Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
612 574-5000

Instruction Sheet
E-317c 12-89

Short Block Modifications - 43 and 48 Cubic Inch Engines

It may be necessary to modify an area or component of the supplied short block, depending on your application. To determine whether a modification is necessary, read through entire instruction sheet. This sheet will describe only the basic modification. For detailed procedures and complete specifications you must refer to the proper engine service manual.

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

GOVERNOR BALL ASSEMBLY

This short block is equipped with a governor assembly consisting of 5 or 10 steel ball bearings located in the camshaft gear. Before assembling the engine, check to see if the number of balls in the replacement governor assembly is the same as the number in the original engine. If not, add or remove balls as required.

BEARING PLATE

Before installing this short block in your equipment, check to see if the bearing plate supplied is compatible in your application. If it is not, reuse your original bearing plate. If reusing original bearing plate, check the main bearing for damage or wear and replace if necessary. Be sure to check the crankshaft endplay if changing bearing plates. Shim as required to adjust endplay.

BREATHER TUBE

When replacing a short block equipped with a valve box cover breather, one of the supplied breather tubes must be used to connect the new breather assembly to the air cleaner. Which breather tube is used depends on which type air cleaner is used. A remote air cleaner will require using the supplied clamp and the clamp from the block being replaced to fasten one end of the breather tube to the air cleaner and the other end to the breather assembly. A standard air cleaner will require the use of the supplied clamp to fasten the end of the breather hose connected to the breather assembly pressed in the engine. The other end of the breather hose inserts into the air cleaner.

CRANKSHAFT BOLT THREADS

The new crankshaft stub end thread pitch may be different from the original engine. Crankshafts with 3/8"-16 UNC have been changed to 3/8"-24 UNF. If using a 3/8" capscrew in the crankshaft stub end, be sure to check the bolt fit in the crankshaft before tightening with a wrench or damage to the crankshaft threads may result.

CRANKSHAFT PTO SPACER

When replacing an engine that has a crankshaft of 1-7/16" diameter and a stub end length of 3-1/16" (measure stub end length, Figure 1), the supplied crankshaft spacer must be installed as shown in Figure 1. If replacing an engine with a stub end length of 2-5/8", do not use the spacer. If installing an electric clutch on the crankshaft, the air gap must be adjusted. Refer to the equipment manufacturer's service manual for the proper adjustment procedure.

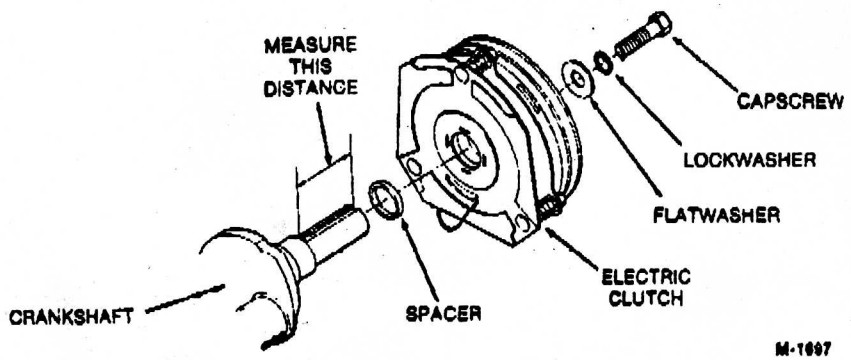


FIGURE 1. PTO SPACER

ENGINE BLOCK HOLES

The two engine block holes above the bearing plate (Figure 2) are through drilled and must be plugged if not used in your application.

⚠WARNING ***Oil leakage resulting from inadequately plugging holes may cause serious personal injury or permanent engine damage. Follow required procedure to plug holes.***

Apply thread sealer to a 3/8"-16 x 5/8" Allen set screw or a 3/8"-16 x 1/2" cap screw with a 3/8" copper flat washer and install in engine block holes.

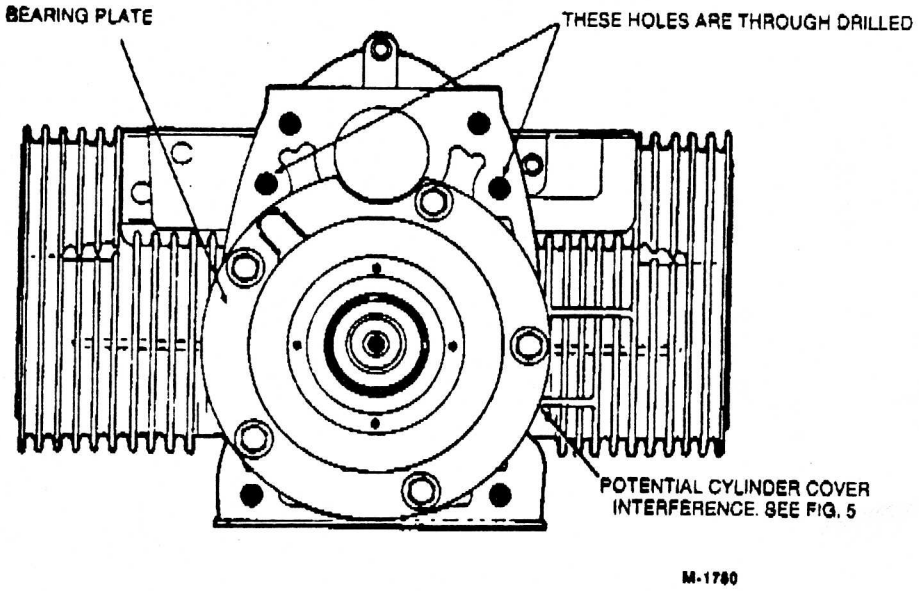


FIGURE 2. ENGINE BLOCK HOLES

STATOR LOCATION

Assemble the stator to the replacement Gearcase cover with the lead connection within the lower 60 degree area as shown in Figure 3.

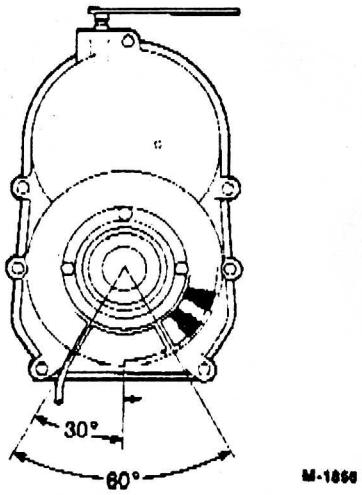


FIGURE 3. STATOR LEAD ORIENTATION

SHEET METAL

Some modifications may be required to allow your sheet metal to be used with the new spec short block. Some short blocks are equipped with the pulse pick-up hose on the gearcase assembly which must be routed to the pulse fitting on the carburetor. Cut out sufficient material in the corner where the front blower housing meets the coil bracket to allow the hose to be routed along the gearcase cover and over the oil bypass area to the carburetor without being pinched. See Figure 4. Avoid cutting sharp notches in the sheet metal to prevent cracking and smooth the rough edges to avoid cutting or damaging the hose during use.

The left side cylinder air housing may interfere with a rib that has been added to the block casting. See Figure 5. Extend the radiused corner up to clear the rib. Again, avoid cutting sharp notches and smooth the rough surface.

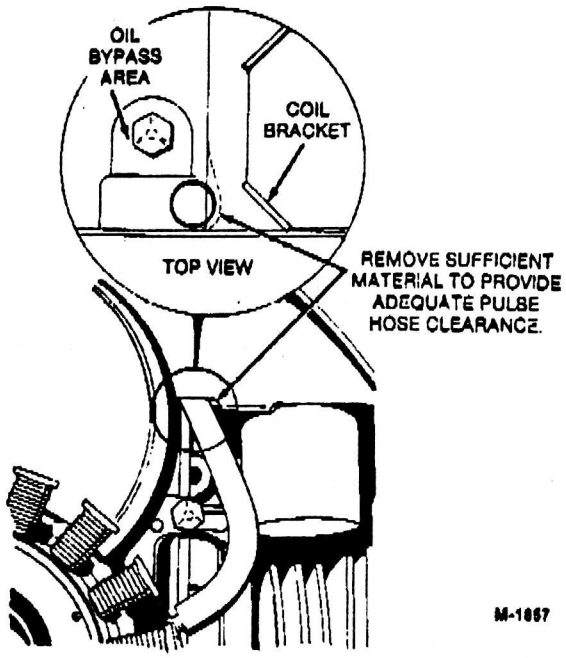


FIGURE 4. PULSE PICK-UP HOSE

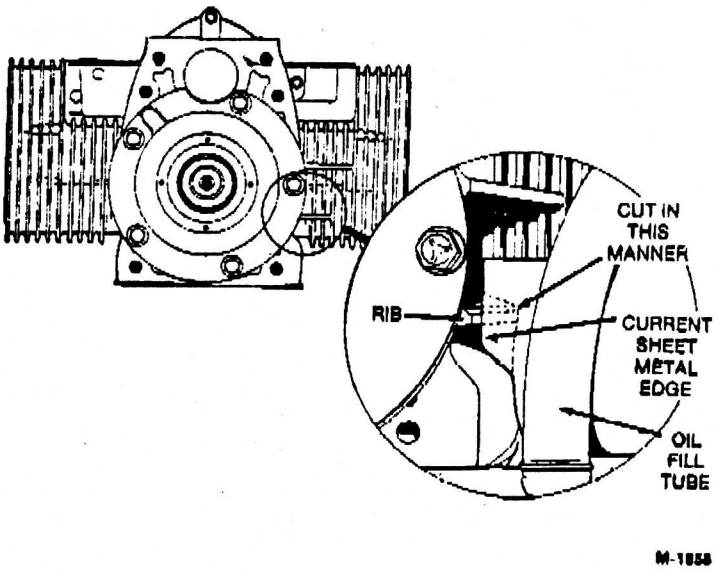


FIGURE 5. CYLINDER AIR HOUSING

"NIKKI" CARBURETOR ADJUSTMENT PROCEDURE

For 1986 Model 226, 446, 448 and 648 Tractors
SUPPLEMENT TO SERVICE MANUAL 9-51392

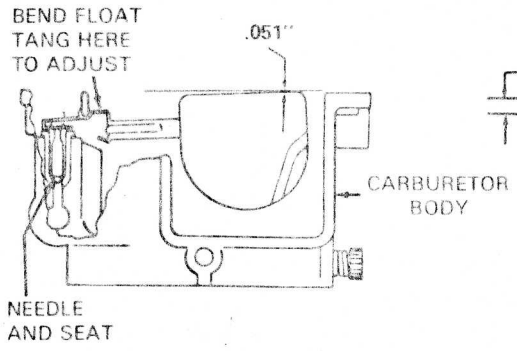
FLOAT ADJUSTMENT

WARNING: IGNITION OF FUEL MIGHT CAUSE SERIOUS PERSONAL INJURY OR DEATH BY FIRE OR EXPLOSION. DO NOT PERMIT ANY FLAME, CIGARETTE OR OTHER IGNITER NEAR THE FUEL SYSTEM.

1. Drain as much fuel as possible from carburetor by starting engine and shutting fuel supply off.
2. Remove and insulate the B + lead at ignition coil. Remove air cleaner and top half of carburetor.
3. Gently push float tang down until needle just seats, measure float level as shown in Figure 1. Adjust float level if necessary. Release float tang and measure float drop as shown in Figure 2. Float drop is the distance from top of the carburetor body to top of the float.
4. Place carburetor top on bowl and fasten, turn fuel supply on and crank engine for 45 seconds (This must be done in 15 second intervals-allow starter to cool for one minute after each 15 second cranking interval). Remove carburetor top to make sure carburetor bowl is full. Measure fuel level in carburetor bowl as shown in Figure 3.
5. Replace top of carburetor and air cleaner. Remove insulation and reconnect B + coil lead. Start engine and check for proper operation.

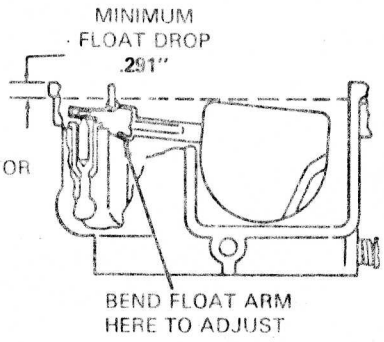
CARBURETORS WITH SPRING ASSIST CHOKE

When checking float level and float drop, measure to float body, not seam.



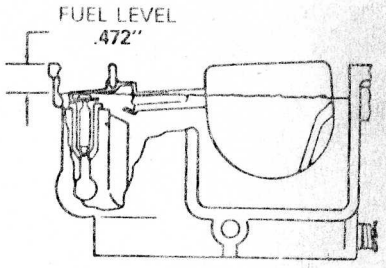
FLOAT LEVEL ADJUSTMENT

FIGURE 1



NO FUEL

FIGURE 2

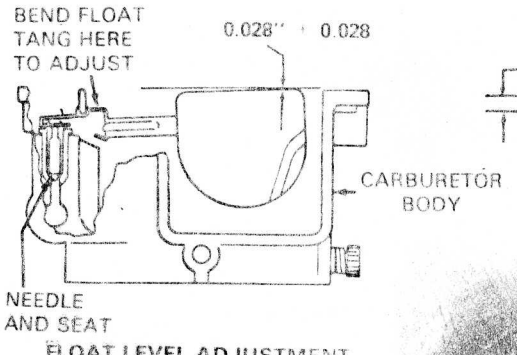


WITH FUEL

FIGURE 3

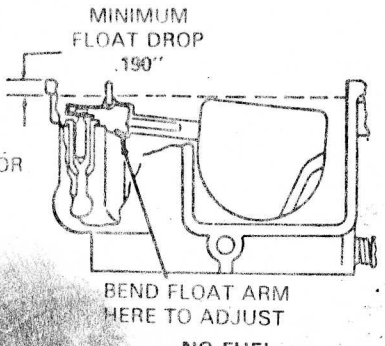
CARBURETORS WITHOUT SPRING ASSIST CHOKE

When checking float level and float drop, measure to float body, not seam.



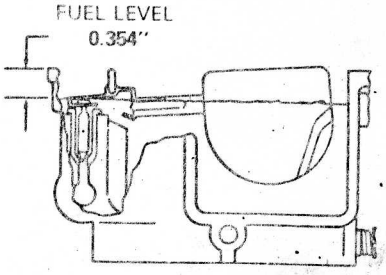
FLOAT LEVEL ADJUSTMENT

FIGURE 1



NO FUEL

FIGURE 2



WITH FUEL

FIGURE 3

INSTRUCTIONS

A. Troubleshooting Procedures for a customer related complaint.

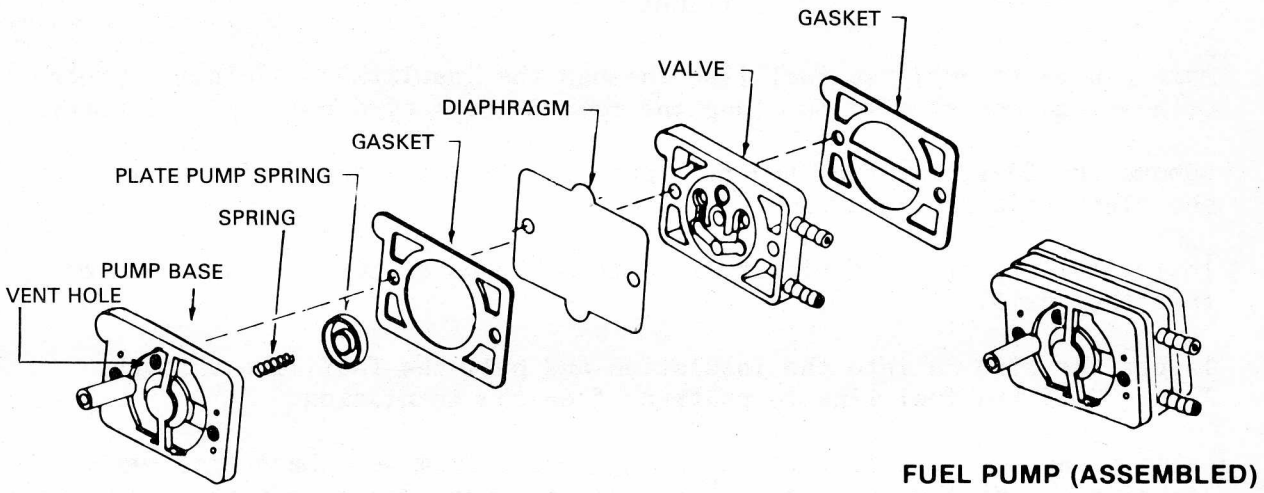
1. Insure that the engine stalling symptom is fuel related. A "quick check" would be to close the choke as the engine stalls. If the engine recovers momentarily, the symptom is confirmed to be fuel related.

2. Insure that the fuel line connection at the fuel pump inlet is tight.

3. Insure that there is free flowing fuel available at the fuel pump inlet. (This will eliminate a kinked or blocked fuel line, blocked fuel strainer and plugged fuel cap vent).

4. Insure that the vacuum line to the fuel pump is securely connected and that the vent hole in the fuel pump cover is open.

5. Insure that the fuel pump is correctly assembled.



EXPLODED VIEW OF FUEL PUMP

B. Installation, P/N C28031, Kit:

1. Remove the air cleaner assembly.

   IMPORTANT: Close the choke plate to prevent accidentally dropped screws or dirt from falling into the intake manifold.

2. Loosen (Do Not remove) the screws which secure the rear cylinder baffles to the pump mounting bracket.

3. Slip the rear cylinder baffle extensions in position. Make certain the corners are closed off. See Figure 1. Tighten the screws.

4. Drill through the rear cylinder baffles and baffle extensions and pop rivet together.

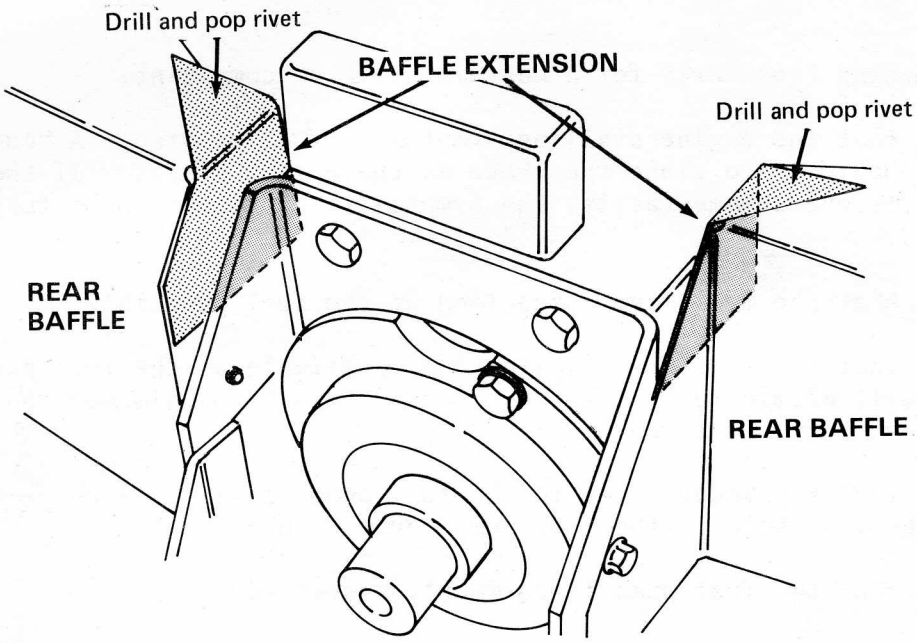


FIGURE 1

5. Make a wire to pull the fuel line through the insulation. Select a piece of heavy mechanics wire 30" long and form 3 loops of a coil 1/2" diameter.

6. Remove the fuel line from the fuel pump inlet. Move the fuel line end to the right side of the carburetor.

7. Insert the tip of the fuel line into the 3 loops of the wire and insure that they grip.

8. Insert the wire up into the insulation and pull the fuel line through. Allow 2" of the fuel line to protrude from the insulation.

   It is necessary to free the insulating sleeve from any "hang ups' or restrictions at the base of the instrument tower area in order to achieve 2" of fuel line protrusion at the top end.

9. Connect the fuel line to the fuel pump inlet. Make sure the fuel line and clamp are secure on the fuel pump inlet.

C. Carburetor Inspection Instructions: (Perform the following checks on carburetors on engines and on P/N C27507 carburetors in parts stock)

1. Remove the air cleaner assembly if not previously removed.

   IMPORTANT: Close the choke plate to prevent accidentally dropped screws or dirt from falling into the intake manifold.

2. Remove the carburetor upper body. See Figure 2.

3. Remove the hinge pin and float spring. See Figure 3.

4. Remove the gasket.

5. A. Inspect the entire carburetor (both upper and lower bodies) for obvious flaws that might:

   1. Prevent the gasket from sealing properly (especially at the fuel port). See Figure 3.
   2. Damage the gasket.
   3. Prevent proper operation of the carburetor.

   Replace the carburetor if a flaw is found.

   B. Check the size of the air bleed orifice. A NUMBER 71 (.026") drill bit must fit easily into the orifice hole. See Figure 2.

   Replace the carburetor if the orifice is undersized.

6. Install the gasket.

7. Install the float as show in the illustration. MAKE CERTAIN THE FLOAT SPRING AND NEEDLE VALVE CLIP ARE INSTALLED AS SHOWN IN THE CORRECT ILLUSTRATION.

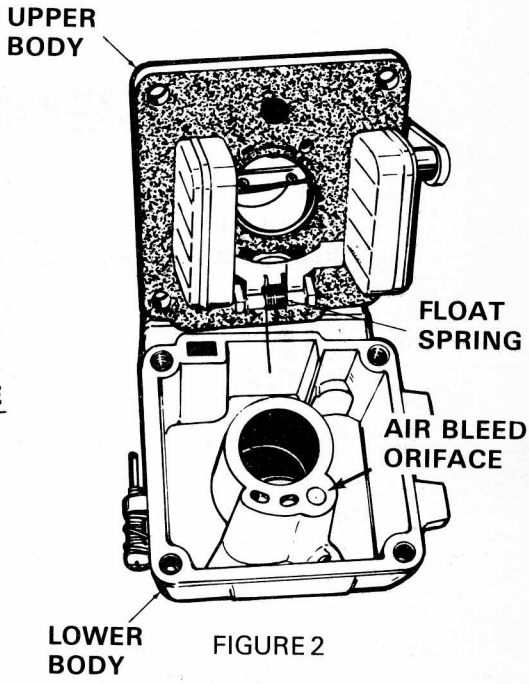


FIGURE 2

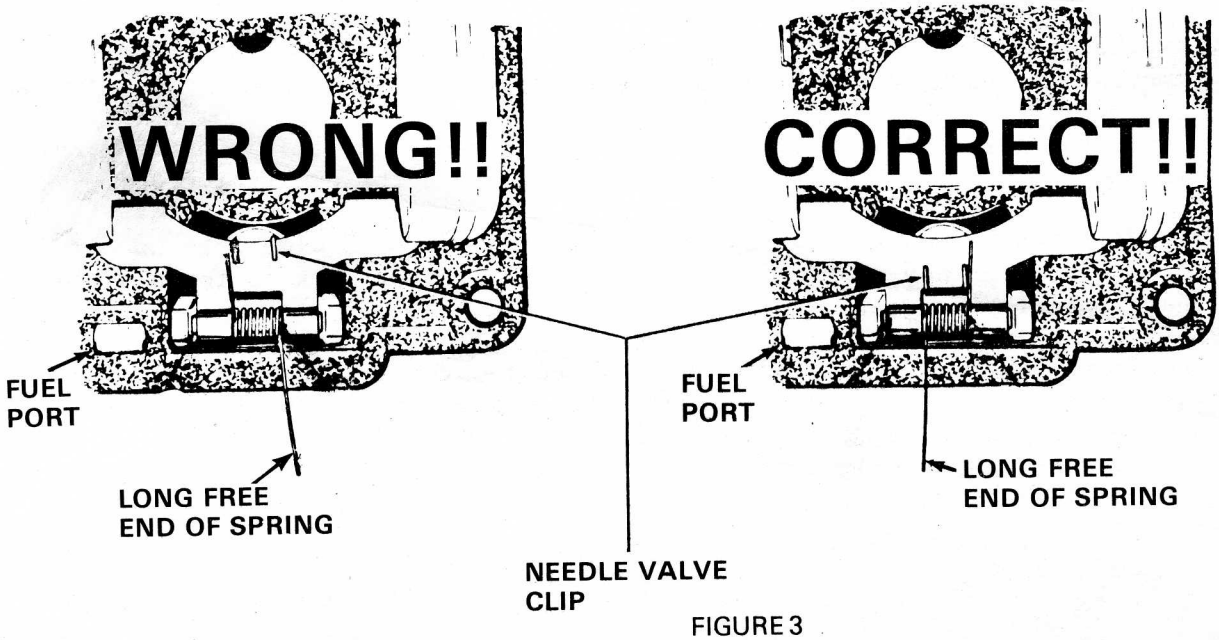


FIGURE 3

8. Reinstall the needle valve clip so it hooks over the float from the hinge pin side.

9. Reinstall the float spring with the long free end pointing away from the float and on the side closest to the fuel inlet passage. Correctly reinstalled the float spring will be "unwinding" as the float sinks. When installed incorrectly the spring tension will prevent the float from providing the proper fuel level.

10. Set the float level between 3/32" and 1/8" between the gasket and float body (not float seam) with the gasket installed. Use a 3/32" drill bit as a "feeler" gauge to help set the float. Insure that both halves of the float are even with each other.

11. Remove the idle jet and main jet needle valves.

12. Flush through all passages using an aerosol can of carburetor cleaner with the plastic straw affixed to the nozzle of the aerosol can.

13. Reinstall the needle valves and adjust the idle fuel needle valve to 1-1/8 turns open and the main fuel needle valve to 1-1/4 turns open. Readjust as required after completing this procedure.

14. Assemble the upper carburetor body to the lower body insuring that the long free end of the helper spring is inserted inside the lower body. See Figure 2.

15. Tighten the carburetor screws to a torque of 25 inch pounds.

IMPORTANT: Close the choke plate to prevent accidentally dropped screws or dirt from falling into the intake manifold.

NOTE: LEAVE THE AIR CLEANER ASSEMBLY OFF until the ignition timing procedure is completed.

D. Ignition Timing Instructions

1. View the timing marks through the opening in the blower housing after removing the carburetor air intake hose.

2. Rotate the flywheel in a clockwise direction until the ("Top Center") mark lines up with the 21° (Before Top Center) mark on the cam gear cover.

The "Top Center" mark is a raised line on one of the 3 wide webs on the outer circumference of the flywheel. The Top Center mark is forward of the flywheel ring gear.

The degree marks are located on the cam gear cover just behind the flywheel ring gear. The degree numbers are raised numerals on the rear lip of the cam gear cover.

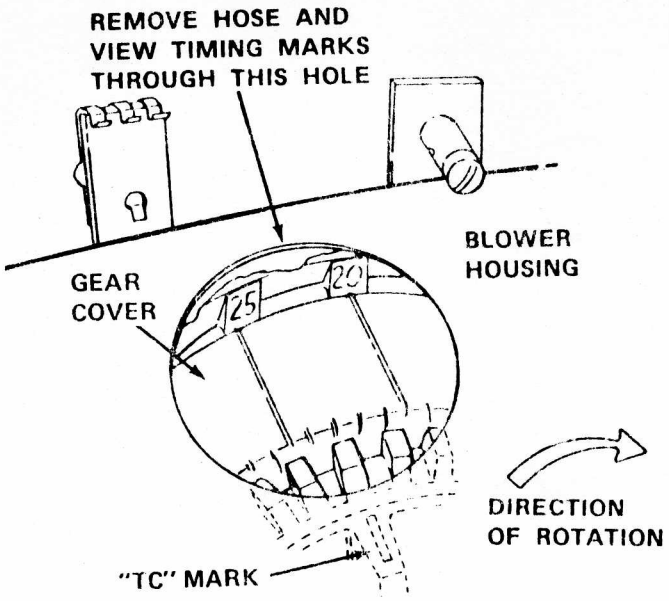


FIGURE 4

3. Before starting the engine, mark a line across the rotating air screen and the blower housing. This new, easier to view, timing mark will then be used to correctly time the engine.

4. Connect the timing light in accordance with its manufacturer's instructions. Use either spark plug because they fire at the same time.

5. Make sure that nothing can enter the carburetor throat.

6. Start and run the engine. If necessary, change the breaker point gap until the timing marks line up.

7. Install the air cleaner assembly. Insure that the choke cable is installed correctly.

E. Instructions for P/N C27506 Brass Floats in Service Parts:

Please check and correct, if necessary, the illustrations on the instruction sheets packaged with P/N C27506 brass floats. Refer to Figure 3.

INGERSOLL PARTS BULLETIN

ISP - 2

DATE: August, 1985

TOPIC: PREMATURE FAILURE OF ONAN CONDENSER -- PART NO. C 23855

MODELS: 226, 446, 448, 648

EFFECTIVE: IMMEDIATELY

Ingersoll Service Department has been receiving reports of erratic engine operation caused by premature ignition condenser failure of Part No. C 23855. The symptoms are:

1] Engine backfires or mis-fires.

2] Engine quits or will not start.

3] Ignition points arcing excessively/continuously.

There are two causes of premature condenser failures:

1] Some C 23855 condensers manufactured by E.U.C. (identified by E.U.C. stamped on the bottom and 321-0244 stamped on the side of the condenser) can have an improperly soldered condenser lead. (See FIGURE 1. (A).

2] Some C 23855 condensers manufactured by Phelon (identified by 312-0246 stamped on the bottom) can breakdown in applications when condenser temperature exceeds manufacturer's guidelines. See FIGURE 1. (B).

To eliminate potential field problems with these condensers, upon receipt of this bulletin, initiate the following action:

1] Remove all C 23855 condensers from your stock and from C 23853 ignition assemblies in your stock.

2] Submit a properly completed Service Adjustment Request for the quantity of C 23855 condensers you have removed from your stock to:

Ingersoll Equipment Co., Inc.
119 South First Street
Winneconne, Wisconsin 54986

See the attached Service Adjustment Request sample.

-OVER-

3] Return the part No. C 23855 condensers to:

Onan Engine Products
1400 - 73rd Avenue, N.E.
Minneapolis, Minnesota 55432

Attention Mr. Don Kimball
Warranty Parts Return

IMPORTANT: BE SURE TO INCLUDE THE BLUE PACKING SLIP COPY OF THE SAR WITH THE RETURNED CONDENSERS.

4] Order a sufficient quantity of the new C 29479 condensers for your stock and for the C 23853 ignition assemblies in your stock from:

Ingersoll Service Parts
3600 Moser Street
Oshkosh, Wisconsin 54903

See FIGURE 2.

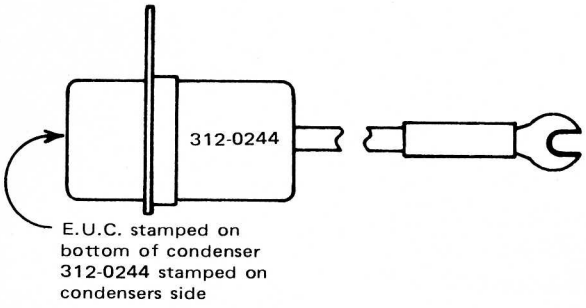


FIGURE 1. (A) **WRONG**

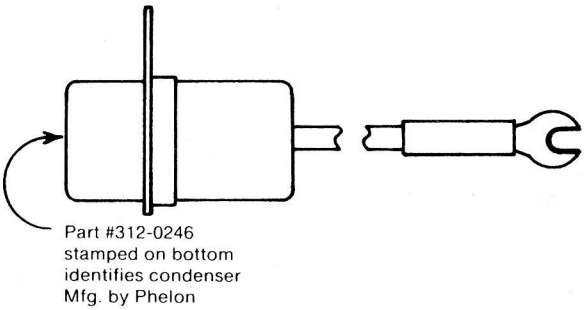


FIGURE 1. (B) **WRONG**

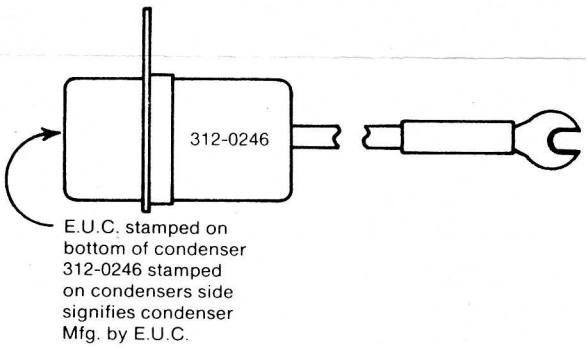


FIGURE 2. **CORRECT**

Ingersoll Equipment Co., Inc.
119 South First Street
Winneconne, WI 54986-9576

Printed in U.S.A.

Ingersoll

INGERSOLL
Ingersoll Equipment Co., Inc.

Exclusive Manufacturer of
JICase Outdoor Power Equipment

SERVICE BULLETIN

June 1, 1985

#85-2

Supercedes Bulletin
#84-1

DIRECTED TO: ALL INGERSOLL/CASE LAWN & GARDEN TRACTOR DEALERS

ATTENTION: DEALER PRINCIPAL
SERVICE MANAGER
PARTS MANAGER

SUBJECT: Vapor Lock Symptoms - Models 226, 446, 448 Tractor and 648 Loaders with Onan Engines

ACTION TO BE TAKEN: (See Instructions Attached)

1. Check and correct all affected 226, 446, 448 tractors and 648 loader tractors during predelivery inspection or if tractor exhibits vapor lock symptoms.
2. Check and correct all P/N C27507 carburetor assemblies with date code of 12-84 and earlier that are in your parts stock.
3. Install the float spring correctly.
4. Set float level to between 3/32" and 1/8".
5. Inspect carburetor for contamination or blocked passages.
6. Check and correct instruction sheets packaged with all P/N C27506 brass floats that are in your parts stock.
7. Install P/N C28031 kit (fuel line insulation and baffle extensions) if not previously installed or not factory installed.
8. Check the ignition timing and adjust if necessary.

PURPOSE:

1. The purpose of the C28031 Kit is to:
   a. Reduce heat at the carburetor by installing 2 baffle extensions on the rear cylinder baffles.
   b. Keep the fuel supply cooler by installing insulation on the fuel line.

PURPOSE: (CONTINUED)

2. The purpose of checking the float spring for correct installation and setting the float level is to:

   a. Insure proper fuel level in the carburetor float bowl.

   NOTE: Low fuel level in the carburetor float bowl can produce vapor lock symptoms.

3. The purpose of inspecting and cleaning the carburetor is to insure that no foreign material is lodged in the carburetor passages.

4. The purpose of checking ignition timing is to insure the proper setting of 21° before top center. Advanced ignition timing can cause excessive engine heat.

AFFECTED TRACTORS:

1. All inventory units within the following P.I.N. ranges. All retail units within warranty which display a vapor lock symptom within the following P.I.N. ranges.

   NOTE: All 16 H.P. and 18 H.P. tractors shipped after May 21, 1985 have had the above carburetor checks performed at the factory.

TRACTOR MODEL	KIT PLUS SPRING/FLOAT CHECK	SPRING/FLOAT CHECK
226	P.I.N. 14057825 through P.I.N. 14058175	P.I.N. 14057825 through P.I.N. 14071641
446	P.I.N. 14060239 through P.I.N. 14060930	P.I.N. 14060239 through P.I.N. 14073858
448	P.I.N. 14062249 through P.I.N. 14062726	P.I.N. 14062249 through P.I.N. 14075635
648		P.I.N. 14063873 through P.I.N. 14076832

The following numbers within the P.I.N. ranges (listed above) have already been corrected at the Ingersoll Factory and do not require further modification.

MODEL 226

14058073	14071524	14071534	14071591	14071608	14071628
14058076	14071525	14071535	14071592	14071609	14071629
14058097	14071526	14071557	14071595	14071610	14071630
14058098	14071527	14071578	14071596	14071611	14071631
14058298	14071530	14071589	14071600	14071612	14071632
14058299	14071531	14071590	14071604	14071626	14071633

MODEL 446

14073621	14073696	14073719	14073760	14073817	14073840
14073622	14073698	14073720	14073761	14073819	14073843
14073623	14073709	14073723	14073763	14073825	14073844
14073640	14073710	14073730	14073783	14073826	14073846
14073641	14073711	14073741	14073809	14073830	14073847
14073644	14073715	14073742	14073810	14073832	14073848
14073687	14073716	14073743	14073811	14073834	14073849
14073689	14073717	14073747	14073815	14073838	14073851
14073690	14073718	14073759	14073816	14073839	14073854
14073695					

MODEL 448

14075397	14075497	14075535	14075564	14075595	14075619
14075458	14075500	14075539	14075571	14075596	14075621
14075459	14075501	14075540	14075572	14075597	14075622
14075469	14075512	14075543	14075573	14075601	14075623
14075477	14075513	14075544	14075583	14075606	14075624
14075488	14075514	14075545	14075584	14075608	14075625
14075490	14075515	14075546	14075585	14075610	14075626
14075491	14075516	14075547	14075587	14075612	14075627
14075492	14075517	14075548	14075588	14075613	14075628
14075493	14075518	14075549	14075589	14075615	14075629
14075494	14075519	14075550	14075591	14075616	14075630
14075495	14075533	14075551	14075592	14075617	14075631
14075496	14075534	14075563	14075594	14075618	14075632

2. A11 P/N C27507 carburetors in dealer service parts stock.

3. A11 P/N C27506 brass float kits in dealer service parts stock.

PARTS INFORMATION:

Part Number C28031 Kit is available at no charge from:

INGERSOLL SERVICE PARTS
3600 Moser Street
Oshkosh, WI 54903

Other parts needed for the repair should be obtained from Ingersoll Service Parts by using your normal ordering procedure.

INSTALLATION INSTRUCTIONS:

A copy of the instructions is attached.

ACCOUNTING:

LABOR: DESCRIPTION	DEALER STOCK	SOLD AT RETAIL
Carburetor and ignition timing inspection only	0.4 hours	1.4 hours
Carburetor and ignition timing inspection and kit installation	0.7 hours	1.7 hours
Carburetor and ignition timing inspection and carburetor replacement	0.9 hours	1.9 hours
Inspection of carburetor in dealer parts stock	0.2 hours	---------

REIMBURSEMENT:

The cost of labor at your registered rate can be recovered by submitting a Service Adjustment Request. See attached samples.

1. Use Prime Part C27506.

2. Use Service Code 275.

3. Use Job Code 38237C.

4. In Remarks Section Enter: Ingersoll Service Bulletin #85-2.

NOTE: Do not enter any other warranty requests on this Service Adjustment Request.

Attachment

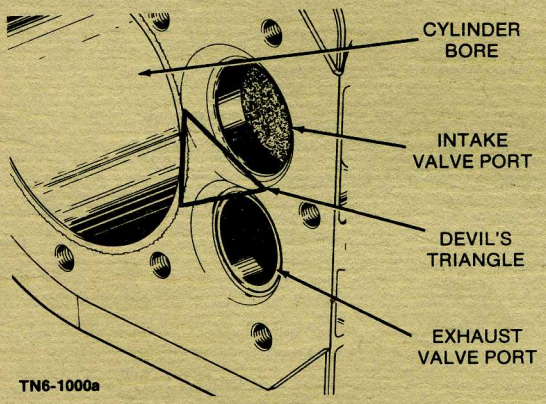
ENGINE BLOCK DESIGN: USING THE RIGHT MATERIAL IN THE RIGHT PLACE

Heat — A Design Problem

When gasoline is ignited in an internal combustion engine, an enormous amount of energy is released—only about a third of which is transformed into usable mechanical power. Almost all the rest leaves the engine in the form of intense heat. This heat is directly responsible for much of the wear that occurs in engine block components and, as such, is one of the most important considerations in engine design.

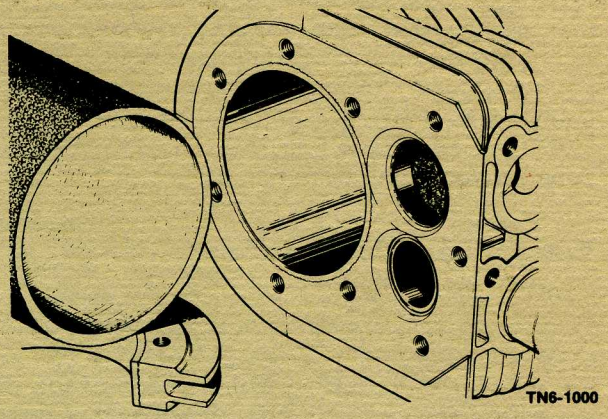
Devil's Triangle

In an L-head engine, the greatest heat build-up occurs in an area between the hot cylinder bore, the super hot exhaust port, and the cool intake port. Engineers often refer to this area as the "devil's triangle" because of the design problems it creates. Cooling the triangle is essential to avoid cylinder-bore and valve-seat distortion and to prevent oil-film burning (followed by surface erosion of the piston and cylinder wall). L-head engine design, however, makes cooling this area difficult.



THE DEVIL'S TRIANGLE

In L-head engines, both the intake and exhaust valves are located in the cylinder block next to the cylinder bore. L-head engines are popular in the small engine market because they are more compact, easier to service, and lighter than similar overhead-valve or overhead-cam engines. L-head design requires that valve ports be located very close to the cylinder bore. If they are not, the combustion chamber becomes too large to achieve high enough compression ratios for reasonable engine efficiency. Unfortunately, such valve-port positioning severely limits the size of the devil's triangle and restricts the passage of cooling air beneath it. If the triangle is enlarged to increase cooling-air flow, compression ratios are reduced. If the roof of the combustion chamber is lowered to bring compression ratios back up, gas flow between



the valve ports and the cylinder bore is restricted and efficiency is reduced.

Fuel Economy

Because air flow is restricted, fuel is used for cooling the triangle in many cast iron air-cooled engines. The engine carburetor is set to provide an extremely rich fuel-air mixture so that excess fuel is available for heat absorption. This method of cooling is a compromise at best. A rich fuel mixture often causes a washing down of cylinder-wall lubricants resulting in premature cylinder-bore wear and piston scuffing. It also reduces engine performance and increases fuel consumption (at a time when fuel economy is so important).

Onan's Solution: An Aluminum Cylinder Block

Onan has solved the problem of the devil's triangle by using an aluminum cylinder block. With an aluminum block, fuel cooling is unnecessary because heat transfer occurs three times faster than it does with cast iron—fast enough to avoid heat build-up problems. Aluminum also maximizes the effectiveness of engine cooling-air by transferring heat evenly to the far reaches of the cooling fins. And because aluminum weighs only about a third as much as cast iron, the horsepower-to-weight ratio of the engine is also dramatically improved.

Design Considerations

Aluminum blocks, however, do require some special design considerations. The softness of aluminum makes it unsuitable for areas that are subject to heavy rubbing or pounding; it also limits its ability to withstand hot, corrosive gases. To overcome this, inserts made of harder metals are used in areas where aluminum is not suitable. Design consideration must then

be given to the difference in thermal expansion of aluminum and that of most harder metals.

The thermal expansion rate of a material is the measure of how much it expands when heated. Compared to most metals, the coefficient of expansion of aluminum is quite high (about twice that of cast iron). Using hard metal inserts in an aluminum block can result in a situation where an insert, tightly press-fitted into a cylinder block at room temperature, will literally fall out as the engine reaches operating temperatures and the aluminum expands. To avoid such problems, Onan carefully selects materials for each insert on the basis of the environment they must withstand and the effect thermal expansion would have on their bond with aluminum.

Tough, Hard Valve Seats That Stay in Place

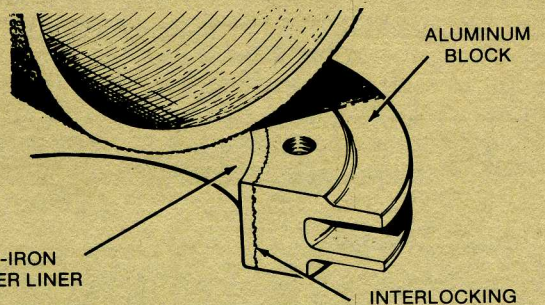
Onan valve-seat inserts are designed to withstand the constant pounding of intake and exhaust valves and yet still offer the flexibility of being replaceable if they are ever damaged or worn. Intake seat inserts are made of Ni-Resist stainless steel, a metal which offers excellent resistance to wear and has the unique advantage of a thermal expansion rate near that of aluminum. Consequently, the valve seats expand with the surrounding aluminum and retain their press-fit bond throughout the life of the engine.

Exhaust valve seats are subject to an extremely harsh environment. They must withstand the pounding of the exhaust valves, the high temperatures of exhaust heat, and the corrosive effect of exhaust gases. To meet the demands of this environment, Onan uses pressed-in seats made of hard chrome-cobalt. This premium insert material has a very hard wear surface and easily withstands the effects of extreme heat. These inserts are only moderately affected by thermal expansion because exhaust heat keeps them much hotter than the surrounding aluminum.

Optimum Cylinder Design

Aluminum, of course, *can* be used for cylinder bores. In fact it often is in aluminum-block engines of lesser durability. But aluminum just does not provide the rugged, long-lasting wear surface that Onan demands from its engines. For this reason Onan uses hardened cast iron cylinder liners—made thick to resist distortion and to allow reboring to 0.040-in. The cast iron in these liners is specially formulated for cylinder-bore use—unlike that used in cast iron block engines where other design parameters must be considered.

To hold these liners firmly in place, Onan incorporates a special casting process that resists the effects of thermal expansion. Before liners are cast, a very coarse ceramic material is centrifugally cast onto the walls of the die. Cast iron is then built up on the mold wall to the proper thickness. After the liner has cooled, the ceramic is removed chemically, leaving the liner with an extremely rough outer surface. Aluminum is then die-cast molded around the liner at extremely high pressures so that it fills all the irregularities in the liner surface. The resulting mechanical bond is so intimate that even if a small section of liner and block were to be removed, the two metals could not be pried apart. This interlocking bond not only keeps the liners tight, but it also increases heat-transfer to engine cooling fins and results in a cooler cylinder bore.



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Durability and Light Weight

In the manufacture of small engines, an almost traditional approach has been to use aluminum when weight is of paramount concern and cast iron when durability is of prime importance. Onan aluminum-block engines make such compromises unnecessary. By incorporating the right material for each cylinder block function Onan provides the advantages of light-weight aluminum in engines that have the durability and strength of cast iron.

In a number of ways Onan aluminum engines are even more durable than those made of cast iron. By minimizing the effects of heat, they provide longer cylinder-bore life, lessen the chance of valve failure, and extend the time between oil changes. Because horsepower-to-weight ratio is improved (and the need for fuel cooling is eliminated) fuel consumption is also reduced. With such advantages as these, the choice of an Onan aluminum-block engine is little more than an exercise in sound judgment.

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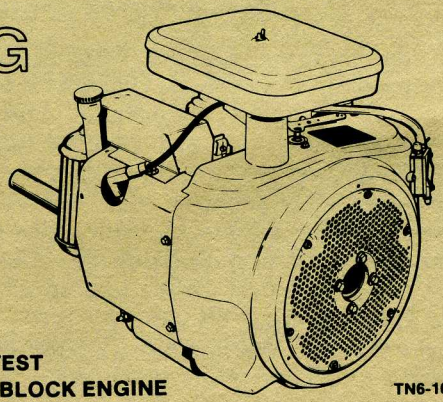

ONAN'S LATEST ALUMINUM-BLOCK ENGINE

TN6-1001

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