (Assembled)	1.3757-1.3787 (34.943-35.019mm)			
Camshaft Bearing Clearance	0.0015-0.0030 (0.038-0.076mm)			
Camshaft End Play	0.003 Min. (0.08mm Min.)			0.0030-0.0120 (0.076-0.305mm)
Camshaft Lift	0.300 (7.62mm)			
VALVES AND LIFTERS				
Valve Spring Free Length (Int and Exh)	1.6620 (42.214mm)			
Valve Spring Compressed Length (Int and Exh)	1.3750 (34.925mm)			
Valve Spring Tension Open (Int and Exh)	71-79 lbs (9.8-10.9N)			
Valve Spring Tension Closed (Int and Exh)	38-42 lbs (5.25-5.8N)			
Valve Face Angle (Int and Exh)	44°			
Valve Seat Angle (Int and Exh)	45°			

MODELS	BF (Spec A-B)	BFA (Spec A-C)	BGA (Spec A-C)	NH (Spec J-P)
Valve Seat Width (Int and Exh)	0.031-0.047 (0.8-1.2mm)			
Valve Stem Diameter (Int)	0.3425-0.3430 (8.700-8.712mm)			
Valve Stem Diameter (Exh)	0.3410-0.3415 (8.661-8.674mm)			0.3410-0.3420 (8.661-8.687mm)
Valve Guide Diameter (Int and Exh)	0.3440-0.3460 (8.738-8.788mm)			
Valve Stem Clearance (Int)	0.0010-0.0025 (0.025-0.064mm)			
Valve Stem Clearance (Exh)	0.002-0.004 (0.06-0.10mm)			0.0025 (0.0635mm)
Valve Lifter Diameter	0.7475-0.7480 (18.987-19.000mm)			
Valve Lifter Bore Diameter	0.7500-0.7515 (19.050-19.088mm)			
Valve Seat Diameter (Int)	1.443-1.444 (36.652-36.678mm)			1.5690-1.5700 (39.853-39.878mm)
Valve Seat Diameter (Exh)	1.192-1.193 (30.28-30.30mm)			1.2550-1.2560 (31.877-31.902mm)
Valve Seat Bore Diameter (Int)	1.4395-1.4405 (36.5633-36.5887mm)			1.5645-1.5655 (39.738-39.784mm)
Valve Seat Bore Diameter (Exh)	1.189-1.190 (30.20-30.23mm)			1.2510-1.2520 (31.775-31.800mm)