INSTRUCTION MANUAL

Superior ENGINES

ENGINE DIVISION NSCO THE NATIONAL SUPPLY COMPANY

ATLAS Imperial DIESEL ENGINES

CARE

OPERATION

PARTS LIST

MANUFACTURED BY

THE NATIONAL SUPPLY COMPANY

Engine Division

28. Sept 2023

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These instructions are arranged alphabetically, in sections, each section dealing with a specific subject or sub-division of the engine.

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GENERAL ENGINE DATA

The Atlas Imperial Diesel Engine described herein is of the heavy duty, solid injection, full Diesel type, designed especially for the reliability and a long life of trouble-free operation. It operates on the four stroke cycle, the sequence of operation being as follows:

<u>1st Stroke</u> On the downward or suction stroke of the piston, the inlet valve is open and pure air is drawn into the cylinder through the air inlet manifold.

<u>2nd Stroke</u> On the second or compression stroke, this air is compressed to about 400 lbs. per square inch, the heat of compression raising the air temperature to a point above the ignition temperature of the fuel. Just before the piston reaches top center fuel injection starts and is completed shortly after the piston has passed the top dead center.

<u>3rd Stroke</u> On the power stroke the injected fuel oil burns, increasing the pressure within the cylinder, which drives the piston down through its working stroke. Shortly before bottom center position is reached, the exhaust valve opens.

<u>4th Stroke</u> As the piston returns toward the head, the burned gases are forced out through the exhaust valve port, and as the piston reaches top center the exhaust valve is closed, the inlet valve is opened, and the cycle is repeated.

The horsepower rating and the rated speed of the engines are stamped on the engine nameplate and these ratings should never be exceeded.

On the nameplate will also be found the engine serial number which should always be stated when ordering parts and in any correspondence with the factory or Sales agencies. The firing order, valve timing and the model designation will also be found on the engine nameplate. When corresponding or ordering parts it is desirable that the model number be stated also. The engine serial number is, however, more important and if the model number is not known the number of cylinders and the bore and stroke of the engine may be stated.

The number of orifices, the orifice diameter and the angle of the orifices in the spray valve tip are also stamped on the engine nameplate. The number of holes or orifices is stamped first, followed by the diameter of the holes in thousandths and in turn followed by the hole angle in degrees. For example, 5-10-20 indicates a spray valve tip which has five holes or orifices of .010" diameter. The axis of the holes or orifices are inclined 20° with the horizontal. If ordering spray valve tips the stamping on the nameplate should be stated.

The following data applies to the following six cylinder engines:

Models 6HM2124 -- 6HM2124SC -- 6HMT2124 -- 6HMT2124SC
6HS2124 -- 6HST2124

BORE - - - - - - - 13"   STROKE - - - - - - - - 16"

HORSEPOWER and OPERATING SPEED -- See engine name plate.

Firing Order -- The firing order may vary due to rotation or hand of engine and therefore this data should be taken from the engine name plate. No. 1 Cylinder is at forward or Governor end of engine.

WEIGHTS:

Cylinder Head Assem - - - - - - - - - - - 640 lbs. (Approx.)
Piston & Connecting Rod - - - - - - - - - 450 lbs. (Approx.)

PRESSURES:

Lubricating Oil Pressure- - - - - - - - - 25 to 40 lbs./Sq.In.
Cooling Water (at Pump discharge) - - - - 20 lbs./Sq.In. MAX.
Note -- Applies to marine engines and only on stationary engines equipped with an Atlas inbuilt pump.
Fuel Oil (at Transfer Pump discharge) - - 10 lbs./Sq.In. MAX.
Fuel Oil (In Rail)- - - - - - - - - - - - 1500 to 4500 lbs./Sq.In.
Starting Air Pressure - - - - - - - - - - 125 to 250 lbs./Sq.In.

TEMPERATURES:

Cooling Water - Engine Outlet
Direct Cooling (Raw Water) - - - - - 125° F. Max.
Indirect Cooling (Closed System) - - 160° F. Max.
Lubricating Oil - Cooler Outlet - - - - - 140° F. Max.
Exhaust Temperature (taken at Cylinder Head)
Full load and full speed - 750° F. Max.

FUEL AND LUBRICATING OILS

1. RECOMMENDED FUEL OIL SPECIFICATION

Viscosity	35 to 70 S.U. Seconds at 100° F.
Gravity (A.P.I.)	Minimum 24°
Conradson Carbon (A.S.T.M.-D189)	Maximum 0.5%
Ash	Maximum 0.05%
B.S.&W.	Maximum 0.1%
Sulphur (A.S.T.M.-D129)	Maximum 1.0%
Ignition Quality	40 to 60 Cetane Number or equivalent in other ignition index.

2. EFFECT OF FUEL PROPERTIES ON PERFORMANCE

As adjusted at the factory the engine will operate satisfactorily on fuels with viscosities per above specification. It is possible to use thinner fuels but the operation is apt to be "snappy" and it may be difficult to maintain even cylinder load balance at varying loads. Fuels with viscosities less than 35 S.U.S. may also require special spray tips with smaller orifice holes than standard or the fuel pressure may have to be reduced. On the other hand fuels with high viscosities may require larger spray orifices than standard, increased fuel pressure and in extreme cases longer period of injection. To insure good operation it is recommended that the viscosity be held to the specification.

The gravity is of secondary importance. A minimum of 24° A.P.I. is merely given since heavier fuels generally require special treatment, such as heating and centrifuging, before they can be burned successfully.

The "Conradson Carbon" or "Carbon Residue" in the oil is an index to the amount of carbon which will form in the combustion chamber. Fuels with high "Conradson Carbon" may cause carbon to build up on the spray valve tips to such an extent that the fuel sprays are deflected causing poor operation and smoky exhaust. The higher the Conradson Carbon the more frequently will it be necessary to clean the spray valve tips. Experience also indicates that maintenance costs will be higher when fuels with high "Carbon Residues" are used.

The Ash content of a fuel is a measure of the amount of mineral material it contains. After burning the mineral residues are abrasive and it is consequently important that the Ash content be limited to 0.05%. If the content is higher rapid wear of cylinder liners, pistons and rings will result.

The item B.S.&W. (Bottom Sediment and Water) is an index to the fuel's cleanliness. It is good economy to use clean fuel and store it in clean tanks. Cleanliness in handling the fuel is also important (See paragraph entitled "Importance of Cleanliness in Fuel Handling" in Section N).

When the fuel oil is consumed in the engine Sulphur burns to Sulphur-dioxide. Under normal operating conditions most of this gas is ejected with the exhaust gases. If, however, temperature conditions are low enough, that is, if the engine is idling at low speed and under cold conditions, the sulphur-dioxide gas combines with condensed water vapors to form a corrosive acid which will attack metals used in the engine and exhaust system. It is consequently particularly important to hold the sulphur content low in fuels used for engines subject to variable loads with long periods of idling and also for engines subject to frequent starting and stopping.

The Cetane number of a fuel is an index of the ignition quality. Low Cetane values produce excessive knocking. Excessively high Cetane fuels cause high exhaust temperatures and smokiness of the exhaust.

Although the Flash Point does not affect the suitability of a diesel fuel it is well to specify a minimum of 150° F. since state laws and Classification Societies generally require this minimum. The Pour Point of the fuel should be at least 15° F. below the lowest temperature to which the fuel storage tank is subjected.

3. LUBRICATING OIL

We recommend that a good grade of Marine type pure mineral oil be used in these engines. The oil should be stable under the temperature conditions encountered in the engine and should be resistant to oxidation and sludging. In general, regarding quality of lubricating oil we refer you to a Lubrication Instruction Book which will be sent to any customer or operator requesting it. This book contains some good pointers on the selection and care of lubricating oils.

It is not necessary to use compounded oils, i.e., oils containing additives, inhibitors, anti-oxidants, carbon removers, etc. in Atlas Engines. There are, however, many good compounded oils on the market and these may be used providing extreme caution is exercised and the action of the oil in the engine is observed closely.

When a pure or "straight" mineral oil is used some carbon or other deposits will generally be found in the crankcase and sump tank. The amount of these deposits depend greatly on the quality of the oil which has been used and for good grades of oil the deposits are not excessive and in any way harmful to the engine. The chemicals contained in the compounded oils enable these oils to carry the carbon and other constituents of the usual crankcase deposits in suspension. The compounded oils also have a strong tendency to break loose and carry away any existing crankcase deposits and since there is a limit to the amount that can be carried in suspension clogging of filters and oil lines may result. It is consequently of utmost importance to thoroughly clean out the crankcase, oil lines and sump tank before changing from a straight mineral oil to a compounded oil. As an added precaution we suggest that the first batch of compounded oil be used only for about 25 hours and then drained off. These precautions apply also when changing from one compounded oil to another compounded oil of different make or brand.

If a compounded oil is used the non-corrosiveness of this oil must be looked into very carefully. In this connection the Engineering Dept. of the Atlas Imperial Diesel Engine Co. is available for consultation and they will be glad to advise whether or not an oil is suitable for use in this engine.

With regard to viscosity grade our recommendations are that the viscosity at 130° F. be between 235 and 270 Secs. Saybolt Universal. This corresponds to an S.A.E. viscosity rating of 30 to 40. In other words, the oil to be used should be a heavy S.A.E. 30 or a light S.A.E. 40 oil.

In regard to drainage periods we suggest that the first batch of oil be drained after 100 hours of service. Thereafter the suggested drainage period is 200 to 250 hours. This period may be lengthened somewhat on engines which are equipped with waste packed filters. In that case if the filter cartridge is changed before the oil is badly discolored and loaded up with insolubles or foreign particles, drainage periods of 400 to 600 hours can be used. In the cases where no waste packed filters are used the oil will of course not be "worn out" after 200 hours of service if it is of a good grade. It will, however, be dirty and will contain insolubles which should be removed from the lubricating oil before it is re-used.

The same lubricating oil as used in the crankcase of the engine is also suitable for use in the mechanical lubricator. In the case of the mechanical lubricator, however, it is highly desirable that new oil be used.

INSTALLATION INSTRUCTIONS

1. PREPARING THE ENGINE BED

The success of a Marine engine installation depends greatly upon the construction of the foundation and upon the care exercised in lining up the engine to the propeller shafting. Poor installations will result in excessive vibration and continual change in engine alignment. The result is poor performance and failure of vital parts. For this reason Atlas Imperial Diesel Engine Co. cannot guarantee an engine unless the engine foundation (engine bed) is strong and rigid enough to prevent vibration and changes in alignment.

The importance of rigidity in the engine foundation cannot be over-emphasized and it must be securely fastened to the hull of the vessel so as to be virtually a part of the hull construction. For installations in old hulls, where the rigidity of the hull is questionable, the foundation should be extended fore and aft as far as possible; twice the length of the engine is suggested. Stiffeners should be fitted to prevent the foundation from twisting and weaving. In twin screw installations it is advisable that both foundations be stiffly connected and braced to each other and to the hull. Steel foundations should be welded or riveted. Avoid bolts or screws which may work loose.

When preparing the engine foundation always obtain certified outline prints. Do not use figures or cuts in bulletins or sales literature. The top faces of the foundation must be straight and should be lined up so that they are parallel to the propeller shafting. Athwartships the two top faces should be level. The foundation should be constructed so as to allow 1" to 1½" thick shims or chocks between the engine supporting flanges and the top faces.

2. INSTALLING THE ENGINE

The engine should be lowered onto the foundation and allowed to rest on the leveling screws. For wooden foundations provide steel plates of sufficient area and thickness for the leveling screws to rest on. (Min. 4" x 4" x ½" to 3/4" thick.) Shift the engine sideways until the centerline of the crankshaft lines up with the centerline of the propeller shafting. Then by means of the leveling screws adjust the height until the centerline of the crankshaft exactly lines up with the centerline of the propeller shafting. Also level the base athwartships. When alignment in all planes is at hand the following check should be made.

a. Turning over shaft there should be no binding between the centering spigot and recess of the two coupling halves.

b. The faces of the coupling halves should be parallel regardless of the angle through which either or both shafts are turned. With the propeller coupling half held against the engine coupling half, but not bolted, it should not be possible to insert a 0.003 in. feeler at any point between them. Check at top and bottom and the two sides before bolting flanges together.

If engine has been installed before launching it is advisable to temporarily bolt it to the foundation at this time. It is not advisable to proceed any further before launching unless the hull is extremely rigid. When the vessel is afloat the alignment should again be checked and if found satisfactory a chock should be carefully fitted at each holding down bolt. This applies to steel foundations. In wooden foundations careful measurements should be taken of the distance between the bottom of the engine supporting flanges and the top of the foundation. A continuous wooden shim should then be prepared and this shim should exactly fit the space between the foundation and the engine supporting flanges. The shims should be at least as wide as the supporting flanges.

After the engine is resting on the chocks or wooden shims it is advisable to check that the foundation is supporting the engine evenly over the entire length. This is best done with a #696 Starrett Strain Gage. Check the distance between the inside faces of the crankwebs with the corresponding crank on upper and lower centers. (See figure in Section F for strain gage location.) Readings for any one crank should not differ more than .003". Distortion of the last two cranks only indicates that the crankshaft is out of line with the propeller shafting. (When making this check the engine and propeller shaft couplings should be bolted together.) Check the last two cranks in the two horizontal positions also. If misalignment or uneven support is indicated determine the cause and correct.

When the final alignment has been accomplished permanent foundation bolts should be fitted. For steel foundations drill and ream for fitted bolts. Spaces between the foundation bolt chocks can then be filled with type metal.

3. SERVICE PIPING

Plan all piping carefully and use as short and direct lines as possible. To improve the general appearance of the installation, piping should be laid below the engine room floor when it is possible to do so. Removable floor plates should be provided and care should be taken that all piping is accessible.

4. FUEL AND LUBRICATING OIL PIPING

See Section N for pipe sizes and arrangement of the fuel day tank. See Section T for lubricating oil day tank connections. Pipe sizes are stated in these Sections. Provide drain valves and vent valves where necessary and remove all scale and dirt from pipes and fittings before installing.

5. COOLING WATER PIPING

Locate the sea chest far enough below the water line to prevent uncovering when the vessel rolls. It should be provided with a coarse grating. Inside the hull a strainer of ample size should be provided with gate valves on each side so that it can be isolated for cleaning. For engines equipped with centrifugal circulating water pumps it is particularly important that the resistance in the sea chest, strainer and piping be as small as possible. Use as few bends as possible and do not make either suction or discharge piping longer than necessary. Locate the overboard discharge not more than 3' above the water line. All valves should be gate valves - not globe valves. Use pipe sizes called for on the outline drawing.

6. STARTING AIR PIPING

Air tanks should conform to A.S.M.E. specifications and should have ample strength for 250 lbs. per square inch pressure. Each tank should be equipped with a safety valve and a globe valve for isolation. A drain valve should also be provided at the lowest point and this valve should be accessible.

Tanks should be connected to the engine starting air header using the pipe size called for on the outline drawing. Provide a globe valve next to the engine. All valves and fittings should be of heavy pattern for at least 250 lbs. per sq. inch pressure. The air compressor on the engine should be connected to the tanks with pipe of the size called for on the outline drawing and valves and fittings of heavy pattern. The air compressor discharge pipe should preferably be run to the air tank. It should not be connected to the piping between the tank and the starting air header. Air compressor unloader should preferably be connected to the tank with its own piping or tubing. Under no circumstances should it be connected to the compressor discharge line.

7. EXHAUST SYSTEM

All exhaust piping should be installed in the shortest and most direct manner possible. When bends are necessary use long sweep fittings. Use the pipe size called for on the outline drawing for lengths up to 20' containing a maximum of three bends. For 3 to 6 bends increase the pipe to the next nominal size and for each additional 30' length increase by one pipe size.

In order to protect the engine and piping from undue strains a length of flexible metal tubing should be installed as near to the engine as possible. It is also recommended that flanged connections be used for ease of dismantling and cleaning. For twin screw installations it is recommended that separate exhaust lines be used. If exhaust lines are combined and only one engine is running, soot and carbon will be blown into the other engine through the open exhaust valve.

OPERATING INSTRUCTIONS

Before the operator attempts to run the engine, he should carefully study the chapters dealing with the mechanical details, especially those of the Control System. After familiarizing himself with the principles of the control mechanism, the operator will understand the significance of each movement of the control wheel and will be able to handle the engine intelligently. In the following only a brief description of the proper method of operating the engine and controls is given.

Observe the construction of the handwheel (1) and its locking device. Note how plunger (9) enters locking disc (8). Observe the positions of pointer (7) when the plunger enters the locking disc. These positions, "AHEAD" and "ASTERN", are the normal running positions.

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TO GO AHEAD FROM STOP (see Fig. D-1)

(a) In STOP position pointer (7) is vertical and indicates STOP position on telltale (10). Turn engine handwheel (1) in the AHEAD direction, so that pointer (7) moves in AHEAD direction, toward START position. At approximately 1-3/4 turns of the handwheel, the plunger (9) will enter locking disc hole. From this position the turning of the handwheel toward START should proceed more slowly for about 1/4 turn until motion is stopped by latch shaft "stop". (If handwheel is turned too quickly, control system may be damaged.) At this position the engine will begin to turn over on starting air.

(b) As soon as the engine has reached maximum cranking speed, turn the handwheel back about 1/4 turn until the plunger enters the locking disc. This will be the "AHEAD" running position.

TO REVERSE THE ENGINE (see Fig. D-1)

(a) Turn handwheel in the ASTERN direction, causing pointer to move in the ASTERN direction. Continue to STOP position and after engine has stopped continue turning in the ASTERN direction until plunger enters locking disc. This will be about 3-1/2 turns from the AHEAD running position. From this position the same caution as above should be observed when approaching START position. In the START position the engine will begin to turn over on starting air.

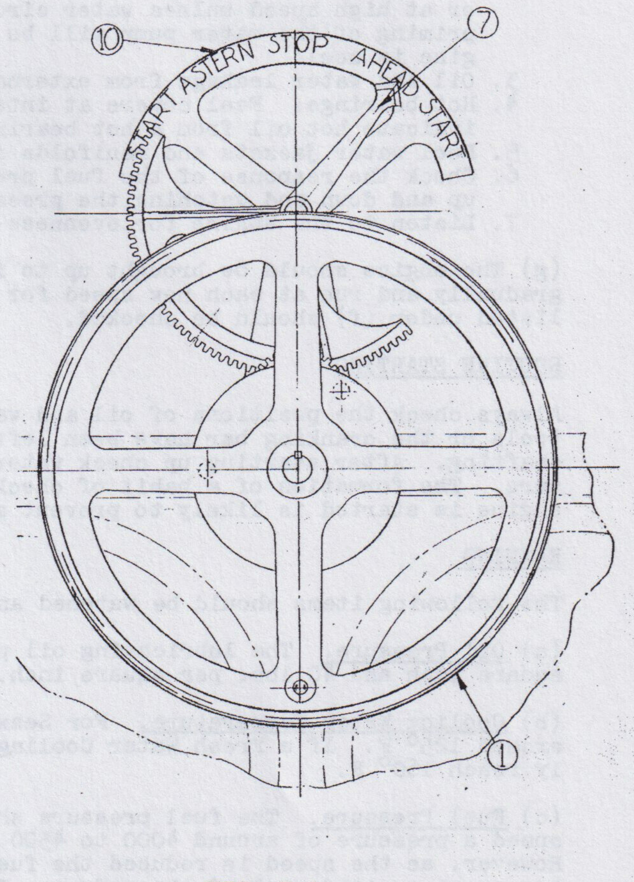

FIG. D-1

(b) As soon as the engine has reached maximum cranking speed turn the handwheel back about 1/4 turn until the plunger enters the locking disc. This will be the ASTERN running position.

INITIAL STARTING AND STARTING AFTER PROLONGED SHUTDOWN

(a) A final check should be given all fuel, air, lubricating oil and water lines, giving attention to the location and position of shut-off valves, check valves, etc. It is well to trace each system through making sure that there are no short circuits or blockages.

(b) For the initial starting it is well, although not absolutely necessary, to fill the pressure lines and passages of the lubricating oil system. For this purpose a small hand operated gear pump or piston pump can be used. When the pressure lines are full, a slight pressure will register on the pressure gauge. This procedure will insure lubricating oil pressure immediately upon starting.

(c) Hand oil the engine at all the points listed under "4-HOUR ROUTINE" in the

"Maintenance & Inspection" section. Fill the mechanical lubricator and turn its crank several revolutions.

(d) Open the two small vents on top of the outlet fittings of the high pressure fuel pump and operate the hand priming pump until fuel flows from both of these points. Then close these vents and pump up approximately 1000 lbs. fuel pressure.

(e) See that valves in starting air piping between air receiver and engine are open and that there is sufficient air pressure available. With the spray valve isolating valves shut and with the "snifters" open crank the engine by air until any excess fuel in the combustion chambers has been blown out.

(f) Start the engine by the method described on the preceding page and run it at a slow speed by setting the governor speed control handle. Then immediately check and watch the following.

1. Lubricating oil pressure and circulation. Observe oil level in day tank. Engine will absorb several gallons when started up.
2. Circulation of cooling water. Do not run the engine longer than 2 minutes or at high speed unless water circulation has started. In some instances priming of the water pump will be necessary but do not prime until the engine is cool.
3. Oil and water leakage from external lines and fittings.
4. Hot bearings. Feel covers at intervals to locate any hot areas which would indicate hot oil from a hot bearing.
5. Feel water jackets and manifolds for even water circulation.
6. Check the response of the fuel pressure relief valve by moving the handle up and down and watching the pressure gauge.
7. Listen to the engine for evenness of firing and mechanical knocks.

(g) The engine should be brought up to full speed and load slowly. Increase speed gradually and run at each new speed for at least one minute. At each speed the items listed under (f) should be checked.

ROUTINE STARTING

Always check the positions of oil and water shut-off valves and make certain that no tools or the cranking bar have been left where they can interfere with flywheel or shafting. After starting up check water circulation, lubricating oil level and pressure. The formation of a habit of checking these items automatically whenever the engine is started is likely to prevent accidents and serious damage.

RUNNING

The following items should be watched and regulated if necessary:

(a) Oil Pressure. The lubricating oil pressure should be maintained between 30 lbs. per square inch and 40 lbs. per square inch.

(b) Cooling Water Temperature. For Seawater Cooling the outlet temperature should not exceed 125° F. If a Fresh Water Cooling system is used the outlet temperature may safely reach 160° F.

(c) Fuel Pressure. The fuel pressure should be varied with the engine speed. At full speed a pressure of around 4000 to 4500 lbs. per square inch will give the best results. However, as the speed is reduced the fuel pressure should also be lowered to prevent too great a withdrawal of the wedges. Too high a fuel pressure at low speeds causes very short injection periods resulting in roughness and uneven engine operation.

(d) Lubricating Oil Temperature: At the outlet of the oil cooler should not exceed 140° F.

(e) Mechanical Lubricator. The feed from the mechanical lubricator should be adjusted to 15 to 20 drops per minute per feed.

(f) Exhaust Temperature. The normal full load and speed exhaust temperatures range from 700 to 750 degrees. If the temperatures for all cylinders are above these limits the propeller is overloading the engine and should be changed. If the exhaust temperature for any one cylinder is too high or too low the injection system is probably at fault. (See section on "Smoky Exhaust" under "Maintenance & Inspection".)

(g) Exhaust Appearance. Observe the exhaust appearance. If it is smoky investigate the cause. In most cases the spray valves are responsible for smoke. (See section on "Smoky Exhaust" under "Maintenance & Inspection".)

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OPERATING INSTRUCTIONS

Before the operator attempts to run the engine, he should carefully study the chapters dealing with the mechanical details, especially those of the Control System. After familiarizing himself with the principles of the control mechanism, the operator will understand the significance of each movement of the control lever and will be able to handle the engine intelligently. In the following only a brief description of the proper method of operating the engine and controls is given.

Observe the construction of the control lever noting the manner in which the latch engages the holes and slots in the latch plate. Depressing the latch button in the end of the handle disengages the latch so that the control handle may be moved. Depressing the button and twisting it holds the latch in the disengaged position. This locking out device is to be used only on that control lever, (engine or pilot house control stand), which is not used for maneuvering the engine. The latch on the control lever by which the engine is being operated should always be free and under control of the operator.

TO GO AHEAD FROM STOP (See Fig. D-1)

(a) Depress the latch button just long enough to release the control lever and move the lever "AHEAD". The latch will slip into the slot between points "A" & "B". As soon as the latch has entered this slot back the lever up until it is stopped at point "A" by the latch and hold it in this position until the reversing cylinder has shifted. (If the cylinder has not shifted the handle will be stopped at a point between "A" & "B".)

(b) Without depressing the button move the lever ahead until it is automatically stopped in position "B" by the latch. The engine will begin to turn over on starting air.

(c) As soon as the engine has reached maximum cranking speed, depress the button and quickly move the lever to "SLOW", position "C". The engine will start and run at its slowest speed ahead.

(d) Depress the handle button and advance the lever until the desired engine speed is obtained. Then release the button so that the latch will engage one of the eight holes between "SLOW" (position "C") and "FAST" (position "D").

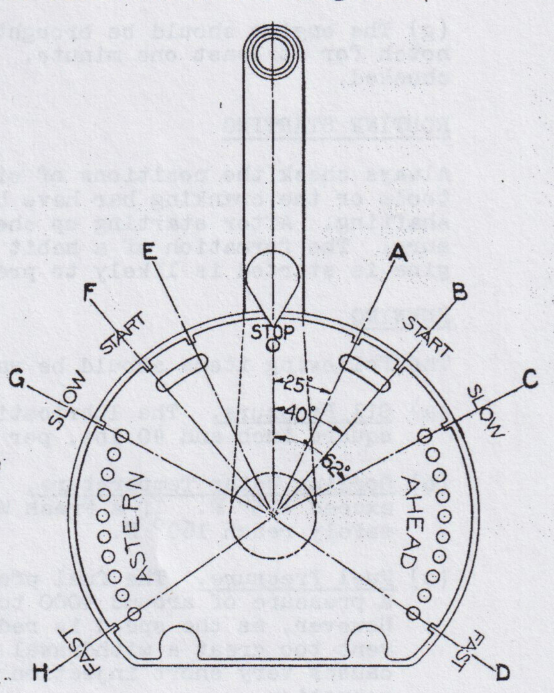

FIG. D-1

TO REVERSE THE ENGINE (See Fig. D-1)

(a) Depress the latch button and return the lever to "STOP". Hold the lever in this position until the engine has stopped.

(b) Depress the button and move the lever to "E" in the "ASTERN" direction. At the same time observe the indicator on the air ram.

(c) As soon as the air ram has moved to its "ASTERN" position move the lever until it is stopped by the latch at "F". The engine will begin to turn over in the astern direction.

(d) When the cranking speed is sufficient, depress the button and quickly move the lever to "SLOW" (position "G"). The engine will start and run at its slowest speed astern.

(e) Depress the handle button and move the lever toward "FAST" astern (Position "H") until the desired speed is attained and then release the button.

INITIAL STARTING AND STARTING AFTER PROLONGED SHUTDOWN

(a) A final check should be given all fuel, air, lubricating oil and water lines, giving attention to the location and position of shut-off valves, check valves, etc. It is well to trace each system through making sure that there are no short circuits or blockages.

(b) For the initial starting it is well, although not absolutely necessary, to fill the pressure lines and passages of the lubricating oil system. For this purpose a small hand operated gear pump or piston pump can be used. When the pressure lines are full, a slight pressure will register on the pressure gauge. This procedure will insure lubricating oil pressure immediately upon starting.

(c) Hand oil the engine at all the points listed under "4-HOUR ROUTINE" in the

"Maintenance & Inspection" Section. Fill the mechanical lubricator and turn its crank several revolutions.

(d) Open the two small vents on top of the outlet fittings of the high pressure fuel pump and operate the hand priming pump until fuel flows from both of these points. Then close these vents and pump up approximately 1000 lbs. fuel pressure.

(e) See that valves in starting air piping between air receiver and engine are open and that there is sufficient air pressure available. With the spray valve isolating valves shut and with the "snifters" open crank the engine by air until any excess fuel in the combustion chambers has been blown out.

(f) Start the engine by the method described in the preceding sections and run it at "SLOW" ahead (position "C" on Fig. 3). Then <u>immediately</u> check and watch the following:

1. Lubricating oil pressure and circulation. Observe oil level in day tank. Engine will absorb several gallons when started up.
2. Circulation of cooling water. Do not run the engine longer than 2 minutes or at high speed unless water circulation has started. In some instances priming of the water pump will be necessary but do not prime until the engine is cool.
3. Oil and water leakage from external lines and fittings.
4. Hot bearings. Feel covers at intervals to locate any hot areas which would indicate hot oil from a hot bearing.
5. Feel water jackets and manifolds for even water circulation.
6. Check the response of the fuel pressure relief valve by moving the handle up and down and watching the pressure gauge.
7. Listen to the engine for evenness of firing and mechanical knocks.

(g) The engine should be brought up to full speed and load slowly. Run at each control notch for at least one minute. At each speed the items listed under (f) should be checked.

<u>ROUTINE STARTING</u>

Always check the positions of oil and water shut-off valves. and make certain that no tools or the cranking bar have been left where they can interfere with flywheel or shafting. After starting up check water circulation, lubricating oil level and pressure. The formation of a habit of checking these items automatically whenever the engine is started is likely to prevent accidents and serious damage.

<u>RUNNING</u>

The following items should be watched and regulated if necessary:

(a) <u>Oil Pressure.</u> The lubricating oil pressure should be maintained between 30 lbs. per square inch and 40 lbs. per square inch.

(b) <u>Cooling Water Temperature.</u> For Seawater cooling the outlet temperature should not exceed 125° F. If a Fresh Water cooling system is used the outlet temperature may safely reach 160° F.

(c) <u>Fuel Pressure.</u> The fuel pressure should be varied with the engine speed. At "FAST" a pressure of around 4000 to 4500 lbs. per square inch will give the best results. However, as the speed is reduced the fuel pressure should also be lowered to prevent too great a withdrawal of the wedges. Too high a fuel pressure at low speeds causes very short injection periods resulting in roughness and uneven engine operation.

(d) <u>Lubricating Oil Temperature</u> at the outlet of the oil cooler should not exceed 140° F.

(e) <u>Mechanical Lubricator.</u> The feed from the mechanical lubricator should be adjusted to 15 to 20 drops per minute per feed.

(f) <u>Exhaust Temperature.</u> The normal full load and speed exhaust temperatures range from 700 to 750 degrees. If the temperatures for all cylinders are above these limits the propeller is overloading the engine and should be changed. If the exhaust temperature for any one cylinder is too high or too low the injection system is probably at fault. (See section on "Smoky Exhaust" under "Maintenance & Inspection".)

(g) <u>Exhaust Appearance.</u> Observe the exhaust appearance. If it is smoky investigate the cause. In most cases the spray valves are responsible for smoke. (See section on "Smoky Exhaust" under "Maintenance & Inspection".)

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SUPPLEMENTARY OPERATING INSTRUCTIONS TURBOCHARGED 13 X 16 ENGINE

The points discussed in these instructions are the differences from the standard engine. The turbocharged engine is the standard engine adapted to turbocharging by the addition of a Buchi Elliott type of turbocharger with whatever changes in details are necessary to accommodate the application of the turbocharger and accomplish the overall result of increasing the horsepower approximately 40 to 45 % over the rating of the standard non-turbocharged engine. Thus the attached text for the standard engine applies except for the special items discussed here.

The Buchi Elliott turbocharger is a gas turbine driven centrifugal type blower mounted at one end of the engine. The exhaust gases from the cylinders pass through the exhaust manifold into the turbocharger for driving the turbine. The exhaust gases pass out from the top of the turbocharger up through the exhaust pipe and muffler as usual. Intake air for the engine passes through the inlet silencer, mounted on the turbocharger, through the centrifugal blower and is delivered to the air inlet manifold. Parts List and Instructions covering the turbocharger will be found at the end of this book under auxiliary equipment. The exhaust manifold consists really of two manifolds inside of a single jacket. Three cylinders discharge into each manifold and are alternate cylinders according to the firing order. This is in order to give proper spacing between exhaust gas impulses. The jacket around the two individual exhaust manifolds provides for water cooling of them.

WORKING PISTON

The working piston for the turbocharged engine has two pockets cut into the top in order to provide mechanical clearance for the inlet and exhaust valves when they are open at the end of the exhaust stroke and at the beginning of the inlet stroke. This is the scavenging period in the Buchi turbocharger cycle and as you will see by reference to the valve timing, there is considerable overlap between the opening of the inlet valves and the closing of the exhaust valves during this period. It is important when installing a piston in the engine to make sure that the pockets in the piston top correspond to the location of the valves in the cylinder head. Otherwise there will be interference between the valves and the piston.

Also note that the distance from the top of the liner to the top of the piston is greater on the turbocharged engine than on the standard engine. The figure for the turbocharged engine is 1-3/32. This greater distance between piston and cylinder heads provides a little larger combustion space for the turbocharged engine. Thus the compression ratio is a little lower on the turbocharged engine than on the standard engine. This is to allow for the effect of the action of the turbocharger which delivers more air to the cylinders than in the standard engine.

VALVE TIMING

The correct valve timing for this engine is given in the following table:

Starting Air Valve Opens	-	5° B.T.C.
Starting Air Valve Closes	-	50° B.B.C.
Inlet Valve Opens	-	80° B.T.C.
Inlet Valve Closes	-	30° A.B.C.
Exhaust Valve Opens	-	40° B.B.C.
Exhaust Valve Closes	-	65° A.T.C.

The fuel spray valve is designed to open 6° B.T.C. and close 22° A.T.C. but the exact timing for each individual engine is given on the engine name plate and the figures on the name plate should be followed when making any adjustments.

INLET AND EXHAUST MANIFOLDS

The air inlet manifold has a separate sleeve with a floating flange and if it ever becomes necessary to replace the manifold on the engine, the new manifold should first be applied in place with the sleeve loose, and when the right adjustment is found between position of sleeve and manifold when both are bolted in place, tack welding will hold the flange temporarily. Then the manifold can be removed for firmly welding the flange to the manifold sleeve.

Similarly, the exhaust manifold has the end flange loose and will require locating and welding at assembly.

Care should be taken when assemblying the turbocharger on its bracket that sufficient shims are used under the support feet to prevent any possibility of the turbocharger weight hanging on the exhaust and inlet connection capscrews. These capscrews are used purely for making tight gas joints and are not intended in any way to help support the weight of the turbocharger.

FUEL SYSTEM

The main high pressure fuel oil header or rail on this engine is larger than on the standard engine and is of sufficient capacity so that no separate accumulator is used. Also, the individual cylinder isolating valves are of larger size and capacity than on the standard engine.

The high pressure fuel pumps need to be of larger size and capacity than on the standard engine in order to supply the increased amount of fuel required for the larger horsepower developed by the turbocharged engine. Thus the diameter of these plungers is 3/4" on the turbocharged engine against 21/32" on the standard engine.

The standard spray tips for the turbocharged engine have seven holes .013" diameter at an angle of 25° from the horizontal. This tip is subject to variation under certain conditions, and the tip actually used will be noted on the engine name plate.

OPERATION

The operation of the turbocharged engine is no different from the operation of the standard engine. The turbocharger itself is entirely automatic and requires no attention except for maintenance. Instructions in the Buchi Elliott turbocharger pamphlet should be followed.

The speed of the turbocharger varies with the load on the engine, thus the quantity of the air delivered to the cylinders varies with the engine load requirements. You will note that the pressure in the air inlet manifold varies with the load on the engine. It is about three pounds per square inch at full load.

The compression pressure in the cylinders varies according to the load on the engine, because of the action of the turbocharger just described. There is also a slight variation between hot and cold engine conditions. Thus, if you measure compression pressure, make sure that you take these factors into account.

Under normal full load rated power conditions, the exhaust gas temperature in the exhaust manifold to the turbocharger is about 750°. Any temperature above this figure represents an overload on the engine, and it is not good practice to operate the engine at overload ratings except for brief periods. The engine should always be kept in first class mechanical condition and in good operating adjustment.

FI - Ed 1(2)

LOWER BASE, CRANKSHAFT AND BEARINGS

1. BASE AND CRANKSHAFT

The cast iron base carries the main bearing saddles and the main lubricating oil manifold from which oil is piped to each main bearing and to the intermediate gear bearings. The crankshaft turns in babbitt lined steel backed bearing shells, held in place in the base by the main bearing caps. Adjustment is by shims, and running clearances should be .0008" to .00095" per inch of shaft diameter when bearings are fitted.

2. MAIN BEARING ADJUSTMENT

Bearing clearances can be accurately measured with two pieces of lead wire of about .025" diameter and one inch long, which are compressed between shell and journal about 1" from each end of the bearing by tightening the cap bolts. The thickness, measured with a micrometer, is the running clearance. Clearances should be checked annually, and should not be allowed to exceed .0015" per inch of shaft diameter. Keep shims even on both sides.

3. MAIN BEARING SHELLS

The bearing shells are prevented from rotating in the base by the shims, and are located fore and aft by a square head dowel pin in the bottom of the bearing saddles which engages a circumferential groove around the outside of the shell. As fitted the shells project above the base and face of the caps from .002" to .003" on each side, but are squeezed down flush when the capnuts are pulled up. There should not be any appreciable clearance between the base, shim, and cap after final tightening. The bearing shells and caps are all numbered and must always be replaced in the bearing from which they were removed. Never interchange them, either from one bearing to another, or from top to bottom.

4. REMOVAL AND ASSEMBLY OF MAIN BEARINGS

After removing the cotter pins and main bearing nuts, the cap, upper shell and shims may be lifted out. As this operation is performed the positions of the numbers stamped on each of these parts should be noted so that the parts can be reassembled in their proper positions. Unless the bearing is considerably worn it may not be possible to remove the lower shell by hand and it is usually necessary to turn it out of the base by barring the engine over after inserting a capscrew in the oil hole in the journal. The head of the capscrew will contact the edge of the bearing shell and roll the bearing out with the journal.

When assembling the main bearing shells care must be taken to keep all parts absolutely clean. It is of utmost importance that any dirt be prevented from lodging between the shell and the saddle. Extreme care must be exercised in locating the bottom shell in a fore and aft direction before turning it into the base. Misalignment will cause the groove to miss the dowel pin in the base and trouble will then be encountered in backing the shell out again for another try.

5. CRANKSHAFT ALIGNMENT

The crankshaft should be checked at annual overhauls, or at intervals not greater than 7000 service hours, for misalignment due to uneven wear of the bearings. When the engine was erected at the factory the bearings were carefully scraped in, so as to bring the bearing surface of all shells in line. If one of these surfaces, due to uneven wear, becomes lower than the adjacent shells, it is evident that the crankshaft will be bent each time the adjacent cylinders fire and the connecting rods force the journal down against this low bearing. This condition must be guarded against, as neglect or ignorance of it will ultimately result in a broken shaft.

The simplest way to check crankshaft alignment is by means of a bridge gauge, which can be supplied with the engine as extra equipment. If a bridge gauge is desired it must, however, be ordered when the order for the engine is placed. It can not be supplied later.

With the bridge gauge straddling the journal and resting firmly and squarely on the bearing cap seats in the lower base the distance between the top of the main bearing journal and the machined face on the bridge gauge is measured by means of a feeler gauge. At the time the engine was erected these measurements were taken and were stamped on the bridge gauge. As the age of the engine increases the bearing surfaces will wear, with the result that these measurements will gradually increase. As long as they all increase by the same amount the shaft will still be in line however, and there need be no worry, even though they do not agree with the original readings stamped on the bridge gauge. But if at any time the reading for one bearing is found to be more than .004" greater than those for the adjacent bearings, this low shell should be replaced at once and the crankshaft re-aligned, a job that should be undertaken only by an experienced mechanic. A careful record should be kept of all bridge gauge readings taken from time to time.

The bridge gauge measurements described above should be made successively, removing one bearing cap at a time and replacing it before proceeding to the next bearing. When making measurements the crankshaft journal must be forced down against the shell by means of a jack bearing against the centerframe. Protect the shaft journal with a piece of wood or sheet copper. An indication of low bearing shells will usually be given by looseness of the shell in the saddle. If it is possible to freely rotate one of the lower shells by hand when adjacent bearing caps are bolted down, it is quite probable that this shell is unduly worn and it should be checked with the bridge gauge at once.

If a bridge gauge is not available, crankshaft alignment may be checked with a gap or strain gage as follows: Stamp two center punch marks as shown in Fig. F-1 on all cranks. Starting with No. 1 cylinder crank remove adjacent main bearing caps and locate the crank as near lower center as gap gage will permit. Using jack screws between bearing journal and center frame force shaft against lower bearing half (protect shaft with a piece of wood or sheet copper) and record the gap gauge reading. Then loosen jackscrews and bar over until crank is on upper dead center. Again tighten jack screws and record the gauge reading. Repeat on all other cranks.

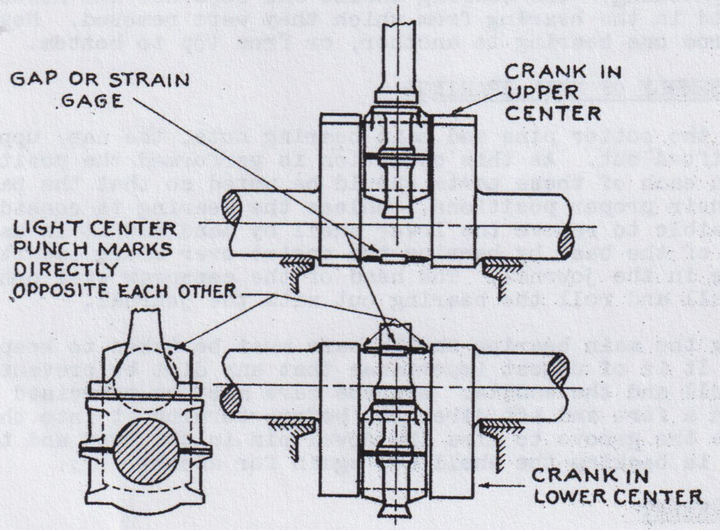

FIG. F-1

Comparison of gauge measurements in upper and lower centers will indicate crankshaft alignment conditions. Normally the measurements for the cranks in top position are slightly larger than measurements for the same cranks in the bottom position. However, the difference in measurement for any one crank should not exceed .0005" per inch of shaft diameter. If this is the case, realignment of the crankshaft bearings is indicated.

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THRUST BEARING

1. MULTI-COLLAR TYPE

All loads in a fore and aft direction resulting from propeller thrust are carried by the thrust bearing. This bearing is located aft of the flywheel on pads at the end of the lower base. Water jackets are provided in the bearing castings and a small supply of cold water is bled from the main water inlet manifold to the bearing. A positive supply of oil is fed to the bearing from the mechanical lubricator located at the forward end of the engine.

In general the thrust bearing assembly consists of three parts: the bearing, the cap and the thrust shaft. Both the bearing and the cap are water jacketed. Each contains dovetailed circumferential grooves which when lined with babbitt about $\frac{1}{4}$" thick form grooves for the thrust shaft collars. Between the grooves the cylindrical areas are also lined with babbitt so that sufficient journal area to carry a substantial radial load is incorporated in the bearing.

In the erection of the engine at the factory the thrust bearing is treated as if it were an additional main bearing. After all the lower main bearing shells have been scraped into alignment the thrust shaft is bolted to the crankshaft and tested for trueness. It is required that the total run out of the thrust shaft at the aft end does not exceed .002". In the meantime the thrust bearing (lower half) is installed temporarily on the base. The thrust shaft is then coated with blueing and the whole shaft assembly is lowered into position. The bearing is then shimmed up or down, moved forward or backward, to one side or the other and scraped until the bearing is satisfactorily located. The finished bearing must be in line with the main bearings. The thrust shoulders on the shaft must be a close fit in the grooves but at the same time have clearance. An end play of approximately .005" to .010" is desirable. The location of the bearing should be such that the crankshaft is slightly aft of its central position in the base since the normal wear on the thrust bearing will allow the crankshaft to move forward slightly.

When the foregoing conditions have been met the thrust bearing (lower half) is doweled to the base. The thrust bearing cap is then scraped in and adjusted for clearance with shims.

2. KINGSBURY TYPE

Referring to Fig. G-1 the standard style GH Kingsbury thrust bearing is equipped with two pairs of thrust shoes (3) (two shoes for ahead and two for astern thrust). These shoes are individually adjustable fore and aft by jackscrews (5) which are locked by lock wrench (6). A journal bearing, babbitted directly in lower thrust bearing housing (1) and upper housing (2) is also incorporated. The journal bearing is located on the flywheel end of the thrust bearing.

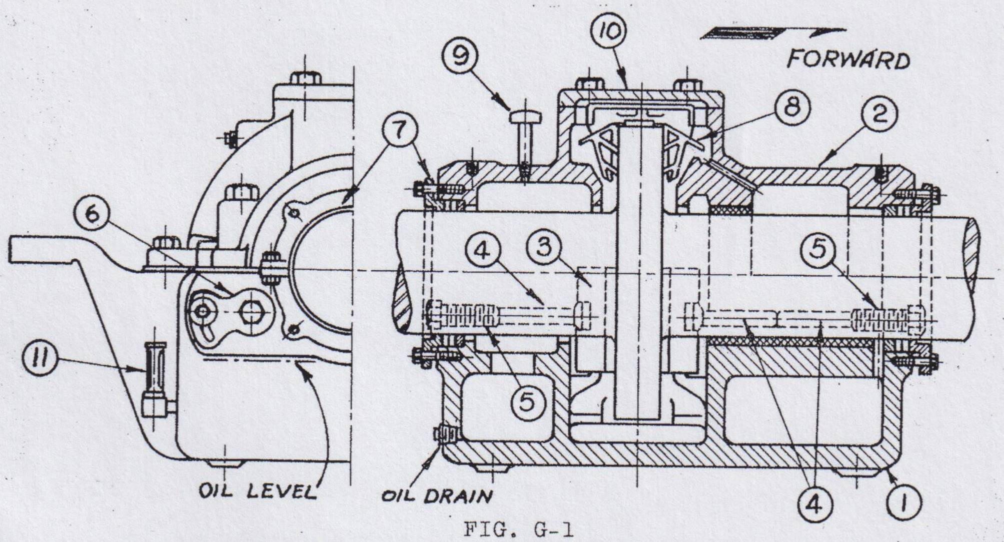

FIG. G-1

There is only one thrust collar which is forged integrally with the thrust shaft. Lubrication is self-contained and automatic. The lower housing contains the lubricating oil supply, the oil level being of such height that the lower part of the thrust collar dips into it. The oil is then carried to the top where scraper (8) distributes it over the collar thrust surfaces and takes off some oil for lubrication of the journal bearing. Oil is retained in the bearing by stuffing boxes at

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both ends. Do not take up hard on stuffing box glands (7), as this will cause unnecessary heating of the shaft.

To allow for oil films between thrust bearing surfaces, and for expansion by heat, it is strictly necessary to provide longitudinal end play in accordance with the following table:

Engine Bore	End Play
14½ and 15"	.017" 0,635 mm
13"	.015"
11½"	.014"
10"	.012"

Using the jackscrews, adjust for end play as follows: Keeping thrust collar in desired fore and aft position, set up firmly on forward-end jackscrews so ahead shoes will bear equally against collar. Lock the screws. Next set up on after-end jackscrews, using a "feeler" gauge, with thickness equal to end play, back of the pivotal support of each shoe. Lock the jackscrews and remove the "feelers".

For average installation of propeller thrust bearings, a heavy turbine or engine oil should be used. The oil should be chosen with due regard to viscosity. If it is too light, the lubricating film may be dangerously thin. If it is too heavy, the friction is needlessly high. Specific advice as to proper viscosity for any definite installation is regularly marked on bearing nameplate. As a rule the viscosity should be about 200 seconds Saybolt at operating temperature of the oil bath. The oil must be clean and free from grit and other injurious substances. Fine grit has a scouring action and may gradually wear down the bearing surfaces. Poor oil may cause corrosion. Oil of good quality does not "wear out" by use in these bearings, but lasts indefinitely if not contaminated.

<u>It is vitally important to maintain the oil at a suitable level.</u> Oil level plates are attached to both sides of housing, with "High" and "Low" oil levels noted. If necessary fill housing with oil to "High" mark when not running. A slight draw down of oil level will be noted when bearing is running. Occasionally oil should be added to make up for leakage and evaporation. Be sure the make up oil is clean. The air vent holes (9) should be kept open. Oil gauge (11) may be placed on either side of housing.

CYLINDER AND LINER, CYLINDER HEAD AND VALVES

1. CYLINDER

The individual cast iron cylinders are secured to the centerframe and base by four studs which are screwed into the base adjacent to the main bearing saddles. The cylinders are located transversely and are aligned to the centerframe by machined pads along one side which register with a step on the top of the centerframe. Crankcase sealer is used between the cylinders and the centerframe. If this joint is disturbed the old sealer must be scraped off and replaced by fresh sealer before tightening the cylinder nuts. Glyptal Lacquer is recommended for sealer. On later engines a gasket is used between the cylinder and centerframe. These gaskets can also be used on engines not originally so equipped.

2. CYLINDER LINER

The cylinder liners are special alloy iron castings, heat treated to relieve stresses and secure correct hardness. They are accurately machined to close tolerances and should be handled carefully and care taken not to damage the fits at top and bottom. Spare liners should always be stored in a vertical position and should be securely fastened down if stored on board ship. The water seal at the bottom of the liner consists of two rubber grommets which should always be replaced with new ones whenever a liner is pulled. When lowering a liner into place, grease the grommets into the cylinder fit or they may be pinched and damaged. The liner has from .004" to .007" clearance in the cylinder at both top and bottom fits and no difficulty should be encountered in installing a new liner. A paper gasket .010" thick is used for the upper water seal between the liner and cylinder and a new gasket should always be used when replacing a liner. The fits and shoulders on both liner and cylinder should be carefully scraped and wiped clean to assure a water tight joint. Care must be taken not to damage these shoulders, as a water leak will result.

A copper gasket, 1/32" thick, forms the gas seal between the liner and the head. The gasket and both sealing surfaces must be carefully wiped free of all dirt when assembling.

3. CYLINDER HEAD

The individual cast iron cylinder heads are carefully designed to assure uniform cooling and accessibility of the water jackets. Depending on the engine model two or three large cleanout covers are provided.

On engines with 11½" bore or larger positive cooling of the spray valve bosses is assured by nozzles projecting into the water jackets and discharging cool water directly against them. Water is supplied from a manifold located close to the exhaust manifold and fed at the center from the water inlet manifold.

The cylinder head is centered by means of a spigot which engages the bore at the top of the cylinder liner. The face of this spigot bears upon the copper gasket forming the gas seal. Brass bushings screwed into the cylinder and extending up into the head carry the cooling water. They are sealed by rubber grommets.

When a cylinder head is removed it should be placed on wooden blocks, never on concrete floor or steel deck. The rubber grommets should always be replaced by new ones and all dirt should be wiped from the bottom of the head before it is lowered onto the cylinder.

4. INLET AND EXHAUST VALVES

Two types of intake and exhaust valves are used on Atlas Imperial Diesel engines. One may be termed one-piece forged type and the other two-piece cast head type.

The two-piece cast head type consists of a valve head cast of special heat resisting alloy iron and a steel stem which is screwed and riveted to the head. Inlet and exhaust valves of the two-piece construction are interchangeable and the same valve may be used for either intake or exhaust.

On engines where valves of the one-piece forged type are used the exhaust valves are of a special heat resistant alloy steel and may be distinguished from the inlet valves by the "EXH." and "INL." stamped on the valve heads. The inlet valves are forged of chrome nickel steel and are not suitable for exhaust valves. The one-piece valves should never be used interchangeably except in an emergency.

In engines with 10½" or smaller bore the valves seat directly in the head. Renewable guides are pressed into the head. Engines with 11½" or larger bore have both inlet and exhaust valves mounted in cages, bushed with renewable guides. The exhaust valve cage is water jacketed. Connections in the cooling water pipes must be broken when the exhaust cage is pulled. Exhaust cages must be pulled and water jackets emptied if engine is permitted to stand for any length of time in freezing weather as they will not empty from the main engine drain.

The cages are secured to the head with studs and are provided with jacking holes to facilitate their removal. Two jack screws are furnished with the tool equipment for this purpose. The cages are sealed against the head with copper gaskets at the bottom and cast iron piston rings installed in grooves above the port openings seal the cages at the top.

Depending on the engine model one or two concentric springs are used per valve. On the larger engine models the springs are held in place by a retainer which is secured to the valve stem by means of a split taper collar. Depressing the spring retainer against the springs permits the removal of the split collar and the disassembly of the valve and cage. On engines with 10" bore the upper end of the valve stem is threaded and spring retainers are held in place by a nut and locknut. On this engine model the length of the spring in place, with the valve closed, should be 4-3/16".

If the renewable valve stem guides are replaced they should be reamed after pressing in place with a standard reamer which produces a hole with a diameter to size or .0005" oversize. For instance, the 13" bore engine uses a valve with a stem diameter of 7/8". A standard 7/8" diameter reamer should then be used after the guides have been pressed into place in the cages. This reamer should then produce a hole with a diameter of .875" to .8755".

When grinding valves mounted in cages it is recommended that the cages be bolted into place in a cylinder head. A spare head may be used, or if a machine shop is available a sturdy fixture can be made up duplicating the cage bore in the head. The clamping nuts holding the cage to the head or fixture should be pulled up to approximately the same tension as when assembling in the engine. In this way any distortion of the cage and seat due to the clamping when the cage is in place will be duplicated while the valve is being ground, and a perfect seat will be assured. It will be found that this practice will practically double the interval between valve grindings. Always finish the grinding with fine compound, and take particular care not to get any grinding compound into the guide. Thoroughly clean all traces of the grinding compound from valve and seat before reassembling.

Lubricate valve stem with clean engine oil before placing in guide. If valve faces are badly pitted they should be refaced in a lathe, as excessive grinding to remove pits will wear down the seats unnecessarily and will also cut a groove in the valve face. Badly pitted seats should also be refaced before grinding. Care must be taken to keep the seat concentric and square with the bore of the guide.

5. <u>AIR STARTING VALVE</u> (Engines with 13" to 15" bore)

The poppet type starting air valve, illustrated in Fig. H-1, is actuated from the camshaft by means of a lifter, pushrod and rocker, and is rendered inoperative while the engine is running by a pneumatic piston arrangement between the top of the valve stem and rocker. Fig. H-1 shows the device in the inoperative or cutout position, as it is when the engine is running. Valve (2) is held closed against its seat by spring (4), and piston (6) is down against cylinder (5), held so by a spring under the lifter. This spring holds the lifter and its latch up clear of the camshaft, so that as the cam rotates it does not contact the latch roller. (See description of latches under paragraph 28.) The pushrod is raised, rotating the rocker and holding piston (6) down against the cylinder as shown.

When the engine is to be started, starting air from the manifold enters port (10) and passes up through the drilled hole (9) in the valve stem to cylinder (5) where it raises piston (6) up against stop (7), collapsing the spring under the lifter, and forcing the lifter and latch roller down against the cam. As the camshaft then rotates piston (6) remains up against stop (7), the air force against the bottom of the piston being greater than that of valve spring (4) and the spring under the lifter,

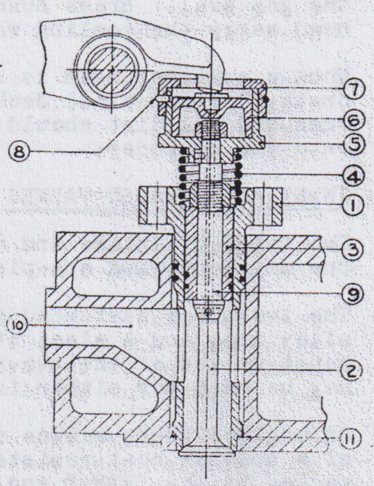

FIG. H-1

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and the valve follows the motion of the cam, admitting starting air to the cylinder at the proper intervals. When the master valve in the starting air manifold closes and the pressure in the manifold drops, piston (6) is returned to its position against cylinder (5) by the lifter spring, and the valve remains closed.

Referring to Fig. H-1 the valve assembly is contained in cage (1) which is sealed to the head by copper gasket (11) at the bottom and by piston rings at the top and is held in place by two studs. Bronze bushing (3) works in the cage and is sealed against the starting air pressure by two piston rings. Stop (7) is threaded onto cylinder (5) and is locked in place by snap ring (8), the end of which is bent in and projects into a drilled hole in the cylinder. If either stop or cylinder are replaced this hole must be drilled in the cylinder, in line with the hole in the stop when the two parts are screwed tightly together. Use a 13/64" drill. The piston travel should be from .300" to .330", and may be adjusted by facing off the top of either the cylinder or the piston.

If the engine has been running or has been shut down for a considerable period of time and a period of maneuvering is anticipated, it is advisable to give the automatic air starting valves in the cylinder head a few drops of penetrating oil. Make sure that they are not stuck and squirt a little penetrating oil between the spring coils so that it will follow the stem down and lubricate bushing (3).

6. AIR STARTING VALVE (Engines with 10" to 11½" bore)

On the smaller bore engines the starting air rocker is mounted eccentrically on the rocker shaft. When starting the engine an air ram described in Section R turns the rocker shaft and lowers the air start rocker until contact is made with the air start cam. Consequently on these engines the pneumatic piston arrangement described in paragraph 5 is not needed and is omitted, the rocker bearing directly on the valve stem. On 11½" bore engines the valve is mounted in a cage similar to that shown in Fig. H-1, while on the 10" bore engine the valve is guided and seated directly in the head. Hand oil the air start valves occasionally as described in paragraph 5.

7. PRESSURE RELIEF VALVES

Either two or three pressure relief valves are provided for each cylinder, located near the bottom of the head on the operating side of the engine. These include a manually operated relief or "snifter valve", a spring loaded safety valve, and on engines equipped with the automatic control system a pneumatically operated relief valve. If used, this valve is described in detail under the "Control System", Section R.

The valves are mounted in a tee screwed into the cylinder head. On standard engines without the pneumatic valve the snifter valve is in the top of the tee pointing up and the safety valve in the bottom. When the pneumatic valve is used it points down, the safety valve up and the snifter valve projects out from the end of the tee.

8. SNIFTER VALVE

The hand operated relief or "snifter" valves are small needle valves for release of the compression when barring over the engine. They are also used as shut-off valves when indicating or taking compression pressures.

9. SAFETY VALVE

The safety valves are spring loaded relief valves for the purpose of relieving excessive cylinder pressures. They act as telltales to indicate that the pressure is too high, and the popping of these valves is a definite indication that something is wrong and should be investigated at once. The valves are adjustable by tightening the spring retaining cover, and should be set to relieve at 800 lbs. per square inch. A setscrew locks the cover to maintain the setting. They should be tried out occasionally by prying up the lower spring washer with a screw driver to assure that they are in operating condition.

and the valve follows the motion of the cam, admitting starting air to the cylinder at the proper intervals. When the master valve in the starting air manifold closes and the pressure in the manifold drops, piston (a) is returned to its position against cylinder (b) by the return spring, and the valve remains closed.

Referring to Fig. 4-1 the valve assembly is contained in cage (1) which is sealed in the head by copper gasket (11) at the bottom and by piston rings at the top and is held in place by two nuts. Bronze bushing (5) moves in the cage and is sealed against the starting air pressure by two piston rings. Stem (3) is threaded into cylinder (9) and is prevented from turning by snap ring (8). The end of stem is bent in and provided with a drilled hole in the extension. If either stem or cylinder are replaced, the hole must be drilled in the cylinder in line with the hole in the stem when the two parts are screwed tightly together. Use a 13/64" drill. The piston travel should be from .290" to .310", and may be adjusted by facing off the top of either the cylinder or the piston.

If the engine has been running or has been shut down for a considerable period of time and a period of maneuvering is anticipated, it is advisable to give the automatic air starting valves in the cylinder head a few drops of penetrating oil. Make sure that they are not stuck and apply a little penetrating oil between the spring coils so that it will follow the stem down and lubricate bushing (5).

AIR STARTING VALVE (Engines with 10" to 11½" bore)

On the smaller bore engines the starting air rocker is mounted eccentrically on the rocker shaft. When starting the engine an air pot described in Section 5 turns the rocker shaft and lowers the air start rocker until contact is made with the air start cams. Consequently on those engines the automatic piston arrangement described in paragraph 3 is not needed and is omitted, the rocker bearing directly on the valve stem. On 11½" bore engines the valve is mounted in a cage similar to that shown in Fig. 4-1, while on the 10" bore engine the valve is seated and guided directly in the head. Hand oil the air start valves occasionally as described in paragraph 5.

PRESSURE RELIEF VALVES

Either two or three pressure relief valves are provided for each cylinder, located near the bottom of the head on the operating side of the engine. These include a manually operated relief or "snifter valve", a spring loaded safety valve, and on engines equipped with the automatic control system a pneumatically operated relief valve. If used, this valve is described in detail under the "Control System", Section 5.

The valves are mounted in a bar screwed into the cylinder head. On standard engines without the pneumatic valve the snifter valve is in the top of the bar pointing up and the safety valve in the bottom. When the pneumatic valve is used it points down, the snifter valve up and the relief valve projects out from the end of the bar.

SNIFTER VALVES

The manually operated, called or "snifter" valves are small needle valves for release of the compression when barring over the engine. They are also used as shut-off valves when indicating or taking compression pressures.

SAFETY VALVES

The safety valves are spring loaded relief valves for the purpose of relieving excessive cylinder pressures. They act as telltales to indicate that the pressure is too high, and the popping of these valves is a definite indication that something is wrong and should be investigated at once. The valves are adjustable by adjusting the spring retaining cover, and should be set to relieve at 800 lbs. per square inch. A set screw locks the cover to maintain the setting. They should be tested and periodically by opening up the inner spring washer with a screw driver to ensure that they are in operating condition.

PISTON AND CONNECTING ROD

1. PISTON

The pistons which are of the one-piece, solid-skirt type are made of high grade cast iron and are heat treated to relieve stresses and to obtain proper hardness. The piston is ground straight, that is without taper, from the bottom up to the ring belt. The clearance in the liner is .001" per inch of bore diameter. Due to manufacturing tolerances the total clearance of the piston skirt may vary .001" up or down from the above value. For example: the piston skirt clearance in a 13" bore engine should be between .012" and .014". The head of the piston being exposed to high temperatures is given a larger clearance, approximately .0055" to .006" per inch of bore diameter.

2. PISTON PIN -- (Tight in Piston)

The case hardened and ground piston pin is stepped, with differential fits in the piston pin bosses. The fits are about .0005" to .0015" press on the small end and metal to metal to .0015" loose on the large end. Rotation of the pin in the piston is prevented by the engagement of a dowel which projects radially from the large end of the pin with a groove in the bottom of the boss. A setscrew threaded into the smaller pin boss enters an indentation in the pin to act as a retainer. The setscrew is in turn secured by a locknut.

PISTON PIN -- (Floating in both Piston and Rod)

Floating type piston pins are retained in the piston by means of cast iron plugs which are pressed into a counterbore in the piston. A tapped hole is provided in each plug to permit removal. After one plug is removed the other one may be removed by inserting a rod or bar thru the piston pin and tapping lightly with a hammer. When replacing these plugs always be sure to line up the dowel pin with the slot in the piston. It is advisable to replace the plugs in the same counterbore from which they were removed. This type of pin should be fitted with a clearance of .0015" to .0025" in the piston.

3. PISTON RINGS

In engines with 10½" or smaller bore there are 6 rings per piston. In engines with larger bores seven rings are used per piston, an oil ring above and below the piston pin and five compression rings. Always assemble the oil rings with the bevel up, to slide over the oil film on the upstroke and scrape it down on the return. When overhauling pistons, thoroughly clean all carbon from rings and grooves and top of piston. Fuel deposit on the piston skirt can best be dissolved with cleaning solvent or paint remover. Be sure oil drain holes below oil rings are open.

Check rings for side clearance in grooves and end clearance, as measured in place in the liner. Side clearance should be .003" to .005" with new pistons and rings and end or gap clearance .005" per inch of bore diameter for the two top rings. For the other rings the gap clearance should be .003" per inch of bore diameter.

Rings should be discarded when the side clearance exceeds .008" and the end clearance .007" to .008" per inch of bore diameter. It is also a good policy to discard any rings which have been stuck for any length of time as they are apt to be out of round and may not hold compression. Always check new rings, measuring the side clearance, in the groove in which the ring is to run, with feeler gauge, and the end clearance with the ring in the liner at the smallest diameter. Never install rings with less clearance than that given above. As the oil rings wear the width of the flat increases, with consequent decrease in width of bevel and oil scraping ability. Experience will determine permissible wear without excessive oil pumping.

4. CONNECTING ROD

The connecting rods are steel drop forgings, rifle drilled to carry oil to the piston pins. Shims between foot of rod and crankpin box provide adjustment to balance compression pressures in the cylinders to the desired value. The distance "X" (see Fig. K-1), between the top of the piston and the top of the liner should be in accordance with the tabulation below.

Engine Bore and Stroke	Dimension "X"	Engine Bore and Stroke	Dimension "X"
10 x 13	13/16"	13 x 16(Turbo.)	1 3/32"
10½ x 13 262	13/16"	14½ x 18	1 7/16"
11½ x 15	15/16"	15 x 19	1 3/16"
13 x 16	1 1/32"	15 x 19(Turbo.)	1 9/32"

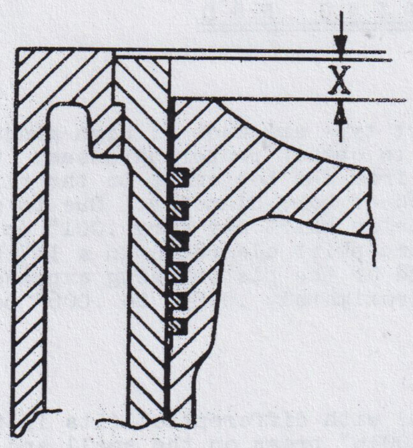

FIG. K-1

When taking measurement "X" the piston should be at top dead center and the cylinder liner must be securely clamped down into the cylinder. The cylinder stud nuts must also be tight when making this adjustment. Connecting rod shim adjustment in accordance with the above tabulation should be used for altitudes from sea-level to 1500' and will then produce compression pressures of 400 to 410 pounds per square inch. If the engine is located at higher altitudes than 1500 feet above sea-level dimension "X" should be smaller than the tabulated values. The Engineering Department of Atlas Imperial Diesel Engine Co. will advise the proper adjustment if the engine serial number and altitude is stated.

A bronze bushing for the piston pin is pressed in the upper end of the rod. If this bushing is replaced it must be reamed to allow a piston pin clearance of .002" to .003" on 10" bore engines and .0035" to .005" on engines with larger bore. Care must be taken to keep the reamed hole exactly parallel with the foot of the rod. The oil grooving in the bushing is carefully designed for correct lubrication, and new bushings must be inserted in rod with the relief grooves on the horizontal axis of the pin. A ball check valve at the bottom of the rod prevents return of the column of oil in the rod. Examine these valves at annual overhauls. The ball lift should not exceed 3/32".

5. CONNECTING ROD BEARINGS

The crankpin boxes are steel castings with babbitt lining centrifugally cast and accurately bored. No attempt should be made to rebabbitt these boxes in the field. New boxes may be obtained from A.I.D.E. Co. and a credit allowance will be made for old boxes returned. Bearing adjustment is by means of shims between halves of bearing. Bearing clearances when adjusted should be .0008" to .0009" per inch of bearing diameter.

Clearances are best measured with a lead wire compressed between bearing and journal, as described in Section F. Keep the shim thickness equal on the two sides. Inspect the bearing surfaces for even bearing. Areas which are not bearing on the shaft will be discolored, and such bearings as well as new ones should be carefully scraped to secure even bearing over at least 3/4 of the entire area. End clearance is .007" to .015" and should not be allowed to exceed .025"

The two crankpin box halves are held together by bolts so that the connecting rods and connecting rod bolts can be removed without disturbing the bearings. On some 13" bore engines the lower base is shallow and at its lowest point the connecting rod box passes close to the lubricating oil header. If the crankshaft in these engines is barred over with the crank pin bearings loose on the shaft be sure to keep the bearings in a vertical position as they approach and pass over bottom center as they will not clear the lubricating oil header below the crankshaft if they are turned appreciably from the vertical. The header may be severely damaged if struck by the crankpin bearing boxes.

NOTE: 15" bore engines built 1941 or later are equipped with loose bearing shells in the crankpin boxes. These shells are bronze backed and care should be taken that backs of shells and bores of boxes are absolutely clean when assembling. The shells project above the faces of the crankpin box halves .003" to .005" but are squeezed down flush when the connecting rod bolts are tightened up.

6. CONNECTING ROD BOLTS

The connecting rod bolts, fitting in reamed holes, hold the two halves of the crankpin boxes together and to the foot of the rod. The nuts should be kept pulled up tightly but not overstressed. They should not be sledged but should be pulled up by hand with a pipe about four feet long on the wrench. It is good practice to keep a record of the length of connecting rod bolts, measured with a micrometer at annual overhauls and to discard bolts that show more than .010" increase in length. It is further recommended that all connecting rod bolts be replaced every two years, assuming the engine to have had continuous service during that time, say 8000 hours or more. It is nearly always old bolts that have been in service for some time and have been overstressed by pulling up the nuts too tightly that fail. Replacing bolts as suggested above is cheap insurance against the possibility of wrecking an engine through connecting rod bolt failure. Replace cotter pins carefully, always using new cotter pins. Be sure that they are a close fit in the hole and bend the ends back tightly against the sides of the nut. If this work is left to inexperienced mechanics it should be very carefully inspected at the completion of the job. Always replace rods, bearings and pistons in the cylinders from which they were removed. All parts are numbered.

CAMSHAFT AND VALVE OPERATING GEAR

1. CAMSHAFT

The camshaft is made of 2" ground steel shafting. The keyways in the shaft are indexed for the firing sequence stamped on the engine nameplate when the engine is running in the "Ahead" direction of rotation. Number 1 cylinder is located at the forward end of the engine. The high pressure fuel pump crankshaft is part of the camshaft assembly and is bolted to a coupling flange which has been shrunk on and keyed to the aft. or pump end of the camshaft.

2. CAMSHAFT BEARINGS

The camshaft bearings are accurately machined cast iron blocks with pressed in bronze bushings. Bearing bore in bushing is reamed to 2.005" - 2.006" diameter which allows a running clearance of .005" to .007". If replaced the bushings must be reamed and oil and mounting holes drilled through after pressing in. A groove must be chipped to communicate with the oil hole if it does not intersect the groove in the bushing. The bearing blocks are held in machined seats cut in the webs of the centerframe and are secured by capscrews.

The camshaft thrust is carried by the two bearings adjacent to the fuel pump crankshaft. These two bearings differ from the other bearings in that the bushings have thrust faces. The face of the forward bearing contacts the forward face of the coupling shrunk on the end of the camshaft and the face of the after bearing engages the web on the after end of the fuel pump crankshaft. The two bearings are adjusted in a fore and aft direction to permit a camshaft end play of .015" to .020". All the bearings except the two thrust bearings and the bearing at the extreme forward end depend upon spray from the connecting rods and main bearings for lubrication. Catch basins in the top of the bearings collect the oil. The two thrust bearings and the forward bearing are supplied with oil from the force feed lubricating oil system.

3. CAMS

The cams are accurately ground to shape after being case hardened. The fuel valve cam consists of a case hardened steel disc in which a case hardened steel toe is inserted. This toe controls the action of the spray valve, the disc serving as a base circle. The cams are a sliding or light tap fit on the camshaft and are held in position by taper keys driven securely into place after the cams have been located to line up with the latch rollers properly. The ahead inlet and exhaust cams serve as hubs to which the astern inlet and exhaust cams, the ahead and astern air starting cams and the fuel cam disc are bolted. This cam sequence or arrangement may not apply to the 13 x 16 Turbo-charged engines, especially late model engines which use two loose cams for either inlet or exhaust. For correct cam sequence see the parts catalog plate facing the Camshaft Group. Elongated holes in the fuel cam disc allow angular adjustment with respect to the hub, permitting exact setting for timing.

4. CAMSHAFT REMOVAL

(a) Disconnect the linkage between the governor and the wedge shaft, and disconnect the lubricator strap and the pump connecting rods on the forward end of the camshaft.
(b) Remove the engine control parts, the latch shaft interlock (on lever controlled engines), and the pilot valves from the top of the latch box.
(c) Remove the latch box.
(d) Remove the latch shaft and latches.
(e) Remove all push-rods.
(f) Pull the lifters upward away from the cams and secure them in this raised position with a hose clamp or some other suitable device.
(g) Remove the rotary pump housing together with the three pumps.
(h) Disconnect the fuel lines from the high pressure fuel pump and remove the pump housing assembly.
(i) Remove the bearing caps of the high pressure fuel pump connecting rods and remove the crosshead plugs, oil guards, sleeves and guides.
(j) Take out the cam bearing retaining capscrews.
(k) Loosen the cylinder nuts on the camshaft side of the engine.
(l) Remove the camshaft. Sledge each bearing block out of its seat a little at a time using a timber inserted through the openings on the exhaust manifold side. The end of the timber should be placed against the camshaft as close to the bearing as possible. When the camshaft has been partially removed it will be possible to withdraw the connecting rods and crossheads of the fuel pump downward.

5. CAMSHAFT DISASSEMBLY

After the camshaft has been removed from the engine it should be disassembled as follows. The bilge pump crank is removed either by a suitable puller or by driving with a babbitt hammer. Then, after removing the first cam bearing the clamping bolts of the camshaft gear hub are loosened and the whole assembly slid off. Bearings and cams are then removed successively from the forward end of the camshaft. FOR ALL RIGHT HAND OR PORT ENGINE, ALSO FOR LEFT HAND OR STARBOARD ENGINES WITH 10", 10½" AND 11½" BORE, the cams are loosened by driving the keys forward with a drift. FOR LEFT HAND OR STARBOARD ENGINES WITH 13" BORE ONLY, the cams are loosened by driving the keys aft with a drift. The cams should slide on the shaft freely after the keys have been removed, but if it should be necessary to drive them off, only a babbitt hammer or brass drift should be used. Any burrs, particularly at keyways, must be dressed down with a file. If this precaution is not taken the cams may seize as they are removed and forcing the cams the remainder of the distance will score the shaft.

6. CAMSHAFT ASSEMBLY & INSTALLATION

When the camshaft is being reassembled the same precautions with regard to burrs apply. Coating the bores of the cams with white lead will aid materially in sliding the cams into place without scratching the shaft. The bores of either new or old cams should be inspected carefully for any defects likely to scratch the shaft. Bearings and cams are installed successively from the forward end but are not keyed to the shaft until later. The hub and cam gear are assembled on the shaft and clamped tightly. The camshaft gear should be located with its forward face a distance from the end of the shaft according to the following table:

10", 10½" and 13" bore engines	6"
11½" bore engines - - -	6¼"

The assembled camshaft is then installed in the engine. After starting each cam bearing in its seat the bearings are driven into place a little at a time with a heavy brass bar. Each bearing should be driven a little and then left until all the others have been knocked in the same amount so that the camshaft will not be bent. The cam bearings will seat more easily if the cylinder nuts are loose.

The connecting rods and crossheads of the high pressure fuel pump must be assembled as the camshaft is being driven into place. The crossheads should be inserted in the holes in the centerframe before the camshaft has been driven in any appreciable distance. When the camshaft has been partially installed it will be possible to place the connecting rods on their respective cranks. After this last step the connecting rods and crossheads need no further attention as the cam bearings are being seated.

After the cam bearings have been securely bolted, the latch shaft and latches should be installed. The cams are then ready for keying. Starting with Number 6 (flywheel end) cylinder place each set of cams directly under the proper latch rollers and secure the cams to the shaft by inserting the taper keys. FOR ALL RIGHT HAND OR PORT ENGINES ALSO FOR LEFT HAND OR STARBOARD ENGINES WITH 10", 10½" and 11½" BORE drive each key toward the after end of the engine (large end of key should be forward). FOR LEFT HAND OR STARBOARD ENGINES WITH 13" BORE ONLY, drive each key towards the forward end of the engine (large end of key should be aft). Complete this procedure with each set of cams before going to the next one and work forward from the after end of the engine.

The engine should next be timed, in accordance with the detailed instructions in Paragraphs 14 to 17 after which the latch box and control parts may be reassembled on engine. For Fuel Spray Valve timing see Section O.

7. VALVE LIFTERS

The steel valve lifters work in cast iron guides bolted to the top of the centerframe and carry case hardened rollers on steel pins on their lower ends. (The air starting lifter does not have a roller.) Clearance between lifters and guides is .0015" to .0025", between rollers and pins is .001" to .002", and the pins are riveted into the lifter forks, with the ends flush, so that they may enter the guide bores. A hole in the lower end of the starting air lifter engages a pin carried in bosses on top of the latch, which serves to lift the latch clear of the cams when the engine is running.

8. PUSH-RODS

The engine may be equipped with either of two types of push-rods. One style connects to the valve rockers with forks which are screwed on to the end of the push-rod and secured by a locknut. The forks are connected to the rockers with steel pins which are held in place by a ball check pressed into the rocker. This ball check engages in a circumferential groove around the center of the pin, and may be removed by tapping with a hammer and drift. The pins are fitted with a clearance in the rocker of .000" to .0025", and a clearance of .0005" to .0027" in the forks. Holes located near the top of the push-rod provide a means for turning the rod when making adjustments.

The other style of push-rod engages the rocker by means of a ball and socket, the socket being in the end of the push-rod. The ball screws into a tapped hole in the rocker and provides the means for adjusting the clearance between the rocker and valve. The ball studs are retained by a capscrew clamping the threads. These clamp screws should be kept tight so that there is no chance of the ball stud working loose and changing the clearance between rocker and valve, and also to prevent stripping of the thread due to the continued hammering action of the push-rods.

The steel pins which link the forks to the rockers have - .0005" to - .0027" clearance in the forks and .000" to .0025" clearance in the rocker ends. The pins are retained by ball checks which are pressed into the rocker ends and which engage circumferential grooves at the centers of the pins. The pins may be removed by tapping with a hammer and drift.

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9. VALVE ROCKERS

The rockers for the inlet, exhaust and starting air valves are fulcrumed on a shaft which is supported by bearings at each end. The bearings are mounted on studs screwed into the cylinder heads and are held between nuts on the studs. By screwing the nuts up or down the rocker shaft can be raised or lowered.

The three rockers are bronze bushed at their fulcrums and the bushings are reamed for .001" to .003" clearance with the rocker shaft after pressing in. The case hardened rollers at the valve end of the exhaust and inlet rockers work directly on the valve stems and turn on steel pins riveted in the rocker forks. The clearance of the rollers on the pins is .0005" to .0015".

The fuel valve rocker is not carried on the shaft with the other three rockers. A support located on the manifold side of the cylinder head acts as a fulcrum. The steel fulcrum pin, retained by cotter pins at each end, has a clearance of .000" to .0017" in both pieces.

10. VALVE TIMING

The correct valve timing for the engine is given in the following table.

	Non Turbocharged	13 x 16 Turbocharged	
Starting Air Valve Opens - - - - - -	5° B.T.C. - - - - -	5° B.T.C.	E.Y.K
" " " Closes- - - - - -	45° B.B.C. - - - - - -	50° B.B.C.	E.A.K
Inlet Valve Opens- - - - - - - -	10° B.T.C. - - - - - -	80° B.T.C.	E.Y.K
" " Closes - - - - - - - - -	35° A.B.C. - - - - - -	30° A.B.C.	J.A.K
Exhaust Valve Opens- - - - - - -	35° B.B.C. - - - - - -	45° B.B.C.	E.A.K
" " Closes - - - - - - - -	5° A.T.C. - - - - - -	65° A.T.C.	J.Y.K
Fuel Spray Valve Opens - - - - - -	see engine name plate		
" " " Closes- - - - - -	see engine name plate		

11. SPOTTING THE PISTON

Before proceeding with the discussion on valve timing the following instructions regarding the correct method of spotting a piston should be considered. Whenever a piston is to be spotted for valve setting it should be brought into position by turning the engine in the direction of <u>ahead</u> rotation in order to take up all gear back-lash. If the engine is turned past the desired position, it should be turned well back in the opposite direction, and then again brought up to the required point.

12. FLYWHEEL MARKINGS

NOTE: The following data applies to Non-Turbo-charged engines and is intended for a general description of the markings only. For actual figures for valve timing see paragraph 10 above.

The 13 x 16 Turbo-charged engine flywheel is marked similarly except the degrees are marked completely around the full circumference due to the earlier opening and later closing of the valves. The description following may be applied to the turbo-charged engines providing the figures given paragraph 10 above are substituted.

The position of the piston may be determined from the flywheel pointer and the markings stamped on the flywheel rim. Top center of each piston is marked and stamped with the corresponding piston numbers, and degree marks are stamped for 25° on each side of top center. These markings are sufficient for all valve timings. The intake valves normally open 10° B.T.C. (Before Top Center) and the exhaust valves close 5° A.T.C. (After Top Center) and these points can of course be determined directly from the degree markings adjacent to the top center marking of the corresponding cylinder.

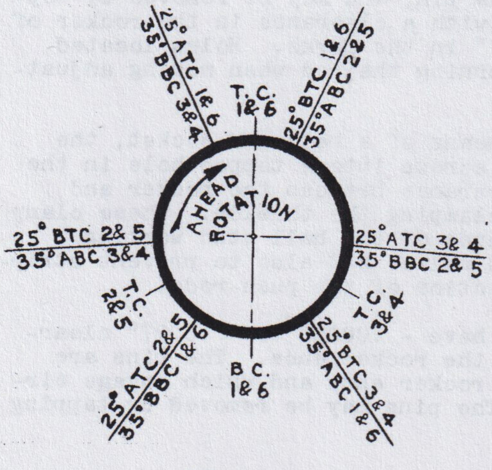

FIG. L-1

The intake valves normally close 35° A.B.C. and the exhaust valves open 35° B.B.C. Referring to Fig. L-1, these points may be obtained on the flywheel as follows. Since the crankshaft has three throws 120° apart the top centers of the three pairs of cylinders will be 120° apart. Bottom center of any pair of cylinders is 180° from top center. Therefore the bottom center of any pair of cylinders is 60° from the top centers of the other two pairs. As previously stated, each top center is marked for 25° in either direction. Subtracting this 25° from the above 60° leaves 35°. Hence each 25° A.T.C. point is also the 35° B.B.C. point for the preceding pair of cylinders and similarly each 25° B.T.C. point is also the 35° A.B.C. point for the following pair of cylinders.

13. POINTER LOCATION

The location of the flywheel pointer should be checked occasionally by "splitting the center". With one of the cylinder heads removed crank the engine to a point about 20° off top center. Measure the exact distance from the top of the liner down to the piston and observe the pointer reading on the flywheel. Then set the piston to the same distance below the top of the liner on the other side of top center and observe the flywheel pointer reading. If the readings do not agree adjust the pointer to give equal readings on each side. These readings should preferably be taken with an indicator and in each case the piston should be cranked upward into position.

14. CAMSHAFT TIMING

In order to time the engine it is necessary to determine the correct relation between the crankshaft and camshaft, which is done by positioning the camshaft gear on its hub, and then to adjust the push rods to open and close the valves at the correct points. Unless the crankshaft gear, camshaft gear or camshaft gear hub have been replaced, the camshaft can be correctly timed after overhauling as follows. Before breaking the gear train spot No. 1 piston exactly on firing top center. With a steel scale bearing firmly against the machined side of the centerframe scribe a line across the side of the camshaft gear parallel to the centerframe face. When re-assembling mesh the gears with the crankshaft and camshaft in the same relative positions, that is, with No. 1 piston on firing top center and the line on the camshaft gear in line with the centerframe face.

If the crankshaft gear, camshaft gear or the camshaft gear hub is replaced, the camshaft may be timed as follows:

(a) Spot No. 1 piston $2\frac{1}{2}^{\circ}$ B.T.C. (13 x 16 Turbocharged $7\frac{1}{2}^{\circ}$ B.T.C.) in the AHEAD direction.
(b) Set the camshaft gear relative to its hub so that clamping bolts are approximately in the center of the slots. Orient camshaft gear so that old dowel holes will not interfere with redowelling.
(c) Turn the latch shaft to the AHEAD position (latches out).
(d) Turn the camshaft (with intermediate gear out of mesh) so that the inlet and exhaust lifters of No. 1 cylinder are each raised an equal distance. (NOTE: The piston was set at $2\frac{1}{2}^{\circ}$ B.T.C. (or $7\frac{1}{2}^{\circ}$) as this is the mean position between the opening of the inlet valve, and the closing of the exhaust valve, and at this position both valves should be open an equal distance.)
(e) Holding crankshaft and camshaft in above positions and allowing the camshaft gear to slip on its hub as required, mesh the intermediate gear and tighten the clamp bolts between the camshaft gear and hub. After all valves have been timed and checked, drill 31/64" holes through gear in line with dowel holes in hub and ream to .497" - .498" for dowels.

After determining the correct relation between the camshaft and crankshaft the push rods must be adjusted as follows: (See Section O for timing of fuel spray valve.)

15. INLET & EXHAUST VALVE TIMING

(a) Non-Turbo-charged engines:
1. Spot piston at 10° B.T.C. at the end of the exhaust stroke.
2. Adjust inlet push-rod so that valve is just opening.
3. Spot piston at 5° A.T.C. on the suction stroke.
4. Adjust exhaust push-rod so that valve is just closing.

(b) 13 x 16 Turbo-charged engines only:
1. Spot piston at 80° B.T.C. near end of exhaust stroke.
2. Adjust inlet push-rod so that the valve is just opening.
3. Spot piston at 65° A.T.C. on the suction stroke.
4. Adjust exhaust push-rod so that valve is just closing.

The following applies to both Non-Turbo-charged & Turbo-charged engines:

(c) Check clearances between valve stems and rocker rollers. The cams are designed for 1/32" clearance with the valves set as above and with the engine cold, but this will vary somewhat due to manufacturing tolerances. When making the adjustments aim at the opening and closing points but keep the clearances between .020" and .040", varying the opening and closing points slightly if necessary. Excessive clearances mean a noisy engine and increased wear on parts. Insufficient clearances prevent valves from seating properly, with consequent blowby and destruction of valves and seats.

(d) Check and record closing point of inlet valve and opening point of exhaust valve. These points should fall within 5° of the position given in the timing table.

(e) Shift latch shaft to ASTERN and check opening and closing points of inlet and exhaust valves when running ASTERN. Discrepancies from the AHEAD timing up to 5° may occur due to manufacturing tolerances, but no attempt should be made to correct this condition, as any changes in the push-rod adjustments will upset the AHEAD timing.

(f) Adjust and record valve timing for the other cylinders as above.

16. STARTING AIR VALVE TIMING - ENGINES WITH 13" BORE

(a) Insert steel block 5/16" thick between the air starting rocker and the top of the piston in the pneumatic tappet in the starting air valve.

(b) Spot piston at 5° B.T.C. at the end of the compression stroke (in the AHEAD direction and with latch shaft AHEAD) and adjust the pushrod so that the valve is just opening. Check the closing point, which should fall within 5° of the position given in the table. (See Paragraph 10)

(c) Shift latch shaft to ASTERN and spot piston at 5° B.T.C. ASTERN.

(d) Adjust astern air starting cam relative to its hub so that starting air valve is just opening and clamp cam to hub. Check closing point.

(e) Adjust and record starting air valves for the other cylinders as above.

17. STARTING AIR VALVE TIMING - ENGINES WITH 11½" OR SMALLER BORE

(a) Bar the valve rocker shaft by hand to its starting position (up against the stop in the air cylinder).

(b) Spot piston at 5° B.T.C. at the end of the compression stroke (in the AHEAD direction and with latch shaft AHEAD) and adjust the pushrod so that the valve is just opening. Check the closing point, which should fall within 5° of the position given in the table. (See Paragraph 10)

(c) Shift latch shaft to ASTERN and spot piston at 5° B.T.C. ASTERN.

(d) Adjust astern air starting cam relative to its hub so that starting air valve is just opening and clamp cam to hub. Check closing point.

(e) Adjust and record starting air valves for the other cylinders as above.

18. CAMSHAFT DRIVE GEARING - ENGINES WITH 13" BORE

The camshaft is driven from a gear on the crankshaft by means of an intermediate gear. The helical crankshaft gear is shrunk on the crankshaft between the two forward main bearings. If replaced the new gear should be heated to approximately 600° F. and slipped over the shaft against a temporary spacer to locate the inner face of the gear 8-1/4" from the machined face of the first crank web. Do not overheat the gear, as this will damage the steel structure, and once it is started onto the shaft move it immediately to the final position, as it will be impossible to move it farther once it begins to cool and seize the shaft. If this should happen it would be necessary to destroy the gear in order to remove it.

The intermediate gear has replaceable bronze bushings and rotates on a case hardened steel shaft. The intermediate gear bracket or bearing in which the gear and shaft are mounted is bolted and doweled to the top of the centerframe. Shims between the bearing and the centerframe and movement of the bearing transversely permit backlash adjustment of the gears, which should be set at .006" to .008". If the bushings in the intermediate gear are replaced they should be reamed to 2.937" to 2.938" diameter and faced to 3.002" to 2.998" in thickness after being pressed into the gear. The clearance between the gear bushings and the shaft should then be .002" to .004" and the total lateral clearance .005" to .012". Lubricating oil under pressure is supplied to the intermediate gear bearing from the header in the base.

The camshaft gear is bolted and doweled to a hub which is keyed and clamped to the forward end of the camshaft. It should be located fore and aft in line with the intermediate gear.

19. CAMSHAFT DRIVE GEARING - ENGINES WITH 11½" BORE

The camshaft is driven from a gear on the crankshaft by means of a compound intermediate gear. The helical crankshaft gear is shrunk on the crankshaft in front of the last forward main bearing. It should be located 1/4" from the machined face of last crank web. Do not overheat the gear, as this will damage the steel structure, and once it is started onto the shaft move it immediately to the final position, as it will be impossible to move further once it begins to cool and seize the shaft.

The intermediate gear has replaceable bronze bushings and rotates on a case hardened steel shaft. The intermediate gear bracket or bearing in which the shaft is mounted is bolted and doweled to the end face of the centerframe. Shims between the gear bracket and the end main bearing cap permit alignment of the gear and adjustment of backlash which should be set at .006" to .008". If the bushings in the intermediate gear are replaced they should be reamed to 2.999 - 3.000 diameter and faced to 5.502 - 5.498 thickness after being pressed into the gear. Lubricating oil under pressure is supplied to the intermediate gear bracket from the lubricating oil pressure system.

The camshaft gear is bolted and doweled to a hub which is keyed and clamped to the forward end of the camshaft. It should be located fore and aft in line with the intermediate gear.

20. CAMSHAFT DRIVE GEARING - ENGINES WITH 10" AND 10½" BORE

Paragraph 19 applies with the following exceptions. The intermediate gear bracket or bearing in which the shaft is mounted is bolted and doweled to the forward end centerframe cover. If gears are replaced backlash should be adjusted to .006" to .008". If bushings in the intermediate gear are replaced they should be reamed to 2.249" - 2.250" diameter and faced to 4 63/64" after being pressed into the gear. The crankshaft gear is in this case located against the machined face of the forward crank.

FUEL SUPPLY SYSTEM

The complete fuel system may be conveniently divided into two parts, the fuel supply system and the fuel injection system. The fuel supply system is made up of the fuel transfer pump, the fuel day tank and the fuel filter, while the fuel injection system includes the high pressure fuel pump, the fuel rail, the accumulator, the fuel pressure regulating valve, the fuel spray valves, and the necessary connecting tubing.

1. IMPORTANCE OF CLEANLINESS IN FUEL HANDLING

The high pressure fuel pumps and fuel spray valves have been referred to as the heart of the Diesel engine and the proper functioning of these parts is necessary for the successful operation of the engine. These pumps depend upon lapped plungers working in cylinders with clearances measured in hundred thousandths of an inch and it is vital that the fuel entering these parts be kept free of any grit or foreign matter. The engine is equipped with filters for this purpose but it is also necessary for the operators to use every possible care in getting clean fuel oil and in keeping it clean until it is delivered to the engine. Fuel tanks and piping should be thoroughly cleaned when installed and should be kept covered at all times.

The fuel filter should be periodically cleaned and serviced according to the detail instructions given in paragraph #3. The best filters obtainable will be useless if dirt is introduced into the fuel after it has passed through them, and it is therefore of great importance that every effort be made to protect the fuel pipes after the filter during repairs and overhauls. Cleanliness in handling fuel, piping and injection equipment is of vital importance and will pay good dividends in trouble-free operation. Many times mysterious and expensive pump and fuel spray valve troubles have been traced to careless handling of fuel and carelessness in storing and installing spare parts.

2. FUEL TRANSFER PUMP

The fuel transfer pump, which is located in the rotary pump housing on the after end of the centerframe, delivers a continuous supply of fuel to the engine from the main storage tank. It is a rotary type gear pump, identical in construction (but smaller in size) with the lubricating oil pumps described in Section S. The description will not be repeated here, nor the instructions regarding direction of rotation, which apply equally well to the transfer pump. (On direct reversible marine engines the rotary gear type fuel transfer pump is reversible. Consequently fuel is delivered from the same port irrespective of direction of rotation.) The fuel transfer pump drive is shown on Fig. N-1. Transfer pump (6) is mounted in adapter (5) which is bolted and doweled to housing (11). If the adapter is replaced it must be positioned for .004" to .005" gear backlash before doweling. A cylindrical fit between pump and adapter permits replacement of the pump without disturbing the drive gear setting. The pump shaft and rotor is

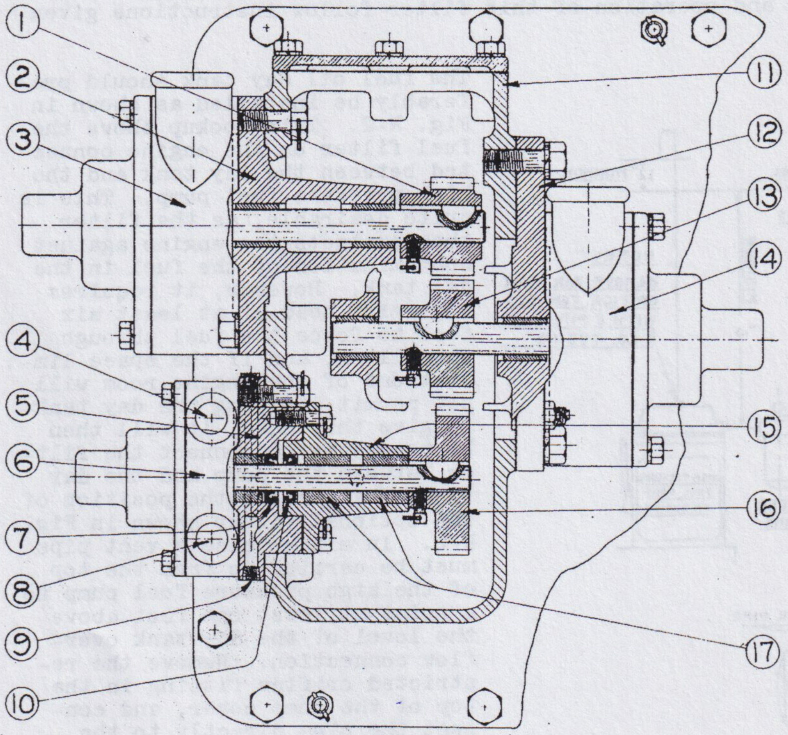

FIG. N-1

carried in three bronze bushings one in the adapter and two in bearing (15) which is bolted to the adapter. If replaced these bushings must be line reamed to .6250"-.6255" dia. after pressing in and with the bearing bolted to the adapter.

The bushing in the adapter is lubricated by fuel oil from the pump, and the two in the bearing by lubricating oil, fed through drilled holes in the castings from a lubricating oil line connecting into the adapter. Oil seals (7) and (10) prevent contamination of the lubricating oil by the fuel oil and if replaced must be installed as shown, that is with the leather ends together and flush with the ends of the bores. Some engine models are equipped with one rotary type seal instead of the two seals shown in Fig. N-1. This type of seal rotates with the pump shaft and seals against the specially prepared faces of the adjacent bushings. Fuel leakage past the seal is drained off through connection (9), which should be piped back to the fuel tank. Under no circumstances should this opening be plugged, or the fuel will drain into the lubricating oil in the crankcase. Drive gear (16) is secured to the shaft with a Woodruff key and setscrew, which should be securely wired, as should all the internal bolts in the assembly.

3. FUEL OIL FILTER - (Series Type - Standard Equip.)

The fuel oil filter is a metal edge type filter, similar to the lubricating oil filter described in Section S and the detailed description will not be repeated here. There are two elements in series, with .002" and .003" spacing. The dirt may be scraped off the elements by turning the cleaning handles on the top, and this should preferably be done when the engine is not running so that the dirt can settle freely to the bottom of the sump tanks although there is no objection to cleaning with the engine running. The sumps should be drained before the dirt builds up to the level of the elements.

After draining refill the filter through the priming plug in the top, and leave the vent cocks slightly open when starting the engine to allow the trapped air to bleed out. The filter elements may be replaced by removing the handles and sump tanks and unscrewing the elements from the head. CAUTION: Element is attached to head with left hand thread. Assemble with .003" element on the inlet side.

4. FUEL OIL FILTER - (Duplex Type - Special Equip.)

This filter (if engine is so equipped) is similar to the series type described above, except that the elements have .0015" spacing, and the filter is provided with a switch-over valve which allows either element to be cut out for cleaning while the engine is running. For care and operation of this filter follow instructions given above for the series type.

5. FUEL DAY TANK

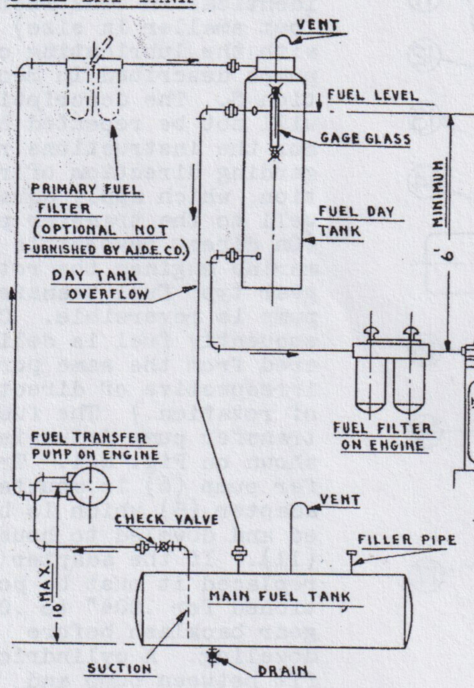

FIG. N-2

The fuel oil day tank should preferably be installed as shown in Fig. N-2. This hookup shows the fuel filter on the engine connected between the day tank and the high pressure fuel pump. This is quite desirable, as the filter then protects the engine against contamination of the fuel in the day tank. However, it requires a gravity head of at least six feet to force the fuel through the filter, and if the space limitations of the engine room will not permit locating the day tank to give this head, it will then be necessary to connect the filter between the pump and the day tank, that is, in the position of the optional filter shown in Fig. N-2. In either case a vent pipe must be carried up from the top of the high pressure fuel pump to a point at least one foot above the level of the day tank overflow connection. Remove the restricted orifice fitting in the top of the pump cover, and connect the pipe directly to the cover, using 3/8" or 1/2" I.P.S. (Iron Pipe Size) pipe or 1/2" to 5/8" O.D. copper tubing. The end of the pipe must be protected to prevent the entrance of dirt and moisture.

The suction pipe from the pump to the storage tank and the day tank overflow pipe should be 1/2" or preferably 3/4" I.P.S. and the pressure pipe from the pump to the engine should be 1/2" or 3/4" I.P.S. For long pipes use the larger of the sizes given.

While the installation with fuel day tank as shown in Fig. N-2 is recommended and the tank is furnished with the engine it is not absolutely necessary. If desired the tank may be omitted and the hookup made according to Fig. N-3. The advantage of the day tank is that fuel is always available under a gravity head for starting the engine and in case of failure or loss of prime of the transfer pump the engine will run for some time on the fuel in the day tank. If a day tank is not used the engine will stop almost immediately upon failure of the transfer pump.

If the hookup without the day tank is used, as shown in Fig. N-3 the vent connection in the top of the high pressure fuel pump must be piped back to the main storage tank as shown, and in this case the throttling orifice in the top of the pump should not be removed, but the fuel return pipe should be connected into this orifice. This return line provides for a continuous flow of fuel through the top of the high pressure pump and insures the removal of any air trapped in the fuel. The restricted opening in the air vent orifice is proportioned to give the desired pressure in the high pressure pump suction chamber. If the main fuel tank is above the engine room level, the return pipe should spill over into the top of the tank, and the pump suction should be taken from some distance above the bottom of the tank to prevent sucking sludge and the water into the engine. The fuel return line should be 3/8" I.P.S. or 1/2" O.D. copper tubing, the pump suction pipe should be 3/4" I.P.S. pipe, and the pressure pipe 1/2" I.P.S. or larger.

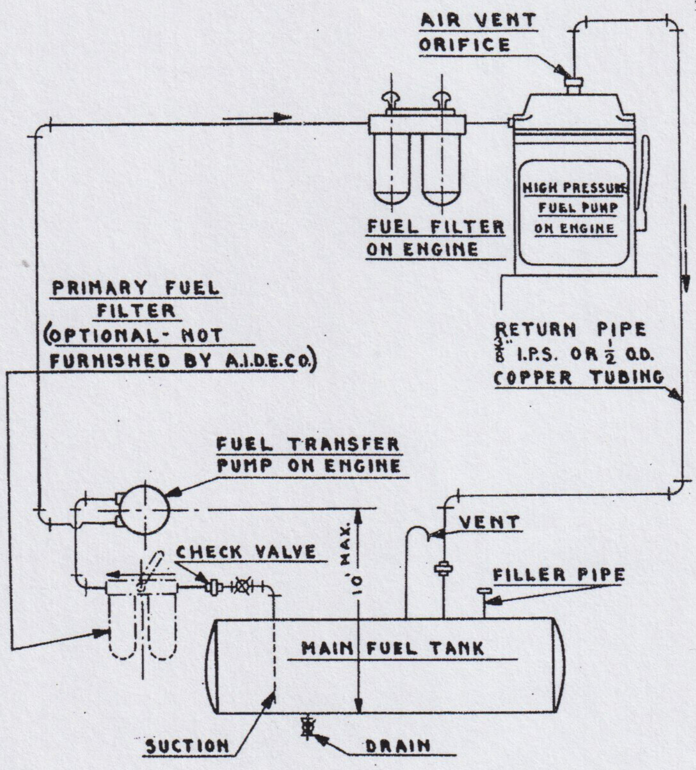

FIG. N-3

While not absolutely necessary, it is suggested that a primary filter (not supplied by A.I.D.E. Co.) be employed in addition to the filter on the engine. This will collect the larger particles of dirt, and will thus materially increase the necessary cleaning interval of the engine filter. If used in connection with a day tank it should preferably be connected before the tank as shown in Fig. N-2 thus keeping the fuel in the tank clean. If a day tank is not used it should be connected in the pump suction, as shown in Fig. N-3. In either case, but particularly in the latter, it should be of ample capacity and of duplex construction, with built-in switch valve for cutting either unit out of service for cleaning. A Purolator filter, Type D113JJ with .003" spacing is recommended.

FUEL INJECTION SYSTEM

1. HIGH PRESSURE FUEL PUMP

The high pressure fuel pump is located on top of the centerframe between the flywheel and Number 6 cylinder on the operating side of the engine. The pump consists of two plungers actuated by crossheads and connecting rods from a crankshaft which is bolted to the after end of the camshaft. A small hand operated plunger is also built into the pump and is used for priming the fuel system and for building up fuel pressure when the spray valves are being timed or tested.

Referring to Fig. 0-1 cast iron guides (30), located in holes in the centerframe and secured by capscrews, carry crossheads (29), which are actuated by the crankshaft and connecting rods (16). The bronze connecting rods have a clearance of .0005" to .0025" on their crankpins and a side play of .005" to .009". Roller bearings in the upper end of the connecting rods constitute the wrist pin bearings, and the pins have .0005" to .0015" clearance in the crossheads. Each crosshead has a replaceable bronze sleeve (28), held in place by a shoulder on the lower end of the crosshead and by the oil guard (27) and plug (26) at the upper end. The clearance between this sleeve and the crosshead guide is .002" to .004" and if it becomes excessive new sleeves should be installed. Lubrication is by spray from the cranks.

Pump housing (15) supports mounting plate (20) and carries handle (10) and shaft of the priming pump. Mounting plate (20) which is bolted to the top of the housing carries the individual pump bodies (21) on its lower face. The pump bodies contain all the essential parts of the pump, namely, barrel (24) and plunger (23) suction valves (19), discharge valves (8), and the priming pump plunger assembly (12) and (13).

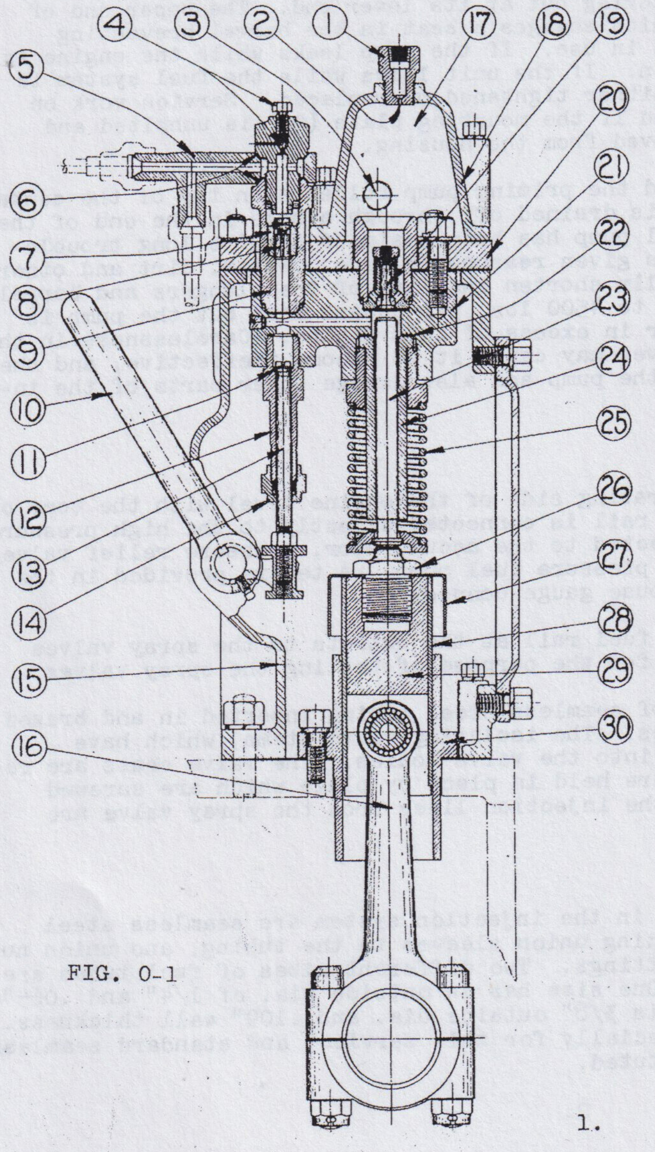

FIG. 0-1

The suction and discharge valve assemblies extend upward through holes in the mounting plate and a suction chamber (17) is formed by the mounting plate and its cover (18). A reservoir of fuel under low pressure is consequently located immediately above the suction valves.

Plunger and barrel assemblies (23) and (24) of the main pumps are installed in seats in the bottom of pump bodies (21). Retaining nuts hold the barrels in place and copper gaskets between the barrels and seats form the seals. Springs, retained at the lower ends of the plungers by special washers, force the plungers downward on the suction strokes. The plungers and barrels are lapped together in matched pairs and are not interchangeable. Always use care to prevent mixing them. If either piece becomes scored or damaged both must be replaced. Always wash parts thoroughly in clean solvent or fuel oil and lubricate with clean engine oil before replacing.

When dismantling the pump, mounting plate (20) together with the pump bodies and plunger barrel assemblies should be removed from the housing as a unit. Hold the plungers in place as the unit is lifted, as they will drop out when free of the crossheads.

Suction valves (19) are located in pockets in the top of the pump bodies immediately above the plungers. They are mounted in cages which form the guides and seats, and are held closed by springs, which are retained by nuts on the valve stems. The cage assemblies are held in place by retaining plugs screwed into the pump bodies, and are sealed to the bodies by copper gaskets. The valve lift is determined by the clearance between the top of the cage and bottom of the spring retaining nut, and should be set at 1/16". The valves may be removed by unscrewing the retaining plugs, after first removing top cover (18).

1.5

Discharge valves (8) are mounted in cages (9) which are screwed into the tops of the pump bodies. Spherical seats make tight joints between cage & body without gaskets. Flutes on the valve stems work in hardened steel inserts (7) pressed into the cages. The valve lift is limited by retaining plugs which screw into the tops of the cages and secure discharge tees (5). The lift should be 3/32". Spherical surfaces between the tees and the cages and plugs form tight joints without gaskets. Bleeder valves (4) in the tops of the retaining plugs permit venting entrained air from the fuel. The above construction is identical for both pumps, two of the tee outlets being connected together, and the other two leading to the fuel rail and to the accumulator and regulating valve.

Leakage of the suction or discharge valves can usually be stopped by lapping lightly with very fine grinding compound, but if this is not successful new valve and cage assemblies should be installed. If the lower end of the retaining plug above discharge valve (8) shows signs of heavy hammering this is usually due to discharge valve seat (7) being loose in the cage. The cage and seat must then be replaced. Hammering may also be due to insufficient discharge valve lift which should never be less than 1/16". 2.5mm

Priming pump assembly (12) and (13) is threaded into the bottom of the forward pump body directly below the discharge valve. The barrel is screwed into the pump body against a copper gasket and has a packing nut at its lower end. The upper end of the plunger (11) has a valve head which engages a seat in the barrel preventing leakage when the priming pump is not in use. If the pump leaks while the engine is running the valve should be lapped in. If the unit leaks while the fuel system is being primed the packing should be either tightened or replaced. Service work on this pump will be greatly facilitated if the mounting plate (20) is unbolted and the whole fuel pump assembly is removed from the housing.

Fuel leakage from the main pumps and the priming pump collects on top of the centerframe inside the pump housing, and is drained off through a hole in the end of the centerframe. The high pressure fuel pump has been designed to give long trouble-free performance provided that it is given reasonable care. Water, dirt and other impurities in the fuel will materially shorten the life of the plungers and barrels. The normal working pressure is 4000 to 4500 lbs. per square inch but the pump is capable of building up pressures far in excess of this figure. Carelessness in the care of the pressure regulating valve, may cause it to become ineffective, and the resulting high pressure may injure the pump and also damage other parts of the injection system.

2. FUEL RAIL

The fuel rail is located on the operating side of the engine level with the tops of the cylinder heads. One end of the rail is connected directly to the high pressure fuel pump and the other end is connected to the accumulator, pressure relief valve, pressure gauge and back to the high pressure fuel pump. A tee is provided in the pressure gauge line for the pilot house gauge connection.

Isolating valves are built into the fuel rail at the outlets to the spray valves and an additional valve is provided for the purpose of testing the spray valves.

The fuel rail consists of a length of seamless steel tubing inserted in and brazed to the bodies of the isolating valves. The isolating valve stems, which have hardened conical ends, are threaded into the valve bodies. The valve seats are replaceable tobin bronze washers and are held in place by plugs which are screwed into the valve bodies and to which the injection lines from the spray valve are connected.

3. INJECTION TUBING

All of the high pressure lines used in the injection system are seamless steel tubing. The ends are formed by brazing union sleeves to the tubing, and union nuts fasten these ends to the various fittings. Two different sizes of fuel tubes are used in the high pressure system. One size has an outside dia. of 1/4" and .065" wall thickness, and the other size is 3/8" outside dia. and .109" wall thickness. A high grade tubing is used, made especially for this service, and standard seamless steel tubing should never be substituted.

The importance of keeping the injection lines clean cannot be overemphasized. When an injection line is removed from the engine the open ends should be covered with clean paper which should not be removed until the tubing is to be placed on the engine again. If there is any doubt as to the cleanliness of an injection line it should be thoroughly cleaned before installing. To clean a line it should be washed repeatedly in cleaning solvent or gasoline and should be blown out with an air hose between each washing. This cleaning process should be carried on until there is no uncertainty as to the cleanliness of the tubing.

4. ACCUMULATOR

The accumulator is a welded steel bottle mounted on the centerframe, and connected to the fuel rail on certain sizes of engines or to both the rail and high-pressure pumps on other sizes. The function of the accumulator is to prevent large pressure fluctuations in the fuel system due to lowering of the pressure each time a spray valve opens, or to the increasing of pressure on each stroke of the fuel pump plungers. Therefore, due to the compressibility of the fuel oil, the accumulator helps to maintain an even pressure in the fuel system.

On the 13 x 16 Turbo-charged engine, the fuel rail has been increased considerably in diameter so that it performs the functions of both the rail and accumulator.

5. FUEL PRESSURE REGULATING VALVE

Fuel injection pressure is controlled by the adjustable pressure relief valve. This valve is of the by-pass type in which the opposing forces of a spring and the fuel pressure acting on the stem of a needle valve maintain constant fuel pressures. If the pressure starts to drop the spring closes the needle slightly reducing the amount of fuel by-passed with the result that the pressure is held constant.

Referring to Fig. 0-2 the regulating valve is built around valve body (7). The hardened steel valve seat (8) is held between the body and adapter stud (9) which screws on the bottom of the body, and through passage (18) allows the by-passed fuel to escape. Fuel inlet elbow (16) is threaded into the side of the body, supplying fuel to the annular space around the reduced section of the valve stem (17). The top of the body is bored to receive stem packing (15) and packing gland (14). Screwed to the top of the body is relief valve spring cage (5). This cage is screwed down upon the drain cup holding the latter in place against a shoulder on the body.

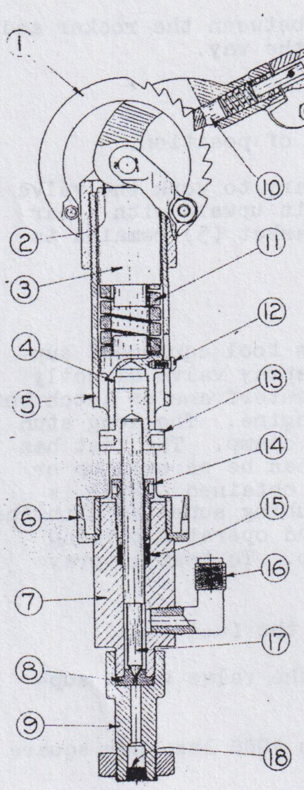

FIG. 0-2

Cage (5) carries upper spring seat (3), Spring (11), and the lower spring seat. Valve spring adjusting screw (13) which is bored to receive the upper end of the valve is threaded into the bottom of the lower spring seat. A small machine screw in the lower spring seat engages a slot in the cage and prevents rotation of the seat when the adjusting screw is being turned. The bearing assembly which holds the control handle and sector (1) is threaded to the upper end of cage (5). The lower part of the control handle is shaped to form a cam which actuates the upper spring seat. A spring loaded pawl (10) in the handle engages teeth in sector (1) so that the handle will remain in position after it has been adjusted. A downward force on the end of the handle pulls the pawl away from the sector and allows the handle to be lowered.

The injection pressure is normally changed by moving the handle up or down. Moving the handle in an upward direction increases the pressure, downward movement lowers the pressure. The pressure increase or decrease per notch is approximately 600 to 800 lbs. However, the pressure in any notch may be changed by means of adjusting screw (13).

Packing (15) will need replacing when the fuel leakage around the valve stem (17) becomes excessive. Tighten the packing gland just enough to prevent leakage. Never attempt to stop leakage by tightening the gland severely when new packing is needed. A loss of fuel pressure can often be traced to dirt lodged between valve stem (17) and the seat (8). This condition can be remedied by removing adapter stud (9) and valve seat (8) from the bottom of the relief valve and thoroughly cleaning the valve and its seat. Occasionally it may be necessary to lap the needle and its seat to prevent excessive by-passing and a low fuel pressure. After performing this operation all traces of grinding compound should be carefully washed off before the valve is reassembled.

6. SPRAY VALVES

The purpose of the spray valve (or fuel injection valve) is to meter the fuel accurately, to deliver it precisely at a definite moment, in a definite time into the combustion chamber in the form of a finely atomized spray. It might be stated that the successful operation of the engine depends upon the proper functioning of the spray valves more than on any other item. If the engine does not perform properly and the exhaust is smoky, the functioning of the fuel valves should be checked first of all. In the great majority of cases servicing the fuel valves and making them function properly corrects the trouble.

Fundamentally, the spray valve is a heavily spring loaded needle valve. Referring to Fig. O-3 the seat of the needle valve is incorporated in the tip or nozzle (1) just above the entrances to the spray orifices. The lower end of valve body (4) is counterbored to receive the end of the spray valve tip. A shoulder on the spray tip (1) which is centered in the counterbore, is held securely against the lower end of the body by nut (2). Valve assembly (3) is made up of two sections. The lower section has a conical end which is ground to the seat in the spray valve tip. This lower stem section is pressed into an extension (10) to which the spring loading is applied and by which the stem is lifted. A shoulder on the extension carries a small ball type thrust bearing (14) which acts as a lower spring retainer. Upper spring retainer (12) screws into the upper end of valve spring casing (13) which in turn is threaded to the upper end of valve body (4).

The flange used for clamping the valve is drilled and tapped to receive fuel elbow (6) which supports the small metal edge type filter (15). Fuel is carried from this point to the nozzle in the annular space surrounding stem (3). Leakage upward along the stem is prevented by packing (7) held between an upper and lower gland and secured by packing nut (8).

7. REMOVAL OF SPRAY VALVE FROM ENGINE (See Fig. O-3)

(a) Remove the cotter pin from one end of pin (37) at the fulcrum end of spray valve rocker (36). Drive the pin out with a brass drift.

(b) Remove horseshoe shaped collar (16) which forms the link between the rocker and the upper end of the spray valve and swing the rocker out of the way.

(c) Disconnect the injection line at the spray valve filter.

(d) Loosen the clamp nut and slide spray valve clamp (11) out of position.

(e) Remove the spray valve from the engine. It may be necessary to work the valve loose by rotating it back and forth and in some cases to pry it upward with a bar to remove it. As the valve is removed, note whether copper gasket (5) remains in the cylinder head or on the end of the valve.

8. TEST EQUIPMENT

All the parts for a spray valve test stand are included in the tool equipment supplied with the engine. The spray test clamp which holds the spray valve directly below the flanged section of the body can be mounted on the centerframe or latch box of the engine or at some other convenient location near the engine. The long stud supplied with this equipment screws into the outer end of the clamp. The test handle is supported on the upper end of the stud by a nut which can be screwed up or down on the stud until the desired height of fulcrum has been obtained. Fuel is supplied from the extra fuel rail valve through a length of tubing supplied with the tool equipment. Fuel pressure is obtained by means of the hand operated priming pump located at the forward end of the high pressure fuel pump. To test a spray valve proceed as follows:

(a) Clamp the spray valve in the test stand and connect it to the fuel rail.

(b) Close all the isolating valves on the fuel rail and open the valve which supplies the test stand.

(c) With the priming pump build up a pressure of about 2000 to 4000 lbs. per square inch.

(d) Open the valve quickly three or four times by hitting the end of the test handle sharp blows with the fist, watching as the valve operates to see if a fine fuel spray comes out of each hole in the tip.

(e) Wipe off the tip carefully, pump up the pressure to about 4000 lbs. per square inch again and operate the spray valve as described in step 4 until the pressure has dropped to about 2000 lbs. per square inch. Then watch the bottom of the tip for a period of time to see if drops of fuel form, indicating tip leakage.

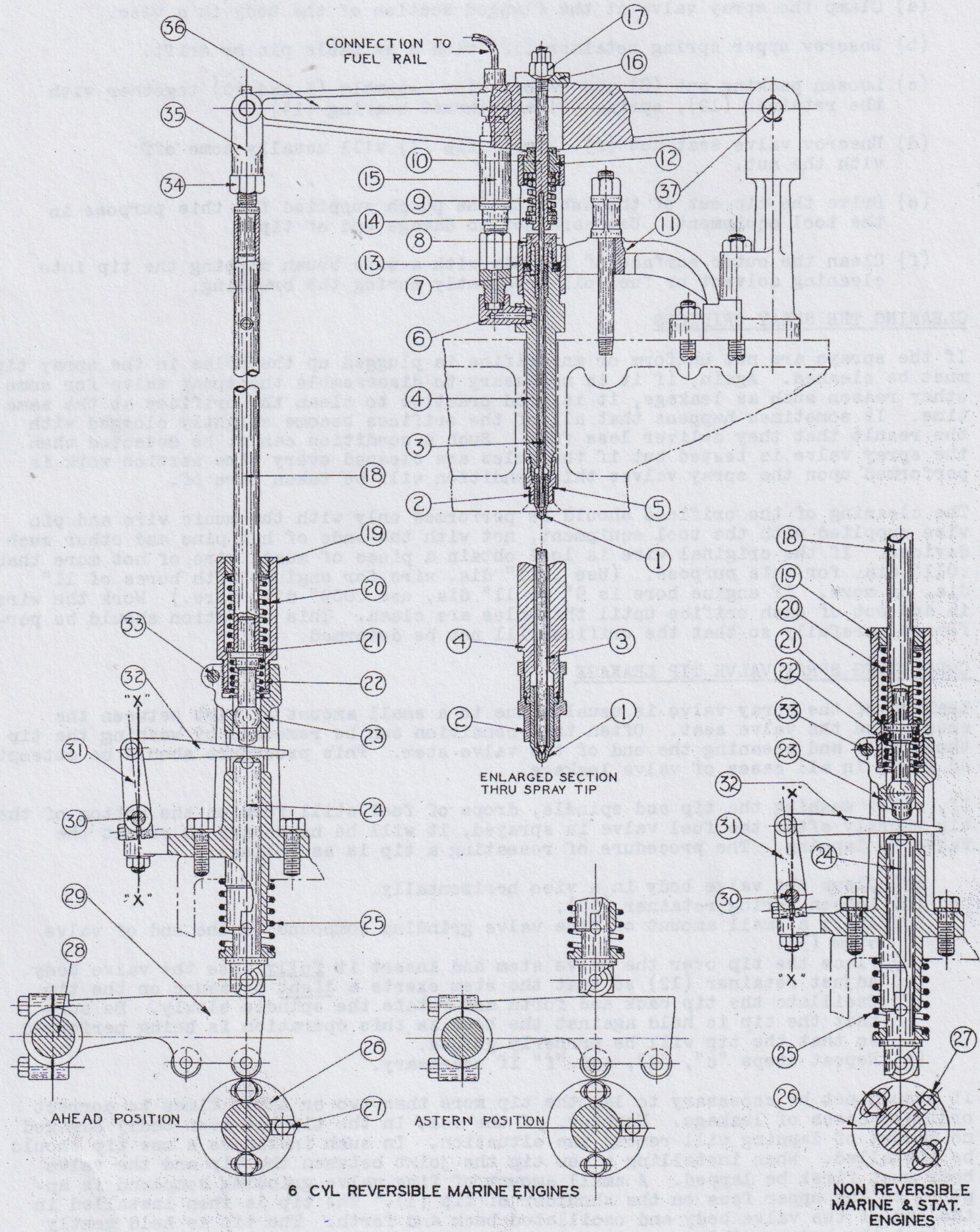

FIG. 0-3

9. DISASSEMBLY OF SPRAY VALVE (See Fig. O-3)

If the sprays are not uniform, if one or more orifices are entirely plugged up, or if drops of fuel form on the end of the tip after testing as described in step (e) of the preceding section, the spray valve must be taken apart and serviced. Proceed as follows:

(a) Clamp the spray valve at the flanged section of the body in a vise.

(b) Unscrew upper spring retainer (12) with a suitable pin or drift.

(c) Loosen packing nut (8) and remove stem assembly (3 and 10) together with the retainer (12), spring (9) and thrust bearing (14).

(d) Unscrew valve seat nut (2). Spray tip (1) will usually come off with the nut.

(e) Drive the tip out of the nut with the punch supplied for this purpose in the tool equipment. Use care not to damage end of tip.

(f) Clean the outer surface of the tip with a wire brush dipping the tip into cleaning solvent or fuel oil frequently during the brushing.

10. CLEANING THE SPRAY ORIFICES

If the sprays are not uniform or an orifice is plugged up the holes in the spray tip must be cleaned. Again, if it is necessary to disassemble the spray valve for some other reason such as leakage, it is good practice to clean the orifices at the same time. It sometimes happens that all of the orifices become slightly clogged with the result that they deliver less fuel. Such a condition cannot be detected when the spray valve is tested but if the holes are cleaned every time service work is performed upon the spray valves this condition will be taken care of.

The cleaning of the orifices should be performed only with the music wire and pin vise supplied with the tool equipment, not with the ends of hat pins and other such devices. If the original wire is lost obtain a piece of music wire of not more than .011" dia. for this purpose. (Use .011" dia. wire for engines with bores of 11" dia. or more. If engine bore is 9" to 11" dia. use .009" dia. wire.) Work the wire in and out of each orifice until the holes are clean. This operation should be performed carefully so that the orifice will not be deformed.

11. CORRECTING SPRAY VALVE TIP LEAKAGE

Leakage of the spray valve is usually due to a small amount of dirt between the needle and the valve seat. Often this condition can be remedied by washing the tip thoroughly and cleaning the end of the valve stem. This procedure should be attempted first in all cases of valve leakage.

If, after washing the tip and spindle, drops of fuel still form on the bottom of the tip shortly after the fuel valve is sprayed, it will be necessary to reseat the valve by lapping. The procedure of reseating a tip is as follows:

(a) Clamp the valve body in a vise horizontally.
(b) Loosen spring retainer (12).
(c) Apply a small amount of fine valve grinding compound to the end of valve stem (3).
(d) Place the tip over the valve stem and insert it <u>fully</u> into the valve body.
(e) Adjust retainer (12) so that the stem exerts a <u>light</u> pressure on the tip.
(f) Oscillate the tip back and forth and rotate the spindle slowly. Be sure that the tip is held against the body as this operation is being performed so that the tip will be properly guided.
(g) Repeat steps "c", "d", and "f" if necessary.

It should not be necessary to lap the tip more than two or three times to correct ordinary cases of leakage. However, if the seat in the tip has been badly damaged no amount of lapping will remedy the situation. In such instances a new tip should be installed. When installing a new tip the joint between the tip and the valve body must first be lapped. A small amount of fine valve grinding compound is applied to the upper face on the shoulder of tip (1). The tip is then installed in the end of the valve body and oscillated back and forth. The tip is held gently against the body as this operation is being performed. One light lapping process should be sufficient to produce a perfect seal between the tip and valve body. The tip is then lapped to the valve stem by the method described in this paragraph.

12. VALVE PACKING ADJUSTMENT

Packing nut (8) snould never be appreciably more than finger-tight. A small amount of fuel leakage past the packing is necessary for proper lubrication of the spindle. Too tightly adjusted packing will prevent this lubrication and will result in a scored spindle and sluggish valve action. If a spray valve leaks excessively along the spindle after the packing has been lightly tightened up the need for new packing or a new spindle or both is indicated.

13. ASSEMBLY OF THE SPRAY VALVE - SPRAY VALVE "LIFT"

Referring to Fig. O-3, spring (9) must be adjusted to a certain tension in order to assure proper functioning of the spray valve. It is further important that the adjustment of all the spray valve springs be the same or that the "lift" on all the spray valves be the same. With "lift" as used in the following instructions is understood the lift which spring (9) will allow before its coils touch each other and prevent further upward movement of the valve stem. (The actual lift when the spray valves are operating in the engine is of course determined by the position of fuel wedge (32), the adjustment on pushrod (18) and cam (27). This actual lift is less than the "lift" as defined in this paragraph.) Proceed as follows to assemble the valve and adjust for proper "Lift" (or opening tension):

(a) Wet spindle (3) with clean fuel oil and slip it into position in the valve body.
(b) Clean the spray valve tip and install it carefully on the valve body. Tighten valve seat nut (2) securely.
(c) Screw down on spring retainer (12) carefully until the coils of spring (9) just touch. Be careful not to screw down so hard that valve stem (3) bends, rendering it useless. It is best to have the valve in the test stand when performing this operation and determine when spring (9) becomes solid by means of the test handle. When it is not possible to lift the spray valve stem by means of the test handle the spring coils are touching. The "Lift" is then zero.
(d) Unscrew spring retainer (12) 3/4 to 7/8 turns which will make the "lift" 1/16". The "lift" on all the valves should be between 1/16" and 5/64".
(e) Screw down on packing nut (8) until it is just finger-tight.
(f) Test the functioning of the valve as described in paragraph 8.

14. ASSEMBLY OF SPRAY VALVE IN ENGINE.

The spray valve is installed in the engine in the reverse order of its removal. Again referring to Fig. O-3, if copper gasket (5) is in the cylinder head merely lower the valve into position. If the copper gasket (5) was removed with the valve, the gasket can be held in position on the lower end of the valve by a thin coating of grease applied to the washer.

After installing the valve it will be necessary to reset the push rod as described in paragraph 18. After timing, in order to clear the cylinder of excess oil, always turn the engine over on air with the snifter valves open and with the fuel isolating valves closed.

15. SPRAY VALVE FUEL FILTERS

In addition to the fuel filter at the high pressure fuel pump an individual filter (15) is supplied at each spray valve. The spray valve filters are of the metal edge type and have a spacing of .0015". They are installed in housing (15) which screw into the fuel inlet elbows at the spray valves. The frequency at which these filters will need cleaning will depend upon the quality of the fuel and the condition of the filter located at the high pressure fuel pump. After disassembling the housings it will be possible to unscrew the filter unit. Wash each unit thoroughly in clean solvent or fuel and blow it clean with compressed air, being careful not to injure the windings when handling it.

16. SPRAY VALVE OPERATING MECHANISM (See Fig. O-3)

The spray valve is actuated by cam (27), lifter or cam follower (24), pushrod (18), and rocker arm (36). In stationary engines the lifter follows the fuel cam directly. In direct reversible marine engineslatch (29) is interposed between the lifter and the cam. Lifter (24) and latch (29) are held against the cam by spring (25).

Motion of the lifter is transmitted to the pushrod through wedge (32). As can readily be seen in Fig. O-3, moving the wedge inward will decrease the gap between the lifter and the pushrod. Consequently the spray valve will open sooner, will lift higher, and will close later. Moving the wedge outward produces the opposite results. The outer end of the wedge is pinned to lever (31) which is clamped to the wedge shaft, which in turn is connected to the governor. Accordingly the governor, by rotating the wedge shaft, completely controls the action of the spray valves.

When the engine was tested at the factory, wedge levers (31) were adjusted to be parallel to each other and in line on wedge shaft (30) and were then clamped and pinned to the shaft. If new levers or a new wedge shaft are installed it is important that they be lined up in accordance with the above. The position of the fulcrum of wedges (32) for the full load full speed position (wedges fully in) should be about 1/4" inside the vertical line X-X through the center of the wedge shaft. The position of the wedge fulcrum for idling at low speed should be as shown in Fig. 11, that is, about 1/4" outside line X-X. In other words, line X-X should approximately divide the total movement of the wedge fulcrum in two equal parts.

Levers (36) should be approximately horizontal and should be approximately parallel for all the spray valves. This is accomplished by means of adjusting nut (17) which bears down on horseshoe collar (16) which in turn bears down on lever (36). With the lever disconnected from push rod fork (35) hold it up against collar (16) and nut (17) without opening the spray valve. Then adjust nut (17) for the proper lever position and lock by means of the lock nut on top.

Buffer spring assembly (19), positions the pushrod relative to the lifter and assists spray valve spring (9) in returning the valve mechanism (rocker, pushrod, etc.) as the spray valve is being closed. The weak spring (22) below buffer spring (20) merely holds the pushrod against washer (21). As buffer spring assembly (19) is screwed down buffer spring (20) and washer (21) force the pushrod downward against the weaker spring and bring the end of the pushrod closer to the wedge and lifter. Proper adjustment of the buffer spring assembly is as follows:

(a) Bar the engine until the fuel cam follower is on the base circle of the cam.

(b) Set the wedge shaft and wedges in <u>full load position</u> (wedges "fully in" as determined by the governor weights being fully in) and unscrew cage (19) until there is clearance between the lower end of the pushrod and the upper face of the wedge.

(c) Slowly screw down cage (19) and at the same time move the wedge back and forth sideways with fingers.

(d) As soon as the wedge is felt to tighten unscrew the cage one-half turn and lock it in this position with the clamping screw.

NOTE: When timing the spray valves as described in the following the buffer spring assembly should always be unscrewed about one or two turns. When timing is completed adjust the buffer spring in accordance with instructions in this paragraph.

17. <u>SPRAY VALVE TIMING</u> (See Fig. O-3)

The timing procedure described in the following is for a spray valve opening of 8° B.T.C. (Before Top Center) and a spray valve closing of 18° A.T.C. (After Top Center). <u>The proper spray valve timing to use is stamped in the engine name plate and should always be followed.</u> If the timing in the name plate differs from 8° - 18° opening and closing the following instructions should be modified accordingly. Proceed as follows:

(a) Turn the latch shaft to the AHEAD position and unscrew all Buffer Spring Cages one or two turns. Shut off all the isolating valves in the fuel rail except for Number 1 cylinder.

(b) Be sure that wedges are in the full load position ("fully in") as determined by the governor weights being against their inner stops. (Normally the wedges will be "fully in" when the engine is shut down but it is well to check this point.)

(c) Spot Number 1 cylinder at 5° A.T.C. on the power stroke. (Half way point between 8° B.T.C. opening point and 18° A.T.C. closing point). Then unbolt and turn the fuel cam until the center of the toe is directly in line with the axis of the lifter. Clamp the fuel cam temporarily.

(d) Set the crankshaft 8° B.T.C. on the compression stroke. Bar the engine up to this point in the ahead direction of rotation.

(e) Pump up a fuel pressure of about 1500 lbs. per sq. inch with the hand pump.

(f) Slowly lengthen the spray valve pushrod until the needle of the pressure gauge drops indicating that the spray valve has opened. Check this adjustment by backing the engine up a few degrees, pumping the fuel pressure up again and barring the engine slowly in the ahead direction until the pressure again drops. If the flywheel pointer is not at 8^{o} B.T.C. readjust the pushrod and check again.

To adjust the length of pushrod (18) loosen locknut (34) and turn the pushrod, using a pin or drift in the holes provided at its upper end. Then tighten the locknut.

If the push-rods use the ball and socket connection to the rocker, then loosen the clamp screw in the rocker and screw the ball stud up or down until the proper adjustment is reached. Be sure that the clamp screw is tightened after the ball stud is adjusted.

(g) Bar the engine over to 25^{o} A.T.C. and again pump up the fuel pressure. Then bar the engine backwards slowly until the pressure drops. This point, which is the closing of the spray valve, should be 18^{o} A.T.C.

(h) If this point is past 18^{o} A.T.C. too long a spray period is at hand. It will be necessary to advance the fuel cam slightly and repeat steps "d", "e", "f", and "g". If on the other hand the spray valve closes before 18^{o} A.T.C., retard the cam slightly and repeat steps "d", "e", "f", and "g".

(i) Repeat steps "c" to "g" on the remaining cylinders. Check and record the spray valve timings for ASTERN. The timing going Astern may be slightly different than the ahead timing. However, the ahead timing is the more important and no changes should be made to favor the astern timing.

(j) Adjust the buffer springs as per instructions in paragraph 16. Note that buffer spring cages should always be unscrewed when spray valves are timed.

18. <u>BALANCING THE ENGINE FOR EQUAL LOAD ON ALL CYLINDERS</u>

Theoretically, if the spray valves have been timed exactly and correctly (as outlined in the preceding paragraph) the amount of fuel injected in each cylinder should be the same. Consequently, the total engine load should also be equally divided between all the cylinders. Practically however, it is impossible to time all the spray valves exactly alike, and even if that could be accomplished manufacturing tolerances on such items as orifices in the spray valve tips, fuel cams, wedges, etc. are apt to affect the cylinder balance. The division of load between the various cylinders should consequently be checked after the engine is running, preferably at full load. Since the exhaust temperatures are proportional to the loads that the various cylinders are carrying the amount of fuel injected should be adjusted so that the exhaust temperatures for the various cylinders are alike, or nearly alike.

The amount of fuel injected and consequently the load carrying capacity of a cylinder may be changed by adjusting the length of pushrod (18). It should be noted, however, that readjusting the pushrod length will affect the spray valve timing. Therefore, this adjustment should not be appreciable and should not exceed one-half turn of the pushrod or ball stud from the position obtained when timing the spray valve.

The proper procedure for balancing the engine can be summarized as follows:

(a) Assuming that all the spray valves have been correctly timed it should be possible to balance the engine by merely lengthening or shortening the pushrods by <u>one-half turn or less</u>. Lengthening a pushrod will increase the exhaust temperature of the cylinder and vice versa.

(b) If a pushrod adjustment of one-half turn is not sufficient, the timing of all the spray valves should be checked and, if necessary, readjusted to the proper timing as indicated on the engine name plate.

(c) If the valve timing is found to be satisfactory or if, after making any necessary correction in the spray valve timing, a correction of one-half turn of the pushrod is still insufficient, defective combustion is indicated. This may be due to one or more spray tip orifices being plugged or to any of the defects dealt with under the heading "Smoky Exhaust" in the "Maintenance and Inspection" section.

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When the engine was tested at the factory spray valves were carefully timed and adjusted to equalize the exhaust temperatures in the various cylinders and while the operator should not continually change adjustments in an effort to improve an engine that is operating satisfactorily he should keep the balance of the various cylinders fairly even. The cylinder balance should be checked whenever a spray valve has been changed. If the exhaust temperatures are kept within a total range of 20° the balance will be excellent, while a range of 50° may not be considered excessive and will give fairly satisfactory operation. However, do not allow the cylinder unbalance to exceed the last mentioned value.

CONTROL SYSTEM

The Control System includes all of the parts necessary for reversing the engine and operating it in the desired direction of rotation, starting and stopping the engine, and controlling its speed of rotation. According to the specific functions of the component parts, it may be subdivided as follows:

The Reversing Mechanism consisting of the Latches, Latch Shaft, Control Wheel and the interconnecting gearing between this control wheel and latch shaft.

The Starting Mechanism which consists of the individual starting air valves in each cylinder head (described in detail in Section H), the Master Starting Air Valve in the starting air manifold, and the Pilot Valve for operating the master valve. In some engine models, as described later, the pilot valve actuates an Air Ram which in turn operates the air starting valves in the cylinder heads and the master valve.

The Fuel Cut-Out Mechanism which operates to stop the engine by taking the wedge shaft out of control of the governor, rotating it to pull out the fuel wedges thereby cutting off the fuel to the engine.

The Flywheel Air Brake which assists in stopping the engine between reversals and is therefore closely related to the reversing mechanism. It is also controlled by a pilot valve.

The Governor which maintains the desired speed of rotation and the Speed Control Lever (or Throttle Lever) by means of which this speed may be changed.

1. LATCHES AND LATCH SHAFT

For a given direction of rotation all the valves must be actuated in a definite sequence and with a definite timing. For direct reversible engines it is consequently necessary to provide dual sets of cams, one set for operation in the AHEAD direction of rotation, the other set for operation when running ASTERN. At the same time means must be provided for throwing one set of cams into operation, while at the same time the other set must be made inoperative.

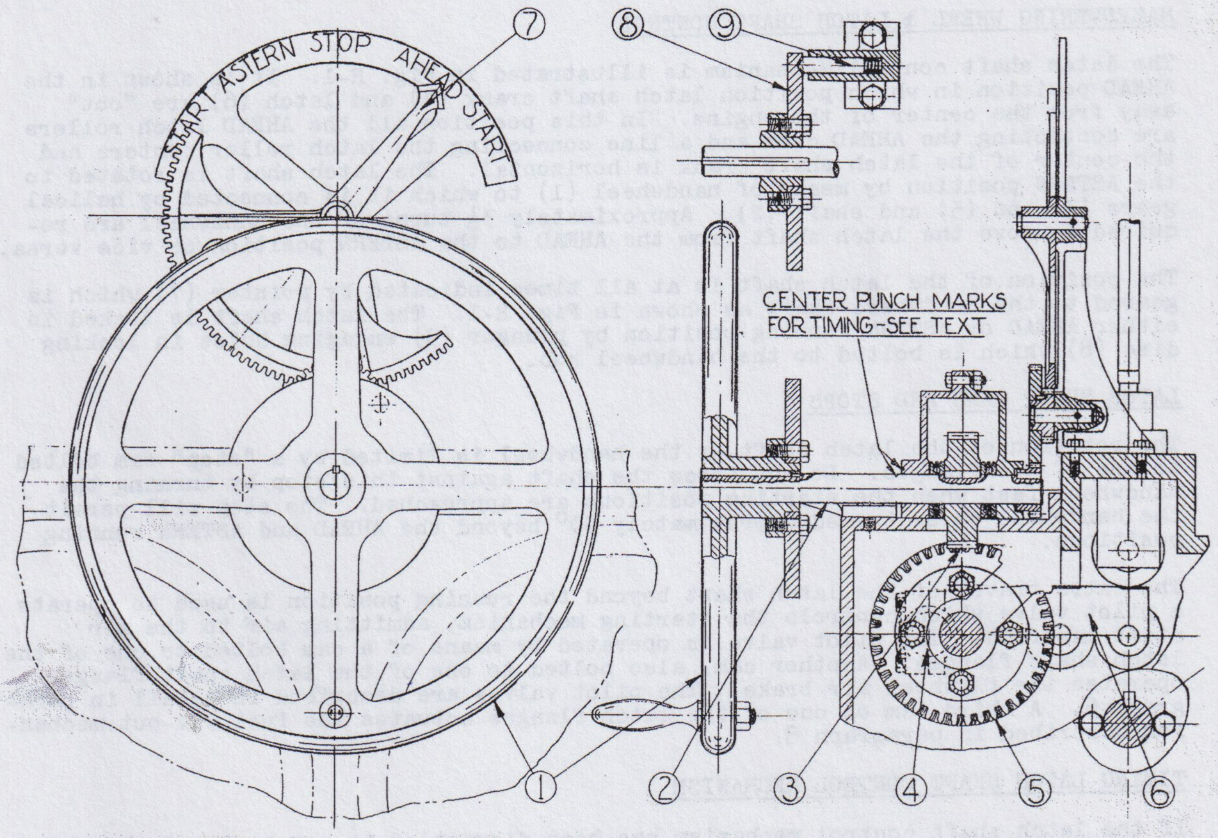


FIG. R-1

In Atlas engines the AHEAD and ASTERN cams are mounted side by side on the camshaft. Referring to Fig. R-1 it will be noted that latches equipped with two rollers are interposed between the cams and the valve lifter rollers. The two latch rollers are offset and lined up relative to the cams in such a manner that in the AHEAD position of the latches one set of rollers contact the AHEAD cams while at the same time the other set of rollers are free of the ASTERN cams. (Astern cam not shown in Fig. R-1) Thus in the position shown in Fig. R-1 the AHEAD cams actuate the latches which in turn actuate the valves by means of the lifters, push-rods and rockers.

By rotating the latch shaft 180° the latch fulcrum points are moved inward (toward the center of the engine) to a point where the ASTERN cams contact the other set of latch rollers. This inward movement frees the AHEAD latch rollers of the AHEAD cams and consequently the ASTERN cams now control the actuation of the valves.

The fuel valve timing is very nearly the same for both directions of rotation. For example, in one direction of rotation the fuel valve may open 8° before top center and close 18° after top center. Then if the rotation was reversed and the latch kept in the same position the fuel valve would open 18° before top center and close 8° after top center. In other words, the timing would be 10° early. It is possible to compensate for this slight difference in timing by properly positioning the ASTERN roller on the fuel valve latch. Consequently only one fuel cam is provided which serves for both AHEAD and ASTERN running and the fuel latch rollers are in line, not offset as on the other latches.

The case hardened steel latch rollers turn on steel pins carried in the bodies of the latches and riveted in place. In the inlet, exhaust and starting air latches, spacers between the walls of the latches and the sides of the rollers establish the positions of the rollers in line with the cams. The fuel valve latch does not require any spacers since only one cam is used and both rollers are in line. The rollers all have a clearance of .001" to .002" on the pins and a side clearance of 1/64".

The latch shaft is built up of six sections, each section comprising the crankshaft for the four latches of a single cylinder. The shaft is mounted on cast iron bearings which are bolted to the side of the centerframe. Journals are turned on the shaft at each end of each crank, and flanges at the ends of each section provide means of bolting the sections together. Bearing clearance is .001" to .0025" and end play is taken by the two outer bearings.

2. MANEUVERING WHEEL & LATCH SHAFT CONTROL

The latch shaft control mechanism is illustrated in Fig. R-1. It is shown in the AHEAD position in which position latch shaft crank (4) and latch (6) are "out" away from the center of the engine. In this position all the AHEAD latch rollers are contacting the AHEAD cams and a line connecting the latch roller centers and the center of the latch shaft crank is horizontal. The latch shaft is rotated to the ASTERN position by means of handwheel (1) to which it is connected by helical gears (3) and (5) and shaft (2). Approximately 3½ turns of the handwheel are required to move the latch shaft from the AHEAD to the ASTERN position or vice versa.

The position of the latch shaft is at all times indicated by pointer (7) which is geared to the handwheel shaft as shown in Fig. R-1. The latch shaft is locked in either AHEAD or ASTERN running position by plunger (9) engaging holes in locking disc (8) which is bolted to the handwheel hub.

3. LATCH SHAFT CAMS AND STOPS

The rotation of the latch shaft by the handwheel is limited by a "stop" cam bolted to one of the flanges. Do not force the shaft against this stop by turning the handwheel fast when the starting positions are approached. The stop will permit the handwheel to be turned approximately 90° beyond the AHEAD and ASTERN running positions.

The extra travel of the latch shaft beyond the running position is used to operate a pilot valve which controls the starting mechanism, admitting air to the air start manifold. The pilot valve is operated by means of a cam bolted to one of the latch shaft flanges. Another cam, also bolted to one of the latch shaft flanges operates the flywheel air brake. The pilot valves are described in detail in paragraph 6. A third cam on one of the latch flanges actuates the fuel cut-out mechanism described in paragraph 8.

4. TIMING LATCH SHAFT CONTROL MECHANISM

If the latch shaft control mechanism has been dismantled it may be timed when reassembling as follows. Place the latch shaft in AHEAD position (crank out). A pointer is mounted on one of the latch shaft bearings for this purpose, and the shaft should be spotted so that the line scribed on the corresponding shaft flange exactly registers with this pointer. Then, with the handwheel in the AHEAD position, as indicated by the register of center punch marks on the handwheel shaft and the end of the bearing housing (See Fig. R-1) mesh helical gears (4) & (5). NOTE: Before dismantling the handwheel assembly observe whether or not these parts have been marked. If not, mark them as indicated, with the latch shaft in the AHEAD running position. The handwheel and gear assembly may then be bolted in place and the indicator assembled, meshing the gears with the pointer midway between AHEAD and START.

5. STARTING MECHANISM - ENGINES WITH 13" BORE

The starting mechanism used on engines with 13" bore differs from that used on engines with smaller bore and the two systems will be described separately.

Fig. R-2 illustrates the master starting air manifold valve. It is pneumatically operated by means of a pilot valve located on top of the latch box. (Pilot valve described in Paragraph 6). The pilot valve is connected by means of tube (7) and for the position of the master valve shown in Fig. R-2 the pilot valve is venting tube (7) and the space above plunger (1) to atmosphere. Consequently spring (4) will hold plunger (1) against its upper stop and in this position the reduced diameter at the middle of the plunger will form a passage through which tube (8) and the starting air manifold is vented to atmosphere. Valve (5) is held closed against its seat by spring (11) and also by the air pressure in chamber (6) which is connected to the air tank.

When the engine is to be started the pilot valve is opened by the cam on the latch shaft as described in paragraph 6, admitting air through tube (7) to the top of plunger (1). The plunger is thus forced down, closing the starting air manifold vent passage and opening the main operating valve (5). As this valve is opened starting air is admitted to manifold (12), leading to the individual starting air valves in the cylinder heads. By-pass valve (10), which is first opened by plunger (1) and pin (4) admits air pressure to chamber (9) above the main operating valve, balancing the air forces acting thereon and permitting it to open under the downward force of plunger (1).

For the operation of the air start valves in the cylinder head refer to Section H.

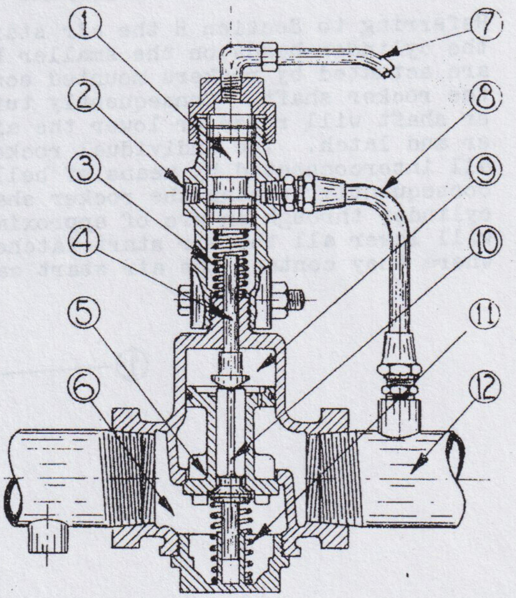


FIG. R-2

6. PILOT VALVES

All the pilot valves for operation of the starting air valve, flywheel brake, etc. are identical and are illustrated in Fig. R-3. They are mounted on top of the latch box between cylinders No. 5 & 6. The operation of all valves is exactly the same, their function being to control the supply of air to the device to which they are connected.

Two valves are provided, pilot valve (3) and vent valve (4). The housing is provided with three pipe tapped connections. Hole (2) is connected to the source of air supply, (1) to the device to be operated, and (9), the vent, is open to the atmosphere.

The valve as shown in Fig. R-3 is in the normal position assumed when the engine is running. Plunger (7) is then held down

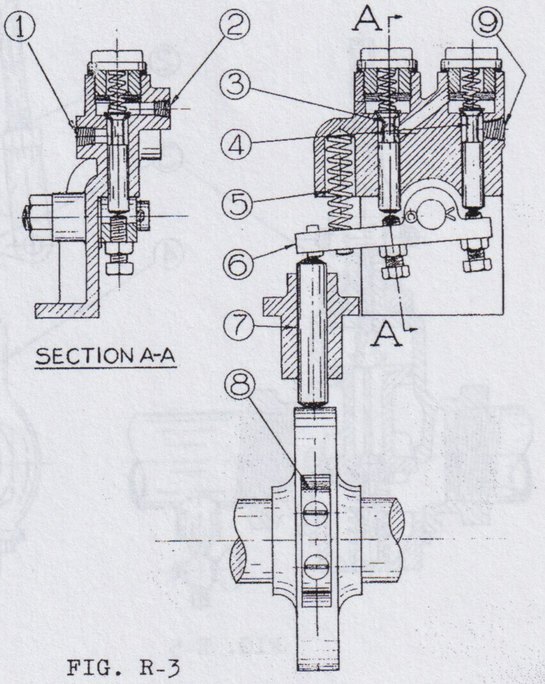


FIG. R-3

against the latch shaft flange by spring (5) acting on rocker (6). The vent valve is open and the pilot valve is closed under the action of the spring. Connection (1), to which the device to be operated is connected is thus vented through the diagonal hole connecting the two valves.

When the latch shaft is rotated so that cam (8) contacts plunger (7) it raises rocker (6) closing the vent valve and opening the pilot valve, admitting air to the device to which the valve is connected. The adjusting screws in the rocker should be set to allow approximately 1/16" clearance between the ends of the screws and the ends of the valve stems when the valves are seated.

7. STARTING MECHANISM
ENGINES WITH $11\frac{1}{2}$" OR SMALLER BORE

Referring to Section H the air starting valves in the cylinder heads on the smaller bore engines are actuated by rockers mounted eccentrically on the rocker shaft. Consequently turning the rocker shaft will raise or lower the air start lifter and latch. The individual rocker shafts are all interconnected by means of bell cranks and consequently turning the rocker shaft on No. 1 cylinder through an arc of approximately 110° will lower all the air start latches to a point where they contact the air start cams, throwing the starting air valves into operation.

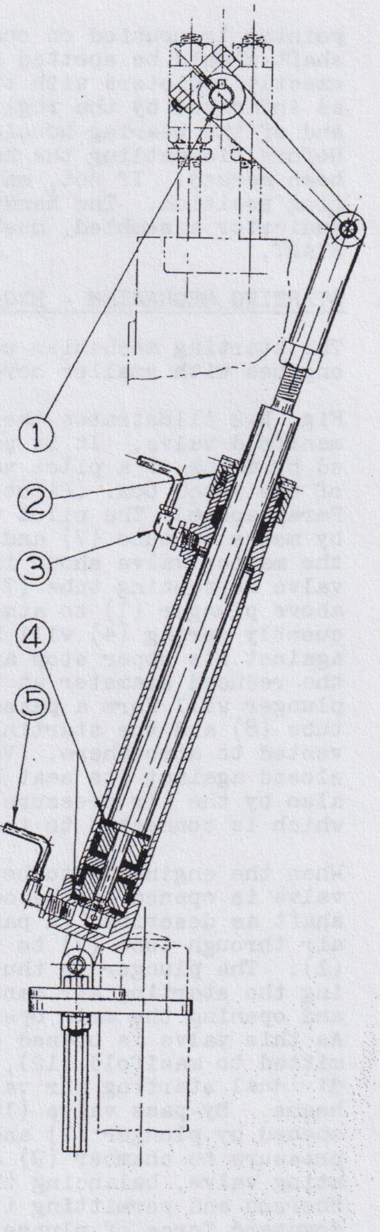


FIG. R-4

The rocker shaft is shifted from one position to the other by means of a pneumatic cylinder mounted forward of cylinder No. 1 and illustrated in Fig. R-4. The pilot valve controlling this cylinder and the manner in which it is operated from the latch shaft are identical with the pilot valve, described in Paragraph 6. As shown in Fig. R-4, it is in the inoperative position, with the plunger down. Air pressure admitted above the piston through connection (3), which is permanently connected to the source of air supply normally holds it in this position. The pilot valve is piped to connection (5), and when in the RUN position vents the

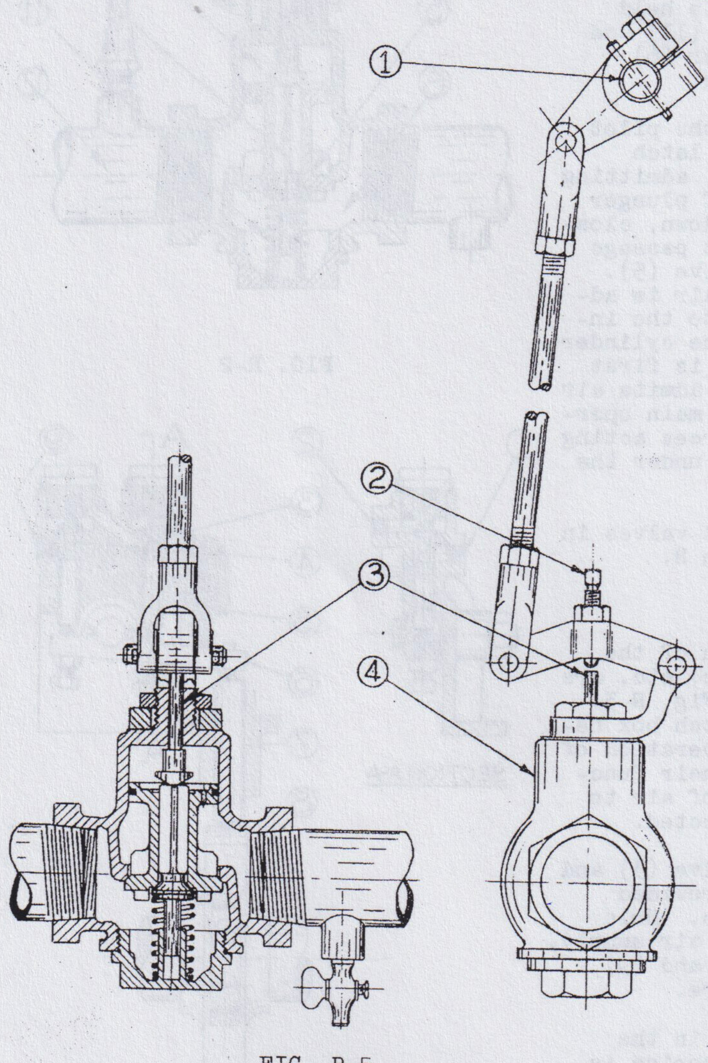


FIG. R-5

lower end of the cylinder. When the latch shaft is shifted to the START position the pilot valve opens, admitting air below the piston. Since the area below the piston is considerably larger than that above the piston it is forced up, shifting rocker shaft (1) to the START position. As soon as the pilot valve closes the space below the piston is vented and the air pressure above immediately returns the piston to the RUN position.

The travel of the piston is limited by contact of thrust washers (4) with the upper and lower heads of the cylinder and the stroke is 9-5/8" for the $11\frac{1}{2}$" bore engine and $7\frac{1}{2}$" for engines with 10" or $10\frac{1}{2}$" bore. Packing gland (2) should be kept sufficiently tight to prevent air leakage, but should not be tightened more than necessary.

The position of the rocker shaft relative to the air ram can be adjusted by means of the threaded end of the air ram piston, turning it in the clevis connecting to the rocker shaft lever. The rocker shaft position should be adjusted so that the bell cranks connecting the various rocker shafts point straight up when air ram piston is in the RUN position.

The master starting air manifold valve used on the smaller bore engines is illustrated in Fig. R-5. Valve (4) is essentially the same as that used on the 13" bore engines and described in Paragraph 5. It is mechanically operated however, by linkage connecting to the valve rocker shaft (1), this linkage replacing the pneumatic piston construction used on the 13" bore engines. When the rocker shaft shifts to the "START" position, adjusting screw (2) contacts pin (3) and opens the valve. Screw (2) should be set so that the valve is opened about $\frac{1}{2}$" when the rocker shaft is in the "START" position.

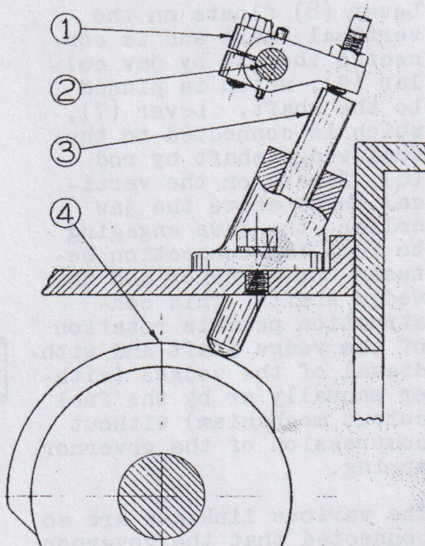


FIG. R-6

8. FUEL CUT-OUT MECHANISM

The fuel cut-out plunger is illustrated in Fig. R-6. As shown in Fig. R-6 the latch shaft is in or near the "STOP" position, with plunger (3) up on cam (4), which is mounted on one of the latch shaft webs. The upper end of the plunger has engaged the adjusting screw in lever (1), rotating the lever and the fuel wedge shaft (2) to pull out the fuel wedges and cut off fuel from the engine. The adjusting screw in lever (1) should be set to allow 1/8" clearance with the top of the plunger when the latter is down off the cam and the fuel wedges are in at the full load position.

9. FLYWHEEL BRAKE

The flywheel brake assembly is shown in Fig. R-7. Brake shoe (1) which is faced with brake lining, is carried by the horizontal arm of crank shaped lever (2). This lever is mounted on shaft (3), and carries the brake cylinder (4) in trunnions on its vertical arm. Shaft (3) is supported by bracket (5) which is bolted to the after end of the centerframe. The projecting end of the piston rod (6) bears against the compressor cylinder and therefore the piston and rod remain stationary when air is admitted to the cylinder. When the pilot valve is opened and air is admitted to the brake, the cylinder moves relative to the piston. Lever (2) is rotated about its fulcrum, applying the brake to the flywheel and stopping the engine. When the air pressure is relieved the brake shoe is withdrawn from the flywheel by spring (7), which bears against a third arm on lever (2).

There are no adjustments necessary on the brake and the only service requirements are the replacement of the shoe lining and the piston cup leather when necessary.

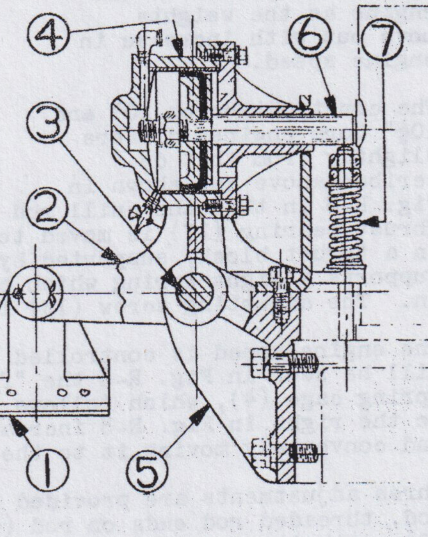


FIG. R-7

10. GOVERNOR AND SPEED CONTROL

The flyball type governor, mounted near the bottom of the forward end of the latch box and driven from the camshaft gear, is shown in Fig. R-8. Cast iron bearing (20) is adjusted and doweled to the latch box to allow .004" to .005" backlash between governor gear (19) which is pressed and keyed to the governor body, and the cam-shaft gear. Running clearance between governor body (21) and the bearing is .0015" to .0025" and lubrication is from a catch basin (11) in the top of the bearing. Basin (11) can be filled from an oil cup in the side of the latch box.

Governor weights (18) mounted on pins in the governor body, carry rollers (14) on riveted pins. As the flyballs tend to move out due to centrifugal force the rollers exert a force against quill rod (22) acting through plate (16) and ball bearing (17). The plate, which is loosely riveted to the rod cap to maintain the assembly when dismantling, rotates with the balls while the rod and cap remain stationary. The thrust reaction is taken by ball bearing (23) and retaining collar (24), which is secured to the governor body by two taper pins. The flyball thrust from the quill rod is transmitted, by means of forked lever (25), vertical shaft (10), lever (8) and rod (5) to governor spring (3).

Lever (8) floats on the vertical shaft and is connected thereto by jaw collar (9), which is pinned to the shaft. Lever (7), which is connected to the fuel wedge shaft by rod (6), floats on the vertical shaft above the jaw collar, the jaws engaging to form the connection between the governor and the wedge shaft. This construction permits rotation of the wedge shaft and withdrawal of the wedges (either manually or by the fuel cutout mechanism) without compression of the governor spring.

The various linkages are so connected that the governor weights are held in by governor spring (3) against the centrifugal force tending to throw them out. Through the connection to the fuel wedge shaft the wedges follow the motion of the weights, decreasing the fuel supplied to the engine as the weights move out with increase in engine speed.

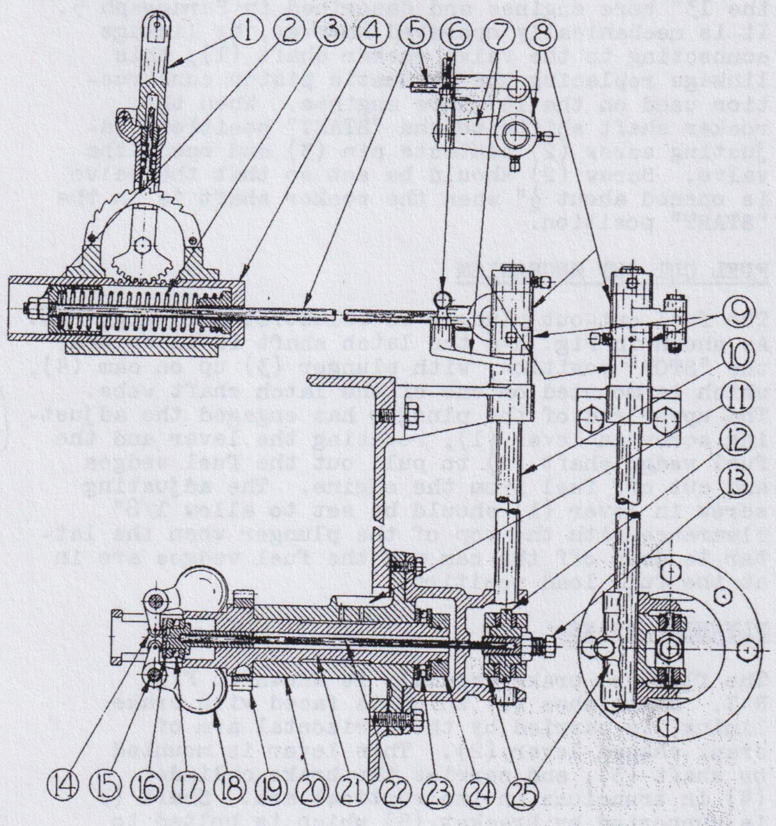


FIG. R-8

The construction on 10" and $10\frac{1}{2}$" bore engines differs slightly from that described above and shown in Fig. R-8 in that the quill rod (22) rotates with the governor body and flyballs. Thrust bearing (17) is moved to the outer end of the quill rod, where it is mounted in a thrust block, supported by the fork lever. A cover plate excludes dirt and supports a light spring which bears against the thrust block, holding the weights in. The adjusting screw (13) is not used in this construction.

The engine speed is controlled by varying the tension of governor spring (3). As will be seen in Fig. R-8 the "fixed" end of the governor spring is supported by spring cage (4), which follows the motion of control lever (1). Moving the lever to the right in Fig. R-8 increases the spring tension and hence the engine speed and conversely moving it to the left decreases the engine speed.

Three adjustments are provided in the governor linkage, setscrew (13) on the quill rod, threaded rod ends on rod (6) connecting to the wedge shaft, and adjusting nut (2), with its locknut, on the end of governor spring rod (5). Nut (2) controls the engine speed, and should be set to give the desired full load speed with the control handle in the last notch to the right. (NOTE: When the engine is idling these nuts project beyond the spring cage and are accessible for adjustment.) This is the only adjustment with which the operator need normally be concerned. The others were set at the factory and should require no attention, unless parts are replaced. In such cases the rod ends on rod (6) should be set so that lever (7) is parallel with the centerline of the engine when the fuel wedge levers are vertical. Adjusting screw (3) should then be set to place the fuel wedges in the full load position when the engine is shut down, and the governor weights are fully in (See Section O). Speed adjustment at full load should then be made as above.

11. MANEUVERING THE ENGINE

In the following the sequence of events as they take place when reversing the engine from AHEAD to ASTERN are described. Assuming that the engine is running the indicator pointer (See Fig. R-1) is in front of AHEAD and locking pin is registering with the hole in the locking disc. The handwheel is then turned in a direction to move the pointer toward "STOP" and when the wheel has been rotated approximately 90° the fuel cutout mechanism (See Paragraph 8) operates to pull out the fuel wedges and the engine begins to slow down. When the handwheel has been turned approximately one revolution from the "AHEAD" position the air brake pilot valve opens applying the brake and stopping the engine. When the indicator pointer reaches "STOP" the operator should hold the handwheel in this position until the engine has come to a full stop. Further rotation of the hand-wheel closes the air brake pilot valve and allows the fuel cutout mechanism to release the wedge shaft. After approximately 3½ turns of the handwheel the latch shaft is in the ASTERN position and indicator pointer in front of ASTERN.

The handwheel can still be moved an additional 80 to 90° before the latch shaft comes up against its stop. This additional movement operates the pilot valve for the starting mechanism (See Paragraphs 5 and 7) and the engine begins to turn over on air. Almost immediately it begins to fire and the handwheel should then be turned back to bring the latch shaft in the ASTERN position which is reached when locking plunger (9) (See Fig. R-1) enters the hole in the locking disc. The engine will then be under governor control, its speed being determined by the setting of the speed control lever and fuel pressure regulating valve lever.

Maneuvering from full speed AHEAD to full speed ASTERN may be accomplished in approximately 10 seconds. Although not absolutely necessary it is advisable to slow the engine down to say 1/2 or 3/4 speed by means of the speed control lever before maneuvering. Maneuvering operations will also be smoother if the fuel pressure is lowered somewhat by means of the fuel pressure regulating valve. About 2500 to 3000 lbs. per square inch fuel pressure is suitable for maneuvering.

CONTROL SYSTEM

The Control System includes all of the parts necessary for reversing the engine and operating it in the desired direction of rotation, starting and stopping the engine, and controlling its speed of rotation. According to the specific functions of the component parts, it may be subdivided as follows:

The Control Mechanism consisting of the Control Lever, mounted on the Control Unit, which is mechanically connected to the Pilot Valves and to the Governor and Fuel Cut-Out mechanisms. The functioning of all the various parts of the Control System is governed by the Control Lever either by means of mechanical connections or by means of pneumatic connections to the Pilot Valves.

The Reversing Mechanism consisting of the Latch Shaft and Latch Mechanism operated by the Air Ram and Reversing Rack which are mechanically connected to the Latch Shaft. The Reversing Rack is locked in the proper position by the Interlocking Mechanism . The position and movement of the Air Ram is controlled by two Air Ram Pilot Valves located in the Control Unit.

The Fuel Cut Out Mechanism in the Control Unit which serves to stop the engine by rotating the wedge shaft, thereby pulling out the fuel wedges and cutting off fuel from the engine.

The Governor which maintains the desired speed of rotation and the mechanical connections to the Control Lever by means of which this speed is changed.

The Starting Mechanism which consists of the individual starting air valves in each cylinder head (described in detail in Section H), the Master Starting Air Valve in the starting air manifold, and the Pilot Valve (in the Control Unit) for operating the master valve.

The Flywheel Air Brake which assists in stopping the engine between reversals and is therefore closely related to the reversing mechanism. It is also controlled by a pilot valve in the Control Unit.

The Cylinder Compression Relief Valves which serve the purpose of relieving the cylinder compression in the event that the engine becomes air locked. Since their operation is desired at the same period in the maneuvering cycle as that of the flywheel brake, they are connected to the Brake Pilot Valve in the Control Unit.

1. CONTROL LEVER, CONTROL UNIT & PILOT VALVES

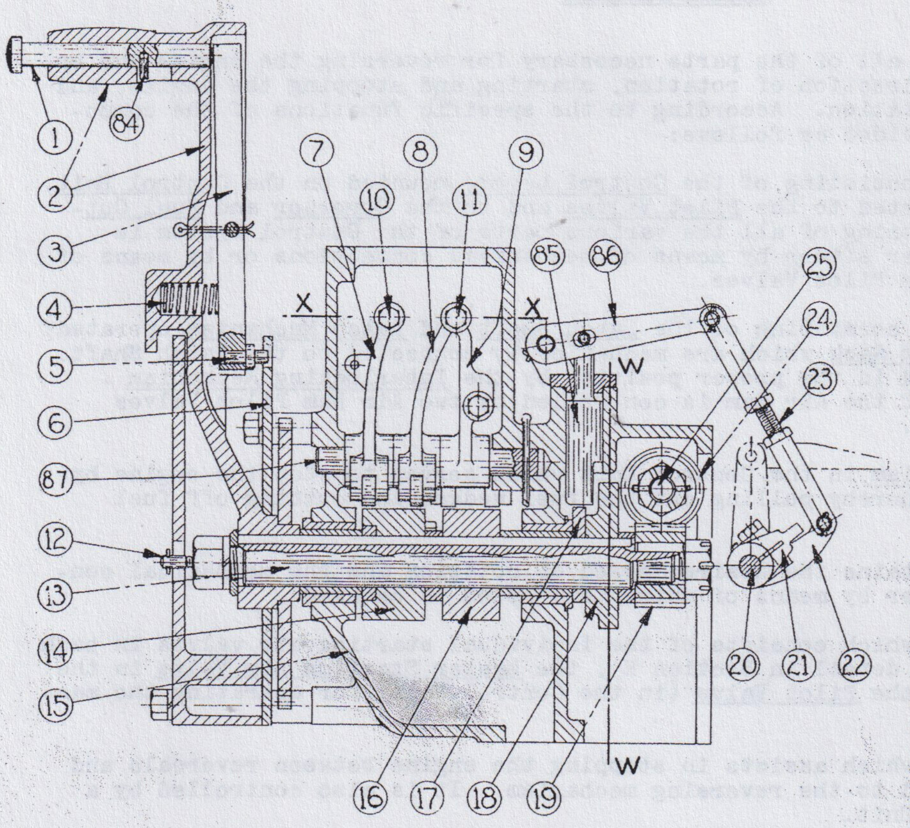
The engine is started, stopped and reversed, and the speed controlled by means of a single control lever located on the centerline of cylinder No. 2. The only other control lever provided is on the fuel pressure regulating valve which governs the fuel injection pressure. This lever is located close to the engine control lever for convenience in operation, so that both levers can be reached from the control station.

The control unit, shown in Fig. R-1, contains four pilot valves, two for operating the air ram, one for the flywheel brake and compression relief valves, and one for the starting air valve. These pilot valves are all actuated by the control lever, which is also mechanically connected to the latch shaft interlock, the governor spring for the governor control, and the fuel wedge shaft for the fuel cutout. Thus the engine is entirely controlled by the one control lever.

NOTE: IT IS OF UTMOST IMPORTANCE THAT DIRT, SCALE AND CHIPS BE KEPT OUT OF THE CONTROL UNIT PILOT VALVE HOUSINGS. CLEAN OUT ALL STARTING AIR PIPING BEFORE INSTALLING.

2. PILOT VALVE LEVERS & CAMS

Referring to Fig. R-1 control lever (2), which is keyed to shaft (13), is held in position by latch pin (5) engaging holes in latch plate (6). It may be released for maneuvering by pressure of the thumb on latch button (1) or it may be permanently unlocked to permit control from the pilot house by depressing and rotating the latch button. When a pilot house control is provided, a chain from the pilot house control stand engages a sprocket which is mounted on the hub of the control lever and transmits motion from the pilot house control stand to the engine control. Control shaft (13), which rotates in bronze bushings in housing (15), carries hubs (14) and (16) for the pilot valve cams, cam (18) for the governor spring control, cam (17) for the fuel cutout and gear (19) for the latch shaft interlock connections. All of these units are keyed and clamped to the shaft, which is drilled for



SECTION THRU CONTROL UNIT

FIG. R-1

lubrication and provided with a grease plug on the outer end.

Referring to Figs. R-1 and R-2, the pilot valves are actuated from the cams on the control shaft by means of levers (7), (8), and (9) which are mounted in the control unit on fulcrum shaft (87). Lever (7) controlling both pilot valves for the air ram, has two rollers, one on each side, which are engaged by the two faces of a cam on hub (14). The right hand side of the cam engages for AHEAD and the left hand side for ASTERN on a right hand engine. When the control lever is in the vertical, or STOP position, lever (7) is also vertical, held in this position by a spring and both rollers are free of the cam. When the control lever is moved in the ahead direction (clockwise on a right hand and counterclockwise on a left hand engine) the lead-cam face contacts its mating roller and turns lever (7) in the opposite direction, thereby opening the ahead pilot valve for the air ram. Thus the ahead pilot valve, that is the valve to shift the latch shaft to the AHEAD position, is on the after side of the control housing and the astern valve is on the forward side. The lever rollers are so located with respect to the cam nose that the pilot valves open, admitting air to the air ram cylinder, when the control lever is turned 14° from the vertical, either AHEAD or ASTERN. As the handle is further rotated to approximately 59° from the vertical, the end of the nose or dwell period of the cam is reached and the roller drops down off the nose, allowing the valve to close and relieving the air pressure in the ram cylinder. The action is reversed as the control lever is moved toward the STOP position from either AHEAD or ASTERN running positions, the pilot valve being opened and air admitted to the ram cylinder as the lever reaches a point 59° from STOP. As it further approaches STOP the valve is closed and the ram cylinder again relieved when the lever reaches a point 14° from STOP.

Lever (8) operates the pilot valve controlling the flywheel brake and compression relief valves. It has only one roller, so located with respect to the cam that when the lever is in the STOP position it is up on the cam nose. The lever is then displaced and the pilot valve is open, admitting air to the brake cylinder and compression relief manifold. As the control lever is moved 14° in either direction the roller drops down to the cam base circle, allowing the pilot valve to close, thus relieving the brake cylinder and compression relief manifold. This action is reversed as the lever is moved toward the STOP position from either AHEAD or ASTERN running positions, applying the brake and opening the compression relief valves as the control lever reaches a point 14° from STOP. The operating cam toe is carried by hub (14).

Lever (9) operates the starting air pilot valve. Since it is not permissible to have this valve open during the stopping portion of the maneuvering cycle, that is when the control handle is moved to STOP from either AHEAD or ASTERN running positions, lever (9) is provided with pawls, one for AHEAD and one for ASTERN, which engage corresponding cam toes carried in hub (16). As the control handle is moved to a point 32° from STOP in either the AHEAD or ASTERN directions one of the cam toes engages and lifts its mating pawl, rotating lever (9) in a clockwise direction and opening the starting air pilot valve. As the motion of the control lever continues to a point 50° from STOP the end of the cam toe is reached and the pawl drops off the cam, allowing lever (9) to return and the pilot valve to close. On the return stroke of the control lever, that is when it is moved toward STOP position from either AHEAD or ASTERN running positions, the pawl rotates on its fulcrum pin in lever (9) when it is contacted by the cam toe, allowing the cam to slip under it without moving lever (9) and opening the pilot valve. The pawls are held in position against stop pins in lever (9) by light tension springs, anchored to pins in the side of control housing (15). The mechanism is accessible through the inspection hole on the left hand side of the control housing.

3. AIR RAM PILOT VALVES

Fig. R-2 showing Section X-X in Fig. R-1, is a horizontal section through the pilot valves. Valves (26B) and (27B) are the air ram control valves, (27B) AHEAD and (26B) ASTERN in a right hand engine. The air ram is essentially a double acting piston and rod, the latter being connected through gearing to the latch shaft. The piston is actuated by compressed air at 125 to 200 lbs. pressure and, for the operation of the ram, it is essential that the pressure and relief on the two sides of the piston be under accurate control. This control is by means of the pilot valves (26B) and (27B) actuated by the control lever through the cam and lever (7) as previously described. The valves are identical on each side, and the operation is the same whether AHEAD or ASTERN. Referring to Fig. R-2 the outer chambers are connected to the air supply and the inner chambers (26) and (27) are connected to the two sides of the air ram cylinder. Fig. R-2 shows the mechanism with the control lever at STOP and lever (7) vertical. In this position the pilot valves (26B) and (27B) are both held closed by their spring (26A) and (27A) and vent valves (26D) and (27D) are held out against adjusting screws (10) in lever (7) by their springs (26C) and (27C). Both sides of the air ram piston are therefore vented into the control housing through the drilled holes in the pilot and vent valves. As the control handle is moved AHEAD lever (7) is moved to the left as seen in Fig. R-2 (for a right hand engine) and vent valve (27D) slides into pilot valve (27B) collapsing spring (27C), until its head engages the end of the pilot valve and seals vent holes (27E). Further motion of lever (7) lifts valve (27B) off its seat, collapsing spring (27A) and admitting air to chamber (27) and so to the AHEAD side of the air ram piston. During this action vent valve (26E) on the opposite side is pushed out by spring (26C) and follows the motion of lever (7). The vent passage through the drilled holes in the valves thus remains open, venting chamber (26), and allowing the air ahead of the piston to escape as the piston is moved to the AHEAD position by the compressed air admitted through valve (27B).

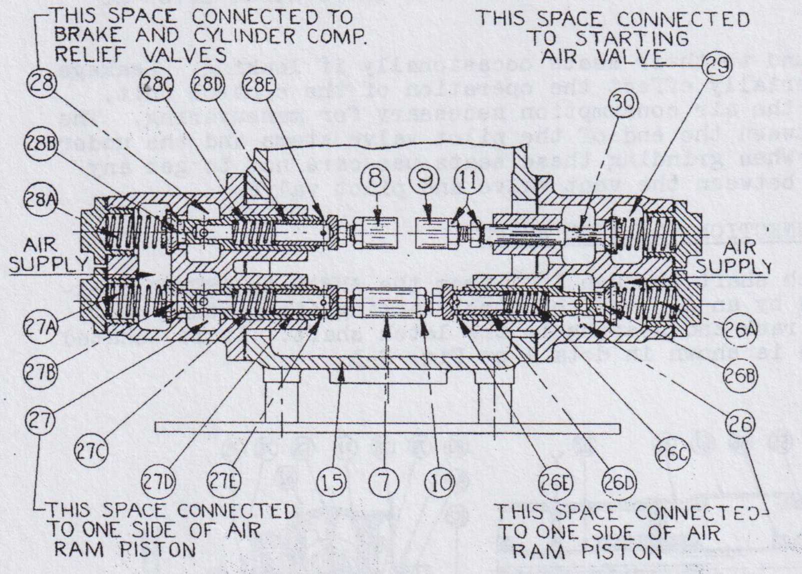


FIG. R-2

The action for ASTERN is exactly opposite to that described above. The total motion of lever (7) each side of center is 3/8", 7/32" of which is utilized in closing the vent valves and 5/32" in opening the pilot valves. Adjusting screws (10) in lever (7) should be set so that the distance between the head of the vent valves and the end of the pilot valves is 7/32" on each side when the control lever is at STOP and lever (7) is vertical, with clearance between cam faces and rollers equal on each side.

4. FLYWHEEL BRAKE & COMPRESSION RELIEF PILOT VALVES

The flywheel brake is actuated by a single acting air piston and is released by a spring. Only one pilot valve is therefore necessary for its control. This valve, (28B) in Fig. R-2, is identical with the pilot valves for the air ram and its action in admitting air to and venting the cylinder is exactly the same. The valve is operated by lever (8) as previously described, and the adjusting screw in the lever should be set the same as the ones for the air ram pilot valves, that is to allow 7/32" opening of the vent valve when the lever roller is on the cam base circle.

The compression relief valves are also actuated by single acting air pistons with spring return, and are therefore operated by the same type of control valve. Since their operation is desired at the same time in the maneuvering cycle as the flywheel brake, the manifold feeding these valves is connected to the brake pilot valve and the one valve controls both flywheel brake and compression relief valves.

5. STARTING AIR PILOT VALVE

Valve (30) in Fig. R-2 is for the control of the master valve in the starting air manifold, described in detail in Paragraph 11. This is a piston operated valve, held closed by the air pressure on the valve head and opened by the pressure above a piston when the cylinder below is vented. The pilot valve operating the master valve must therefore vent the cylinder below the piston. It is a simple poppet valve, mechanically opened and spring closed. Referring to Fig. R-2 chamber (29) is connected to the cylinder below the piston in the master starting valve. When the pilot valve is opened by lever (9) as previously described, this chamber is vented into the control housing and the master starting air valve opens, admitting air to the starting air manifold. When the pilot valve is closed pressure immediately builds up below the piston and the master valve closes.

The position of lever (9) when free from the cams is determined by an adjusting screw in the lever and bearing against a boss in the control housing. This screw should be set to bring the cams on hub (16) (See Fig. R-1) into contact with the pawls on lever (9) when the control handle is 32° from STOP either AHEAD or ASTERN. Equalize the adjustment on either side, making the mean 32°. After locating the lever as above, set the adjusting screw in the end of the lever to allow .015" clearance between screw head and the pilot valve stem with the control lever at STOP.

The pilot valves should be ground to their seats occasionally if leaking. Leakage, unless excessive, will not materially effect the operation of the control unit, but it will of course increase the air consumption necessary for maneuvering. The seal for the vent valves is between the end of the pilot valve stems and the under side of the vent valve heads. When grinding these seats use care not to get any grinding compound into the fit between the vent valve and pilot valve.

6. AIR RAM, REVERSING RACK AND CONNECTION TO LATCH SHAFT

The power for rotating the latch shaft through 180° from the AHEAD to ASTERN positions or vice versa is supplied by an air ram, or double acting air piston, connected by means of a reversing rack and gearing to the latch shaft. It is located on the top of the latch box and is shown in detail on Fig. R-3.

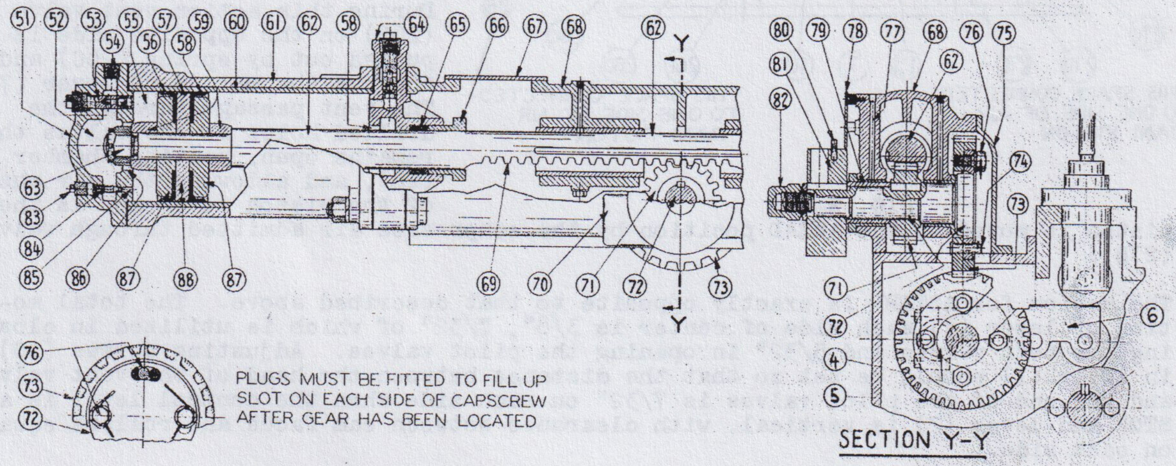


FIG. R-3

Referring to Fig. R-3, housing (68), which is bolted to the top of the latch box, carries reversing rack (62) and pinion shaft (72) in replaceable bronze bushings. If renewed bushings must be reamed to 2.002" - 2.003" and 2.249" - 2.2505" diameter respectively after pressing in, and the oil holes must be drilled through the bushings in line with the holes in the housing. The unit is located on the latch box with the pinion shaft at the center of the engine, midway between cylinders 3 and 4. Cylinder (61) is provided with a bronze liner to prevent rusting, and is bolted together with front head (64), to the after end of housing (68). A stuffing box (65) and gland (66), accessible through cover plate (67), seal the piston rod where it passes through the front head. The after end of the cylinder is closed by back head (51). Connection (54) in the back head and a similar connection in the front head are connected by copper tubing to the pilot valves in the Control Unit, described in detail in paragraph 3.

The piston assembly is made up of piston (88) with ring (57), cup leathers (56) and (58), followers (87) and collars (59). The assembly is mounted on the after end of the piston rod (62), and is clamped by nut (63). The reversing rack teeth (69) which engage pinion (71) are cut in the forward end of the piston rod (62).

The travel of the piston is limited at each end by contact between followers (87) and the cylinder heads. In order to prevent shock the piston is cushioned at each end of its stroke by trapping part of the air ahead of it. Referring again to Fig. R-3 and assuming that air is being admitted to the right side of the piston from the pilot valve in the control housing, the piston will be moving toward the left. The air in front of it will be expelled through connection (54) and the pilot valve in the Control Unit, the vent valve of which will be open. As the piston approaches the end of its stroke collar (59) enters opening (86) in the head, closing it off, and traps the air in front of the piston. This trapped air must then pass through needle valve (85), which should be adjusted to produce the desired cushioning effect on the piston. Remove plug (83) to reach the needle valve for adjustment.

Check valve (53) is provided to admit air to the full face of the piston when it is to be returned to the opposite end of the cylinder. This valve is made necessary by the closing of opening (86) by collar (59), thus preventing air from chamber (52) reaching the full face of the piston until collar (59) clears the head. Valves (53) and (84) are duplicated in front head (64), but are not shown in Fig. R-3. The action of the piston at the front end of the cylinder is exactly the same as that described above. Valves (84) and (53) are not shown in their correct positions in Fig. R-3, valve (53) and connection (54) from the pilot valve actually being located on the horizontal centerline toward the engine in the back head and valve (84) 30° off the vertical. In the front head, both valves are in the top, 5/8" each side of the centerline, and the inlet connection from the pilot valve is on the horizontal centerline away from the engine.

Section YY in Fig. R-3 shows a transverse section through pinion shaft (72). This shaft, which is driven from reversing rack (62) by means of pinion (71) to which it is keyed, has a flange on its inner end to which is bolted helical gear (73). This gear meshes with a similar gear (5) on the latch shaft (4) and thus completes the connection between the air ram piston and the latch shaft. Housing (68) is located and doweled on the latch box so that these gears mesh properly, and if replaced the new housing must be carefully located, and new dowel holes drilled so that these gears are correctly meshed.

The holes in the hub on shaft (72) for mounting gear (73) are slotted, and if either gear (73) or its mating gear (5) on the latch shaft are replaced, gear (73) must be adjusted radially on the shaft to correlate the motion of the air ram piston and the latch shaft. The correct AHEAD and ASTERN positions of the latch shaft are shown by marks scribed on one of the latch shaft webs registering with a pointer mounted on the adjacent latch shaft bearing. The latch shaft should be set in the correct AHEAD position and the gear and hub then adjusted radially to locate the air ram piston at the extreme end of its stroke, that is, against the back head of the cylinder. Three of the four capscrews (76) holding gear and hub together are then tightened. The one remaining capscrew will require plugs to be fitted on each side to fill up the slot in the hub (72). These plugs will retain the gear in its proper position and eliminate the necessity of redrilling and reaming for a dowel pin. In fitting these plugs make sure that each plug contacts both the end of the slot and the capscrew so that it would be impossible for the gear to slip, as any slippage would change the valve timing. After the plugs are fitted the capscrew may be tightened and secured by the lockwire which passes thru the head of all four of the gear retainer capscrews. Four oil cups on the top of the reversing rack housing provide lubrication for the reversing rack and pinion shaft, and should be oiled as often as necessary to keep the bearings well lubricated. Two small pipe plugs are provided in the top of the air cylinder for lubricating the piston.

Barring hub (81) on the outer end of the pinion shaft provides means for operating the reversing mechanism manually in an emergency or while working on the engine. A one inch bar about four feet long may be used.

The required motion of the latch shaft is 180° and the tooth ratio of the two gears is such that shaft (72) must rotate 270° to give this latch shaft motion. This requires a total piston travel of 10-1/16" which may be adjusted if necessary by changing the thickness of the gaskets under the cylinder heads. The position of shaft (72) and hence of the entire assembly, including the air ram piston and the latch shaft, is indicated by pin (80) in barring hub (81). This pin registers with the AHEAD and ASTERN on indicator plate (78). The AHEAD on this plate is forward and the ASTERN aft. The pin rotates through the lower arc, and the reversing rack must therefore be moving aft (to the left in Fig. R-3) when the latch shaft is moving from ASTERN to AHEAD. The air must be admitted to the forward (or right hand in Fig. R-3) side of the piston to produce this motion, which puts the engine in AHEAD position. Therefore the ahead pilot valve in the control housing, (which is on the left or after side of the housing, as explained in paragraph 3) must be connected to the forward or front head of the ram cylinder. Conversely the astern valve is connected to the rear head. The position of the piston is aft when the engine is running AHEAD and forward when it is running ASTERN. (The above discussion holds true for both right and left hand engines.)

7. LATCHES AND LATCH SHAFT

For a given direction of rotation all the valves must be actuated in a definite sequence and with a definite timing. For direct reversible engines it is consequently necessary to provide dual sets of cams, one set for operation in the AHEAD direction of rotation, the other set for operation when running ASTERN. At the same time means must be provided for throwing one set of cams into operation, while at the same time the other set must be made inoperative.

In Atlas engines the AHEAD and ASTERN cams are mounted side by side on the camshaft. Referring to Fig. R-3 it will be noted that latches equipped with two rollers are interposed between the cams and the valve lifter rollers. The two latch rollers are offset and lined up relative to the cams in such a manner that in the AHEAD position of the latches one set of rollers contact the AHEAD cams while at the same time the other set of rollers are free of the ASTERN cams. (Astern cam not shown in Fig. R-3.) Thus in the position shown in Fig. R-3 the AHEAD cams actuate the latches which in turn actuate the valves by means of the lifters, pushrods and rockers.

By rotating the latch shaft 180° the latch fulcrum points are moved inward (toward the center of the engine) to a point where the ASTERN cams contact the other set of latch rollers. This inward movement frees the AHEAD latch rollers of the AHEAD cams and consequently the ASTERN cams now control the actuation of the valves.

The fuel valve timing is very nearly the same for both directions of rotation. For example, in one direction of rotation the fuel valve may open 8° before top center and close 18° after top center. Then if the rotation was reversed and the latch kept in the same position the fuel valve would open 18° before top center and close 8° after top center. In other words, the timing would be 10° early. It is possible to compensate for this slight difference in timing by properly positioning the ASTERN roller on the fuel valve latch. Consequently only one fuel cam is provided which serves for both AHEAD and ASTERN running and the fuel latch rollers are in line, not offset as on the other latches.

The case hardened steel latch rollers turn on steel pins carried in the bodies of the latches and riveted in place. In the inlet, exhaust and starting air latches, spacers between the walls of the latches and the sides of the rollers establish the positions of the rollers in line with the cams. The fuel valve latch does not require any spacers since only one cam is used and both rollers are in line. The rollers all have a clearance of .001" to .002" on the pins and a side clearance of 1/64".

The latch shaft is built up of six sections, each section comprising the crankshaft for the four latches of a single cylinder. The shaft is mounted on cast iron bearings which are bolted to the side of the centerframe. Journals are turned on the shaft at each end of each crank, and flanges at the ends of each section provide means of bolting the sections together. Bearing clearance is .001" to .0025" and end play is taken by the two outer bearings.

8. LATCH SHAFT INTERLOCKING DEVICE

The latch shaft interlock is shown in Fig. R-4. The two plungers (41) and (47) are located fore and aft so that they are in line with adjacent latch shaft webs, and they engage slots (48) and (49) cut in the respective webs. These plungers are interconnected by rockers (38) and (44) and shaft (43), the whole assembly being mounted in bracket (42) on top of the latch box, just aft of the control unit. The device is operated from the main control shaft in the control unit by means of shaft (25), to the far end of which a helical gear, ((24) in Fig. R-1) is keyed and clamped, which gear in turn meshes with a similar gear ((19) in Fig. R-1) on the control shaft. Shaft (25) carries crank (35) on its overhung end, and pin (36) in the crank is connected through link (37) and fork (39) to plunger (41).

For plunger positions shown in Fig. R-4, the control handle is at STOP, the latch shaft is in AHEAD position, slot (49) registers with plunger (47), slot (48) is

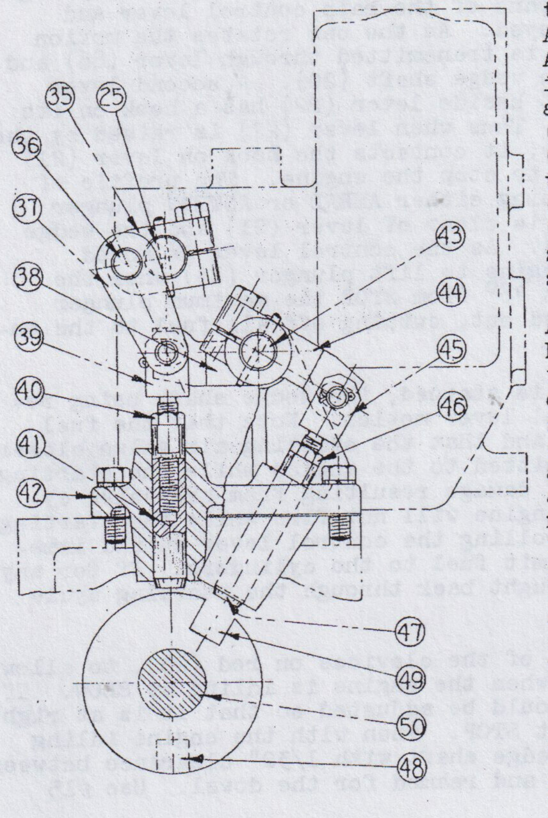


FIG. R-4

180° out of register with plunger (41), and both plungers are up clear of the latch shaft webs so that the latter is unlocked and free to turn. Assume now that the control lever is moved in the AHEAD direction. The hand of the helical gears is such that shaft (25) will be rotated clockwise as viewed in Fig. R-4, which will lift plunger (41) through the action of crank (35) and link (37). Plunger (47) will be lowered at the same time, through the interconnection of the rockers (38) and (44) and shaft (43), and will enter slot (49) in the latch shaft web, thereby locking the shaft in the AHEAD position and preventing its shifting to any other position.

As a second assumption, consider the control handle to be moved toward ASTERN. The above action will be reversed, and plunger (41) will move downward. Since it is not in register with the slot in its mating latch shaft web it can move only until it contacts the web, and will then arrest the motion of the control lever. This action takes place when the control lever is moved 25° from STOP and it cannot be moved further until the latch shaft shifts to ASTERN and slot (48) is brought into register with plunger (41). Thus it is impossible to admit starting air to the engine unless the latch shaft is in the position corresponding to the direction in which the control handle is moved.

It should be understood that this interlock stop is primarily a safety device to prevent starting the engine before completion of the latch shaft shift, and it should not be abused by deliberately jamming the lever over against it, as this will result in excessive wear throughout the mechanism, if not in damaged and broken parts. Normally the latch shaft will shift almost immediately upon opening of the pilot valve (which occurs with 14° motion of the control handle), and it will be possible to move the control handle right along to the starting air period, with only a slight pause at the 25° stop point. During this pause, while the latch shaft is shifting, the control handle should not be held up against the stop, with the plunger bearing against the latch shaft web and consequent wear on both parts.

Before disassembling the interlock drive mechanism the helical gears should be marked so that they may be remeshed in the same relation. Crank (35) and rocker (44) are pinned to their shafts with taper dowels, while the helical gears and rocker (38) are keyed so that the device can only be assembled in one way, so long as the gears are correctly meshed. If at any time the gears, shafts, crank or rockers are replaced, the plungers must be retimed, which may be done as follows. With the control handle at STOP, adjust crank (35) relative to shaft (25) so that the vertical distance from the top of the latch box up to the center of the pin in fork (39) is 4-1/4". Be sure that shaft (25) is forced to the left so that gear (24) (Fig. R-1) is bearing against the control housing boss, and allow .010" thrust clearance between crank (35) and the housing. Clamp crank (35), drill a hole through the shaft using #7 drill (.201" dia.) then taper ream for #4 taper dowel. Adjust rocker (44) relative to shaft (43) so that the vertical distance from top of latch box to center of pin in fork (45) is 3-1/16", clamp rocker and drill and ream rocker and shaft for #4 taper dowel.

Set latch shaft at some intermediate position, and move control lever in AHEAD direction until latch pin (5) (Fig. R-1) drops into the slot in latch plate (6). Position lever so that pin is about 1/8" from upper end of slot, and then adjust plunger (47) (Fig. R-4) relative to fork so that end of plunger bears against latch shaft web. This will allow some clearance between plunger and web when latch pin bears against upper end of slot. Repeat adjustment on plunger (41) for reverse, and tighten jam nuts to lock plunger adjustments. Interlock bracket (42) (Fig. R-4) is doweled to the latch box, and if replaced the new assembly must be located so that the plungers will enter the slots in the latch shaft webs before drilling the new dowel holes.

9. <u>FUEL CUT OUT MECHANISM</u>

The fuel cut out mechanism shown in Fig. R-1 serves to stop the engine by taking the wedge shaft out of the control of the governor and mechanically rotating it to pull out the wedges and cut off fuel to the engine. Referring to Fig. R-1, plunger (85) bears on cam (17) which is rotated by means of the main control lever and shaft (13) to which both lever and cam are keyed. As the cam rotates the motion of plunger (85) follows the cam profile, and is transmitted through lever (86) and rod (23) to lever (22) which floats freely on wedge shaft (20). A second lever (21), which is clamped and keyed to the shaft beside lever (22) has a hook on its free end which projects out over lever (22). Thus when lever (22) is raised by the action of cam (17) and the connecting linkage, it contacts the hook on lever (21) and rotates the wedge shaft counterclockwise to stop the engine. The profile of cam (17) is such that when the engine is running either AHEAD or ASTERN plunger (85) is down, dropping lever (22) so that it is clear of lever (21) and the wedge shaft is free to float under governor control. As the control lever is moved toward STOP through SLOW position cam (17) begins to lift plunger (85) when the lever reaches a position 56° from STOP and at 48° from STOP the maximum plunger lift is reached and the fuel wedges are pulled out, cutting off all fuel to the engine.

The above action is reversed when the engine is started, the wedge shaft being released to governor control with 56° of control lever motion. Note that the fuel cut out does not begin to release until 48°, and that the starting air valve closes at 50° so that there is virtually no fuel admitted to the engine while the starting air is on, thus preventing any possibility of damage resulting from excessive cylinder pressures. This also means that the engine will not fire while the starting air valve is open, so that as soon as it is rolling the control lever should immediately be moved along to SLOW in order to admit fuel to the cylinders. If for any reason it does not fire the lever must be brought back through the starting cycle and the action repeated.

The fuel cut out should be adjusted, by means of the clevices on rod (23), to allow 1/32" clearance between levers (21) and (22) when the engine is idling at SLOW. If the wedge shaft is ever replaced, rod (23) should be adjusted so that it is at right angles to lever (22) with the control lever at STOP. Then with the engine idling at SLOW lever (21) should be clamped to the wedge shaft with 1/32" clearance between it and lever (22) and the wedge shaft drilled and reamed for the dowel. Use #15 (.180") drill and #3 Taper reamer.

10. GOVERNOR AND GOVERNOR CONTROL

The flyball type governor, mounted near the bottom of the forward end of the latch box and driven from the camshaft gear, is shown in Fig. R-5. Cast iron bearing (34) is adjusted and doweled to the latch box to allow .004" to .005" backlash between governor gear (33) which is pressed and keyed to the governor body, and the camshaft gear. Running clearance between governor body (32) and the bearing is .0015" to .0025" and lubrication is from the force feed system of the engine.

The engine speed is controlled by varying the governor spring tension through a linkage from the control lever, as shown in the upper portion of Fig. R-5. (This is section W-W in Fig. R-1 taken through the governor control cam (18)).

Referring to Fig. R-5, it is seen that the governor spring reaction is transmitted from lever (23) which carries hardened rollers that bear against collar (39), through vertical shaft (20) to upper lever (17). This lever is connected by rod (7) to governor cam plunger (5) and by linkage is made to follow motion of governor cam (18). As shown in Fig. R-5, the control lever is in the FAST AHEAD position and cam plunger (5) is pulled to the left the limit of its travel compressing governor spring (35) to its shortest length and allowing fuel wedges to be drawn into maximum fuel position by tension in wedge shaft torsion springs which move governor quill rod (26) to the left till linkage is solid. As the control handle is moved back toward SLOW, the cam drops allowing the roller (3) and cam plunger (5) to move to the right, decreasing the governor spring tension, and allowing governor weights (31) to move out and push the wedges out decreasing the fuel supply to the engine.

Governor weights (31) mounted on pins in governor body (32) carry rollers on riveted pins. As the flyballs tend to move out due to the centrifugal force the rollers exert a force against sleeve (38) acting through spring (35), spring guide (27), ball bearing (28) and plunger (30). Plunger (30) rotates with the governor body while quill rod (26) and spring guide (27) remain stationary. The thrust reaction is taken by ball bearing (37) and retaining collar (24) which is threaded on governor body (32). The clearance for collar (24) is adjusted to .010" and the collar is then secured to the governor body by a setscrew and lockwire. The governor weight thrust is transmitted directly to the governor spring (35). The spring reaction is taken by sleeve (38) and collar (39) to vertical shaft fork (23).

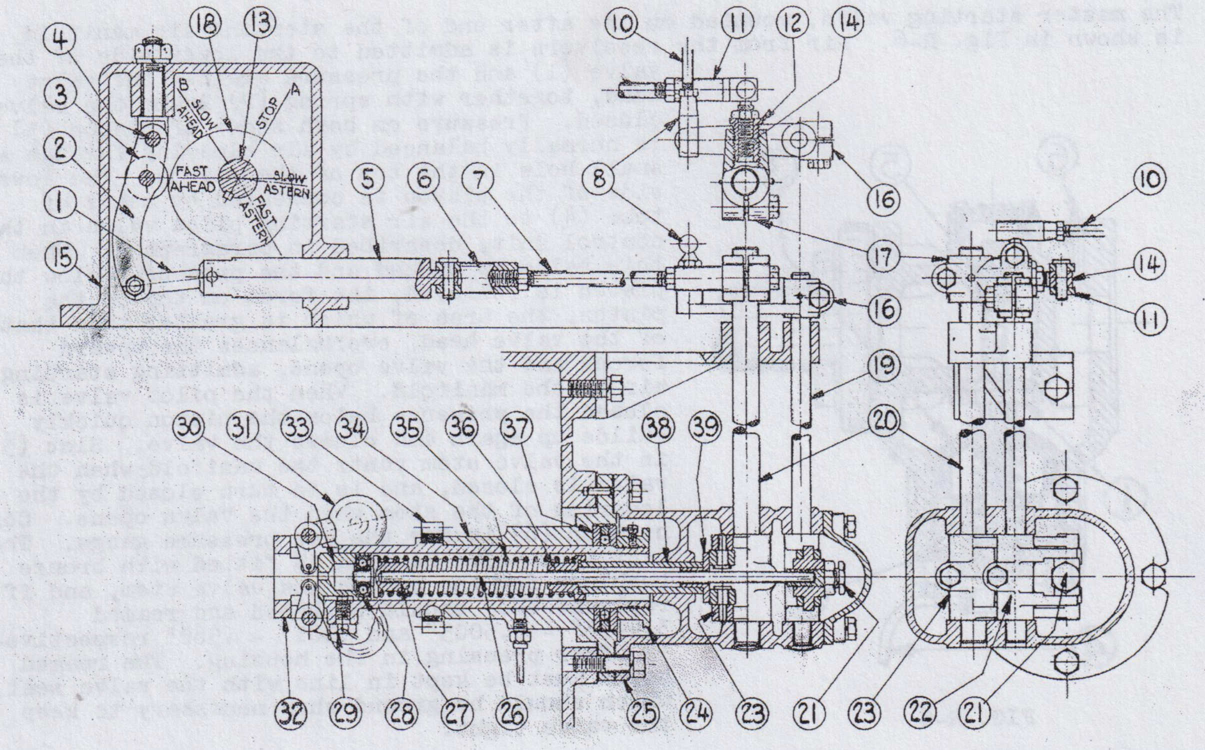


FIG. R-5

The quill rod motion is independent of the linkage which compresses the governor spring and is transmitted to the fuel wedge shaft through an independent vertical shaft (19) actuated at its lower end by fork (22) and at its upper end through lever (16) and ball joint (8). The spring reaction is such that the governor weights are held in by governor spring (35) against the centrifugal force tending to throw them out. Through the linkage to the fuel wedge shaft the wedges follow the motion of the weights, moving out and decreasing the fuel supplied to the engine as the weights move out with increase in speed. At SLOW (Point "B" on the cam) practically all tension on the governor spring is released and the torsion spring on the wedge shaft is acting as the governor spring. The action ASTERN is exactly as described for AHEAD, cam (18) being symmetrical about line A. The speed range of the engine from FAST to SLOW is adjusted by lever (17). Turning threaded sleeve (12) will cause the lever to lengthen or shorten thereby causing smaller or greater travel of governor spring lever (23).

For full speed setting (control lever at FAST), the tension of the governor spring is varied through levers (17) and (23) by lengthening or shortening rod (7) which is threaded with right and left hand threads. This setting must be coordinated with the speed range setting to insure proper operation of both adjustments.

For adjustments of the wedge shaft linkage, setscrew (21) bearing against the end of the quill rod (26) should be set to equalize the motion of lever (22) on each side of its midposition.

The torsion spring on the wedge shaft is primarily for the purpose of taking up the lost motion in the linkage, but since it acts in the same direction as the governor spring and is considerably lighter it serves well as a governor spring during idling and is so used. The idling speed may be varied by adjusting the clamp holding this spring to the wedge shaft, thus changing the tension of the spring. It should be set at about 100 to 120 R.P.M. at SLOW, which should be obtained by tightening the spring about one half turn from its free position.

There is also another spring acting on the wedge shaft. It is mounted on a stud on the centerframe and bears against a lever clamped to the shaft, serving as a buffer spring to prevent over regulation of the governor when the propeller is thrown clear of the water in rough seas. It does not enter into the normal governing of the engine. The adjusting nuts on the mounting stud should be set so that the upper spring washer just contacts the lower nut when the engine is at SLOW.

11. MASTER STARTING AIR VALVE

The master starting valve, mounted on the after end of the starting air manifold, is shown in Fig. R-6. Air from the receivers is admitted to the lower side of the valve (1) and the pressure against the valve head, together with spring (2) keeps the valve closed. Pressure on both sides of piston (3) is normally balanced by air bleeding through a small hole in the top of the piston. The lower side of the piston is connected by means of tube (4) to the air starting pilot valve in the control unit, described in paragraph 5. When this valve is opened and the pressure below the piston is relieved, the force on top of the piston, the area of which is greater than that of the valve head, overbalances the upward forces and the valve opens, admitting starting air to the manifold. When the pilot valve is closed the pressure below the piston quickly builds up again and closes the valve. Slot (5) in the valve stem vents the manifold when the valve is closed, and is in turn closed by the lowering of the stem when the valve opens. Connection (6) is for the air pressure gauge. The cast iron valve housing is fitted with bronze bushings for the piston and valve stem, and if replaced they should be bored and reamed 3.4995" - 3.5005" and .561" - .562" respectively after pressing in the housing. The reamed holes must be kept in line with the valve seat, which should be ground when necessary to keep the valve tight.

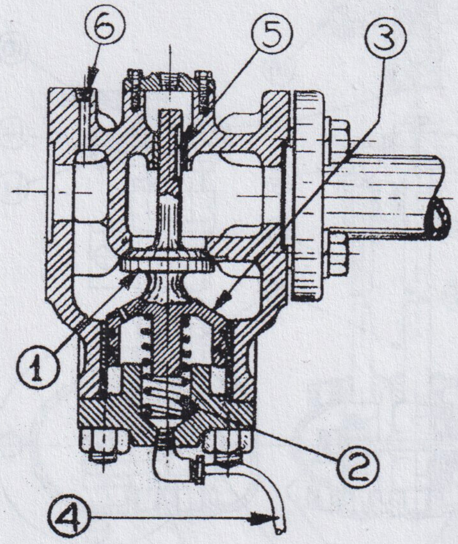


FIG. R-6

12. FLYWHEEL BRAKE

The flywheel brake assembly is shown in Fig. R-7. Brake shoe (1) which is faced with brake lining, is carried by the horizontal arm of crank shaped lever (2). This lever is mounted on shaft (3), and carries the brake cylinder (4) in trunnions on its vertical arm. Shaft (3) is supported by bracket (5) which is bolted to the after end of the centerframe. The projecting end of the piston rod (6) bears against the compressor cylinder and therefore the piston and rod remain stationary when air is admitted to the cylinder. When the pilot valve in the Control unit is opened, as described in paragraph 4 and air is admitted to the brake, the cylinder moves relative to the piston. Lever (2) is rotated about its fulcrum, applying the brake to the flywheel and stopping the engine. When the air pressure is relieved the brake shoe is withdrawn from the flywheel by spring (7), which bears against a third arm on lever (2).

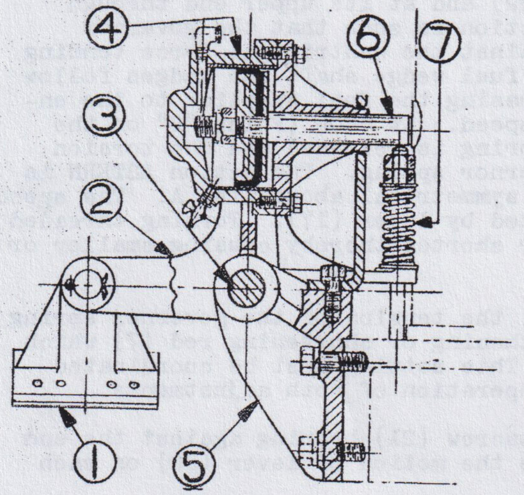


FIG. R-7

There are no adjustments necessary on the brake and the only service requirements are the replacement of the shoe lining and the piston cup leather when necessary.

13. COMPRESSION RELIEF VALVES

NOTE: These valves are not supplied as standard equipment, but only when specifically ordered.

The pneumatically operated cylinder compression relief valves, illustrated in Fig. R-8, serve to relieve the pressure in the cylinders in the event that the engine becomes air bound on top center. These valves receive air from a manifold mounted just below the starting air manifold. As previously explained, the air is supplied from the flywheel brake pilot valve in the control unit. Since it is only at infrequent intervals that the operation of these valves may be required, a globe valve is placed in the line feeding the manifold, and it is recommended that it normally be kept closed. If at any time the engine refuses to start due to the cylinders being air bound, the valve should be opened while the engine control lever is at STOP, and the cylinder pressures will immediately be relieved.

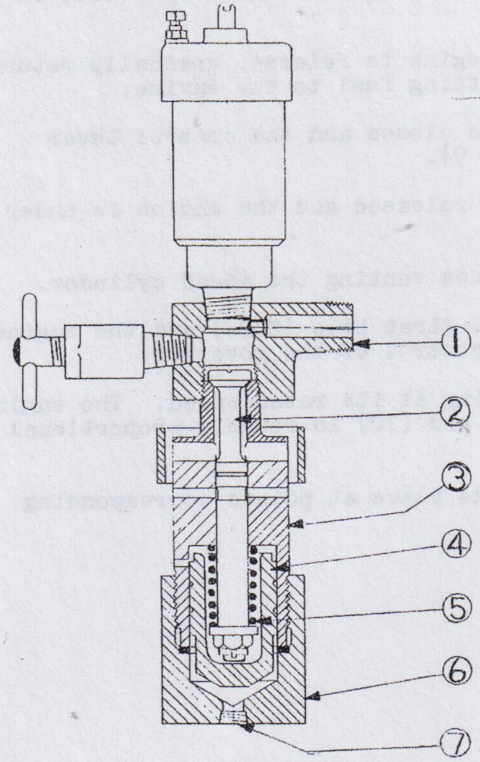


FIG. R-8

Referring to Fig. R-8, valve body (3) is screwed into tee (1), which is in turn screwed into the cylinder head.

Valve (2) is held against its seat in the body by spring (5), which is secured to the top of the valve stem by a nut and washer.

Piston (4) bears against the end of the valve stem, and when air from the manifold is admitted to the hole (7) in cap (6) the force on the piston overbalances the spring force and the force due to the cylinder gases on the head of the valve and the valve is opened, relieving the cylinder pressure through the drilled holes in the valve body.

The relief valves should not need any adjustment, other than to grind the seats in occasionally if they leak.

14. <u>MANEUVERING THE ENGINE - SUMMARY OF CONTROL EVENTS</u>

Assume that the engine has been running ASTERN and that it is desired to go AHEAD. The Control Lever has then been located somewhere between FAST and SLOW on the ASTERN side and the first step is to move it to the STOP position as shown in FIG. R-9. On its way up to STOP the Control lever has then caused the fuel to be cut off and the Flywheel Air Brake to go on. Consequently with the Lever in STOP as shown the engine will rapidly come to a stop. <u>The lever should be kept in the STOP position until the engine has come to a full stop.</u>

After the engine has stopped, the Control Lever can be moved toward START on the AHEAD side. Referring to the numbered positions on Fig. R-9, the following events take place.

(1) In this position the pilot valve controlling the flywheel brake and the compression relief valves is closed and the vent is opened, releasing the brake and closing the compression relief valves. At the same point the ahead pilot valve for the air ram is opened and the ram operates to put the latch shaft in the AHEAD position.

(2) Keep the control lever in this position for a moment until the air ram has shifted the latches to AHEAD. Watch the indicator pin on the barring hub of the air ram mechanism which indicates the latch shaft position.

(3) In this position the latch shaft interlock mechanism operates and prevents further motion of the control lever until the latch shaft has been shifted to AHEAD position.

(4) In this position the starting air pilot

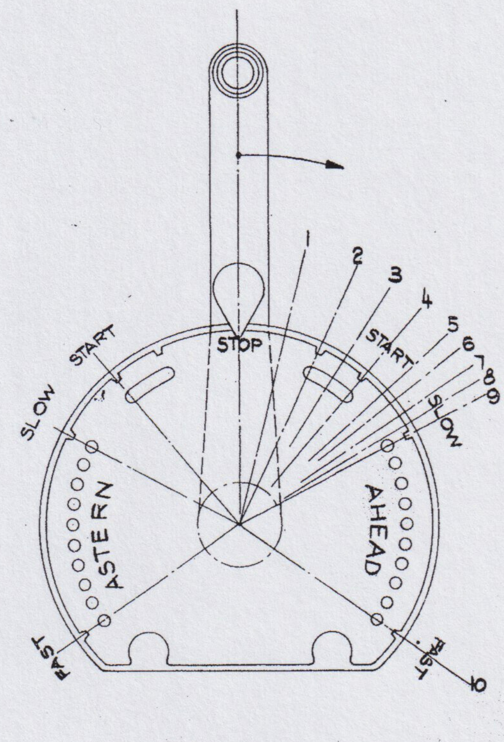


FIG. R-9

valve is opened admitting starting air to the engine, and it begins to rotate in the AHEAD direction of rotation.

(5) In this position the fuel cutout mechanism begins to release, gradually returning the wedge shaft to governor control and admitting fuel to the engine.

(6) In this position the starting air pilot valve closes and the control lever should immediately be moved on to SLOW (position 9).

(7) In this position the fuel cutout is entirely released and the engine is under control of the governor.

(8) In this position the air ram pilot valve closes venting the ahead cylinder.

(9) In this position the control lever enters the first hole (SLOW) and the engine is idling at approximately 100 to 120 RPM under control of the governor.

(10) In this position (FAST) the engine is operating at its rated speed. The engine speed at the various holes between positions (9) and (10) is roughly proportional to the position of the hole.

The various control events on the ASTERN side take place at points corresponding to those on the AHEAD side.

LUBRICATING OIL SYSTEM

1. The lubricating oil system consists of the day tank, two lubricating oil pumps (pressure and scavenge), the lubricating oil filter, the lubricating oil cooler and the necessary piping and manifolds to carry the oil through the system and to the bearings. In addition to the main lubricating oil system as outlined above there is also the Madison-Kipp lubricator, supplying a measured quantity of oil to each piston and cylinder liner. The normal oil flow is from the day tank to the pressure pump, then through the oil cooler to the manifold in the base supplying the main bearings. In special cases (when engines are ordered with a full flow filter) the normal oil flow is from the pressure pump through the filter and then through the oil cooler to the manifold in the base supplying the main bearings. Drilled holes in the crankshaft carry oil to the crankpin bearings and the rifle drilled connecting rods feed the piston pins. The oil from the bearings drains down to a sump in the after end of the base, from which it is sucked up by the scavenge pump and discharged back to the day tank.

The by-pass filter (Std. equip.) is fed from the pressure pump discharge line, ahead of the oil cooler, and the discharge from this filter lubricates the rotary pump drive and the camshaft bearings adjacent to the camshaft gear and the high pressure fuel pump crank. When a full flow filter is used this line comes direct from the pressure pump discharge line to the rotary pump drive and camshaft bearings. The intermediate camshaft bearings are lubricated from catch basins in the tops of the bearings.

A four-way cock interconnecting the piping to and from the lubricating oil cooler permits by-passing and isolating the cooler. A pressure relief valve in the line protects the pressure pump in the event that the cock is thrown to an intermediate position (and thus shut off), or against a stopping up of the oil cooler. The cock should always be thrown quickly from one position to the other, and should never be left in an intermediate position.

The lubricating oil pressure is regulated by means of a relief valve connected in the pressure pump discharge line. This valve should be adjusted so that the pressure gage (located on the gage board) shows a reading of 35 to 40 lbs. per square inch, when the oil is hot.

Note that low lubricating oil pressure may not necessarily be due to relief valve adjustment. It may result from one or more of the following causes. They should be investigated before attempting to correct the pressure by adjusting relief valve at the pressure pump.

(a) Low lubricating oil level in day tank.
(b) Restriction in suction pipe to either of the lubricating oil pumps.
(c) Broken pressure pipe or fitting.
(d) Crankshaft bearing failure.
(e) Worn pump gears.
(f) Viscosity of oil too low, excessive temperature of oil, or thinning out with fuel oil.

2. LUBRICATING OIL DAY TANK

The cylindrical lubricating oil day tank, has a capacity of about 16 gallons on 10" bore engines and about 20 gallons on engines with larger bore. It should be mounted vertically with the bottom at least three feet above the engine room floor, and should be piped by the customer to the discharge from the lubricating oil sump pump and the suction of the pressure pump. The former connection should be 1" to 1-1/4" pipe, leading to the 1-1/4" pipe tap hole in the top of the tank, and the latter connection should be 1-1/4" to 1-1/2" pipe, and should lead to the 1-1/4" or 1-1/2" pipe tap hole 6" to 8" above the bottom of the tank. A drain valve should be connected to the bottom of the tank.

A gage glass near the top indicates the oil level, which should be maintained between the center and top of the glass when the engine is running. Under no circumstances should it be permitted to drop below the glass. The tank should be drained and flushed out at intervals to keep the sludge in the bottom from building up to the pump suction connection. New oil should be added to the system through the filler hole in the top of the tank, which is protected by a screen.

3. LUBRICATING OIL PUMPS

The lubricating oil pump drive is shown in Fig. T-1. The pressure pump (14) and scavenge pump (3), together with the fuel transfer pump (6) are mounted in a common housing on the after end of the control side of the engine. The lubricating oil pumps, which are identical except for the length of the shafts and the keyways, are gear type reversible pumps, employing an internal gear, an idler and a crescent shaped baffle to maintain the direction of flow through the pump regardless of direction of rotation. When the engine reverses the crescent shifts position, following the rotation of the idler, and maintaining the direction of flow of the oil through the pump.

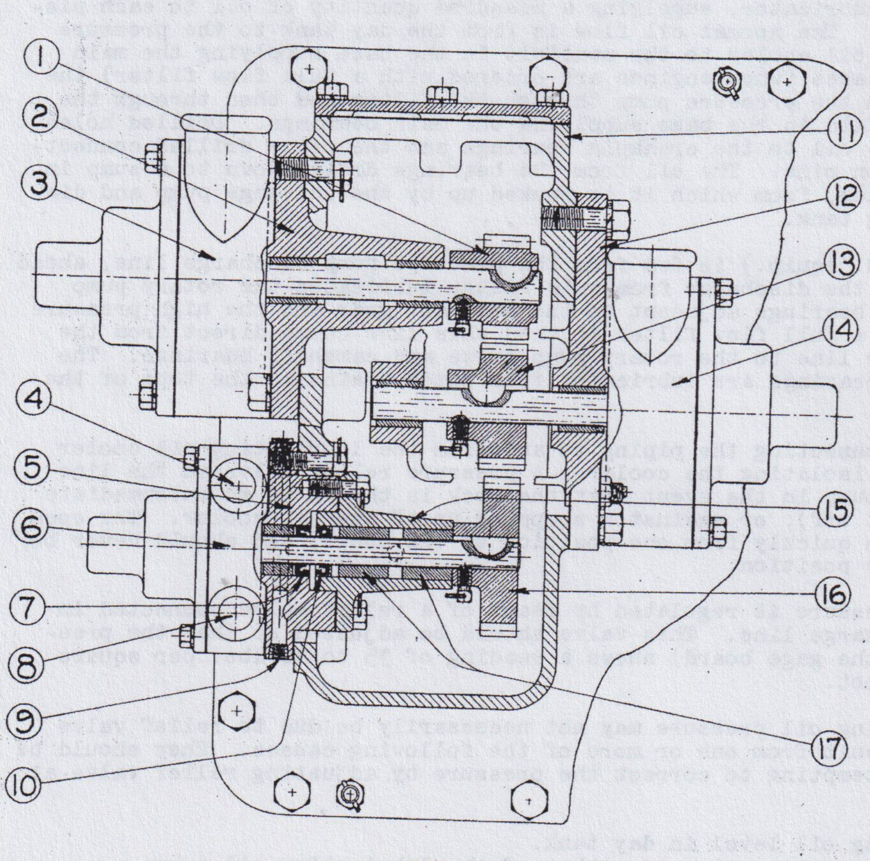


FIG. T-1

If dismantled the pump must be reassembled with the parts in the same positions, as reversing the assembly will reverse the suction and discharge ports. The correct assembly may be determined by remembering that the crescent always moves through the suction zone when reversing. There is a projection on one side of the cover which acts as a stop for the crescent, and the cover should be assembled with this projection on the suction port side of the pump. Follow these instructions in determining the flow direction of the pumps rather than the arrows stamped on the castings, as these arrows may not always be correct.

The total end play between the pump rotor and the end covers and adapters (2) and (12) should be very small, only about .001" to .003". However, some end play must be allowed so that when the engine is reversed the crescent can move in the new direction of rotation until it is up against the stop. If a pump has been disassembled, re-assemble it to adapters (2) or (12) and turn the shaft by hand in both directions of rotation. It can then be felt when the crescent hits the stops. This is important because if the crescent cannot move the oil flow will not be reversed when the engine reverses and consequently the lubricating oil pressure will drop.

The lubricating oil pumps are mounted in the housing in adapters (12) and (2) which are doweled to the housing after positioning for a gear backlash of .004" - .005". Cylindrical fits locate the pumps in the adapters so that the pumps may be replaced without disturbing the gear setting. If the adapters are ever replaced for any reason however, they must be located on the housing to properly mesh the gears, and new dowel holes drilled.

Bronze bushings in the adapters carry the pump shafts, and if replaced must be reamed to .7500" - .7505" after pressing in. Use care to keep reamed holes square with face of adapter. The bushings adjacent to the pumps are lubricated by leakage along the shaft from the pump and the outboard bushings from catch basins on the adapter castings which are filled by the lubricating oil spray nozzle which lubricates the whole assembly. (Note: On later engines both inboard and outboard bearings are pressure lubricated by oil lines inside the pump housing.) The oil holes for the outboard bushings must be drilled when renewing bushings. The pinions driving the pumps are keyed to the shafts and locked with setscrews and mesh with a gear on the after end of the camshaft. The setscrew heads are drilled for locking wire, and should be well wired when reassembling. The gears are accessible through cover plates on the housing.

4. LUBRICATING OIL FILTER - (By-pass Type - Standard Equip.)

The filter is of the metal element type as shown on Fig. T-2. The elements are made up of flat metal ribbon wound around a central spool, adjacent layers being slightly separated from each other by raised ridges running across the ribbon. The successive

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layers of the ribbon are spaced .003" apart and it is these spaces that form the filtering medium. The oil flows from the outside toward the center and leaves the dirt on the outside of the spool. The filter may be cleaned by turning the cleaning handles on top, which rotates a knife bearing on the edge of the windings, scraping off the dirt and allowing it to settle to the bottom of the sump tank. The filter should preferably be cleaned when the engine is not running so that the dirt may settle to the bottom, although there is no objection to cleaning with the engine running. Cleaning should be at sufficiently frequent intervals to prevent stoppage of oil flow and the sump tanks should be drained before the dirt in the bottom builds up to the level of the elements. Experience will determine the correct intervals.

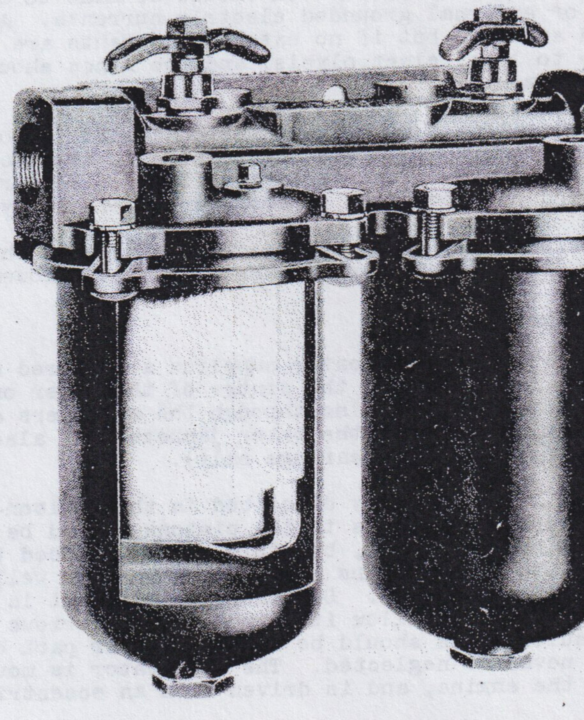


FIG. T-2

5. LUBRICATING OIL FILTER - (Full Flow Type - Special Equip.)

The filter is a duplex unit of the metal element type and is very similar to the by-pass type described above, except that the filter is equipped with a switch over valve which allows either of the two units to be cut out for cleaning or servicing. For care and operation of this filter follow instructions shown above for the by-pass type.

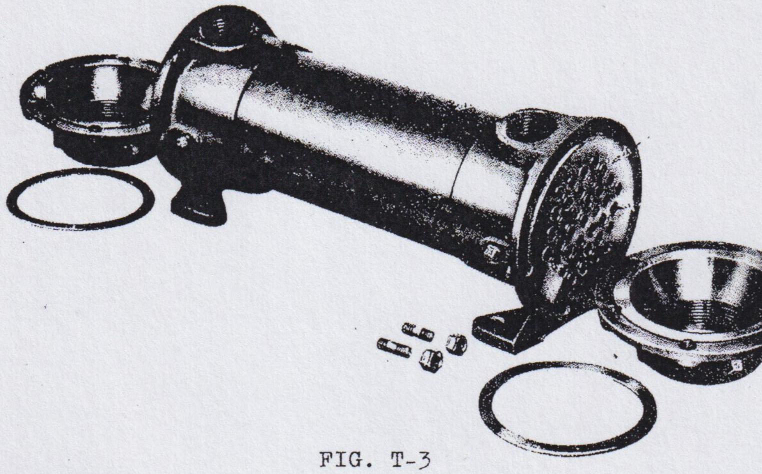


FIG. T-3

6. LUBRICATING OIL COOLER

The construction of the Ross type oil cooler is shown on Fig. T-3. The shell of the cooler is a completely closed circuit effected by brazing the tube sheets on each end to the seamless copper shell, and then mechanically rolling the tubes securely into the tube sheets at both ends. The bonnets are bolted to the shell flanges, with molded asbestos gaskets between, and can be removed for inspection and cleaning of the inside of tubes. The flow of the oil is guided by bronze baffles inside the shell to produce the most efficient heat transfer.

Zinc electrode plugs are provided in the bonnets to prevent electrolysis. They should be examined thirty days after installation and every thirty days thereafter. Any appreciable erosion within this period indicates electrolytic action, and if present a careful inspection should be made to determine if it is due to short circuits or external grounded electric currents. Any such conditions should be corrected at once, but if no external currents are found it is evident that the erosion is due to local electrolysis, and the zincs should be replaced frequently to protect the equipment.

The cooler should be cleaned periodically. Remove the cooler from the engine, take off the bonnets and clean the inside of the tubes. Fill the jacket with suitable cleaning solution, but avoid any fluids which are corrosive to bronze or copper. Drain and blow out with compressed air carefully.

The drain plugs at the bottom of both bonnets should be removed and all water in the cooler drained out whenever the engine is allowed to stand in freezing weather.

7. <u>LUBRICATOR AND DRIVE</u>

The Madison-Kipp lubricator supplies a measured quantity of lubricating oil to the pistons, introduced at the center of the liner on each side. Nipples screwed into the liners and projecting through the cylinders and sealed thereto by packing glands carry the oil through the water jackets. It also feeds oil to the thrust bearing (multi-collar thrust bearings only).

The lubricator is fully described in the Madison-Kipp bulletin attached at the end of the book. Oil feeds to the pistons should be adjusted to 20-25 drops per minute when the engine is new, but this may be reduced to approximately 15 to 20 drops per minute after the pistons and rings have been well worn in. KEEP THE LUBRICATOR WELL FILLED WITH CLEAN OIL. Use the same oil that is used in the engine. Do not under any circumstances allow it to run dry as serious damage to the pistons and liners may result. This should be made a regular part of the engine room routine and should never be neglected. The lubricator is mounted on a bracket on the forward end of the engine, and is driven from an eccentric on the end of the camshaft.

WATER COOLING SYSTEM

1. Atlas Diesel Engines are furnished with either raw water or fresh water cooling systems.

In raw water systems, the sea water is pumped directly thru the oil cooler, thru the engine and is then discharged overboard. This system uses a single pump either centrifugal or plunger type.

Fresh water or closed cooling systems, recirculates fresh water from a storage or surge tank and requires dual water pumps, one for the fresh water and the other for the raw water which is pumped thru a heat exchanger for cooling the fresh water.

With either of the above systems the water circuit from the oil cooler thru the engine is the same, while the arrangement or flow to the pump and cooler can vary considerably.

2. The water circuit from the oil cooler thru the engine is as follows:

(a) The water passes thru the oil cooler, cooling the lube oil and then to the water inlet manifold which distributes the water to the lower portion of each cylinder. The water rises to the top of the cylinders and then thru brass nipples (screwed into the cylinder) up into the cylinder head. Each nipple is sealed between the cylinder and head by means of a rubber grommet. The water circulates thru the cylinder heads and out thru elbows to the exhaust manifold. The exhaust manifold is made up of several sections and the water is by-passed from each and finally discharged at the top of the forward end of the manifold. From here, the water is passed overboard (in the case of raw water cooling) or recirculated back to the pump or surge tank depending on the type of installation.

(b) In addition to the main flow there are several minor parallel circuits as follows:

1. Air Compressor - The water is piped directly from the main cylinder inlet manifold to the air compressor cylinder. From this cylinder it flows thru a pass-over pipe to the cylinder head and then to the aft end of the exhaust manifold.

2. Fuel Spray Valve Cooling (Engines with 11½" or larger bore) - On engines with 11½" or larger bore there is provided a fuel spray valve cooling circuit. Nozzles, discharging cool water directly against the spray valve bosses, are screwed into the cylinder head water jackets, and greatly reduce the tendency for coke to build up on the spray valve tips. The nozzles also prevent muck and scale from accumulating in the center of the heads around the valve bosses. The nozzles are fed from a manifold extending fore and aft just below the exhaust manifold. Since these nozzles discharge into the cylinder head water jackets there is no return line for this circuit.

3. Valve Cage Cooling (Engines with 11½" or larger bore only) - Water is piped from the main water inlet manifold up to the valve cage cooling manifold (inlet) and then by copper tubing to each valve cage. The water is then returned to an outlet manifold which discharges into the exhaust manifold water outlet connection. On certain raw water cooling installations, this water is piped overboard.

4. Thrust Bearing - Atlas Multi-collared Type (Used only with raw water cooling systems) The thrust bearing cooling water is piped directly from either the main water inlet manifold, or the circulating water pump discharge. The water circulates thru the lower half of the bearing and then by means of pass-over pipes to the upper half of the bearing. After circulating thru the upper portion of the bearing the water is piped overboard.

5. On certain engines (raw water cooled) the bilge pump discharge is connected to the water inlet manifold by a three-way cock, and the engine may be temporarily run <u>at slow speed</u> on this pump if the main circulating pump is out of service. Provision should be made for connecting the suction to a sea chest if the pump is to be used in this way.

3. DRAINING THE WATER

If the engine is to be allowed to stand idle in freezing weather it will be necessary to drain all water. Drain plugs will be found on the water pumps, air compressor exhaust manifold, water inlet manifold and the thrust bearing if it is the Atlas multi-collared type. If the engine is equipped with valve cages it will also be necessary to remove the water. This can be accomplished by removing the cages, blowing the water out with air, or sucking it out with a hand suction pump.

4. PISTON TYPE CIRCULATING WATER PUMP (Engines with 13" or larger bore)

For construction of the pump refer to the Parts Catalog Plate facing the "Circulating Water Pump" group list sheet. Referring to this plate the pump piston is connected by means of a piston rod, crosshead, connecting rod and strap to an eccentric on the crankshaft. The pump body is divided into two chambers so that each side of the piston acts as a separate pump. Each chamber has a separate set of disc type, spring loaded, suction and discharge valves.

The piston rod packing nut is easily accessible and can be tightened with a pin or drift. New packing can be installed after loosening the splash guard and sliding it out of the way. A hand hole in the outer end of the pump body permits inspection and servicing of the piston. However, if much work is to be done on the pump, it is recommended that the connecting rod be unbolted from the eccentric and the whole pump assembly removed from the centerframe.

The piston assembly is made up of two piston discs, separated by a spacer and faced with cup leathers. Brass washers, approximately five on each side, are let into the leathers between the pistons and spacers, so that the clamping is through metal only, and the assembly cannot work loose due to compression of the leathers. It is important that these washers always be used on each side, and that the clamp nut be securely tightened and cotter pinned.

By removing the whole pump assembly as previously described and also the centerframe cover above the pump mounting, the crosshead and eccentric strap are made readily accessible for inspection or service. The strap which is babbitt lined, is fitted to the eccentric with a clearance of .006" - .010" on the diameter and has a side clearance of .003" - .006".

A bronze bushing is pressed into the crosshead end of the connecting rod for the wrist pin bearing. If replaced the new bushing should be reamed after pressing in to allow a clearance of .001" to .002" between the bushing and pins. The crosshead is reamed to a slightly smaller diameter, so that the clearance between crosshead and pin is .0005" to .0015".

Air chambers are provided to prevent water hammer, one on the suction and one in the discharge side of the pump. The chamber on the suction side is fitted with a ball check or snifter valve and a pet cock. When the pet cock is opened air is admitted to the chambers with each suction stroke of the pump. This valve should be opened as often as necessary to keep the chamber charged with air. Water hammer in the system indicates a lack of air in the chamber and the snifter valve should be opened. If the pet cock is left open continuously it should be opened just enough to prevent water hammer. If left wide open the pump capacity is lowered and the engine may not receive enough cooling water.

A zinc block is bolted in the bottom of the pump suction chamber to protect the various metals from electrolytic action. This block should be replaced when about 75% dissolved. New blocks can be installed after removing either the air chamber elbow or the suction line flange from the suction chamber.

5. PISTON TYPE CIRCULATING WATER PUMP (Engines with 11½" or smaller bore)

For construction of pump refer to Parts Catalog Plate facing the "Circulating Water Pump" group list sheet. The drive is by means of piston rod, crosshead and connecting rod to a crank which in the case of 10" and 10½" bore engines is mounted on the end of the camshaft. On 11½" bore engines the crank is on the end of the jackshaft which is gear driven from the crankshaft.

For the functioning of the pump, servicing of the piston rod packing, and the piston construction see paragraph 4. Crank pins and crosshead pins should slide freely in the corresponding connecting rod bushings. Allow about .0015" to .003" clearance.

6. CENTRIFUGAL PUMPS (Single or Dual)

The water pumps, driven by a roller chain from a sprocket on the crankshaft, are mounted on a housing at the end of the engine. For illustration of the pumps and drive refer to the Parts Catalog Plate facing the "Circulating Water Pump" group sheet. The pumps are driven from opposite ends of a common drive shaft, rotating on ball bearings. Either pump may be removed by unbolting the pump mounting bracket from the drive housing and breaking the shaft coupling. Both pumps are identical and are interchangeable. When replacing a pump, the half coupling on the drive shaft should be removed and replaced by the one supplied with the new pump. The pump packing gland should be kept only sufficiently tight to prevent excessive leakage, and should never be tightened unnecessarily.

7. WATER PUMP DRIVE

The tension on the pump drive chain is adjusted by means of an idler sprocket bearing against the outside of the chain. The sprocket rotates on ball bearings which are eccentrically mounted on a fixed shaft. Referring to the Parts Catalog Plate it will be seen that the idler shaft is keyed to the idler adjusting disc which is bolted to the drive housing. To tighten the chain remove the retaining bolts and rotate the adjusting disc to move the sprocket in against the chain. Do not tighten chain excessively. With all of the slack on the top side, the chain should be loose enough to permit a vertical movement of approximately 3/4" to 1". If the eccentric does not provide sufficient adjustment to take up the slack in the chain it is probable that the chain is excessively worn and should be replaced. The ball bearings for the pump drive shaft and idler sprocket are force feed lubricated from the engine pump. They should be examined at annual inspections, and replaced if showing evidence of wear.

AIR COMPRESSOR

1. SINGLE STAGE COMPRESSOR

On engines with 13" or smaller bore a single stage compressor is used. This air compressor is of the single acting type and is located at the after end of the engine. The cast iron, jacketed cylinder is bolted to the top of the centerframe directly behind number six cylinder. The cylinder head contains the spring loaded, disc type, suction and discharge valves. The compressor output is controlled by a diaphragm type suction valve unloader. This unloader is connected to the air tanks and when the pressure in these tanks reaches a pre-determined value, usually 225 lbs. per square inch, it acts to hold the suction valve open, thus cutting out the compressed air delivery. The unloader is mounted directly over the suction valve.

The piston, which is driven from the crankshaft by a connecting rod, strap and eccentric, is fitted to the cylinder with a clearance of .004" to .006". Five piston rings in all are used. Three 3/8" wide step cut compression rings are installed in grooves above the wrist pin and two 3/8" wide step cut, ventilated oil rings are placed below the pin. Side clearance is .0025" - .005" for all rings. The ring gaps should be .012" on the two top rings and .009" on all the lower rings.

The wrist pin is given a clearance of .000" to .001" in the pin bores and a clearance of .001" to .002" in the bearing assembly of the connecting rod. The pin is secured in the piston by a setscrew threaded into one of the pin bosses and locked by a jam nut. Shims between the foot of connecting rod and the strap allow for adjustment of the piston height. The top of the piston should be flush with the top of the cylinder when the cylinder is pulled down, and with the eccentric at top center. The strap is allowed a diametral clearance of .006" to .010" and a side clearance of .003" to .005".

2. TWO-STAGE COMPRESSOR

A two-stage single acting compressor is used on 14½" and 15" bore engines. It is located at the forward end of the engine and is bolted to the centerframe. A stepped piston is used which is driven by a connecting rod, strap and eccentric on the crankshaft. The piston and cylinder construction is shown on the Parts Catalog plates. It should be noted that the first stage is formed between the top of the piston and the cylinder head whereas the second stage is formed between the lower face of the piston step and the upper face of the cylinder step. The first stage or intermediate pressure is approximately 68 pounds per square inch and second stage pressure is the final discharge pressure of the compressor.

There are two lubricating oil holes on the air compressor cylinder which are combined into one lead to the mechanical oiler. It takes very little oil to lubricate the compressor and the mechanical oiler should be set for not more than one drop of oil per revolution of the oiler shaft. This will be a total of approximately 4 to 6 drops of oil per minute to the compressor if the engine is running at full speed. Under no circumstances should this amount of oil be increased.

The intermediate cooler, which is cast integral with the cylinder body, is provided with a safety valve set at 100 pounds per sq. inch. It is mounted on the side of the cylinder. If this safety valve pops the first stage discharge valves may be sticking or leaky, or the 2nd stage suction valve may not perform its function properly. Do not allow the intermediate stage safety valve to pop. If this happens, check the above mentioned valves and correct the trouble.

The lower portion of the intermediate cooler forms a water trap for the condensate which forms when the air is cooled. A drain is provided for this water. The drain line is carried out to the forward end of the engine where a cock is provided for draining purposes. The air compressor intermediate cooler should be drained at regular intervals, as otherwise the water which is formed will be carried into the 2nd stage. The water trap portion of the intermediate cooler holds approximately 2 quarts, and the drainage periods should be spaced at such intervals that less than this amount is drained out at one time.

The compressor output is controlled by a diaphragm type suction valve unloader acting on one of the first stage suction valves. The unloader should be connected to the air tanks and when the pressure in these tanks reaches a predetermined value, usually 225 lbs. per square inch, one suction valve is held open, thus cutting out the first stage air delivery. Due to the large clearance volume in the second stage no air will be delivered by this stage when the intermediate pressure is atmospheric. Consequently the first stage suction valve unloader controls the total output of the compressor. The unloader is mounted on a small cover over the first stage suction valves.

The piston is provided with four compression rings on its large diameter and four compression and one oil control ring on the smaller diameter lower part. The oil control ring is mounted below the piston pin. The side clearance in the ring grooves should be .003" to .005" for all rings. The rings gap on all the large diameter rings and the two upper small diameter rings should be .016". The other rings should have a gap clearance of .012".

The case hardened and ground piston pin is stepped, with differential fits in the piston pin bosses. The fits are .0005" to .0015" press on the small end and metal to metal to .0015" loose on the large end. Rotation of the pin in the piston is prevented by the engagement of a dowel which projects radially from the large end of the pin with a groove in the bottom of the boss. A setscrew threaded into the smaller pin boss enters an indentation in the pin to act as a retainer. The setscrew is in turn secured by a locknut. A piston pin clearance of .0015" to .0025" is allowed in the connecting rod bushing.

Shims between the foot of the connecting rod and the top of the eccentric strap allow for adjustment of the piston height. The top of the piston should be flush with the top of the cylinder when the piston is on top dead center. The cylinder nuts should be tight when making this adjustment. No adjustment is provided, or necessary, for second stage clearance. All that is required is that the top of the piston be flush with the top of the cylinder in accordance with above instructions. The eccentric strap is allowed a diametral clearance of .006" to .009" and a side clearance of .005" to .008".

The construction of the suction and discharge valves is clearly shown on the parts catalog plate facing the "Cylinder and Head" group list sheet. Note that the suction valves are provided with spring retainers which screw on the ends of the valve stems. The retainers are locked by means of snugly fitting cotter pins and should be screwed down to <u>allow a maximum suction valve lift of 1/8"</u>. On the first stage suction valves particularly, <u>it is important that the spring retainer cotter pin fits snugly in the valve stem hole</u>. Cotter pin should not be smaller than 1/8" dia. and should be long enough to allow the ends to be bent over so that pin will be securely locked. <u>The small cover over the first stage suction valves in the cylinder head should be removed approximately once a month to make sure that the valve spring retainers are securely locked by their cotter pins.</u> If the cotter pins should work out the spring retainers might unscrew allowing the suction valves to drop down into the cylinder with consequent damage to piston and head.

M A I N T E N A N C E & I N S P E C T I O N

1. GENERAL RULES

Observing the following general rules will go a long way toward insuring satisfactory and trouble-free operation. Refer to preceding sections for detail instructions.

KEEP YOUR ENGINE CLEAN

Inspect the engine regularly and keep it wiped clean. If oil is left standing it quickly hardens and must be washed or scraped off. It is much easier to keep the engine clean than to get it clean, and there is always less trouble with a clean engine than with one that is covered with oil and dirt.

LEAVE WELL ENOUGH ALONE

When the engine is running satisfactorily and smoothly, do not continually try to better the operation with minor adjustments.

NEVER ALLOW YOUR ENGINE TO SMOKE

When the exhaust from an engine is smoky it clearly indicates that combustion is not perfect and that residue, in the shape of smoke, is clinging to the oily surfaces of the cylinders, pistons, piston rings, valves, etc. When this happens you are creating trouble for yourself and doing an injustice to the engine. Therefore, the first thing in consideration of the operation of a Diesel engine is: DO NOT ALLOW YOUR ENGINE TO SMOKE

KEEP A COMPLETE LOG OF ENGINE OPERATION

A complete log should always be kept of the engine operation, and back sheets should be consulted frequently and compared with present conditions. In this way gradual changes can be detected and investigated and insignificant troubles corrected before becoming real ones. Any unusual noises or other irregularities should be logged so that they will be investigated at the regular routine inspections.

INSPECTING REPAIRS

At completion of any adjustment or repair job, always make a thorough inspection to see that all parts have been correctly replaced, that bolts and nuts are tight, and that all cotter pins and locking wires are in place. If work involved rotating parts, bar engine around at least two full revolutions (so that camshaft is turned one revolution) to be sure that all parts are clear. Be sure that no tools or rags are left inside the engine.

2. SMOKY EXHAUST

Smoky exhaust indicates defective combustion which is usually due to one of the following causes:

(a) Excessive carbon on spray valve tips.

(b) Leaking spray valve.

(c) Leaky exhaust, inlet, or air starting valves.

(d) Buffer springs may be incorrectly adjusted.

(e) Fuel cam or roller may be worn.

(f) Leaky or stuck piston rings.

(g) Uneven cylinder load balance.

TURBO-CHARGER

Maintenance, inspection, general instructions and parts list are contained in a separate booklet usually placed after the parts catalog section of this book. If this booklet is not included, one will be supplied by writing the A.I.D.E. Co., Oakland or the Elliot Co. at Jeannette, Pa. When requesting a new booklet always be sure and give the Turbo-charger Serial Number and the Engine Serial Number.

If exhaust smoke is not even but occurs in the form of puffs it is likely that the combustion is defective in one or two cylinders only. Where the trouble lies can usually be determined by cutting out spray valves one at a time. When this is done however, the engine should not carry more than about 3/4 load or the remaining cylinders will be overloaded.

3. INSPECTION AND MAINTENANCE ROUTINE

The following routine for regular inspection and maintenance work is suggested as a guide for the operator, but experience with the engine over a period of time may indicate changes that should be made in the schedule.

It will be noted in the following schedules that spray valve cleaning has not been included. It is believed the spray valves should be cleaned only when necessary, rather than at definite intervals. The necessity for cleaning will be indicated by increased or uneven exhaust temperatures or smoky exhaust and at either of these indications the spray valves should be inspected and cleaned, if necessary.

In the following, work to be done under each routine should include work listed under preceding routines. For example, work under "Annual Routine" includes everything listed under all other routines.

4-HOUR ROUTINE

(a) Hand oil the following points:

1. The inlet and exhaust valve stems.
2. The rocker arms at their fulcrums and at their push rod ends.
3. Inlet and exhaust lifters, fuel wedges, lifter and buffers.
4. Wedge shaft bearings.
5. Tachometer drive.
6. Governor bearing.
7. Bilge pump connecting rod - both ends.
8. Mechanical lubricator strap.

For oiling the inlet and exhaust valve stems it is preferable to use penetrating oil. If this is not available a mixture of equal parts of engine lubricating oil and kerosene may be used. (A mixture of two-thirds engine fuel oil and one-third lubricating oil can be used in an emergency.) For all other points in above schedule use engine lubricating oil.

(b) Check the oil level in the mechanical lubricator. Fill the lubricator with clean engine oil of the grade used in the engine when necessary.

(c) Turn the handle of the lubricating oil filter.

(d) Turn the handle of the fuel oil filter.

Always turn filter handles immediately after stopping the engine.

DAILY OR 24-HOUR ROUTINE

(a) Clean out the sump tanks of the lubricating oil and fuel oil filters.

(b) Hand oil the air brake.

(c) On engines equipped with pneumatic control, hand oil the air ram and interlock and grease the control unit shaft with cup grease.

200 TO 300-HOUR ROUTINE

(a) Check intake and exhaust valve timing.

(b) Check spray valve timing. (After starting engine check cylinder load balance.) (See Section O)

(c) Clean out lubricating oil day tank if lubricating oil is dirty or dark in color.

(d) Remove crankcase doors and inspect connecting rods. Be sure that all connecting rod bolts are tight and that everything is in order. Inspect lower part of cylinder liner bore.

(e) On engines equipped with waste type filters these may or may not need repacking. The time between packings will vary with the type of lubricating oil used and with the operating conditions to which the engine is subjected. When the lubricating oil turns black rapidly following an oil change, the filter should be repacked.

SEMI-ANNUAL ROUTINE

(a) Pull cylinder heads and pistons, remove rings and clean pistons and grooves thoroughly. Check rings for side and end clearance.

(b) Examine cylinder liner walls. Watch for shoulders due to ring travel.

(c) Grind intake and exhaust valves. Check valve springs for length and tension and for defects.

(d) Recondition spray valves. Inspect stem packing and repack if necessary. Inspect stem for wear and replace if worn. Inspect and clean spray valve tips. Grind stem to tip.

(e) Inspect main and connecting rod bearings. Check clearances and inspect bearing surfaces. Adjust clearances if necessary.

(f) Inspect gear train carefully, observing backlash, indications of wear on teeth, and clearance on intermediate gear bearings.

(g) Inspect camshaft and latch shaft assemblies. Watch for worn or loose cams, loose or worn rollers or pins on the lifters. Be sure all keys and lock bolts are in place and tight.

(h) Inspect water pump and renew zinc plug if necessary.

(i) Inspect engine control parts, adjust and grind valves if necessary.

(j) Disassemble lubricating oil cooler and inspect for corrosion. Clean thoroughly before reassembling. Renew zinc plugs if necessary.

(k) Check propeller shaft coupling bolts and thrust bearing and flywheel clamp bolts.

(l) Check all hold-down bolts between engine and foundation. If they are loose check the engine alignment.

ANNUAL ROUTINE

(a) Check crankshaft and thrust shaft alignment. If shaft needs realignment it is recommended that the work be done by an experienced and careful mechanic.

(b) Examine cylinder jackets and exhaust manifold water jackets. If scale is over 1/16" thick it should be removed by scale remover solution.

(c) Remove and inspect lubricating oil and fuel oil transfer pumps. Note conditions of bearings, shafts and seals. Replace if necessary.

(d) Remove top cover and mounting plate on high pressure fuel pump. Note condition of pump plungers and barrels. Disassemble crossheads and connecting rods and inspect for wear. Inspect suction and discharge valves and grind seats. Check valve lifts.

(e) Disassemble governor and inspect carefully all moving parts for wear and signs of distress. Inspect entire linkage between governor and wedge shaft for lost motion and wear. Fuel wedges, links and pins should also be inspected for wear and replaced if necessary.

(f) Inspect Mechanical Lubricator and connections to cylinder liners. Inspect ratchet mechanism for wear and proper functioning. Hand crank lubricator and observe the feed to each liner. Watch for water leaks at the nipples going through the water jackets.

(g) Clean out crankcase thoroughly. Be sure that all cleaning solution is drained out after cleaning is completed.

FOREWORD

This Parts Catalog has been compiled to serve the dual purpose of providing a means for ordering parts and to furnish illustrations to aid in the dismantling and reassembling of the various units of the engine.

This Parts Catalog is made to conform to the original construction of the engine, and The National Supply Co. does not assume the responsibility or obligate itself to maintain this catalog to conform to any subsequent changes made on the engine after it leaves the factory. Complete records of all changes and service orders for each engine are maintained at the factory in an effort to always supply correct parts, but due to occasional substitution of parts in the field, of which we have no knowledge, and the fact that we have no assurance that parts furnished from the factory are installed, we cannot guarantee the furnishing of correct parts.

The right is reserved to change the construction or material of any part or parts without incurring the obligation of installing such changes on engines already delivered.

INSTRUCTIONS FOR ORDERING PARTS

Always furnish Engine Number when ordering parts or when communicating with factory or agency. This number will be found on name plate located on operating side of engine. It is VERY NECESSARY THAT THE ENGINE NUMBER BE GIVEN as it helps to insure the furnishing of correct parts and is also the means whereby the factory service records of each engine are maintained.

Always give PART NUMBER, PART NAME AND QUANTITY. If part has no **Part** Number then give a COMPLETE DESCRIPTION AND SIZE OF PART.

Be particular to state POST OFFICE ADDRESS, TOWN, COUNTY and STATE to which parts are to be shipped.

Specify how merchandise is to be shipped--whether by FREIGHT, EXPRESS or PARCEL POST.

Confirm all Telephone and Telegraph orders in writing.

Claims for shortages or errors must be made within five days from the receipt of goods or same will not be considered.

Broken or damaged goods should be refused, or a complete description made of damage by the carrier agent on the freight bill. If this is done, full damage can generally be collected from the transportation company.

No responsibility is assumed for delay or damage to merchandise while in transit. Our responsibility ceases upon delivery of shipment to the transportation company, from whom a receipt is received showing that shipment was in good condition when delivered to them; therefore, claims if any, should be made with the transportation company and not with The National Supply Co. - Engine Division-Springfield, Ohio

INSTRUCTIONS ON "HOW TO USE PARTS CATALOG"

In order TO LOCATE PART NUMBERS it is IMPERATIVE that the person concerned thoroughly understands the makeup of this book. He should CAREFULLY READ THE INSTRUCTIONS given on this and the following page, and thoroughly familiarize himself with the necessary steps involved. Particularly is this important when sub-assemblies are involved.

DO NOT ORDER PARTS BY REFERENCE NUMBERS as these numbers sometimes change and wrong parts might be supplied.

This catalog is made up of four basic sections, as follows:-

1. INDEX SHEET -- This sheet lists the various groups into which the engine is divided and must be used for obtaining the group sheet number. This sheet also lists any special parts used on engine.

2. GROUP LIST SHEET -- This sheet lists the parts which comprise the group, and are numbered with the prefix "L" or "2L" NOTE - Catalog may contain sheets which are not used - Use only those sheets listed on index.

3 PLATE (OR LINE DRAWING) -- Plates are arranged to face the group sheet to which they apply, and in most cases shows only the parts listed in the group. Occasionally a plate may include two or more groups making it necessary to always first obtain the group number from the index. If this is not done you may by chance turn to a plate showing the part wanted but will not find it listed on the group sheet facing this plate.

NOTE:----- If no plate is found facing the group sheet, then the part wanted can be identified by the description. This will apply mainly to piping, and in this connection the actual pipe and fittings on the engine should always be measured and then ordered accordingly, due to unavoidable variations between engines.

4. SUB-ASSEMBLIES -- The term "Sub-assembly" (or the Word "Assembly" appearing in the part name) is used to indicate parts which are made up of two or more parts (or pieces) and yet must be considered as a unit part. For example, parts that are welded together, parts that have bushings pressed in, or parts that have to be machined together.

A Sub-assembly list will be found immediately following the last group sheet, and itemizes the various parts used in each assembly. These assemblies are arranged in numerical sequence.

NOTE: ----- Certain parts of assemblies indicated by an "*" in place of a reference number are not sold individually, and if wanted, the complete assembly must be ordered.

Sub-assembly lists contains assemblies used on several different engines. Use only assemblies listed on group list sheets.

REFERENCE NUMBERS ON PLATES OR ASSEMBLY DRAWINGS

SINGLE NUMBERS or the TOP NUMBER (when more than one number appears in the circle) refers directly to a corresponding number on the group list sheet.

A circle with MORE THAN ONE NUMBER indicates part in question is a component part of a sub-assembly. The top number will refer to a corresponding number on the group list sheet, and the lower number will refer to a corresponding number in the sub-assembly.

TO FIND A PART WITH TWO REFERENCE NUMBERS IN THE CIRCLE PROCEED AS FOLLOWS: - (NOTE:- Select a part on any plate and follow step by step as explained.)

1st -- Using the top number in the circle locate corresponding reference number on the group list sheet, which will be an assembly.

2nd -- Using the Part Number of the assembly locate same in the numerical assembly list at rear of book.

3rd -- Refer back to the plate and obtain the second or lower number in the reference circle, then locate this number in the reference number column of the sub-assembly, and this will be the part desired.

If there are MORE THAN TWO NUMBERS in the reference number circle, proceed exactly as outlined above, only this time the part in the first assembly located will be another sub-assembly, so therefore it will be necessary to find the second assembly, and then referring back to the plate take the third number in the reference circle and match it with the corresponding number in the second assembly.

The following page will show a typical example and illustrate the above explanation step by step.

The following illustrated example will show the procedure as explained on opposite Page, for finding parts involved in sub-assemblies.

For this illustration assume that the part number for the Cylinder Head Cleanout Cover is wanted:-

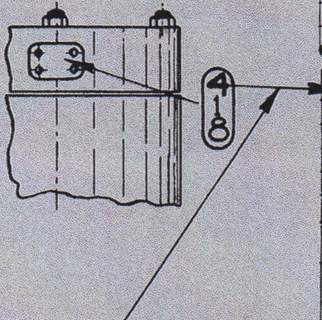
We know that this cover would be listed with the "Cylinder Head" so we turn to the Index Sheet and locate the "Cylinder & Head Group" which gives us the sheet number.

PARTS CATALOG---- INDEX — ENGINE NO. 11830

6 Cyl. 13 x 16 Marine Engine

	No. Req'd.	Group No.
BASE SECTION		
Base -- (Studs - Covers - Bearing Caps Etc.)	1	2L27
Base Oil Piping-(Main Manifold - Crank Brg.Oil Lines)	1	2L629
Crankshaft & Flywheel -- (Thrust Shaft & Bearing)	1	2L30
CYLINDER & VALVE MECHANISM SECTION		
Cylinder & Head	6	L-9776
Valve Rockers & Push-Rods	6	L-9777
Valve Lifters & Guide	6	L-6919
Piston & Connecting Rod	6	2L351

We find the sheet number for this group to be L-9776, and now we turn to this sheet and opposite we find a Plate or group drawing.



ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

L-9776 — PLATE NO. K-1890

REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		X1283	1	CYLINDER ASSEMBLY	
2		753A-FB4	4	WASHER - Cyl. to Centerframe Stud	
3			4	NUT -- 1 3/4-5-NC-Hex. - - (Steel)	
4		X2810	1	HEAD ASSEMBLY - Cylinder	
5		C-3957	1	GASKET - Head to Cylinder	
6		610A-03	8	GROMMET - Cyl. to Head Water By-Pass Pipe	
7			8	NUT -- 1 1/2-6-NC-Hex. - - (Steel)	
8		785	1	FLANGE - Cyl. Head Water Outlet Hole (Blind)	

NAME CYLINDER & HEAD GROUP

ORIGINALLY ISSUED FOR 13 X 16 MAR. - STAT.

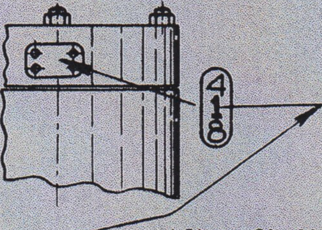
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

L-9776

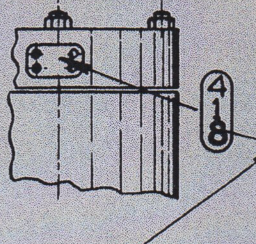
Looking at the Plate we locate the part we want and find the reference number to be 4-1-8. We now take the top number "4" and match this with the reference number "4" on the group list sheet. We find this to be X2810 Head Assembly, so that this assembly must next be found in the sub-assembly list at rear of book.



SUB-ASSEMBLY LIST

REF. No.	PART NO.	NO. REQ'D.	NAME
	X2810		HEAD ASSEM. - CYLINDER -- Includes
1	X2818	1	HEAD ASSEM.
2	X2811	1	VALVE & CAGE ASSEM.
3	X2812	1	VALVE & CAGE ASSEM.
4	C-2155L5	2	RING - Piston

After finding assembly X2810 in sub-assembly list, we now take the second of the reference numbers in the oval which is "1" and match this with the corresponding number of the sub-assembly. We find this to be X2818 Head Assembly so we now have to proceed to this assembly.



SUB-ASSEMBLY LIST

REF. No.	PART NO.	NO. REQ'D.	NAME
	X2818		HEAD ASSEM. - CYLINDER -- Includes
*		1	HEAD CYLINDER
*		6	PIPE PLUG -- 1 1/4 Std.
1	C-5520L5	4	STUD - In. & Exh. Cage
2	S-3060	2	STUD - Air Valve Cage
7	C-447	2	NOZZLE - Cooling
8	C-8214	2	COVER - Cleanout (Blind)

After this assembly X2818 is found we now take the bottom reference number in the oval which is "8" and match this with the corresponding reference number in X2818. We now have the unit part which we want.

ATLAS IMPERIAL DIESEL ENGINE CO.

INDEX

CATALOG APPLIES ONLY TO ENGINES INDICATED ➤ ENG. NO. 12092 TO 12115 INCL.

ENG. SIZE 13 x 16 NO. CYL. 6 TYPE Marine(Single Lever Cont.)

GROUP NAME	NO. USED	GROUP SHEET NUMBER
<u>BASE SECTION</u>		
Base -- (Studs - Covers - Bearing Caps Etc.)	1	2L27
Base Oil Piping(Oil Man. - Crank. Brg. Oil Lines)	1	2L1108
Crankshaft & Flywheel -- (Thrust Shaft & Bearing)	1	2L1072
Flywheel Air Brake	1	2L47
<u>CENTERFRAME SECTION</u>		
Centerframe & Covers -- (Covers - Studs - Breather)	1	2L577
Intermediate Gear	1	2L33
Camshaft -- (Bearing - Fuel Pump Crank - Gears)	1	2L34
Cams	6	2L265
<u>ENGINE CONTROL SECTION</u>		
Engine Control Housing (Covers - Air Valves)	1	2L514
Engine Control - (Hand Lever - Cams Etc.)	1	2L601
Latch Shaft Interlock	1	2L516
Latch Shaft (Latch Crank - Latch - Bearings)	1	2L517
Reversing Cyl. & Rack (Hous.-Covers-Rack-Pinion)	1	2L491
<u>GOVERNOR & WEDGE SHAFT SECTION</u>		
Governor & Control (Gov. - Cam Follower - Levers Etc.)..	1	2L733
Fuel Wedge Shaft (Wedges - Shaft - Control Linkage)	1	2L734
Fuel Wedge Thro-out	1	2L676
Fuel Wedge Shaft Spring	2	2L678
<u>CYLINDER & VALVE MECHANISM SECTION</u>		
Cylinder & Head - (Comp. Release & Safety Valve)	6	L-9776
Valve Rockers & Push-Rods	6	L-9777
Valve Lifters & Guide	6	L-6919
Piston & Connecting Rod	6	2L351
Fuel Spray Valve	6	L-9778
Spray Valve Tip .... ---- Part No. 6184 ----	6	
<u>MANIFOLD SECTION</u>		
Inlet & Exhaust Manifolds	1	2L719
Air Starting Manifold	1	2L1027
Water Manifolds -- (Inlet & Outlet)	1	2L623
<u>PUMP SECTION</u>		
Fuel Pump Housing & Covers	1	2L37
Priming & High Pressure Fuel Pumps	1	2L534
Fuel Transfer Pump	1	2L705
Lube Oil Pumps - (Sump - Press. - Hous. & Covers)	1	2L39
Circulating Water Pump	1	2L525
Bilge Pump	1	2L356
<u>FUEL SYSTEM</u> -- (Rail - Accumulator Etc.)	1	2L380
<u>AIR COMPRESSOR SECTION</u>		
Cylinder & Head	1	2L42
Piston - Connecting Rod - Eccentric Strap	1	2L43
<u>MISCELLANEOUS SECTION</u>		
Lubricator -- (Lubricator - Drive - Piping)	1	2L1073
Lube Oil Pressure Piping	1	2L580
Water Piping	1	2L69
Water Piping	1	2L70
Water Piping	1	2L1076
Lube Oil Cooler	1	2L66
Air Piping	1	2L1028
Latch Shaft Oil Piping	1	2L1109
Pressure Gages	1	2L1075
Tachometer Drive	1	2L457

SPEC. NO. 1480-2

ES NO. Contract #W-2789-tc-54

ISSUE NO. 1

INSTR. 7M

...td. Filters
Kings. Thrust Brg.

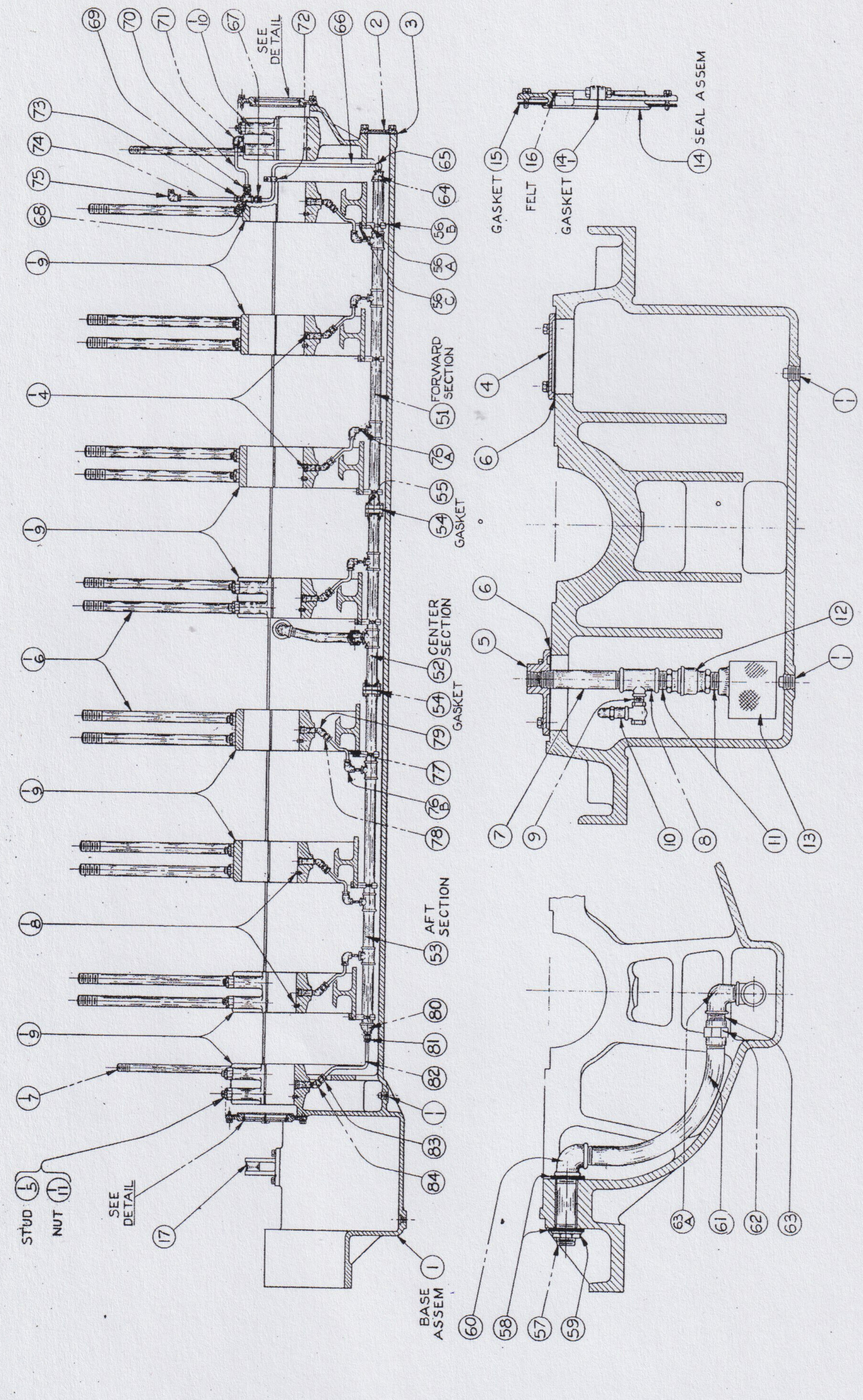


PLATE
No. K-2019

DO NOT ORDER PARTS BY REF. NUMBERS.

TYPED BY GF DATE 2-28-47 CHKD. ISSUED BY DATE

Retyped from 2-19-43 (No Changes)

CHANGES

2L27

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-2019

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME — ASSEM. DRWG. NO. K-1718
1		1	X2774	1	BASE ASSEMBLY
2		2	F-6112	1	COVER - Base End - (Lube Man. Hole)
3		3	2C1282	1	GASKET - Cover to Base
4				6	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. -- (St.)
5				6	LOCKWASHER -- 1/2 SAE Reg. -- (St.)
6		4	2C1279	1	COVER - Base Oil Sump Hole - (Blind)
7		5	2C1278	1	COVER - Base Oil Sump Hole - (Strainer Side)
8		6	2C1280	2	GASKET - Cover to Base
9				8	CAPSCREW -- 3/8-16-NC x 1 Lg. -- (St.)
10				8	LOCKWASHER -- 3/8 SAE Reg. -- (St.)
11		7		1	NIPPLE -- 1 1/4 x 7 1/2 Lg. - (Brass)
12		8		1	TEE -- 1 1/4 x 1 1/4 x 1/2 Std. Reducing-(Brass
13		9		1	CLOSE NIPPLE -- 1/2 Std. -- (Brass)
14		10	PG21L 1/2	1	VALVE - Pressure Relief - (35 Lb.)
15		11		2	CLOSE NIPPLE -- 1 1/4 Std. - (Brass)
16	C-9066	12	C-9066P1 1/4	1	VALVE - Check
17	2C1272	13	X2775	1	STRAINER ASSEM. - Lube Oil
18		14	X582	2	SEAL ASSEM. - Crankshaft Oil
19		15	C-295	2	GASKET - Oil Seal to Base
20				24	CAPSCREW -- 3/8-16-NC x 1 Lg. - (St.)
21				24	LOCKWASHER -- 3/8 SAE Reg. -- (St.)
22		16	C-3379	4	FELT - Oil Seal
23		17	F-5948	2	BRACKET - Barring Over
24				8	CAPSCREW -- 3/4-10-NC x 2 Lg. - (St.)
25				8	LOCKWASHER -- 3/4 SAE Reg. -- (St.)

2L27

FOR OPP. HAND SEE

FOR OPP. ROT. SEE

NAME BASE GROUP

ORIGINALLY ISSUED FOR 6 Cyl. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV. 1/46 2M TRANS. PRINTED IN U.S.A.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

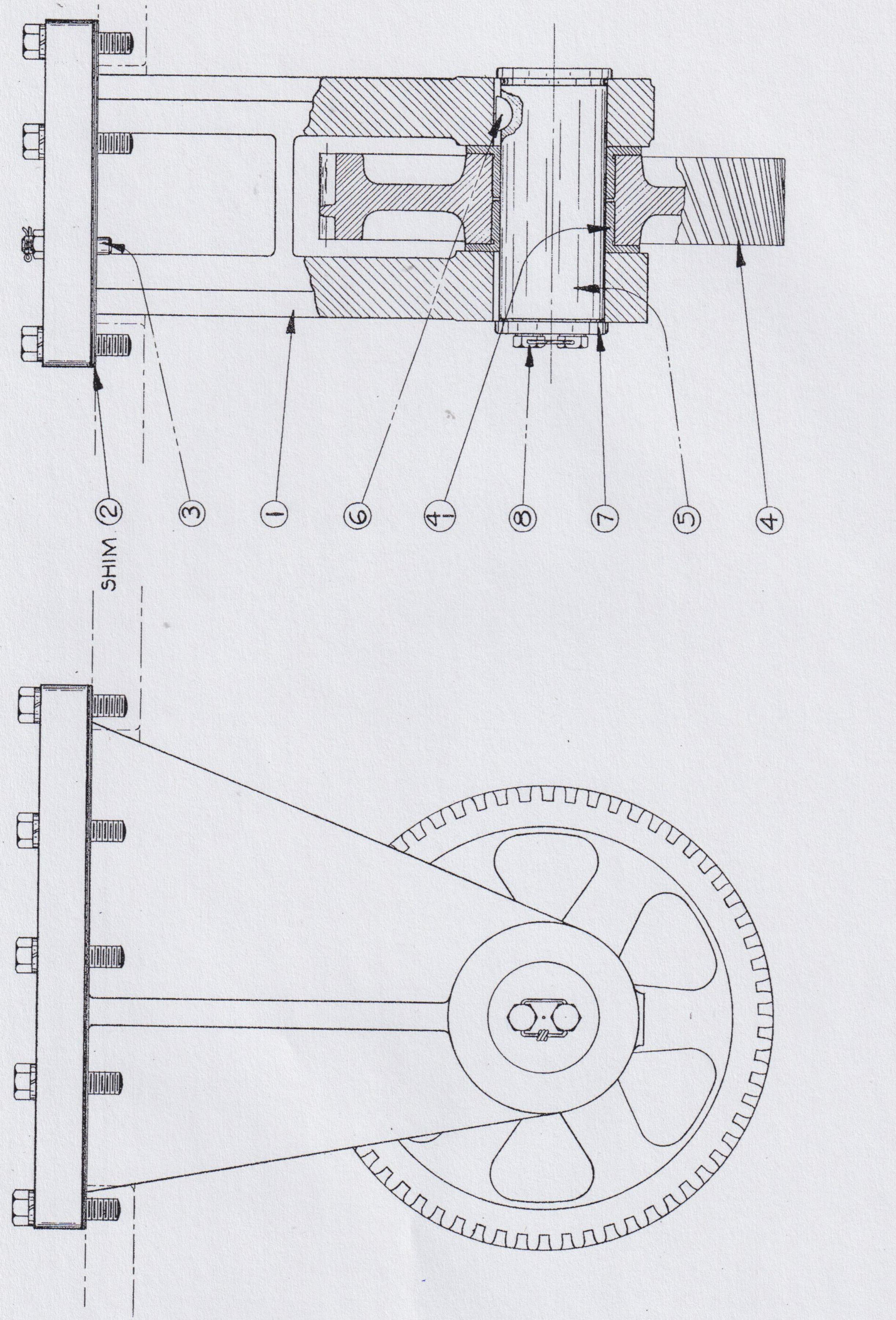


PLATE No.
W-1656

DO NOT ORDER PARTS BY REF. NUMBERS

Retyped from sheet dated 4-28-49.

CHANGES

2L33

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. W-1656

DRWG NO.	REF. NO.	PART NO	NO REQ'D.	PART NAME	ASSEM DRWG. NO.
	1	W-1500	1	BEARING - Intermediate Gear	
C-1210	2	C-1210-C	5	SHIM - Bearing to Centerframe - (1/64)	
C-1210	2	C-1210-E	3	SHIM - Bearing to Centerframe - (.003)	
			12	CAPSCREW - 5/8-11-NC x 2-1/2 Lg. - (St.)	
			12	LOCKWASHER - 5/8 SAE Reg. - (St.)	
C-6633	3	C6633L2-1/2	2	PIN - Bearing to Centerframe Dowel	
			2	HALF NUT - 1/2-13-NC-Hex.- (St.)	
			2	COTTER PIN - 1/16 x 3/4 Lg. - (St.)	
F-6125	4	X2782	1	GEAR ASSEM. - Intermediate	
	5	2C1287	1	PIN - Intermediate Gear	
	6		1	WOODRUFF KEY - 1/4 x 1 Std. - (St.)	
	7	C-8202	1	WASHER - Pin Retainer	
C-2408	8	C2408L-7/8	2	CAPSCREW - Washer to Pin	
			1	WIRE - #16 Ga. x 5 Lg. - (St.)	

2L33

P. HAND SEE

P. ROT. SEE

NAME INTERMEDIATE GEAR GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

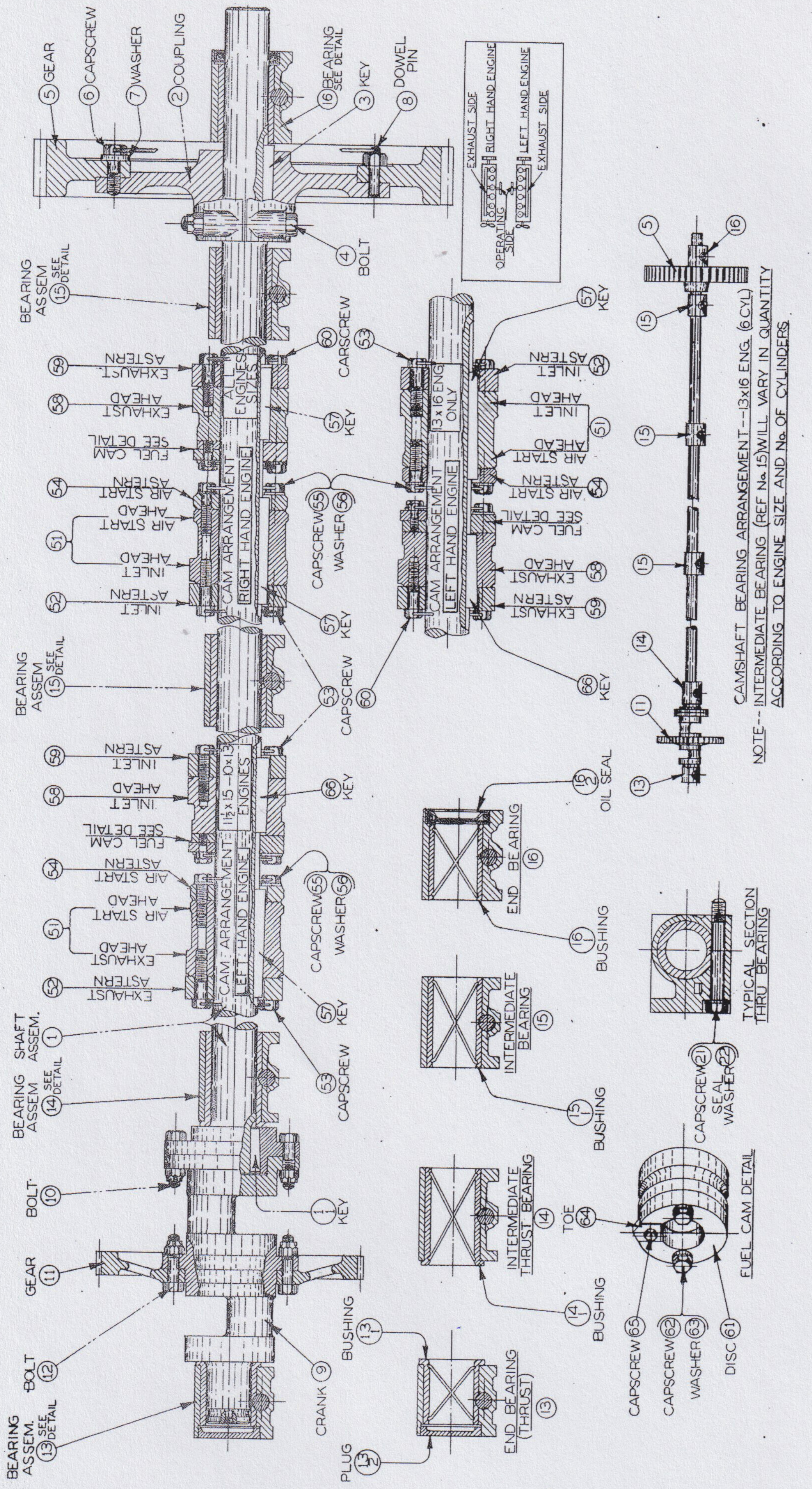


PLATE No.
K-1877 (ED. 4) DO NOT ORDER PARTS BY REF. NUMBERS

OPIES TO

Retyped from sheet dated 2-28-47.
#1-4-6-54 -Added Part # Line26

CHANGES

2L34

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. (See Note Below)

ASSEM. DRWG. NO. K-1719

DRWG. NO.	REF. NO	PART NO	NO REQ'D.	PART NAME
F-5891	1	X532	1	CAMSHAFT ASSEMBLY
	2	W-1501	1	HUB - Camshaft Gear
C-7108	3	C-7108L4	1	KEY - Hub to Camshaft
C-2510	4	C2510L41/2	2	BOLT - Camshaft Gear Hub Clamp
			2	CASTLE NUT - 5/8-18-NF-Hex. - (St.)
			2	COTTER PIN - 1/8 x 1-1/4 Lg. - (St.)
	5	F-6127	1	GEAR - Camshaft Drive
C-2410	6	C2410L1-3/4	6	CAPSCREW - Gear to Hub
C-6160	7	1222A-C3	6	WASHER - Gear to Hub Capscrew
C-6633	8	C-6633L2	2	PIN - Gear to Hub Dowel
			2	HALF NUT - 1/2-13-NC-Hex. - (St.)
			1	WIRE -(Capscrew & Dowel)-16 Ga. x 39Lg.-(St.
	9	X2783	1	CRANK ASSEM. - H.P. Fuel Pump
C-2608	10	C-2608L2	4	BOLT - Crank. to Camshaft Coupling
			4	CASTLE NUT - 1/2-20-NF-Hex. - (St.)
			1	WIRE - #16 Ga. x 18 Lg. - (st.)
	11	F-6109	1	GEAR - Lube & Fuel Pump Drive
C-2608	12	C-2608L2	4	BOLT - Gear to Crank
			4	CASTLE NUT - 1/2-20-NF-Hex. - (St.)
			1	WIRE - #16 Ga. x 18 Lg. - (St.)
2C1334	13	X2784	1	BEARING ASSEM.-Fuel Pump Crank-(End-Thrust)
C10004	14	X2834	1	BEARING ASSEM.-Camshaft-(Pump End-Thrust)
C-1342	15	G680-C	6	BEARING ASSEM. - Camshaft
C-7919	16	X2074	1	BEARING ASSEM. - Camshaft - (Gov. End)
	21	3A3305	9	CAPSCREW -5/8-11-NC- x 4-1/2 Lg.-(St.)
	22	C-4921	9	WASHER - Camshaft Brg. Bolt Seal

----- PARTS CATALOG NOTE-----

Use Plate No. K-1877 (Ed.4) for Marine Engines (Non Turbo

Use Plate No. K-2356 for Stationary Engines (Non Turbo.)

Use Plate No. K-2709 for Marine - Turbo - Charged.

2L34

P. HAND SEE 2 35

P. ROT. SEE

NAME CAMSHAFT & FUEL PUMP CRANK GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE R.H.

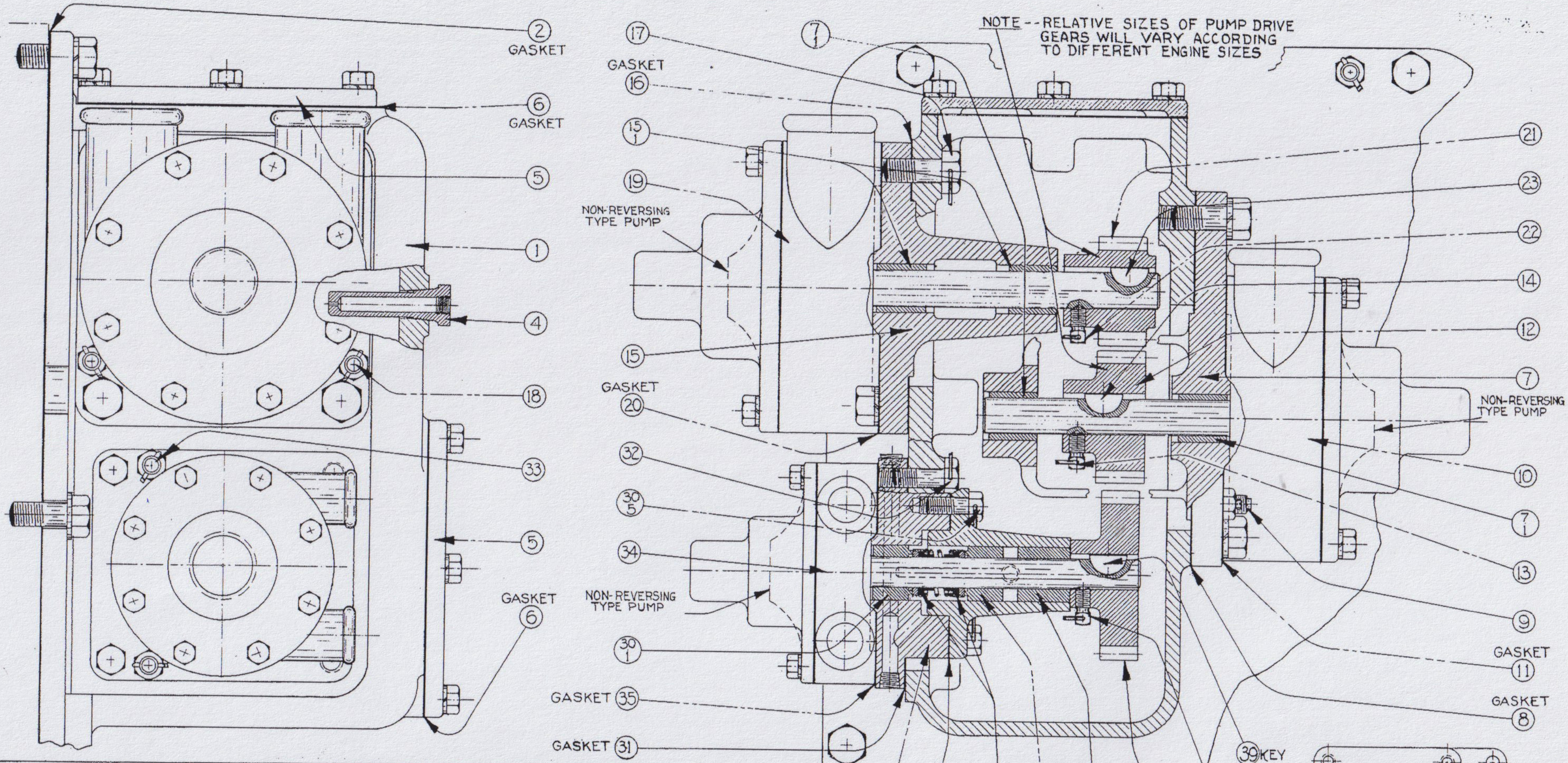
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

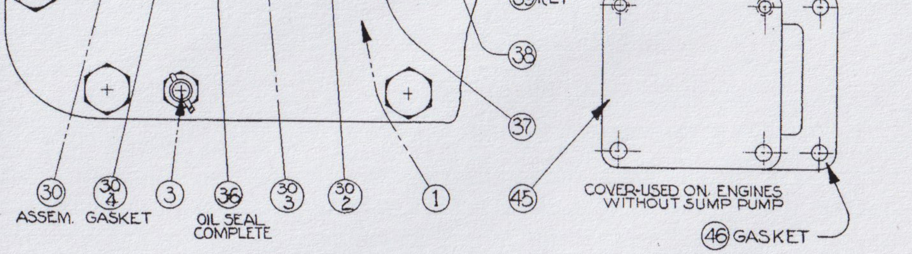
PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

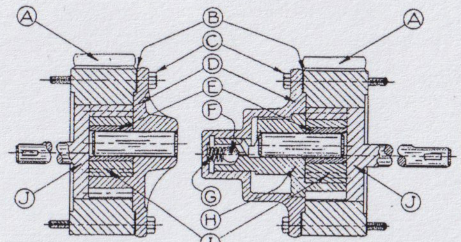
PLATE
No K-2036-(ED.3)

DO NOT ORDER PARTS BY REF No.





DETAIL OF PUMPS



NON-REVERSING PUMP REVERSIBLE PUMP

REF No	PART NAME	PUMP No. C-9289-P	PUMP No. C-9290-P	PUMP No. 2C37-P	PUMP No. 2C47-P	PUMP No. 2C121-P	PUMP No. 2C122-P	PUMP No. 2C151-P	PUMP No. 2C152-P
A	HOUSING	C-9289-P1	C-9290-P1	2C47-P1	2C47-P1	2C122-P1	2C122-P1	2C151-P1	2C68-P1
B	GASKET	C-8193	C-8193	C-9849-P	C-9849-P	C-9849-P	C-9849-P	C-9849-P	C-9849-P
C	CAPSCREW	1/4-20×2 1/4	1/4-20×2 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×2 1/2
D	COVER	C-9289-P2	C-9290-P2	2C47-P2	2C47-P2	2C122-P2	2C122-P2	2C151-P2	2C68-P2
E	BUSHING	C-9290-P3	C-9290-P3	2C47-P3	2C47-P3	2C47-P3	2C47-P3	2C68-P3	2C68-P3
F	STEEL BALL		9/16 DIA.	9/16 DIA.	9/16 DIA.			9/16 DIA.	
G	SPRING		C-9290-P4	2C47-P4	2C47-P4			2C151-P4	
H	CARRIER & PIN		C-9290-P5	2C47-P5	2C47-P5			2C151-P5	
I	IDLER & BUSHING	C-9290-P6	C-9290-P6	2C47-P6	2C47-P6	2C47-P6	2C47-P6	2C68-P6	2C68-P6
J	ROTOR & SHAFT	C-9290-P7	C-9290-P7	2C37-P7	2C47-P7	2C37-P7	2C47-P7	2C151-P7	2C152-P7

NOTE - ORDER PUMP PARTS AS PER ABOVE PART NUMBERS
THESE PARTS ARE NOT LISTED ON GROUP SHEET
PARTS NOT LISTED ARE NOT SOLD INDIVIDUALLY

TYPED BY BJR DATE 12-31-48 CHKD. ISSUED BY DATE 12-31-48

Retyped from 9-1-43 (No changes)

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

2L39

PLATE No. ~~K-1995~~ K-2036

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQ'D.	PART NAME	ASSEM. DRWG. NO.
1		1	K-1706	1	HOUSING - Rotary Pump Drive	
2		2	2C1211	1	GASKET - Housing to Centerframe	
3				11	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. -- (St.)	
4				10	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
5				1	PLAIN WASHER -- 1/2 SAE Std. -- (St.)	
6	C-7950	3	C-7950L1 5/8	2	PIN - Housing to Centerframe Dowel	
7				2	HALF NUT -- 3/8-24-NF-Hex. -- (St.)	
8				2	COTTER PIN -- 3/32 x 3/4 Lg. -- (St.)	
9		4	2C1319	1	NOZZLE - Pump Gear Lube Oil	
10		5	2C1205	2	COVER - Pump Housing - (Top & Side)	
11		6	2C1206	2	GASKET - Cover to Housing	
12				8	CAPSCREW -- 3/8-16-NC x 7/8 Lg. -- (St.)	
13				8	LOCKWASHER -- 3/8 SAE Reg. -- (St.)	
14						
15	2C1219	7	X2791	1	ADAPTOR ASSEM. - Lube Press. Pump	
16		8	2C1217	1	GASKET - Adaptor to Housing	
17				3	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. -- (St.)	
18				3	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
19	C-8265	9	C-8265L1	2	PIN - Adaptor to Housing Dowel	
20						
21						
22	2C37	10	2C37-P	1	PUMP - Lube Pressure	
23	C-9849	11	C-9849-P	3	GASKET - Pump to Adaptor	
24				8	CAPSCREW -- 5/16-18-NC x 3 1/4 Lg. -- (St.)	
25				8	LOCKWASHER -- 5/16 SAE Reg. -- (St.)	
26		12	2C1218	1	GEAR - Lube Press. Pump Drive	
27		13	2C2502	1	SETSCREW -- Gear to Pump Shaft	
28		14		1	WOODRUFF KEY -- 3/16 x 3/4 Std. -- (St.)	
29				1	WIRE -- #16 Ga. x 8 Lg. -- (St.)	
30						
31	2C1221	15	X2793	1	ADAPTOR ASSEM. - Lube Sump Pump	
32		16	2C1210	1	GASKET - Adaptor to Housing	
33	C-2408	17	C-2408L1 1/4	2	CAPSCREW - Adaptor to Housing	
34				1	WIRE -- #16 Ga. x 12 Lg. -- (St.)	
35				2	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. -- (St.)	
36				2	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
37	C-8265	18	C-8265L1	2	PIN - Adaptor to Housing Dowel	
38						
39						
40	2C47	19	2C47-P	1	PUMP - Lube Sump	
41	C-9849	20	C-9849-P	3	GASKET - Pump to Adaptor	
42				8	CAPSCREW -- 5/16-18-NC x 3 1/4 Lg. -- (St.)	
43				8	LOCKWASHER -- 5/16 SAE Reg. -- (St.)	
44		21	2C1220	1	GEAR - Lube Sump Pump Drive	
45		22	2C2502	1	SETSCREW - Gear to Pump Shaft	
46		23		1	WOODRUFF KEY -- 3/16 x 3/4 Std. -- (St.)	
47				1	WIRE -- #16 Ga. x 8 Lg. -- (St.)	
48						
49						
50						

2L39

OPP. HAND SEE 2L40

OPP. ROT. SEE

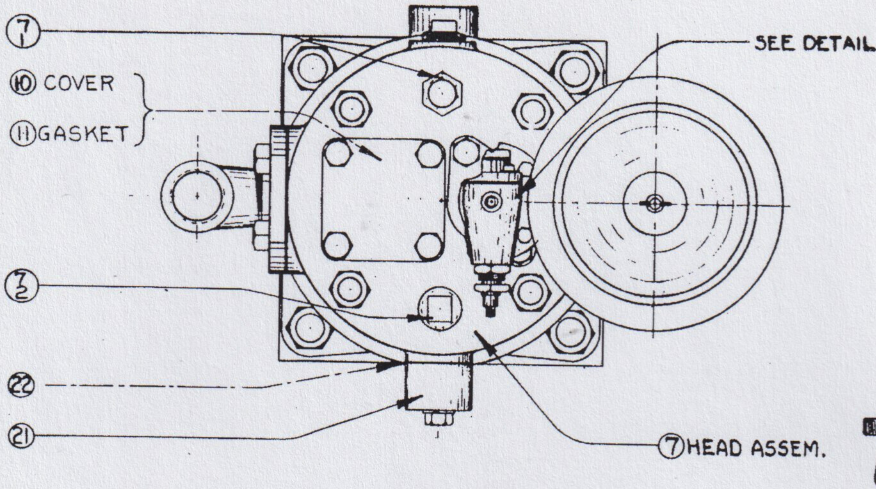
NAME LUBE OIL PUMPS & HOUSING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE -R.H.

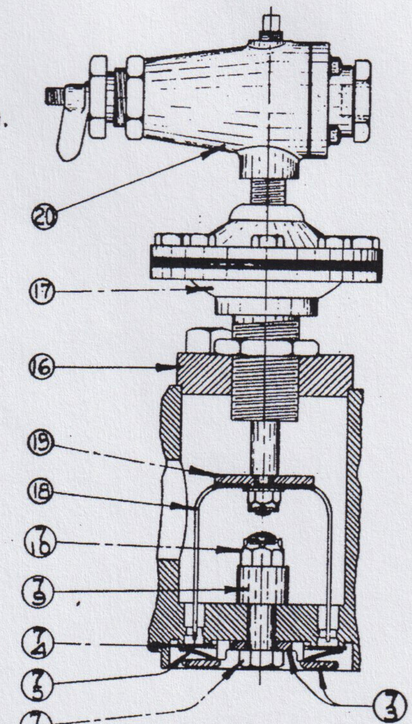
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST ATLAS IMPERIAL DIESEL ENGINE CO. OAKLAND, CALIF. MATTOON, ILL.

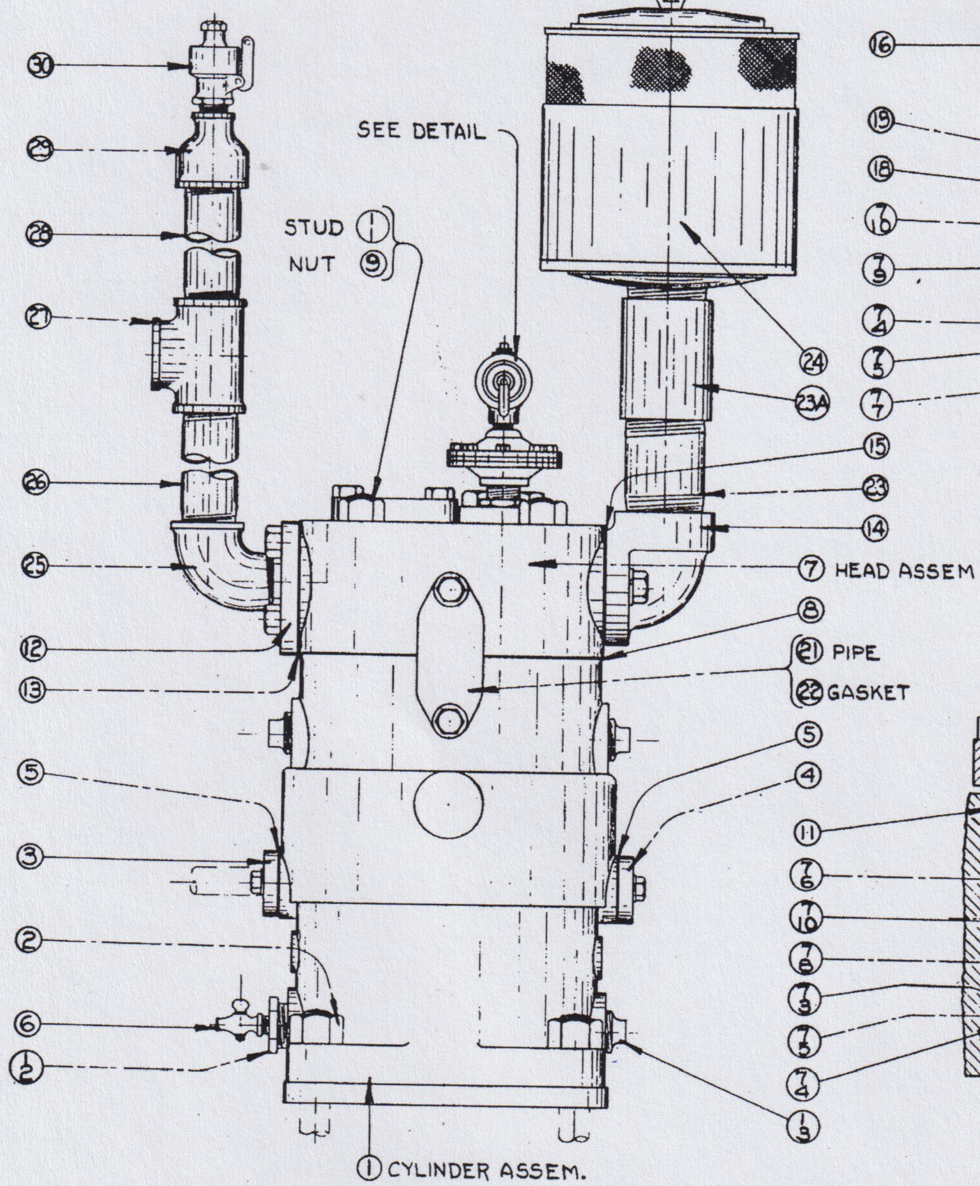
240 REV. 1/46 2M TRANS. PRINTED IN U.S.A.

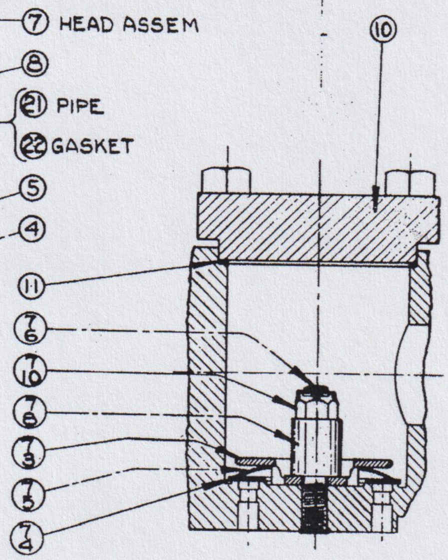


TOP VIEW OF COMPRESSOR



SUCTION VALVE





DISCHARGE VALVE

PLATE
No. K-1844
ED-2

DO NOT ORDER PARTS BY REFERENCE NUMBERS

TYPED BY DLC DATE 5-3-49 CHKD. ISSUED BY [illegible] DATE 5-9-49

Retyped from 10-23-43 (no changes)

#3

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. K-1844 2L42

ASSEM. DRWG. NO. W-1235

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
	1	G900-J	1	CYLINDER ASSEM.-Air Compressor
	2		4	NUT -- 7/8-9-NC-Hex. - - (St.)
	3	C-3306	1	FLANGE - Water Inlet
C-491	4	783	1	FLANGE - Water Inlet (Blind)
	5	S-2332	2	GASKET - Flange to Cylinder
			4	CAPSCREW --3/8-16-NC x 1 Lg. - (St.)
			4	LOCKWASHER -- 3/8 SAE Reg. - - (St.)
C-9045	6	C-9045P 1/4	1	COCK - Tee Handle Air (Water Drain)
	7	X1117	1	HEAD ASSEM. - Cylinder
S-901	8	901A-J	1	GASKET - Head to Cylinder
	9		4	NUT -- 3/4-10-NC-Hex. - - (St.)
	10	F-1695	1	COVER - Discharge Valve Hole
	11	S-1733	1	GASKET - Cover to Cyl. Head
			4	CAPSCREW - 1/2-13-NC x 1 1/4 Lg. - (St.)
	12	C-5279	1	FLANGE - Air Comp. Discharge Pipe
	13	C-4026	1	GASKET - Flange to Cyl. Head
			4	CAPSCREW -- 5/8-11-NC x 1 1/2 Lg. - (St.)
	14	2C1212	1	ELBOW - Air Comp. Suction Pipe
	15	S-2329	1	GASKET - Elbow to Cyl. Head
			2	CAPSCREW -- 5/8-11-NC x 1 1/2 Lg. - (St.)
			2	LOCKWASHER-- 5/8 SAE Reg. - - (St.)
	16	C-9160	1	FLANGE - Suction Valve Unloader Adaptor
			2	CAPSCREW -- 1/2-13-NC x 1 Lg. - (St.)
C-9158	17	C-9158P	1	DIAPHRAGM - Suction Valve Unloader
	18	S-1397	1	PRONG - Suction Valve Unloader
	19	C-8222	1	WASHER - Unloader Prong Retainer (Upper)
			1	PLAIN WASHER -- 1/4 SAE Std. - - (St.)
			1	CASTLE NUT --1/4-28-NF-Hex. - - (St.)
			1	COTTER PIN -- 1/16 x 1/2 Lg. - (St.)
C-9159	20	C-9159P	1	PILOT - Suction Valve Unloader
S-1710	21	34-X	1	PIPE - Cyl. to Head Water By-Pass
S-618	22	610A-X	1	GASKET - By-Pass Pipe
			2	CAPSCREW -- 1/2-13-NC x 2 Lg. - (St.)
			2	LOCKWASHER -- 1/2 SAE Reg. - (St.)
				--- Compressor Suction ---
	23		1	NIPPLE -- 2 x 4 1/2 Lg. - - (W.I.)
	23A		1	COUPLING -- 2 Std. Pipe - - - (M.I.)
2C2467	24	2C2467P	1	AIR CLEANER
				---Compressor Discharge ---
	25		1	STREET ELL -- 1 1/4 Std. - (M.I.)
	26		1	NIPPLE -- 1 1/4 x 6 Lg. - (W.I.)
	27		1	TEE -- 1 1/4 Std. - - (M.I.)
	28		1	NIPPLE -- 1 1/4 x 8 Lg. - (W. I.)
	29		1	REDUCING(Bell)-1 1/4 x 1/2 Std. - (M.I.)
C-9974	30	C-9974P 1/2	1	VALVE - Pop Safety

2L42

DR OPP. HAND SEE

DR OPP. ROT. SEE

NAME AIR COMPRESSOR CYLINDER & HEAD GROUP (6")

ORIGINALLY ISSUED FOR 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY No. REQ'D FOR GROUP GIVEN ON INDEX SHEET.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM 240 REV. [illegible] TRANS
PRINTED IN U.S.A.

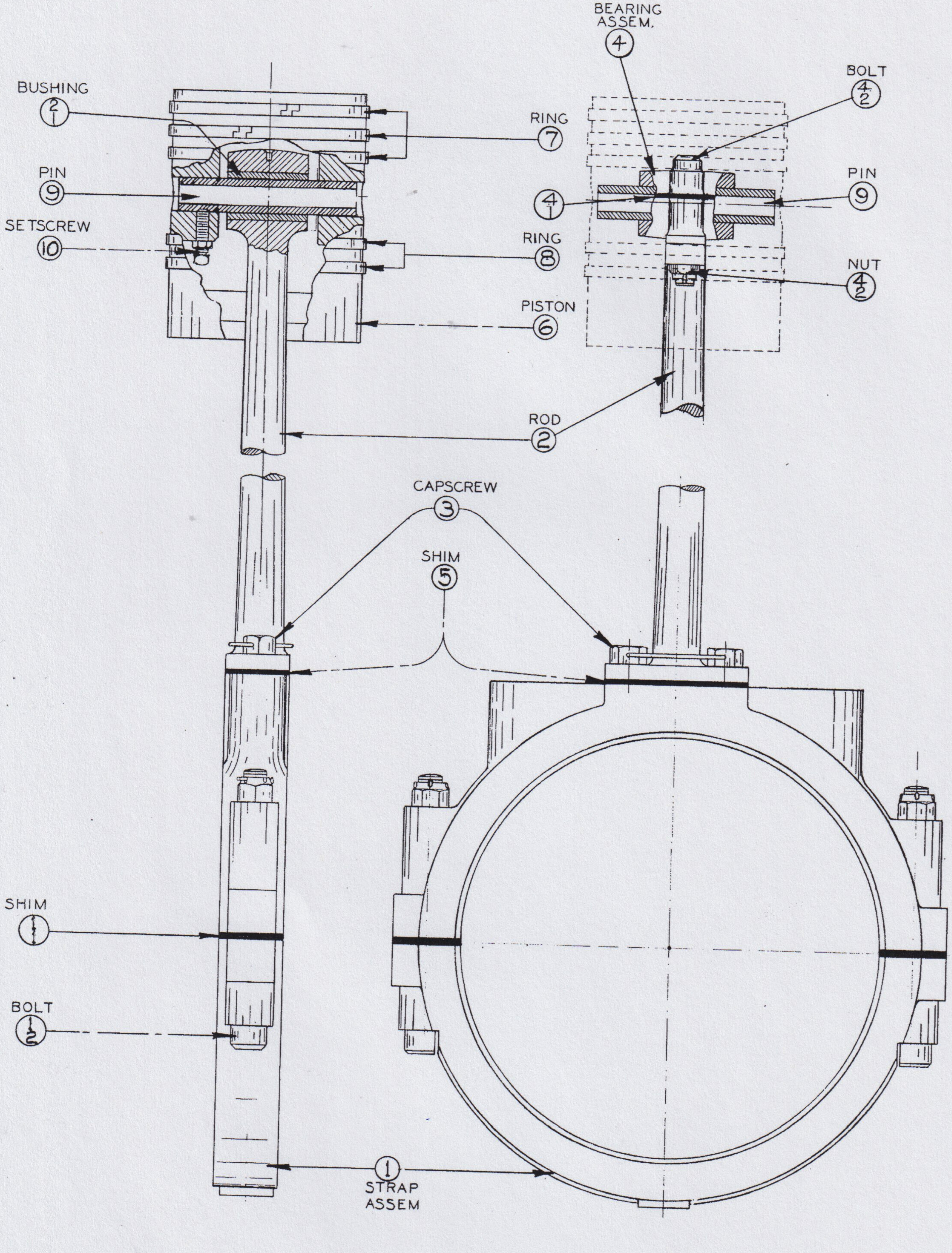


PLATE
No. W-1671 (ED.2) DO NOT ORDER PARTS BY REFERENCE NUMBERS

TYPED BY BW DATE 11-24-44 CHKD. DATE ISSUED BY APRVD.

Retyped from 9-21-39 (No changes)
#3

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. W-1671

2L43

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	F-3266	1	G930-03	1	STRAP ASSEM. - Air Comp. Eccentric	
2	F-6580	2	929-03	1	ROD - Connecting	
3	C-2412	3	C-2412L1 3/4	2	CAPSCREW	
4				1	WIRE -- #16 Ga. x 10 Lg. - (St.)	
5	F-6605	4	G130-4	1	BEARING ASSEM. - Piston Pin	
6				2	COTTER PIN -- 1/8 x 1 Lg. - (St.)	
7	C-4432	5	C-4432-B	11	SHIM - Rod to Eccentric Strap (1/32)	
8	C-4432	5	C-4432-D	3	SHIM - Rod to Eccentric Strap (.010)	
9						
10	F-3097	6	925-J6	1	PISTON	
11	C-2155	7	C-2155L6	3	RING - Piston	
12	C-2455	8	C-2455L6	2	RING - Piston	
13	C-1075	9	927-J6	1	PIN - Piston	
14		10		1	SETSCREW--3/8-16-NC x 1½ Lg.-Sq.Hd.Cup Pt.(St.)	
15		10		1	NUT -- 3/8-16-NC-Hex. - - (St.)	

2L43

FOR OPP. HAND SEE

FOR OFF. ROT. SEE

NAME AIR COMPRESSOR PISTON, ROD & STRAP GROUP

ORIGINALLY ISSUED FOR 13 x 16

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM 240 REV. 12-43 IM TRANS.

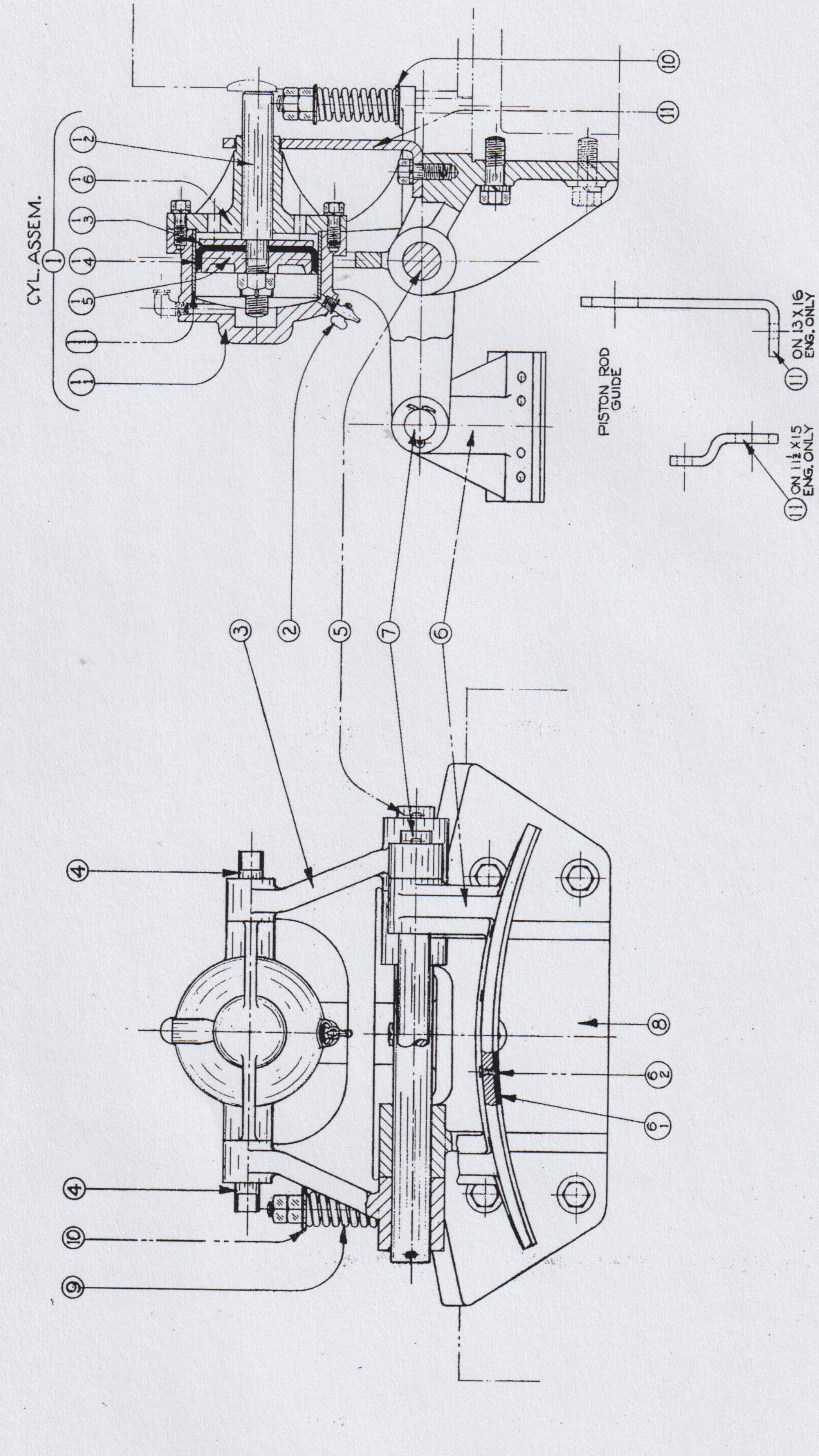


PLATE
No. K-1824

DO NOT ORDER PARTS BY REF. NUMBERS

TO: [Re]typed from 9-27-39 (No Changes)

TYPED BY GB DATE 10-23-43 CHKD. DATE ISSUED BY APRVD.

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L47

PLATE NO. K-1824

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1	X2797	1	CYLINDER ASSEM. - Fly. Air Brake (& Piston)	
2	C-9045	2	C-9045-P 1/4	1	COCK - Air	
3		3	F-6031	1	LEVER - Brake Shoe	
4		4	S-2620	2	PIN - Air Brake Cyl. To Lever	
5		5	S-2635	1	SHAFT - Brake Shoe Lever to Post	
6				2	COTTER PIN -- 1/4 x 2 Lg. - (St.)	
7		6	X549	1	SHOE ASSEM. - Fly. Air Brake	
8		7	S-2636	1	SHAFT - Brake Shoe	
9				2	COTTER PIN -- 1/4 x 1 3/4 Lg. - (St.)	
10		8	W-1428	1	POST - Flywheel Air Brake	
11				5	CAPSCREW -- 3/4-10-NC x 2 Lg. - (St.)	
12				5	LOCKWASHER -- 3/4 SAE Reg. - (St.)	
13	C-326	9	582-E	1	SPRING - Brake Shoe Lever	
14		10	C-7948	2	WASHER - Spring Retainer	
15				2	NUT -- 5/8-11-NC-Hex. - (St.)	
16	2C3187	11	5941	1	GUIDE - Piston Rod	
17				1	CAPSCREW -- 1/2-13-NC x 3 Lg. - (St.)	
18				1	LOCKWASHER -- 1/2 SAE Reg. - (St.)	

2L47

FOR OPP. HAND SEE 2L48

FOR OPP. ROT. SEE

NAME FLYWHEEL AIR BRAKE GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE -R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

40 REV. 5-42 1M TRANS 1M BOND

FILES TO ____ TYPED BY DLC DATE 4-28-49 CHKD ____ ISSUED BY ____ DATE ____

Retyped from 2/19/43 (no changes)

#3

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. 2L66

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1			2C1342	2	BRACKET - Oil Cooler	
2				6	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
3				6	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
4						
5			2C49P	1	OIL COOLER	
6				4	CAPSCREW -- 3/8-16-NC x 1 Lg. - - - (St.)	
7				4	PLAIN WASHER -- 3/8 SAE Std. -- (St.)	

2L66

FOR OPP. HAND SEE ____

NAME OIL COOLER GROUP - - - - - - - - - - - (ROSS COOLER)

FOR OPP. ROT. SEE ____

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM 240 REV. ... PRINTED IN U.S.A.

TYPED BY MED DATE 8-2-43 CHKD. [illegible] DATE ISSUED BY APRVD

Revised & Retyped from 12-26-39 -
Added Pipe Clamps

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. 2L69

ASSEM. DRWG. NO. A-238

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
1			---- Water Pump to Inlet Manifold ----		
2				1	NIPPLE -- 2 x 6 1/2 Lg. - (Galv. Iron)
3				1	ELBOW -- 2 Std. - - (M.I.)(Galv.)
4				1	NIPPLE -- 2 x 6 Lg. - (Galv. Iron)
5				1	TEE -- 2 x 1 1/4 x 2 Std. Reduc.(M.I.)(Galv.)
6				1	CLOSE NIPPLE -- 1 1/4 Std. - (Galv. Iron)
7				1	TEE--1 1/4 x 1 1/4 x 3/4 Std. Reduc.(M.I.)(Galv.)
8				1	CLOSE NIPPLE -- 1 1/4 Std. - (Galv. Iron)
9	2C10		2C10-P1 1/4	1	RELIEF VALVE
10				1	NIPPLE -- 2 x 4 1/2 Lg. - (Galv. Iron)
11	C-9054		C-9054-P2	1	COCK - Three Way
12				1	NIPPLE -- 2 x 2 3/4 Lg. - (Galv. Iron)
13			---- Three Way Cock to Cooler ----		
14				1	NIPPLE -- 2 x 6 Lg. - (Galv. Iron)
15				1	ELBOW -- 2 Std. - (M.I.)(Galv.)
16				1	PIPE--2 x 11 1/2 Lg(Thr'd. 2 Ends)-(Galv. Iron)
17	2C158		2C158-P2	1	UNION
18				1	NIPPLE -- 2 x 2 3/4 Lg. - (Galv. Iron)
19				1	REDUCING BUSHING--2 1/2 x 2 Std.-(Galv. Iron)
20			---- Cooler to Inlet Manifold ----		
21				1	REDUCING BUSHING -- 2 1/2 x 2 Std.-(Galv. Iron)
22				1	NIPPLE -- 2 x 2 3/4 Lg. - (Galv. Iron)
23	2C158		2C158-P2	1	UNION
24				1	PIPE -- 2 x 13 Lg.(Thr'd. 2 Ends)-(Galv. Iron)
25				1	ELBOW -- 2 Std. - (M.I.)(Galv.)
26				1	NIPPLE -- 2 x 5 1/4 Lg. - (Galv. Iron)
27			---- Water Out. Man. to Ex. Man. ----		
28				1	NIPPLE -- 2 x 3 1/2 Lg. - (Galv. Iron)
29				1	ELBOW -- 2 Std. - (M.I.)(Galv.)
30				1	CLOSE NIPPLE -- 2 Std. - (Galv. Iron)
31				1	ELBOW -- 2 Std. - (M.I.)(Galv.)
32				1	PIPE--2 x 129 1/4 Lg.(Thr'd. 2 Ends)(Galv. Iron)
33				1	CROSS -- 2 Std. - (M.I.)(Galv.)
34				1	PIPE PLUG -- 2 Std. - (C.I.)(Galv.)
35				1	NIPPLE -- 2 x 11 Lg. - (Galv. Iron)
36			---- Water Inlet Man. to Air Comp. Cyl. ----		
37				1	NIPPLE -- 1/2 x 2 1/2 Lg. - (Galv. Iron)
38				1	ELBOW -- 1/2 Std. - (M.I.)(Galv.)
39				1	PIPE--1/2 x 29 Lg.(Thr'd. 2 Ends)(Galv. Iron)
40			---- Air Comp. Cyl. Head Outlet to Water Manifold ----		
41				1	NIPPLE -- 1/2 x 3 1/2 Lg. - (Galv. Iron)
42	2C158		2C158-P 1/2	1	UNION
43				1	PIPE--1/2 x 47 Lg(Thr'd. 2 Ends)(Galv. Iron)
44			---- Water Out. Man. to Ex. Man. ----		
45			2C3192	2	CLAMP - Pipe to Air Inlet Man.
46			2C3193	2	CLAMP - Water Pipe
47				1	BLOCK - Clamp
48				2	CAPSCREW -- 3/8-16-NC x 2 1/4 Lg.-(St.)
49				2	NUT -- 3/8-16-NC-Hex. - (St.)
50				2	LOCKWASHER -- 3/8 SAE Reg. - (St.)

2L69

OPP. HAND SEE

OPP. ROT. SEE

NAME WATER PIPING GROUP - - - - - - - - - (FOR ROSS OIL COOLER)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

240 REV. 3-42 1M TRANS. 1M BOND

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

IES TO: Retyped from 10/13/39 (No Changes)
5-10-43 Added Union Fitting Part Nos.
Changed Brass to Galv. - Line 28
Added Drg. No. - Added Line 42

CHANGES

TYPED BY DJA DATE 2/19/43 CHKD MEL DATE 2-24-43 ISSUED BY [signature] APRVD.

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. 2L70

ASSEM. DRWG. NO. A-238

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
1					--- Ex Man. Inlet Line to Ex. Valve Cage ---
2				1	REDUCING BUSHING -- 2 x 1 Std. - - (Galv. Iron)
3				1	CLOSE NIPPLE -- 1 Std. - - (Galv. Iron)
4	C-9049		C-9049-P1	1	ANGLE VALVE
5				1	NIPPLE -- 1 x 4 1/2 Lg. - (Galv. Iron)
6				1	ELBOW -- 1 Std. - - (M.I.)(Galv.)
7				1	NIPPLE -- 1 x 2 1/2 Lg. - (Galv. Iron)
8	2C158		2C158-P1	1	UNION
9			C-3392	1	MANIFOLD - Ex. Valve Cage Cooling (Inlet)
10			C-3391	1	MANIFOLD - Ex. Valve Cage Cooling (Outlet)
11			C-455	8	CLAMP - Manifold Support
12				8	CAPSCREW -- 1/2-13-NC x 1 Lg. - (St.)
13				8	LOCKWASHER -- 1/2 SAE Reg. - - (St.)
14				4	CAPSCREW (Clamp)-- 1/2-13-NC x 2 1/4 Lg.-(St.)
15				4	NUT -- 1/2-13-NC-Hex. - - (St.)
16				6	TUBE(Inlet)--3/8 ODx .035 x 14 Lg.-(S.D. Cop)
17				6	TUBE(Outlet)--3/8 ODx .035 x 14 Lg.-(S.D. Cop)
18	C-9817		C-9817-P 3/8	24	CONNECTOR - Tube Fitting
19	C-9816		C-9816-P 3/8	24	NUT - Tube Fitting
21					--- Spray Valve Cooling (From Water In. Man.)---
22				1	CLOSE NIPPLE -- 1 1/4 Std. - - (Galv. Iron)
23	C-9048		C-9048-P1 1/4	1	GLOBE VALVE
24				1	CLOSE NIPPLE -- 1 1/4 Std. - (Galv. Iron)
25	2C158		2C158-P1 1/4	1	UNION
26				1	NIPPLE -- 1 1/4 x 4 1/2 Lg. - (Galv. Iron)
27				1	STREET ELL -- 1 1/4 Std. - - (M.I.)(Galv.)
28	F-6986		X2809	1	MANIFOLD ASSEM. - Spray Valve Cooling
29				1	PIPE PLUG -- 1 Std. - - (C.I.)(Galv.)
30				6	TUBE -- 1/2 O.D. x .049 x 14 1/2 Lg.-(H.D. Cop.)
31				5	TUBE -- 1/2 O.D. x .049 x 35 Lg.-(H.D. Cop.)
32				1	TUBE ---1/2 O.D. x .049 x 43 Lg.-(H.D. Cop.)
33	C-9817		C-9817-P 1/2	12	CONNECTOR - Tube Fitting
34	C-9821		C-9821-P 1/2	12	ELBOW - Tube Fitting (Female)
35	C-9816		C-9816-P 1/2	24	NUT - Tube Fitting
36			C-3286	2	CLAMP - Manifold Support
37				2	CAPSCREW -- 1/2-13-NC x 7/8 Lg. - (St.)
38				2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)
39			C-8267	2	CAP - Support Clamp
40				4	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)
41				4	NUT -- 1/2-13-NC-Hex. - - (St.)
42				1	REDUC. BUSHING(Man. End Tee)-1 x 3/8 Std(Galv Ir

2L70

OPP. HAND SEE 2L1344
OR OPP. ROT. SEE

NAME WATER PIPING GROUP

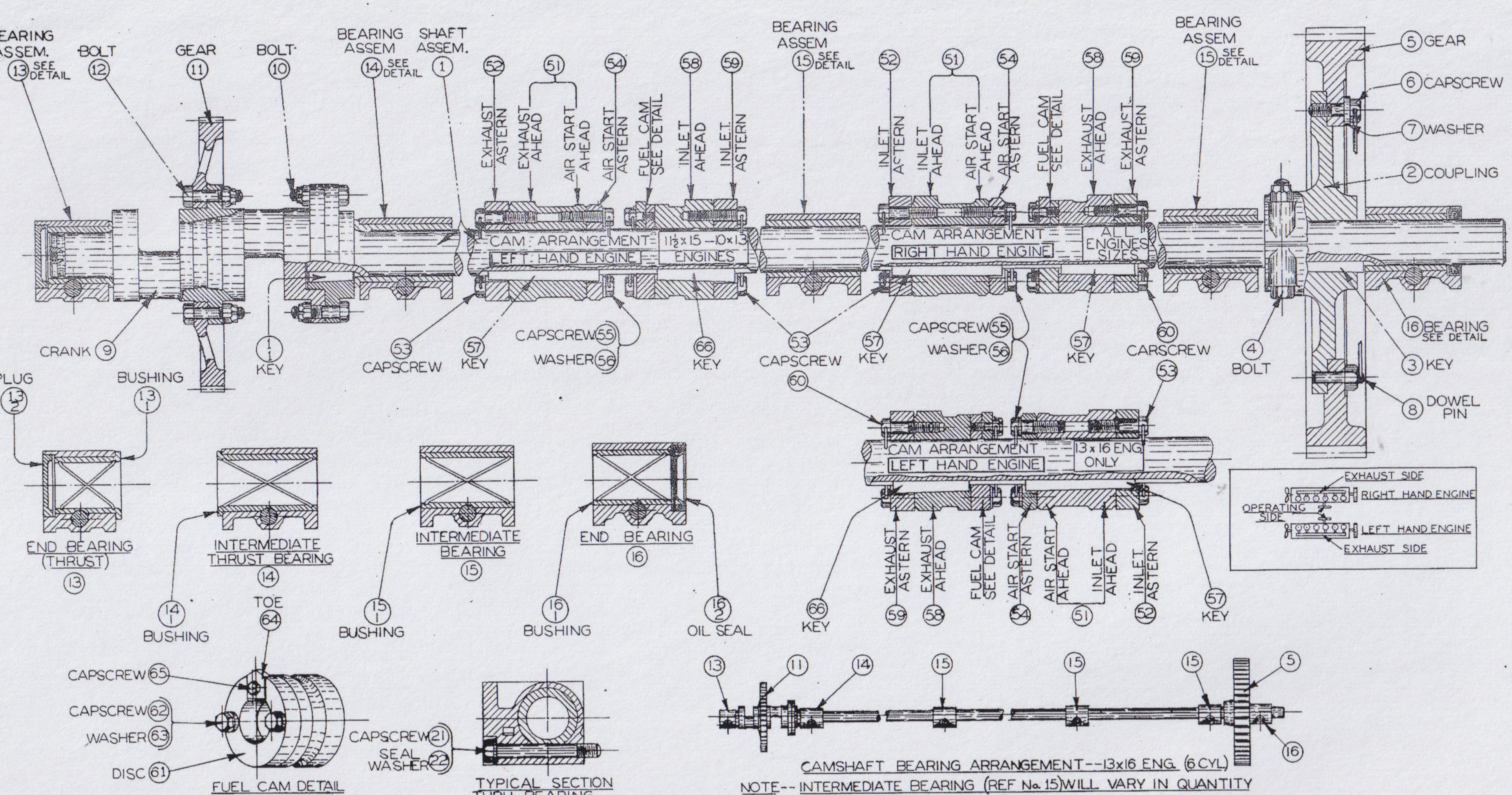
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV. 5-42 1M TRANS. 1M BOND

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND MATTOON, ILL.



CAMSHAFT BEARING ARRANGEMENT--13x16 ENG. (6 CYL)

NOTE-- INTERMEDIATE BEARING (REF No. 15) WILL VARY IN QUANTITY ACCORDING TO ENGINE SIZE AND No. OF CYLINDERS

XTRA ES TO | TYPED BY BJR | DATE 1-3-49 | CHKD. | ISSUED BY | DATE 1-3-49

Retyped from 4-18-40 (No changes)

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

2L265

PLATE No. K-1877

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME — ASSEM. DRWG. NO. F-2653
1	-	51	F-6311	1	CAM - Inlet & Air Start. (Ahead)
2	S-3033	52	532A-P6	1	CAM - Inlet --- (Astern)
3	C-2408	53	C-2408L1 3/4	2	CAPSCREW -- Astern Cam to Ahead Cam
4				1	WIRE -- #16 Ga. x 10 Lg. -- (St.)
5	S-2979	54	597-E6	1	CAM - Air Starting (Astern)
6	C-2408	55	C-2408L1 1/2	2	CAPSCREW - Air Start. Cam to Inlet Cam
7	S-2233	56	881A-E	2	WASHER - Air Start. Cam Capscrew
8				1	WIRE -- #16 Ga. x 10 Lg. -- (St.)
9	2C1432	57	2C1432L5 1/2	1	KEY - Inlet & Air Starting Cam to Camshaft
10					
11	F-2643	58	560-P6	1	CAM - Exhaust - (Ahead)
12	S-3033	59	532A-P6	1	CAM - Exhaust - (Astern)
13	C-2408	60	C-2408L1 3/4	2	CAPSCREW - Astern Cam to Ahead Cam
14				1	WIRE -- #16 Ga. x 10 Lg. -- (St.)
15	S-2978	61	881-E	1	DISC - Fuel Cam
16	C-2408	62	C-2408L1 1/2	2	CAPSCREW - Disc to Exhaust Cam
17	S-2233	63	881A-E	2	WASHER - Fuel Cam Capscrew
18	F-1656	64	880-E	1	TOE - Fuel Cam
19	C-2406	65	C-2406L 3/4	1	CAPSCREW - Toe to Fuel Cam Disc
20				1	WIRE -- #16 Ga. x 12 Lg. -- (St.)
21	2C1432	66	2C1432L4 1/2	1	KEY - Exhaust & Fuel Cam to Camshaft

---- NOTE ----

Left Hand -- 10 x 13 & 11 1/2 x 15 Engines -- Inlet Cams Listed above are used as Exhaust Cams -- Exhaust Cams are used for Inlet Cams.

Left Hand -- 13 x 16 Engines -- Cams same as listed above

2L265

FOR OPP. HAND SEE | FOR OPP. ROT. SEE 2L266

NAME CAM GROUP - - - - - - - - (INBOARD ROTATION)

ORIGINALLY ISSUED FOR 6 CYL. MAR-10x13 to 13x16 ING.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

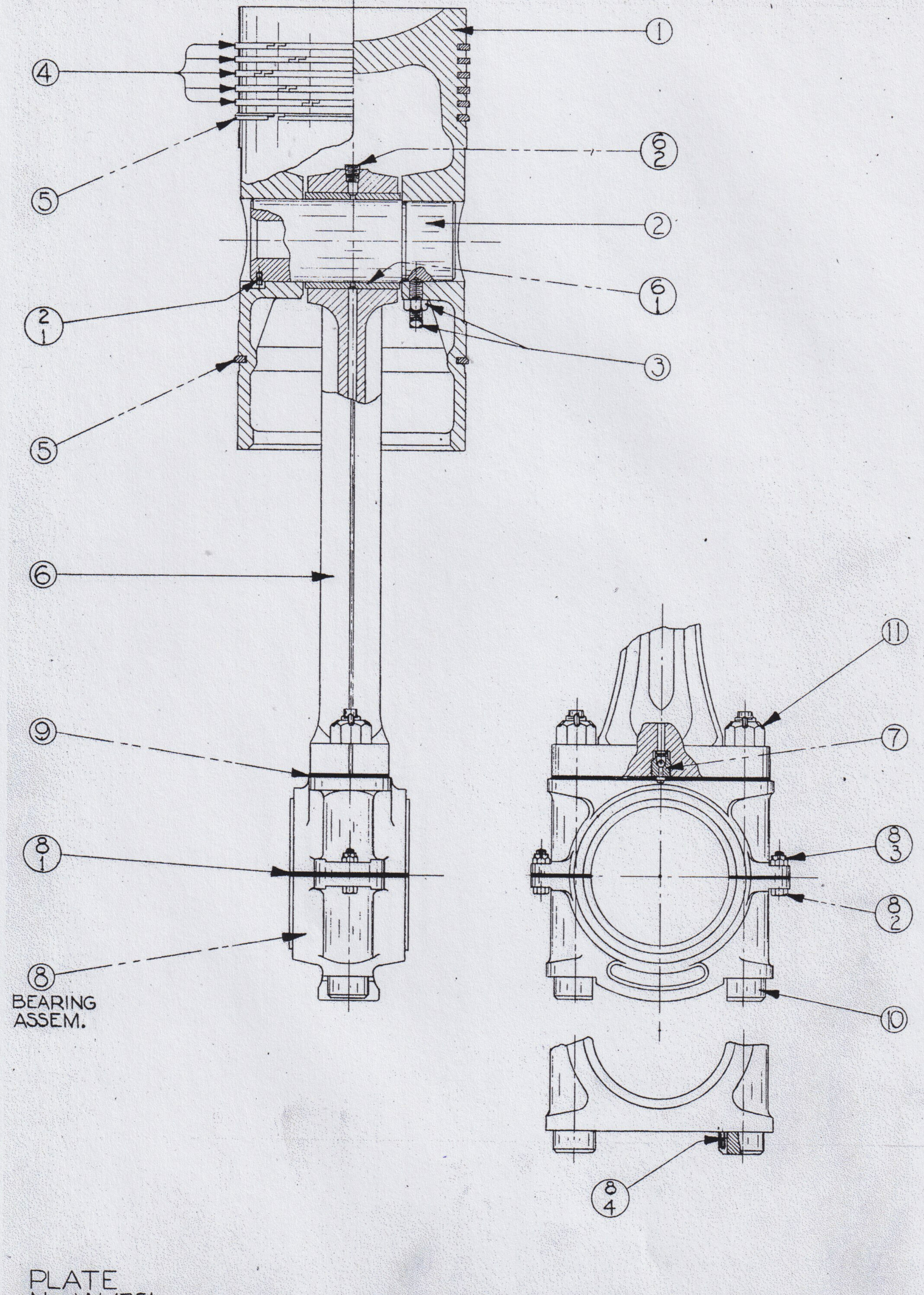


PLATE
No. W-1751

DO NOT ORDER PARTS BY REF. NUMBERS

TYPED BY ABC DATE 7-23-46 CHKD. CWJ ISSUED BY CWJ DATE 7-26-46

Retyped from 11-24-44 (no changes)

CHANGES

2L351

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. W-1751

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1	K-1297	1	PISTON	
2		2	X1289	1	PIN ASSEM. - Piston	
3		3		1	SETSCREW--3/4-10-NC x 2 1/4 Lg. - Sq. Hd. Cup	
4					Pt. - - (St.)	
5				1	NUT -- 3/4-10-NC-Hex. - - (St.)	
6						
7	C-2155	4	C-2155L13	5	RING - Piston (Compression)	
8	C-2355	5	C-2355L13	2	RING - Piston (Oil Control)	
9						
10	F-6221	6	X3105	1	ROD ASSEM. - Connecting	
11	2C1515	7	X3106	1	VALVE ASSEM. - Ball Check	
12	W-1552	8	X3107	1	BEARING ASSEM. - Connecting Rod	
13	2C1487	9	2C1487-A	1	SHIM - Bearing to Rod - (1/16)	
14	2C1487	9	2C1487-B	1	SHIM - Bearing to Rod - (1/32)	
15	2C1487	9	2C1487-C	2	SHIM - Bearing to Rod - (1/64)	
16		10	2C1463	2	BOLT - Connecting Rod to Bearing	
17		11	S-2716	2	NUT - Connect. Rod Bolt	
18				2	COTTER PIN -- 1/4 x 2 3/4 Lg. - - (St.)	
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FOR OPP. HAND SEE

FOR OPP. ROT. SEE

NAME PISTON & CONNECTING ROD GROUP

ORIGINALLY ISSUED FOR 13 x 16 MAR. & STAT.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L351

247 REV. 1/46 2M TRANS.
PRINTED IN U.S.A.

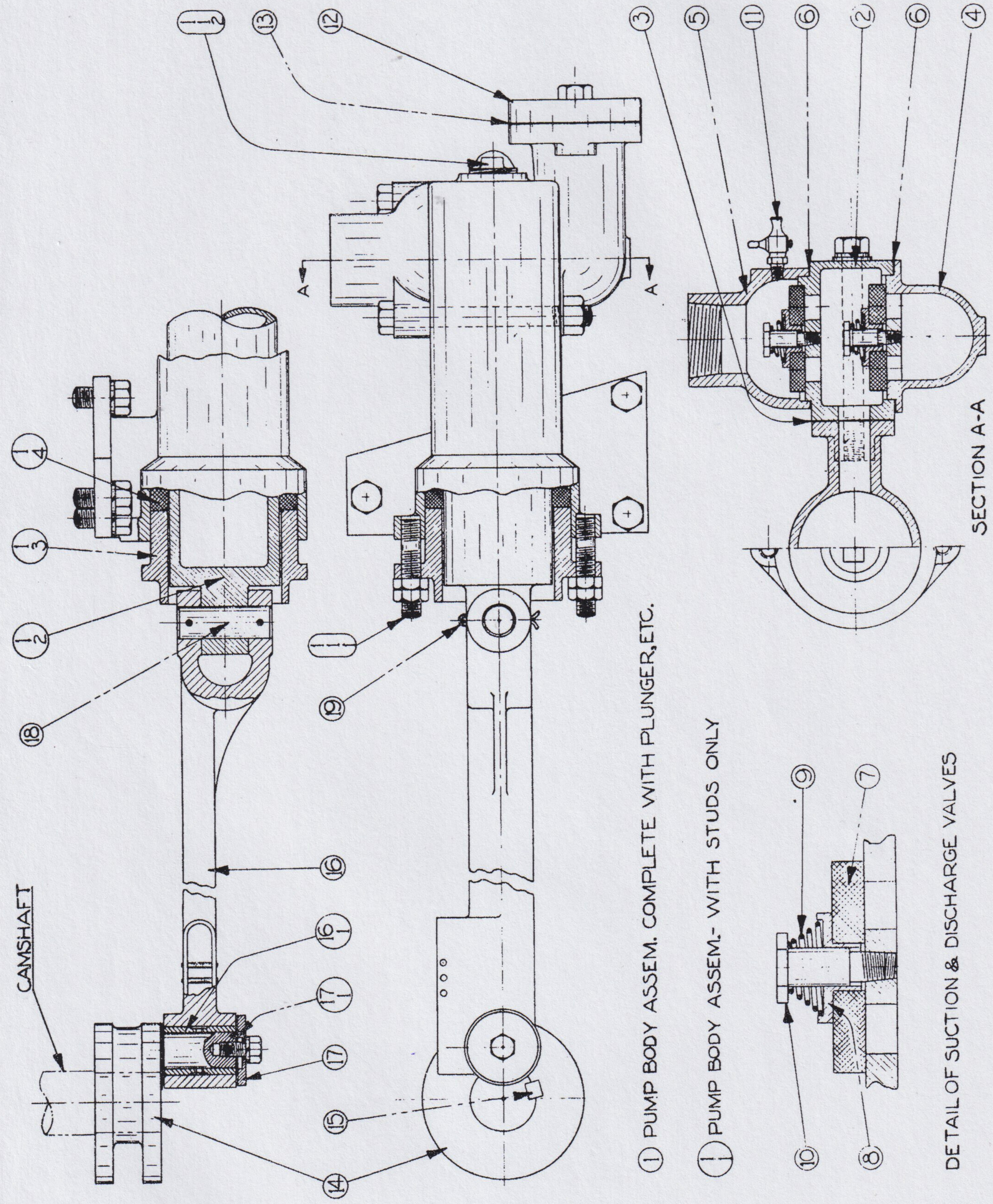


PLATE
No. W-1731

DO NOT ORDER PARTS BY REF. NUMBERS

TYPED BY BJR DATE 1-3-49 CHKD. [illegible] ISSUED BY DATE 1-3-49

Retyped from 10-17-40 (No Changes)

CHANGES

2L356

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. W-1731

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1	X1123	1	PUMP ASSEM. - Bilge	
2				3	CAPSCREW -- 5/8-11-NC x 1 1/4 Lg. -- (St.)	
3				3	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
4	W-23	2	214-E	1	GRID - Bilge Pump Discharge Valve	
5		3	C-1217	1	GASKET - Grid to Pump Body	
6				2	CAPSCREW -- 5/8-11-NC x 6 Lg. -- (St.)	
7				2	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
8		4	W-1690	1	BONNET - Suction Valve	
9	C-242	5	216-E	1	BONNET - Discharge Valve	
10	S-2050	6	215A-E	2	GASKET - Bonnets to Grid	
11				2	CAPSCREW -- 5/8-11-NC x 6 Lg. -- (St.)	
12				2	NUT -- 5/8-11-NC-Hex. -- (St.)	
13	S-1788	7	219-E1	2	VALVE - Bilge Pump Suction & Discharge	
14	S-2289	8	219A-6	2	BUSHING - Bilge Pump Valve	
15	C-461	9	218-E	2	SPRING - Bilge Pump Valve	
16	S-2046	10	217-7	2	STUD - Bilge Pump Valve	
17	C-9045	11	C-9045-P 1/4	1	COCK - Air (Discharge Bonnet)	
18				1	PIPE PLUG -- 1/4 Std. -- (Brass)	
19	C-5356	12	788-B	1	FLANGE - Bilge Pump Suction Pipe	
20		13	S-924	1	GASKET - Flange to Pump Bonnet	
21				2	CAPSCREW -- 5/8-11-NC x 1 1/2 Lg. -- (St.)	
22						
23	C-1123	14	266-CX	1	CRANK - Bilge Pump Drive	
24	S-3234	15	5354	1	KEY - Crank to Camshaft	
25	F-3271	16	G264-03	1	ROD ASSEM. - Bilge Pump Connecting	
26	C-8880	17	X2362	1	WASHER ASSEM. - Connect. Rod Retainer	
27				1	CAPSCREW -- 1/2-13-NC x 3/4 Lg. -- (St.)	
28				1	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
29	S-2002	18	264B-E	1	PIN - Conn. Rod to Pump Plunger	
30				2	COTTER PIN -- 3/16 x 2 1/2 Lg. -- (St.)	

FOR OPP. HAND SEE 2L357

FOR OPP. ROT. SEE

NAME BILGE PUMP GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV. 1/46 2M TRANS. PRINTED IN U.S.A.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L356

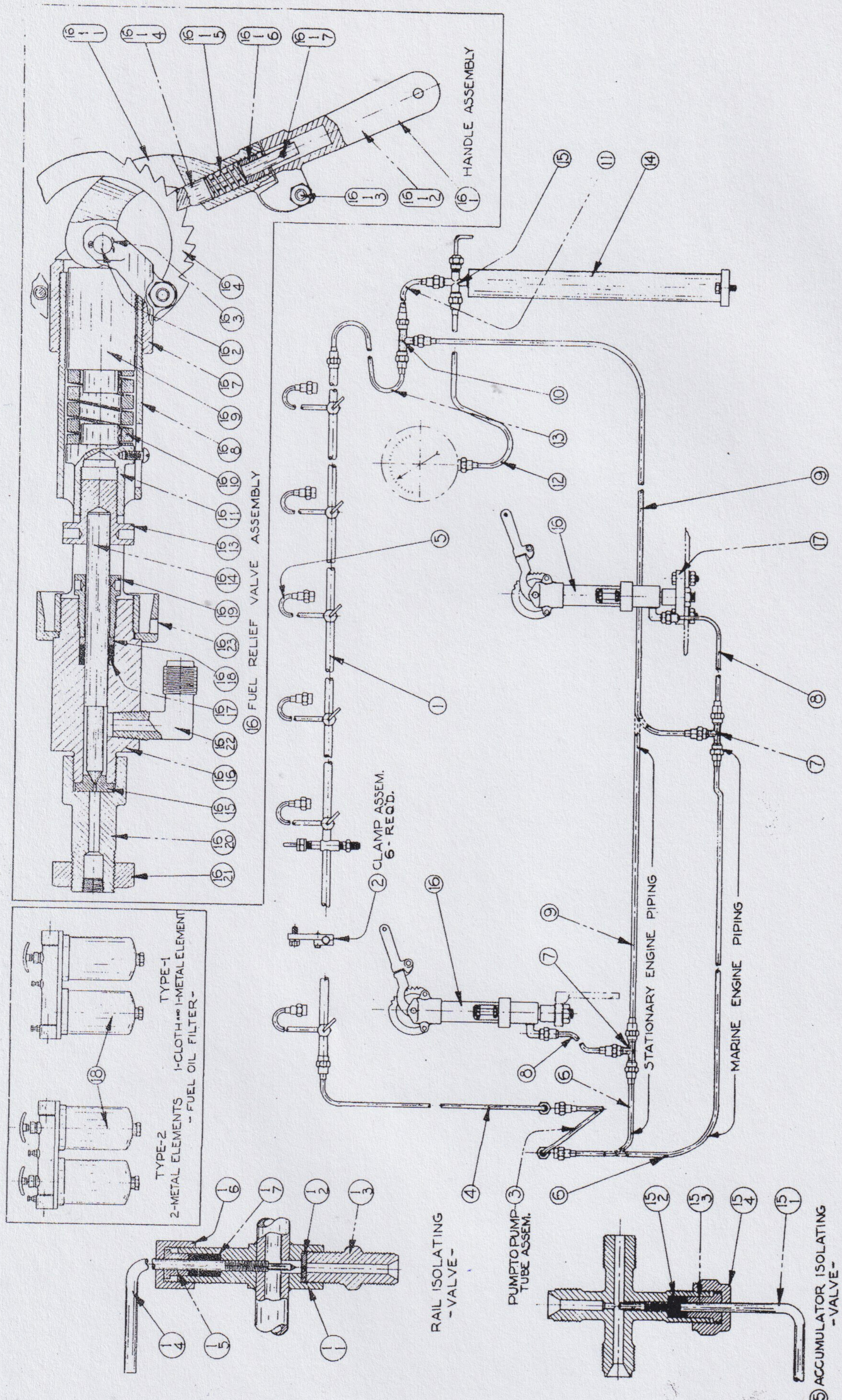


PLATE
No. K-1912

DO NOT ORDER PARTS BY REF. NUMBERS

CHANGES: 12-30-40 Line 17 Part No. Was X210
Line 18 Length of Capscrew Was $1\frac{1}{2}$"

MOD DATE 11-?-40 BY ___ DATE 11-11-40 CHKD. ___ APRVD. ___

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L380

PLATE NO. K-1912

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	K-613	1		X8	1	RAIL ASSEM. - Fuel	
2	S-2238	2		G1203-AX3	6	CLAMP ASSEM. - Fuel Rail	
3					6	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
4					6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
5	C-3348	3		X575	1	TUBE ASSEM. - Pump to Pump (13")	
6	C-3348	4		X3055	1	TUBE ASSEM. - Pump to Rail (38")	
7	S-3178	5		X5011	6	TUBE ASSEM. - Rail to Spray Valve (27")	
8	C-3348	6		X1007	1	TUBE ASSEM.-Pump to Tee(Opp. Reg. Valve)-(108")	
9		7		F-707	1	TEE - Fuel Tube	
10	C-3348	8		X688	1	TUBE ASSEM. - Tee to Regulat. Valve (16")	
11	C-3348	9		X895	1	TUBE ASSEM.-Tee to Tee(Opp. Accumulator)-(78")	
12		10		F-707	1	TEE - Fuel Tube	
13	C-3348	11		X575	1	TUBE ASSEM. - Tee to Accumulator (13")	
14	S-3178	12		X4	1	TUBE ASSEM.-Accumulator to Press. Gage (84")	
15	C-3348	13		X3054	1	TUBE ASSEM. - Tee to Rail (20")	
16							
17	F-6457	14		X3234	1	ACCUMULATOR ASSEM. - Fuel	
18					2	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
19					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
20		15		G1215-E	1	VALVE ASSEM. - Accumulator Isolating	
21							
22	W-28	16		G1230-E1	1	VALVE ASSEM. - Fuel Pressure Regulating	
23		17		S-2132	1	BRACKET - Fuel Press. Regulating Valve	
24					2	CAPSCREW -- 5/8-11-NC x 2 Lg. - (St.)	
25					2	NUT -- 5/8-11-NC-Hex. - - (St.)	
26					2	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
27							
28							
29						-- L.P. Fuel Piping - Filter to H.P. Pump ---	
30	F-6418	18		F-6418-P	1	FILTER - Fuel	
31					2	REDUCING BUSHING -- 1/2 x 3/8 Std. - (C.I.)	
32					2	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
33					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
34	C-9804			C-9804-P 1/2	1	ELBOW - Tube Fitting	
35					1	TUBE -- 1/2 O.D. x .049 x 9 Lg.-(H.D. Cop.)	
36	C-9804			C-9804-P 1/2	1	ELBOW - Tube Fitting	
37					1	REDUCING BUSHING -- 1/2 x 3/8 Std. - (C.I.)	
38							
39							
40						---Press. Regulat. Valve to Trans. Pump(By-pass Line)	
41	C-9801			C-9801-P 3/8	1	CONNECTOR - Tube Fitting	
42					1	TUBE -- 3/8 O.D. x .035 x 118 Lg.-(S.D. Cop.)	
43	C-9801			C-9801-P 3/8	1	CONNECTOR - Tube Fitting	
44					1	TEE -- 1/2 x 1/2 x 1/4 Std. Reducing(Brass)	
45					1	CLOSE NIPPLE -- 1/2 Std. - (Brass)	
46					3	CLAMP - Tube	
47					3	MACHINE SCREW-1/4-20 x 3/8 Lg-Rnd.Hd.-(St.)	
48					3	LOCKWASHER -- 1/4 SAE Reg. - (St.)	
49							
50							

2L380

OPP. HAND SEE 2L381

OPP. ROT. SEE

NAME FUEL SYSTEM GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

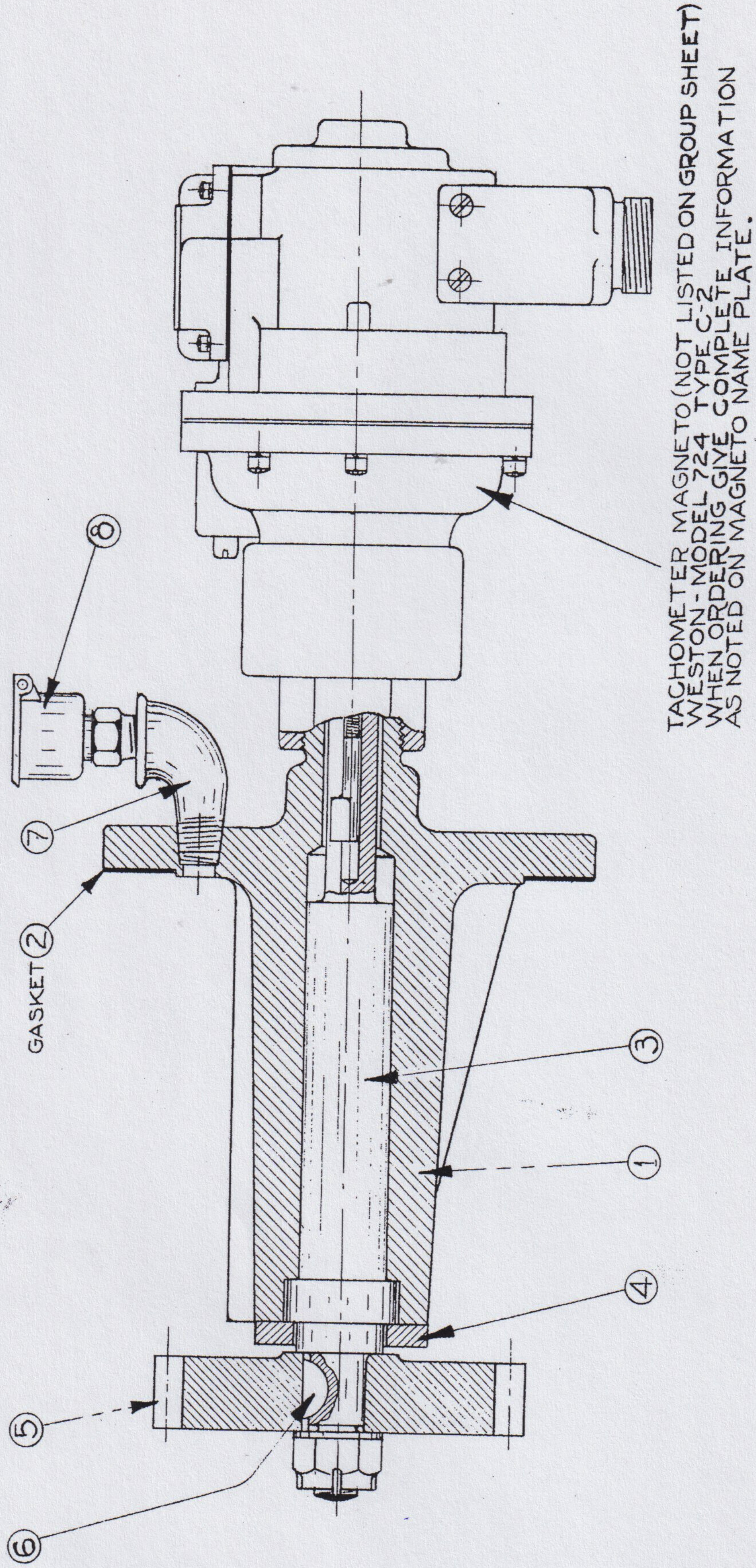


PLATE
No. W-1784
ED-2

DO NOT ORDER PARTS BY REF. No.

Retyped from sheet dated 1-21-49.

CHANGES

2L 457

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. W-1784

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQ'D	PART NAME	ASSEM. DRWG. NO.
		1	W-1682	1	BEARING-Tachometer Drive Shaft	
2		2	C-7527	1	GASKET-Bearing to Centerframe	
				4	CAPSCREW-3/8-16-NC x 7/8 Lg.- (St.)	
4				4	LOCKWASHER-3/8 SAE Reg. - (St.)	
		3	2C1881	1	SHAFT - Tachometer Drive	
6		4	2C1880	1	WASHER- Tach. Drive Shaft Thrust	
				2	MACHINE SCREW-1/4-20-NC x 1/2 Lg.Flat Hd(St.	
8		5	2C1882	1	GEAR - Tachometer Drive	
		6		1	WOODRUFF KEY-1/8 x 1/2 Std.- (St.)	
10				1	PLAIN WASHER - 3/8 SAE Std. - (St.)	
				1	CASTLE NUT-3/8-24-NF-Hex.--(St.)	
12				1	COTTER PIN-3/32 x 3/4 Lg. - (St.)	
14		7		1	STREET ELL- 1/8 Std. -- (M.I)	
		8		1	OIL CUP -1/8 Hinged Lid-Gits #802 or Eq.(St.)	

2L 457

NAME TACHOMETER DRIVE GROUP

ORIGINALLY ISSUED FOR 6/c 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION · SPRINGFIELD, OHIO

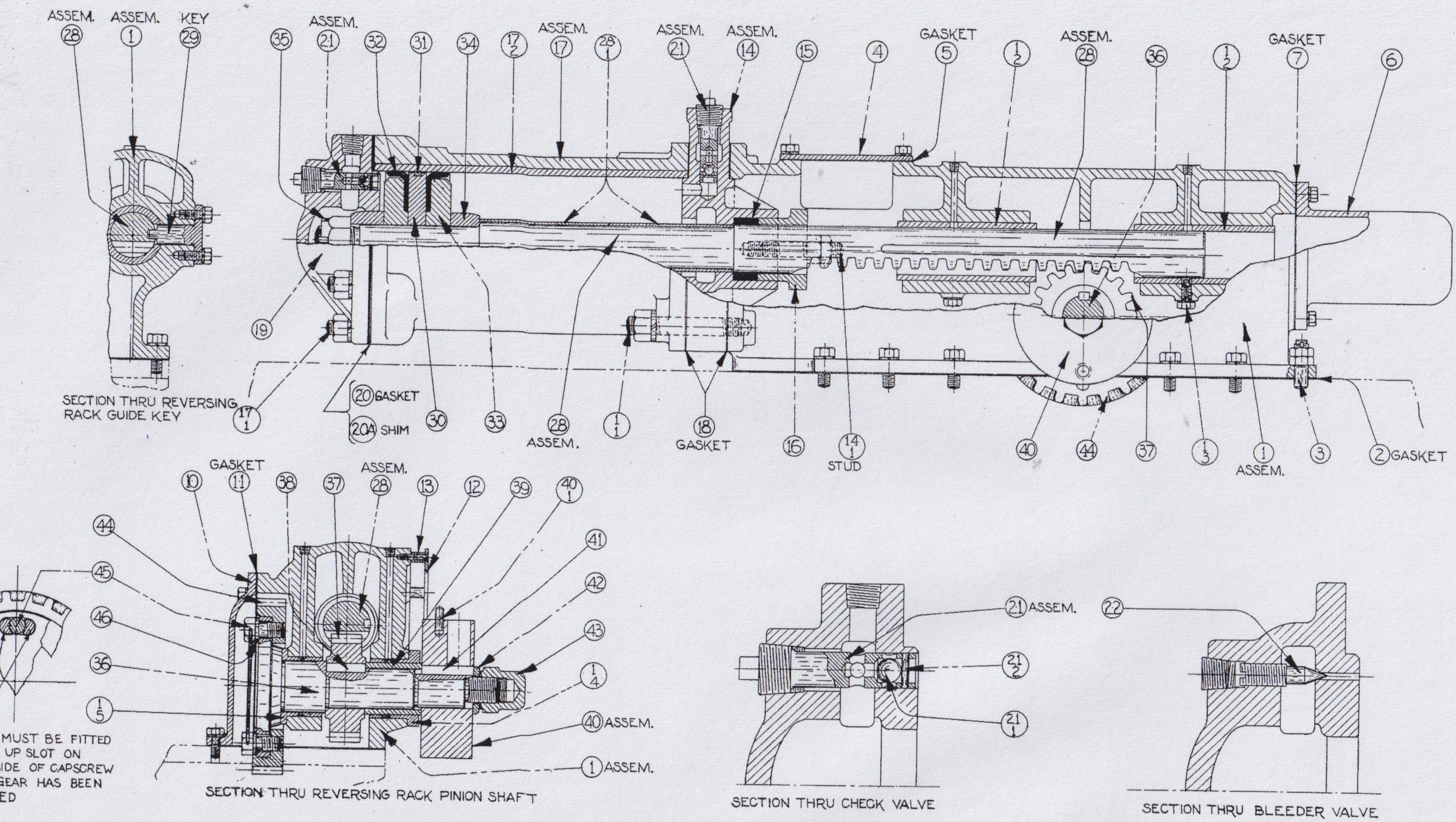


PLATE
No. K-1989-(ED 2)

DO NOT ORDER PARTS BY REF. No.

TO BY JL DATE 2-24-41 BY DATE CHKD. APRVD.

CHANGES:
5-7-41 Line 5 Part No. Was 2C1301L2
Removed Two 5/8-11 Half Nuts & 5/32 Cotter Pins - Added Four Oil Cups
4-7-44 Removed Part No. 2C2149 & 2C2148
9-1-44 Line 38 No. Req. was 1-Line 45 Added

2L491 SHEET 1 OF 2

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-1989 (Ed 2)

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	W-1787	1		X3262	1	HOUSING ASSEM. - Reversing Rack	
2		2		F-6473	1	GASKET - Housing to Latch Box	
3					12	CAPSCREW -- 1/2-13-NC x 1-1/4 Lg. - (St.)	
4					12	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
5	2C2394	3		2C2394L1 1/4	2	PIN - Housing to Latch Box Dowel	
6					4	OIL CUP -- Lunkenheimer #540 Size 0 - 1/8 Pipe	
7						Thread - (St.)	
8		4		F-6472	1	COVER - Rack Housing Top	
9		5		2C2151	1	GASKET - Cover to Housing	
10					4	CAPSCREW -- 3/8-16-NC x 7/8 Lg. - - (St.)	
11					4	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
12		6		C-9731	1	COVER - Rack Housing End	
13		7		C-9735	1	GASKET - Cover to Housing	
14					4	CAPSCREW -- 3/8-16-NC x 1-1/4 Lg. - - (St.)	
15					4	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
20		10		2C2132	1	COVER - Rack Housing Side - (Gear Cover)	
21		11		2C2159	1	GASKET - Cover to Housing	
22					7	CAPSCREW -- 3/8-16-NC x 1 Lg. - - (St.)	
23					7	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
24		12		C-9745	1	PLATE - Rack Indicator	
25		13		2C2167	3	SPACER - Plate to Housing	
26					3	MACHINE SCREW -- 1/4-20 x 1-1/8 Lg.-Flat Hd.(St	
27		14		X3265	1	COVER ASSEM. - Cylinder & Rack Housing End	
28		15			5	PACKING RING - Garlock #235--	
29						2-3/4 O.D. x 2 I.D. x 3/8 wide	
30		16		2C1505	1	GLAND - Packing	
31					2	NUT -- 5/8-11-NC Hex. - - (St.)	
32					2	HALF NUT -- 5/8-11-NC-Hex. -- (St.)	
33	2C2147	17		X3264	1	CYLINDER ASSEM. - Reversing	
34		18		2C2162	2	GASKET - End Cover to Cylinder & Housing	
35					4	NUT -- 3/4-10-NC-Hex. - - (St.)	
36					4	LOCKWASHER -- 3/4 SAE Reg. - - (St.)	
37		19		W-1572	1	COVER - Rev. Cylinder End	
38		20		2C1506	4	GASKET - Cover to Cylinder	
39					6	NUT -- 5/8-11-NC-Hex. - - (St.)	
40					6	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
41	2C1497	21		X3060	2	VALVE ASSEM. - Air Cyl. Check	
42		22		2C1504	2	VALVE - Air Cyl. Bleeder	
43					2	PIPE PLUG -- 3/8 Std. C't's'k. Hd. - (C.I.)	
45		20A		2C4017	2	SHIM - Rev. Cyl. End Cover	

---- CONTINUED ON SHEET NO. 2 ----

FOR OPP. HAND SEE 2L1244
FOR OPP. ROT. SEE

NAME: REVERSING CYLINDER & RACK GROUP
ORIGINALLY ISSUED FOR 6-CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 2?0 10-39

2L491 of 2

TYPED BY JL DATE 2-24-41 ISSUED BY DATE CHKD. APRVD.

CHANGES:
4-2-41 Lines 23 & 24 Was One 1 1/8-12 Castle Nut & One 3/16 Cotter Pin
4-1-43 Line 9 Part No. Was F-6232 - Line 10 Part No. Was F-6233
2-18-44 Line 28 Part No. was C-2154
#4 2-24-44 Line 20 Part No. was X2582
#5 4-7-44 Removed Part No. C-6633L1 3/4 Added Part No. 2C1438L 1/2

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L491 SHEET 2 OF 2
PLATE NO. K-1989 (Ed 2)

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1						---- CONTINUED FROM SHEET NO. 1 -----	
2							
3	F-6475	28		X3263	1	RACK ASSEM. - Reversing - (& Piston Rod)	
4		29		2C2137	1	KEY - Reversing Rack Guide	
5					2	CAPSCREW -- 3/8-16-NC x 7/8 Lg. - - (St.)	
6					2	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
7		30		2C1500	1	PISTON - Air Cylinder	
8		31		2C71-P6	1	RING - Piston	
9		32		F-6944	2	CUP-SEAL - Air Cyl. Piston -- SEE SERVICE NOTE	
10		33		F-6943	2	FOLLOWER - Cup-Seal	
11		34		2C2157	2	COLLAR - Air Cyl. Piston	
12		35			1	CASTLE NUT -- 1-1/4-12-NF. Hex - - (St.)	
13					1	COTTER PIN -- 3/16 x 2 Lg. - - (St.)	
14							
15							
16		36		F-6463	1	SHAFT - Reversing Rack Pinion	
17		37		2C2130	1	PINION - Reversing Rack	
18		38		C-6908L1-5/8	1	KEY - Pinion to Shaft	
19		39		2C2152	1	SLEEVE - Rev. Rack Pinion Shaft	
	2C3880	40		X3756	1	COLLAR ASSEM. - Latch Position Indicator	
21		41		C-6808L2-1/4	1	KEY - Collar to Shaft	
22	S-912	42		727A-FXC4	1	WASHER - Collar Retainer	
23		43		2C2339	1	NUT - Indicator Collar Retainer	
24					1	LOCKWASHER -- Shakeproof Type 12 - 1 1/8 - (St.	
25		44		2C2131	1	GEAR - Latch Shaft Control	
26		45		C-2510L1-1/4	4	CAPSCREW - Gear to Shaft	
27		46		S-565	4	WASHER - Gear to Shaft Capscrew	
					1	WIRE -- #16 Ga. x 16 Lg. - (St.)	
29	2C1438	47		2C1438L 1/2	2	PIN - Gear Retainer Capscrew Spacer	

---- SERVICE NOTE ----

When Supplying new Piston Cup-seal F-6944 to replace Cup-Leather F-6232 on Engines below #12076 always include one 2C3379 Adaptor Ring with each Cup-seal.

R OPP. HAND SEE 2L1244
R OPP. ROT. SEE

NAME REVERSING CYLINDER & RACK GROUP

ORIGINALLY ISSUED FOR 6-CYL. 13 x 16 MARINE - R.H.

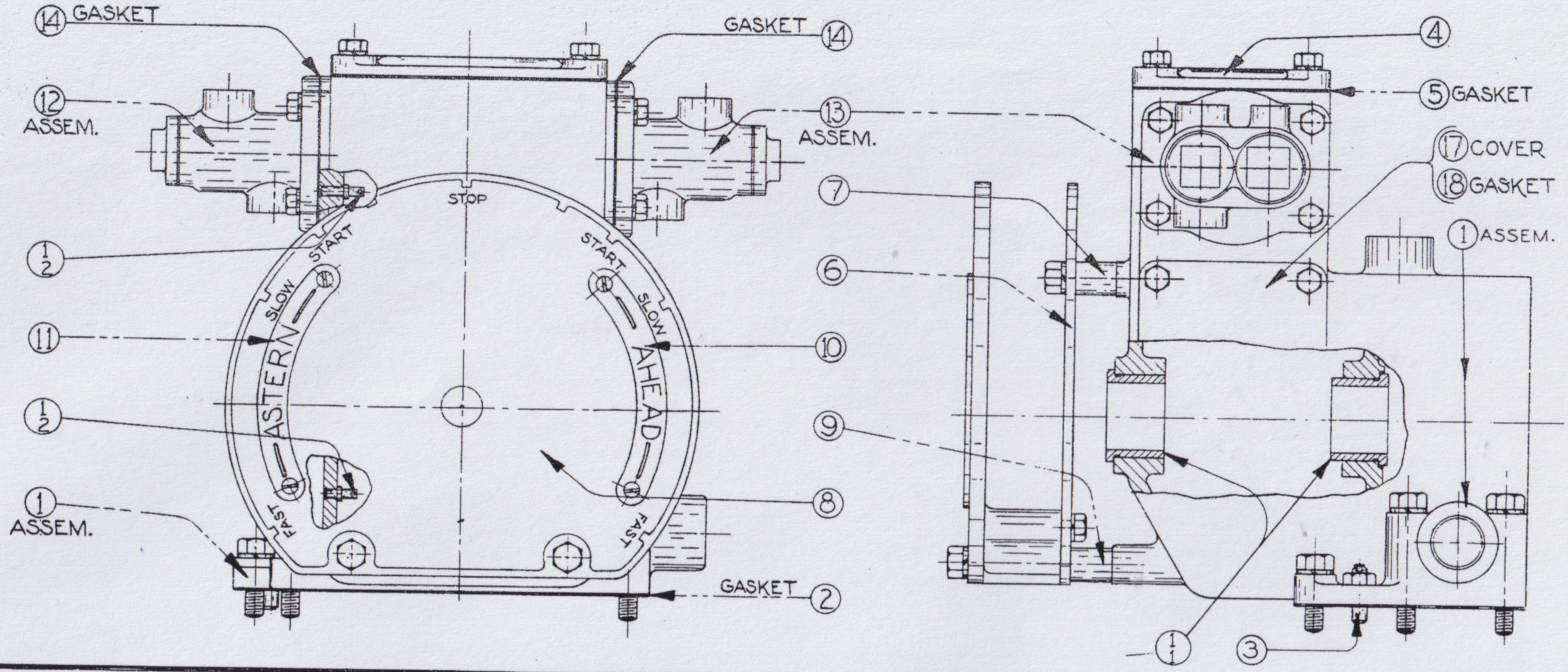
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

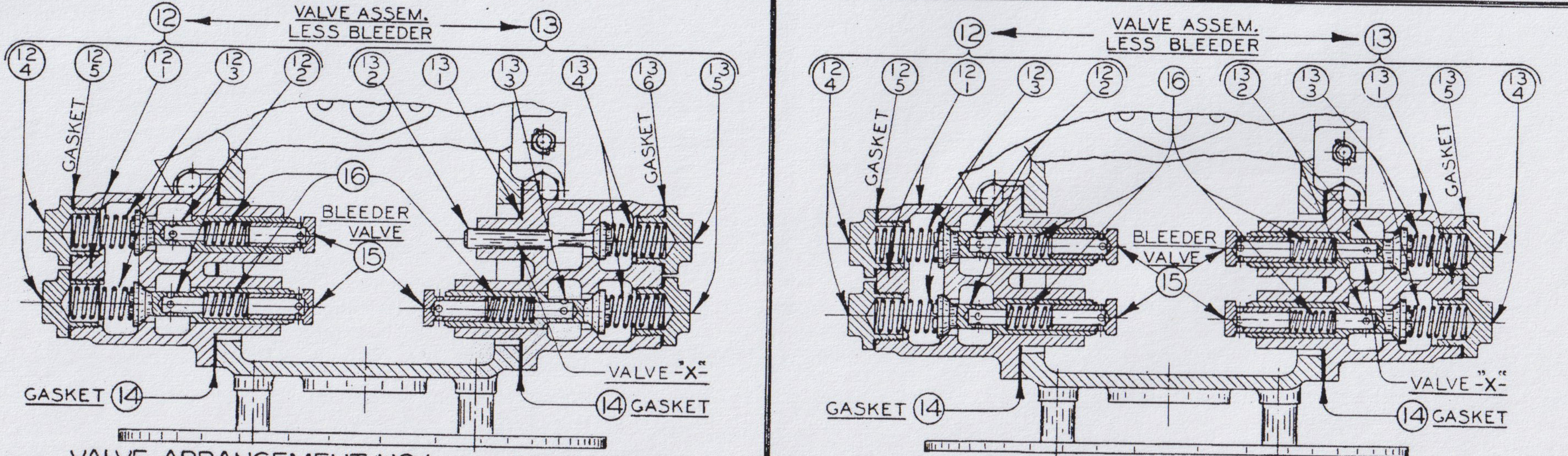
PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 240 10-39

2L491 OF 2





VALVE ARRANGEMENT NO.1 FWD. END →

VALVE ARRANGEMENT NO.2 FWD. END →

PLAN (OR TOP) VIEW OF VALVE ARRANGEMENT

NOTE THAT EITHER OF TWO ARRANGEMENTS MAY BE USED -- ONLY DIFFERENCE IS VALVE "X"

VALVE ARRANGEMENT USED CAN BE DETERMINED BY NOTING THE NUMBER OF BLEEDER VALVES (REF. 15) SPECIFIED ON GROUP LIST SHEET. IF 3 ARE SPECIFIED-ARRANGEMENT NO.1 IS USED-IF 4 ARE SPECIFIED-ARRANGEMENT NO.2 IS USED.

PLATE
No. W-1855 (ED-3)

DO NOT ORDER PARTS BY REF NUMBERS

TYPED BY MED DATE 3-4-41 ISSUED BY DATE CHKD. APRVD.

CHANGES

3-31-41 Added Part Nos. 2C2332 & 2C2337 Also Eight 3/8 Capscrew & Lockwashers
2-10-44 Removed Line 2
12-27-51 Line 27 was C-7446

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L514

PLATE NO. W-1855

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	2C2262	1		X3267	1	HOUSING ASSEM. - Engine Control	
3		2		2C2272	1	GASKET - Housing to Latch Box	
4					3	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
5					3	CAPSCREW -- 1/2-13-NC x 3 Lg. - (St.)	
6					6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
7	C-7950	3		C-7950L1 1/2	2	PIN - Housing to Latch Box Dowel	
8					2	HALF NUT -- 3/8-24-NF-Hex. - - (St.)	
9					2	COTTER PIN -- 3/32 x 3/4 Lg. - (St.)	
10		4		2C2232	1	COVER - Control Housing Top	
11		5		2C2233	1	GASKET - Cover to Housing	
12					4	CAPSCREW -- 3/8-16-NC x 1 Lg. - (St.)	
13					4	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
14		6		W-1811	1	PLATE - Control Handle Latch	
15	C-8477	7		C-8477L1 1/16	2	SPACER - Plate to Housing	
16					2	CAPSCREW -- 1/2-13-NC x 2 Lg. - (St.)	
17					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
18		8		W-1810	1	PLATE - Engine Control Indicator	
19					1	CAPSCREW(Ind. Plate to Latch Plate)--3/8-16-NC	
20						x 3/4 Lg.-(St.	
21	C-8477	9		C-8477L1 1/16	2	SPACER - Latch Plate to Housing	
22					2	CAPSCREW(Ind. & Latch Plate to Hous.)- -	
23						1/2-13-NC x 4 1/4 Lg.-(St.)	
24		10		2C2220	1	PLATE - Direction (Ahead)	
25		11		2C2221	1	PLATE - Direction (Astern)	
26					4	MACHINE SCREW--10-24 x 1/2 Lg.-Flat Hd.-(Brass)	
27				T-1247-E	1	PLATE - Name	
28					6	DRIVE SCREW -- Parker-Kalon #6 x 3/8 Lg. -	
29						Hardened - - (St.)	
32		12		X3274	1	VALVE ASSEM. - Air Cyl. & Brake Control	
33		13		X3275	1	VALVE ASSEM.-Air Start. & Cylinder Control	
34		14		2C2273	2	GASKET - Valve to Control Housing	
35					8	CAPSCREW -- 3/8-16-NC x 1 Lg. - (St.)	
36		15		2C2198	3	VALVE - Air Valve Bleeder	
37		16		2C2225	3	SPRING - Bleeder Valve	
40		17		2C2332	2	COVER - Eng. Control Housing Side	
41		18		2C2337	2	GASKET - Cover to Housing	
42					8	CAPSCREW -- 3/8-16-NC x 3/4 Lg. - (St.)	
43					8	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	

OPP. HAND SEE 2L1245

OPP. ROT. SEE

NAME ENGINE CONTROL HOUSING COVERS & AIR VALVE GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13x16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

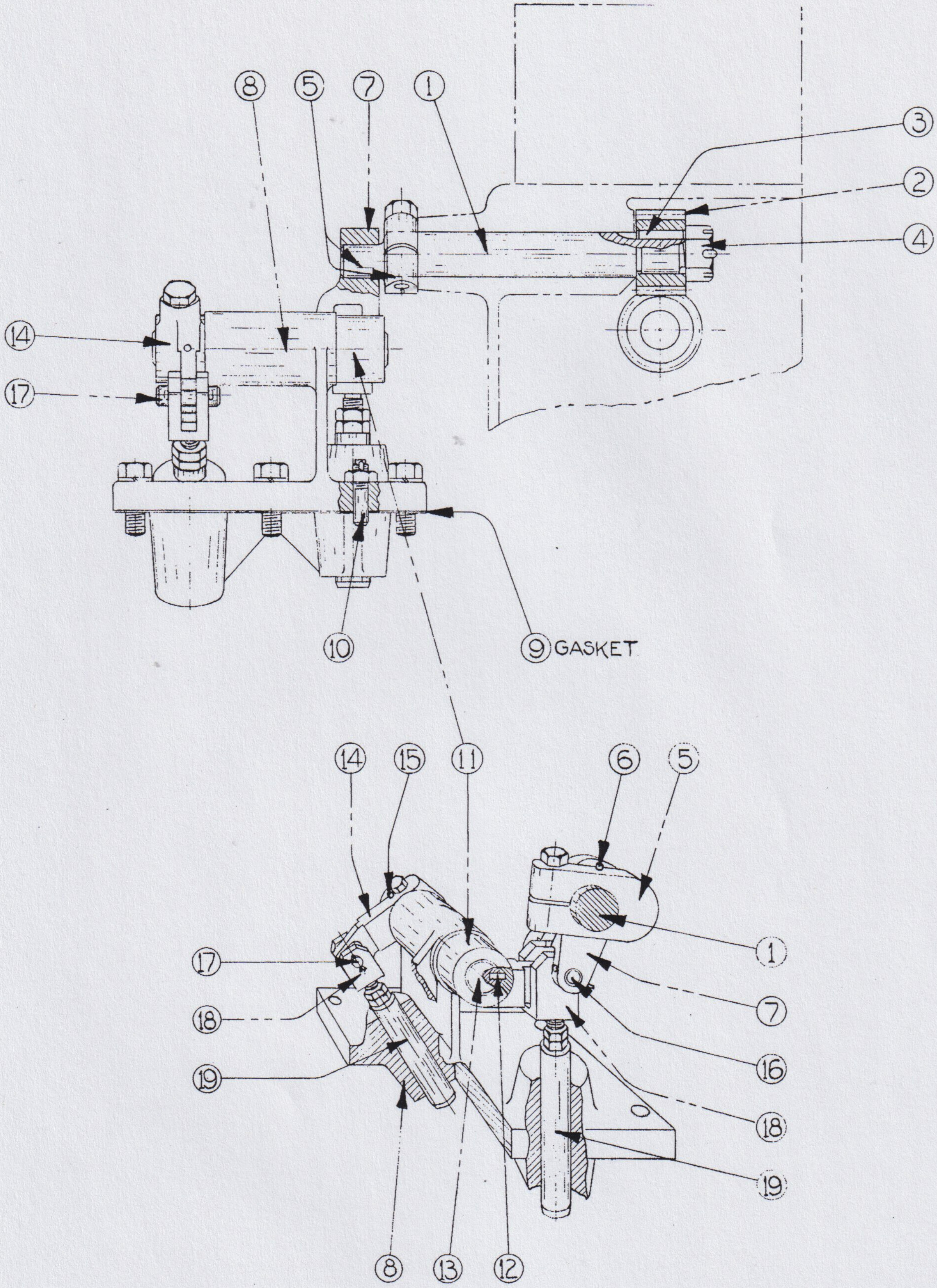


PLATE
No.-W-1862

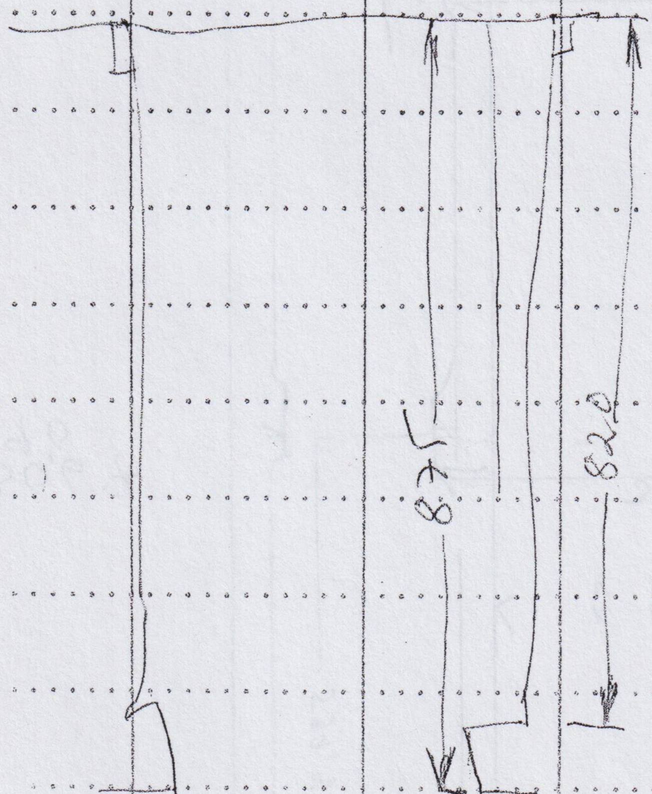
DO NOT ORDER PARTS BY REF. No.

OULUN KAUPUNGIN
SATAMALAITOS

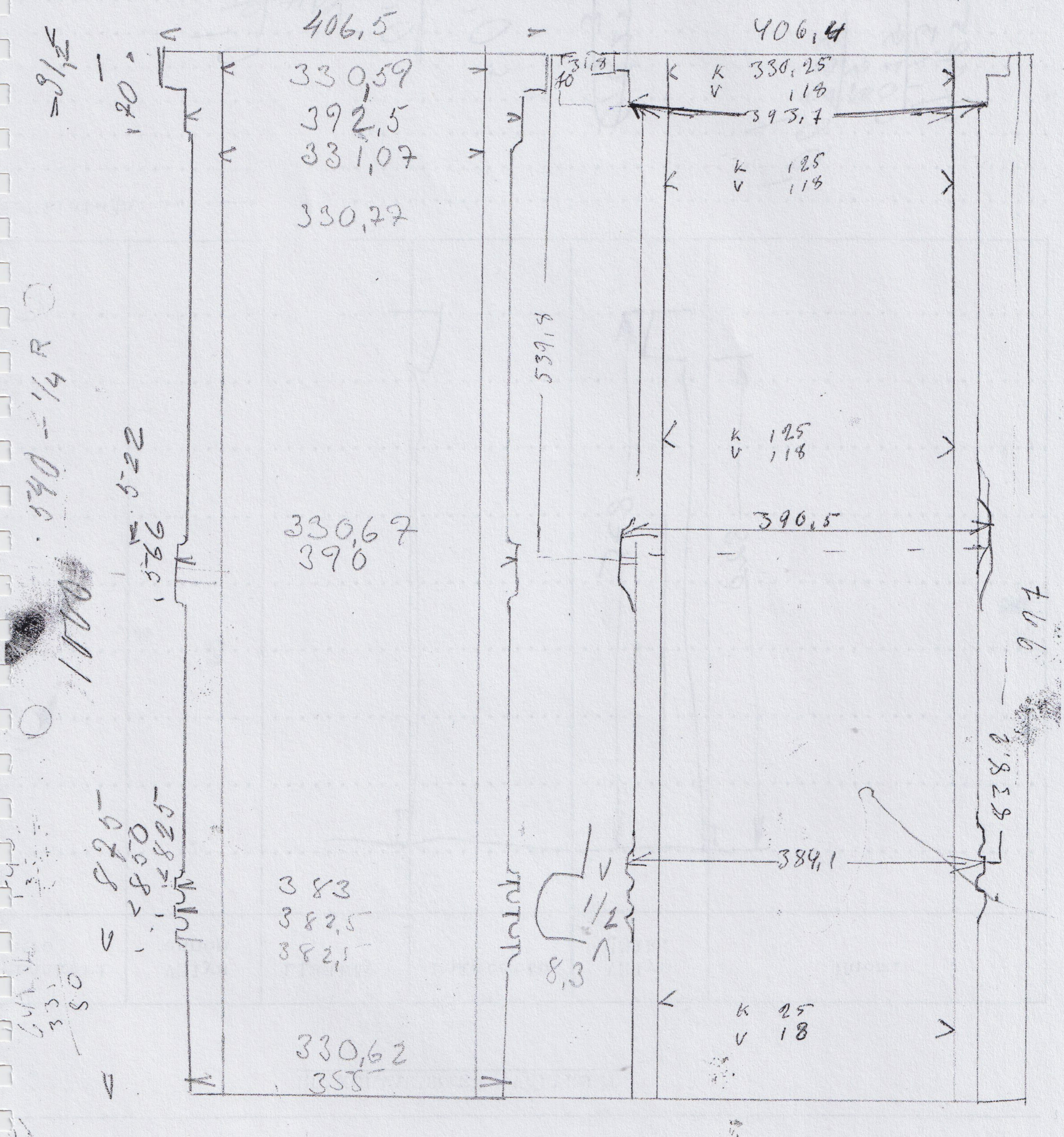
M.S. ....
Moottori ....
Suoritti ....
Päiväys ....

RUNKOLAAKERIEN VÄLYKSET

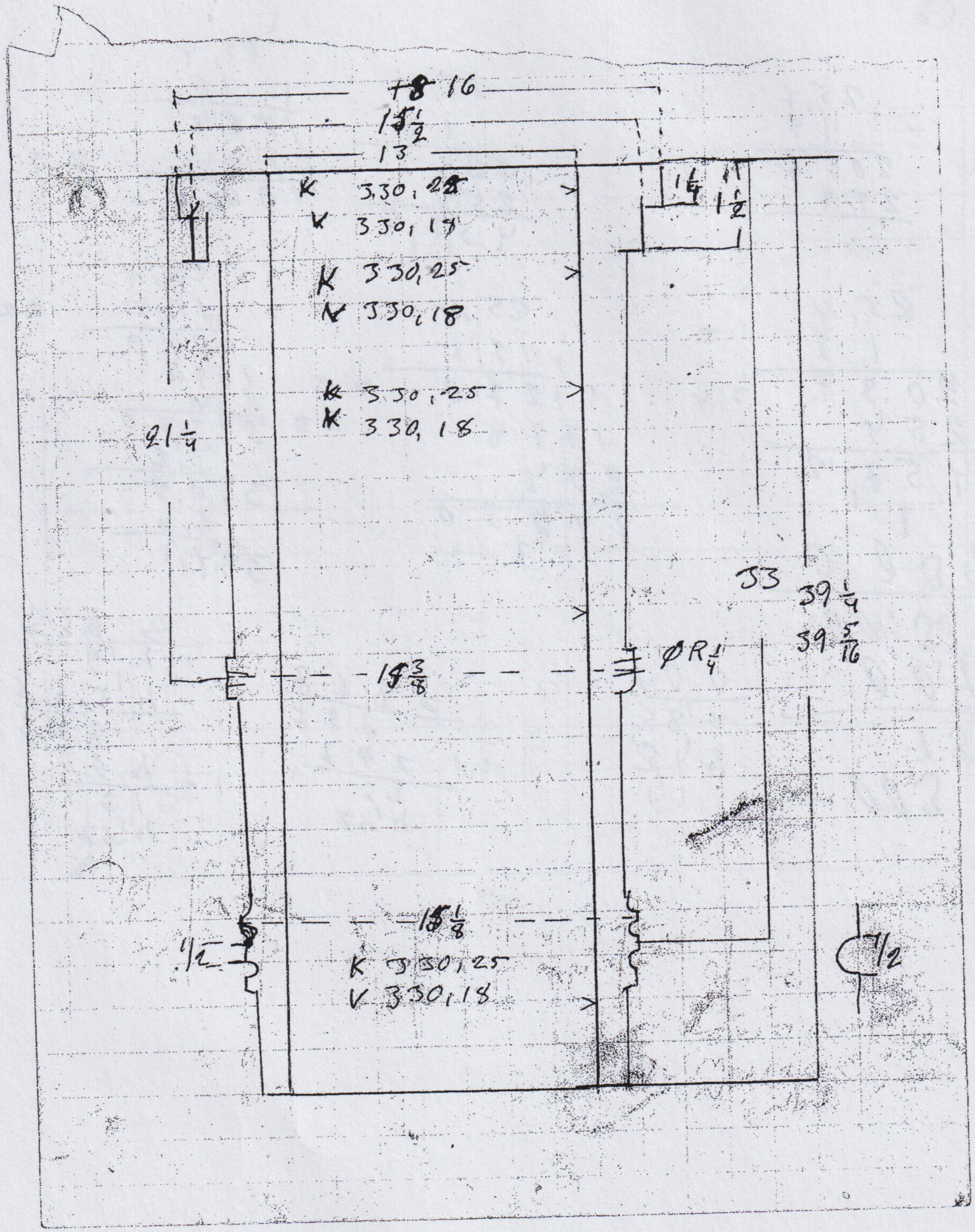
Laakeri n:o	Välys ennen	Lisätty	Poistettu	Välys jälk.	Huom.



Lisätietoja: ....



sisämitta K = Kemiläinen
V = Varikolta



16
15 1/2
13
K 330, 25
V 330, 18
K 330, 25
V 330, 18
K 330, 25
K 330, 18
1 1/4
1 1/2
21 1/4
33
39 1/4
39 5/16
ØR 1/4
15 3/8
15 1/8
1/2
K 330, 25
V 330, 18
1/2

25,7
19
2056
277

54

25,4
18
2032
287
487,2

25,4
16
1524
254
406,4

23

25,4
18
2032
254
457,2

34

25,4
17,5
1270
1778
254
444,50

22

23

25,4
15,5
1270
1270
254
393,70
3,2
390,5
6,4
384,1

22

RA
ES TO | TYPED BY MED | DATE 3-31-41 | ISSUED BY | DATE | CHKD. | APRVD.

Revised & Retyped From Sheet Dated 3-4-41
8-31-43 Line 23 Part No. was C-9453

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L516

PLATE NO. W-1862

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1		2C2254	1	SHAFT - Latch Shaft Interlock Control	
2		2		2C2231	1	GEAR - Latch Shaft Interlock Drive	
3	C-7104	3		C-7104L1 1/4	1	KEY - Gear to Shaft	
4		4			1	SLOTTED NUT -- 3/4-10-NC-Hex. - - (St.)	
5					1	COTTER PIN -- 1/8 x 1 1/2 Lg. - (St.)	
6		5		2C2253	1	CRANK - Latch Shaft Interlock Drive	
7					1	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
8		6			1	TAPER PIN -- No. 4 x 2 Lg. - (St.)	
9		7		2C2192	1	LINK - Interlock Control	
10		8		K-1974	1	BRACKET - Latch Shaft Interlock	
11		9		2C2338	1	GASKET - Bracket to Latch Box	
12					6	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
13					6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
14	C-7950	10		C-7950L1 3/4	2	PIN - Bracket to Latch Box Dowel	
15					2	HALF NUT -- 3/8-24-NF-Hex. - - (St.)	
16					2	COTTER PIN -- 3/32 x 3/4 Lg. - (St.)	
17		11		2C2334	1	ROCKER - Interlock Plunger	
18		12			1	WOODRUFF KEY -- 1/4 x 1 Std. - (St.)	
19		13		2C2335	1	SHAFT - Interlock Plunger Rocker	
20		14		2C2333	1	ROCKER - Interlock Plunger (Clamped)	
21					1	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
22		15			1	TAPER PIN -- #4 x 2 Lg. - - (St.)	
23	2C3712	16		2C3712L1 3/4	1	PIN - Link to Plunger & Rocker	
24					1	COTTER PIN -- 1/8 x 1 1/2 Lg. - (St.)	
25	2C2257	17		2C2257L1 5/8	1	PIN - Rocker to Plunger	
26					2	COTTER PIN -- 1/8 x 1 Lg. - - (St.)	
27		18		2C2194	2	FORK - Latch Interlock Plunger	
28					2	HALF NUT -- 1/2-20-NF-Hex. - - (St.)	
29		19		2C2193	2	PLUNGER - Latch Interlock	

2L516

OPP. HAND SEE 2L1247
OPP. ROT. SEE

NAME LATCH SHAFT INTERLOCK GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

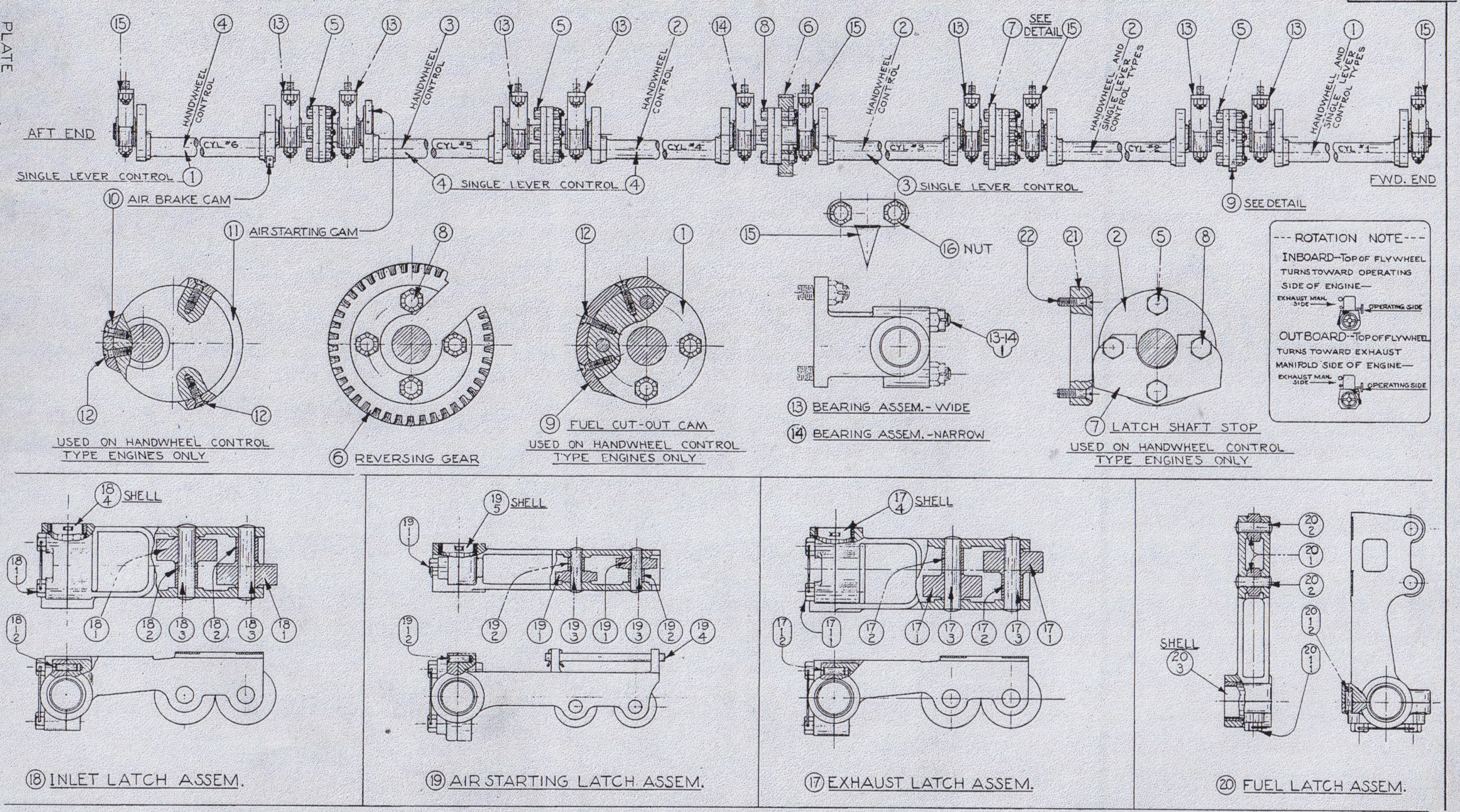
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

M NO. 240 10-39

PLATE
No. K-1536-(ED. 4)



DO NOT ORDER PARTS BY REF. NUMBERS

TYPED BY MED DATE 6-6-41 ISSUED BY ______ DATE ______ CHKD. ______ APRVD. ______

Retyped From 3-5-41 - Cranks for Cyl. 1 & 6 Consolidated into one Item

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L517

PLATE NO. K-1836 (ED 2)

ASSEM. DRWG. NO. K-1960

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME
1		1		F-2342	2	CRANK - Latch Shaft (Cyl. #1 Fwd. - #6 Aft)
2		2		F-6508	1	CRANK - Latch Shaft (Cyl. #2)
3		3		F-6535	1	CRANK - Latch Shaft (Cyl. #3)
4	F-2344	4		1692-062	2	CRANK - Latch Shaft (Cyl. #4-5)
5		5		C-3045	16	CAPSCREW - Latch Crank
6					16	CASTLE NUT -- 5/8-18-NF-Hex. - - (St.)
7					4	WIRE -- #16 Ga. x 16 Lg. - (St.)
8		6		C-9724	1	GEAR - Latch Shaft
9	C-2610	8		C-2610L2 5/8	4	BOLT - Gear & Latch Cranks
10					4	CASTLE NUT -- 5/8-18-NF-Hex. - - (St.)
11					1	WIRE -- #16 Ga. x 16 Lg. - (St.)
13	F-3698	13		X376	8	BEARING ASSEM. - Latch Shaft (Wide)
14	F-3699	14		X377	4	BEARING ASSEM. - Latch Shaft (Narrow)
15					12	CASTLE NUT -- 5/8-18-NF-Hex. - - (St.)
16					24	COTTER PIN -- 1/8 x 1 1/4 Lg. - (St.)
17		15		2C1891	1	POINTER - Latch Shaft
18		16		C-9321	2	NUT - Latch Shaft Brg. Cap (& Pointer)
21	F-3671	17		X345	6	LATCH ASSEM. - Exhaust
22	F-3672	18		X347	6	LATCH ASSEM. - Inlet
23	F-3673	19		X349	6	LATCH ASSEM. - Air Starting
24	F-3677	20		X357	6	LATCH ASSEM. - Fuel Spray Valve
25					24	WIRE -- #16 Ga. x 8 Lg. - (St.)

2L517

OPP. HAND SEE 2L1243

OPP. ROT. SEE

NAME LATCH SHAFT GROUP - - - - - - - - (INBOARD ROTATION)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

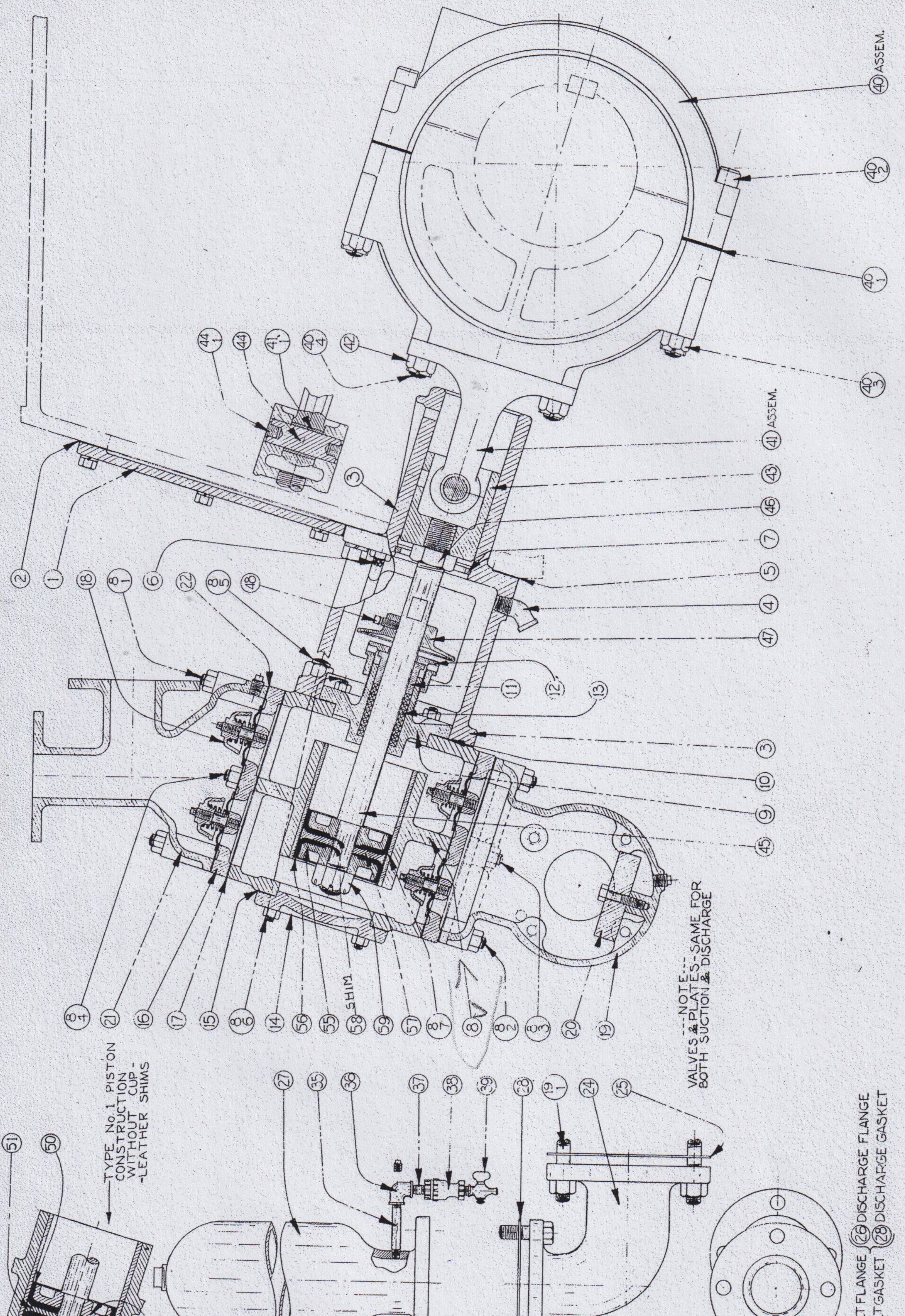


PLATE
No. K-1905-(ED-2)

DO NOT ORDER PARTS BY REF. NUMBERS

TO
TYPED BY MED DATE 3-6-41 ISSUED BY DATE -6-41 CHKD. APRVD. F.

CHANGES:
1 10-20-41 Line 28 Part No. Was PG 28
2 10-2-42 Line 3 Length of Capscrews was 1 1/4"
3 1-10-44 Line 36 Part No. was C-9391-P
Line 40 - Part No. was 2C50-P
#4 12-18-45 Line 3 & 4 was 1/2

2L525 SHEET 1 OF 2

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-1905 (ED 2)

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1		C-3274	1	COVER - Centerframe Pump Opening Top	
2		2		C-3275	1	GASKET - Cover to Centerframe	
3					8	CAPSCREW -- 5/8-11-NC x 1 1/4 Lg. - (St.)	
4					8	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
5		3		W-318	1	GUIDE - Water Pump Cross-head	
6		4			1	STREET ELL -- 1/2 - 45° Std. - (Brass)	
7		5		C-3244	1	GASKET - Guide to Centerframe	
8					7	CAPSCREW -- 3/4-10-NC x 2 Lg. - (St.)	
9					7	LOCKWASHER -- 3/4 SAE Reg. - - (St.)	
10	C-6633	6		C-6633L2	2	PIN - Guide to Centerframe Dowel	
11					2	HALF NUT -- 1/2-13-NC-Hex. - - (St.)	
12					2	COTTER PIN -- 1/16 x 1 Lg. - (St.)	
13		7		C-3245	1	RING - Water Pump Piston Rod Oil	
14	W-477	8	✓	X1372	1	BODY ASSEM. - Water Pump	
15					4	NUT -- 3/4-10-NC-Hex. - - (Brass)	
16		9		F-3761	1	BOX - Piston Rod Stuffing	
17		10		C-3269	1	GASKET - Stuffing Box to Body	
18					6	NUT -- 3/8-16-NC-Hex. - - (Brass)	
19		11		C-3247	1	GLAND - Piston Rod Packing	
20		12		S-3066	1	NUT - Piston Rod Packing Gland	
21		13			10	PACKING--5/16 Sq. x 5 Lg.-(Flax - Belmont #552)	
22		14		C-3268	1	COVER - Pump Body End	
23		15		C-3269	1	GASKET - Cover to Pump Body	
24					6	NUT -- 3/8-16-NC-Hex. - - (Brass)	
25		16		W-473	2	PLATE - Water Pump Valve	
26		17		F-4419	2	GASKET - Valve Plate to Pump Body	
27					4	NUT -- 1/2-13-NC-Hex. - - (Brass)	
28	2C150	18		2C150-P	12	VALVE - Water Pump Suction & Discharge	
29		19		X1373	1	COVER ASSEM. - Water Pump Body (Bottom)	
30		20		C-3258	1	BLOCK - Zinc	
31					1	CAPSCREW -- 3/8-16-NC x 1 1/2 Lg. - (Brass)	
32		21		W-474	1	COVER - Water Pump Body (Top)	
33		22		F-4418	2	GASKET - Top & Bottom Cover to Pump Body	
34					20	NUT -- 1/2-13-NC-Hex. - - (Brass)	
35					2	PIPE PLUG (Top & Bottom Cover)--1/4 Std.(Brass)	
36	2C3070	23		2C3070-P3	1	FLANGE - Water Pump Suction Pipe	
37	C-9392	24		C-9392-P	1	ELBOW - Pump Suction Air Chamber	
38		25		C-3448	2	GASKET - Flange & Elbow to Pump Body	
39					8	NUT -- 5/8-11-NC-Hex. - - (Brass)	
40	2C3070	26		2C3070-P2	1	FLANGE - Water Pump Discharge	
41		27		C-3276	2	CHAMBER - Air - (Pump Suct. & Disch.)	
42					2	PIPE PLUG -- 1 Std. - (Brass)	
43					1	PIPE PLUG(Suct. Chamber)--1/8 Std.-(Brass)	
44	C-9393	28		C-9393-P	3	GASKET - Air Chamber & Discharge Flange	
45					12	CAPSCREW -- 5/8-11-NC x 2 Lg. - (Brass)	
46					12	NUT -- 5/8-11-NC-Hex. - - (Brass)	
47							
48							
49							
50							

---- CONTINUED ON SHEET NO. 2 ----

2L525 OF 2

FOR OPP. HAND SEE 2L526
FOR OPP. ROT. SEE

NAME CIRCULATING WATER PUMP GROUP
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 240 10-39

TO 4-25-41 Added Line 29

TYPED BY MED DATE 3-6-41 ISSUED BY DATE CHKD. APRVD. ✓

CHANGES

2L525 SHEET 2 OF 2

PLATE NO. K-1905 (ED 2)

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
					------ CONTINUED FROM SHEET NO. 1 -----	
	35			1	NIPPLE (Snift. Valve) -- 1/8 x 2 1/2 Lg.-(Brass	
	36			1	ELBOW (Snift. Valve) -- 1/8 Std. - (Brass)	
	37			1	CLOSE NIPPLE -- 1/8 Std. - - (Brass)	
C-9066	38		C-9066-P 1/8	1	VALVE - Vertical Check	
C-9045	39		C-9045-P 1/8	1	COCK - Air	
F-3757	40		X531	1	STRAP ASSEM. - Water Pump Eccentric	
	41		X544	1	ROD ASSEM. - Water Pump Connecting	
	42			2	CASTLE NUT -- 3/4-16-NF-Hex. - - (St.)	
				2	COTTER PIN -- 1/8 x 1 1/4 Lg. - (St.)	
	43		F-3760	1	CROSS-HEAD - Water Pump	
	44		X545	1	PIN ASSEM. - Water Pump Cross-head	
	45		C-3266	1	ROD - Water Pump Piston	
	46			1	HALF NUT(Piston Rod Lock)--1 1/4-7-NC-Hex.-(St.	
	47		C-3246	1	GUARD - Piston Rod Splash	
	48			1	SETSCREW -- 3/8-16-NC x 7/8 Lg. - Sq. Hd. - Cup Point - (St.)	
	55		2C2120	2	PISTON - Water Pump	
	56		2C2121	2	CUP-LEATHER - Water Pump Piston	
	57		C-3265	1	SPACER - Piston Cup-Leather	
	58		2C2122	10	WASHER - Piston Cup-Leather Spacer	
	59		C-3267	1	NUT - Water Pump Piston Retainer	
				1	COTTER PIN -- 1/8 x 1 3/4 Lg. - (Bronze)	

FOR OPP. HAND SEE 2L526

FOR OPP. ROT. SEE

NAME CIRCULATING WATER PUMP GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 240 10-39

2L525 2 OF 2

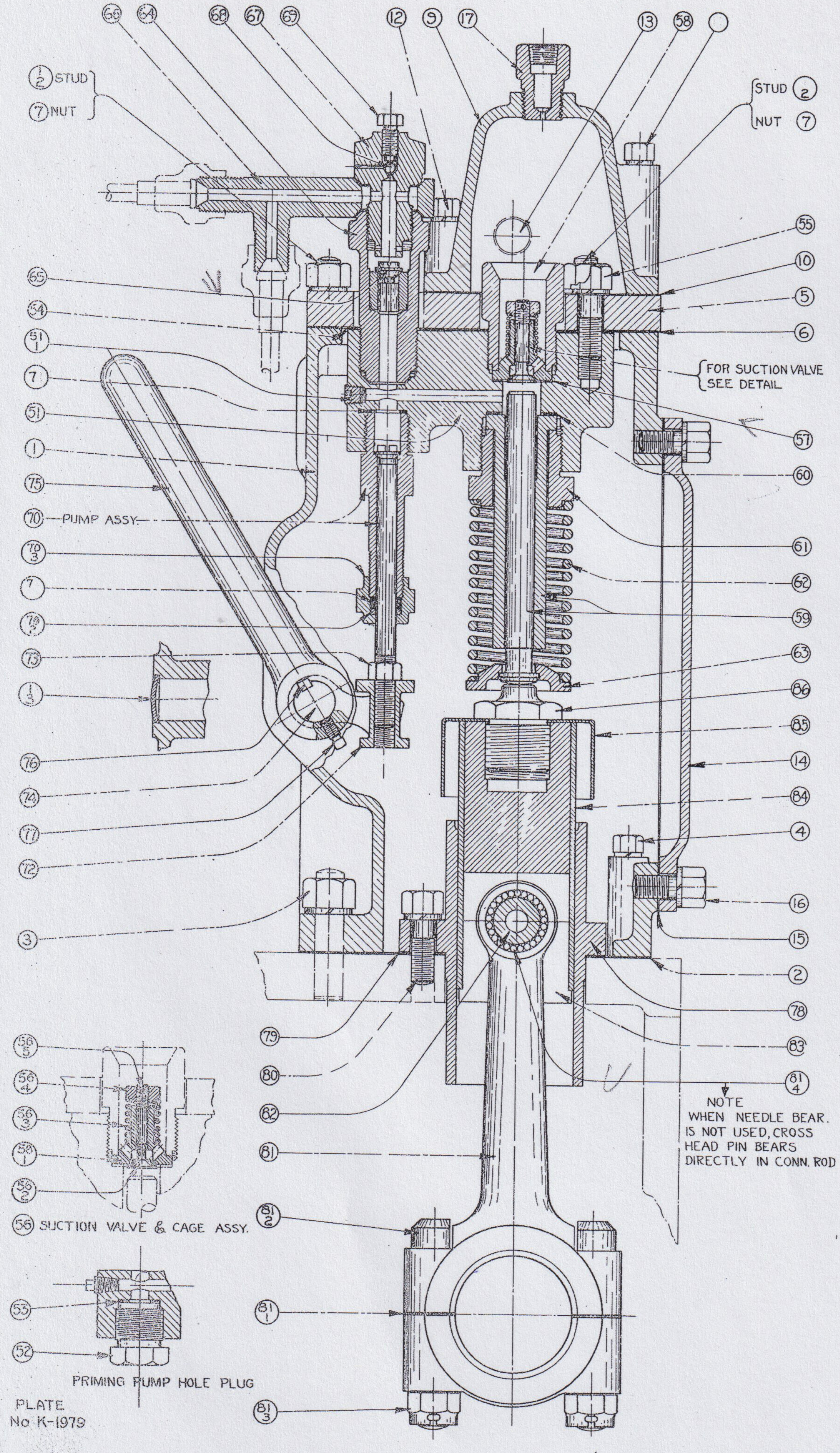


PLATE
No K-1979

EXTRA COPIES TO | TYPED BY EJC | DATE 5/4/52 | CHKD | BY | DATE

...ped from copy dated 12/31/48. No changes.
#3

CHANGES

2L 37

PLATE NO. K-1979

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

DRWG. NO.	REF. NO.	PART NO	NO REQ'D	PART NAME	ASSEM. DRWG. NO.
2C1228	1	X2787	1	HOUSING ASSEM. - Fuel Pump	
	2	2C1226	1	GASKET - Housing to Centerframe	
			2	CAPSCREW - 5/8-11-NC x 2 Lg. (St.)	
			2	CAPSCREW - 5/8-11-NC x 4 Lg. (St.)	
			4	LOCKWASHER - 5/8 SAE Reg. (St.)	
			1	CAPSCREW - 1/2-13-NC x 2 3/4 Lg. (St.)	
			1	LOCKWASHER - 1/2 SAE Reg. (St.)	
	5	F-6108	1	PLATE - Fuel Pump Mounting	
	6	2C1209	1	GASKET - Mounting Plate to Housing	
			1	PIPE PLUG - 1/4 Std. (C.I.)	
			6	NUT - 1/2-13-NC-Hex. (St.)	
			6	LOCKWASHER - 1/2 SAE Reg. -(St.)	
	9	W-1492	1	COVER - Fuel Pump Mtg. Plate Top	
	10	2C1207	1	GASKET - Cover to Mounting Plate	
			2	CAPSCREW - 3/8-16-NC x 3 1/4 Lg. (St.)	
			4	CAPSCREW - 3/8-16-NC x 2 Lg. (St.)	
		C-5919	6	GASKET - Capscrew	
			1	PIPE PLUG - 1/2 Std. (C't's'k. Hd. (C.I.)	
	17	C-9512	1	PLUG - Mtg. Plate cover By-Pass	
	14	2C1227	1	COVER - Fuel Pump Housing Side	
	15	2C1208	1	GASKET - Cover to Housing	
			4	CAPSCREW - 1/2-13-NC x 1 Lg. (St.)	
			4	LOCKWASHER - 1/2 SAE Reg. (St.)	

2L 37

SP. HAND SEE

OPP. ROT. SEE

NAME H.P.FUEL PUMP HOUSING & COVERS GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

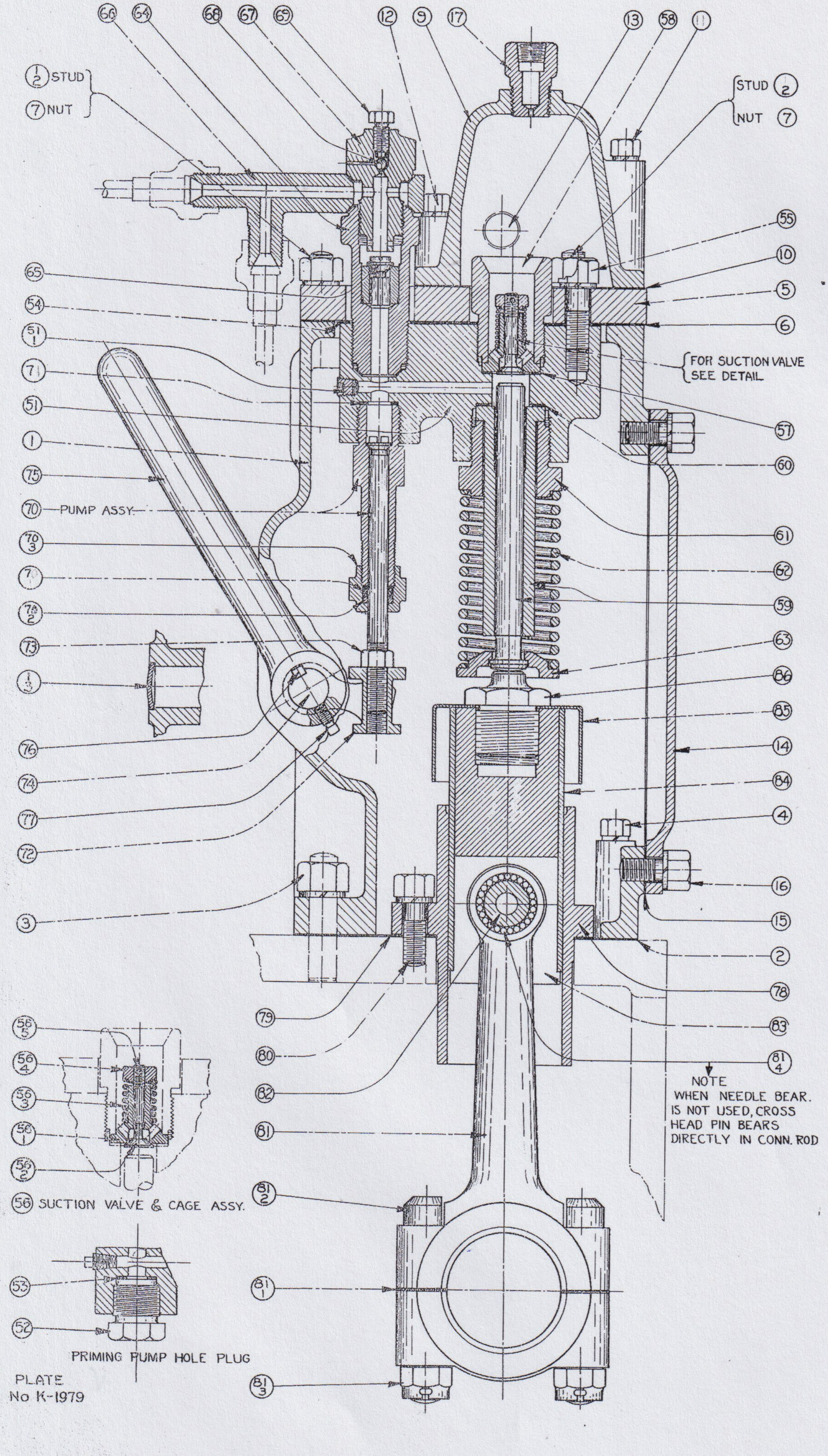


PLATE
No K-1979

COPIES TO ______ EJC DATE 3/4/52 CHKD ______ BY ______ DATE ______

typed from copy dated 3/4/52. No changes.
#2

CHANGES

2L 534

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-1979

DRWG. NO.	REF. NO.	PART NO.	NO. REQ'D.	PART NAME	ASSEM. DRWG. NO.
	51	X3251	2	HEAD ASSEMBLY - H.P. Fuel Pump	
	52	2C2160	1	PLUG - Pump Head (Priming Pump Hole)	
	53	2C2119	1	GASKET - Plug to Head	
	54	C-8109	2	GASKET - Head to Mtg. Plate	
	55		10	CAPSCREW - 1/2-20-NF x 1 1/2 Lg. (St.)	
			10	LOCKWASHER - 1/2 SAE Reg. - (St.)	
C-8098	56	X2163	2	VALVE ASSEM. - Fuel Pump Suction	
	57	C-8116	2	GASKET - Suct. Valve to Pump Head	
	58	C-8118	2	RETAINER - Pump Suction Valve	
C-8122	59	X2164	2	PUMP ASSEMBLY - H.P.Fuel	
	60	C-8117	2	GASKET - Pump Body to Head	
	61	C-8119	2	NUT - Pump Body to Head	
	62	C-8124	2	SPRING - Fuel Pump Plunger	
	63	C-8123	2	RETAINER - Pump Plunger Spring	
2C1225	64	X2789	2	CAGE ASSEM. - Fuel Pump Discharge Valve	
	65	C-9225	2	VALVE - Fuel Pump Discharge	
	66	2C1222	2	TEE - Fuel Pump Discharge	
	67	2C1223	2	PLUG - Discharge Tee Retainer & Bleeder	
	68		2	STEEL BALL - 1/4 Dia. Std. (St.)	
	69	C-6073	2	PLUG - Discharge Valve Bleeder	
	70	X3227	1	PUMP ASSEM. - Fuel Priming	
	71	2C2119	1	GASKET - Priming Pump to Head	
C-7546	72	1279-BXB3	1	COLLAR - Priming Pump Plunger	
	73		1	NUT - 7/16-20-NF-Hex. (St.)	
	74	C-8088	1	SHAFT - Priming Pump Lever	
	75	F-6144	1	LEVER - Priming Pump	
S-3137	76	5127	1	KEY - Lever to Shaft	
	77		1	SETSCREW - 1/4-20-NC x 1/2 Lg. (Sq.Hd.-Cup Pt.(St.)	
	78	C-8084	2	GUIDE - Fuel Pump Cross head	
	79	C-8108	2	GASKET - Guide to Centerframe	
	80		6	CAPSCREW - 1/2-13-NC x 1 1/2 Lg. (St.)	
			6	LOCKWASHER - 1/2 SAE Reg. (St.)	
F-6103	81	X2790	2	ROD ASSEMBLY - Fuel Pump Connect.	
	82	2C1188	2	PIN - Connect. Rod & Crosshead	
	83	2C1187	2	CROSSHEAD - Fuel Pump	
C-553	84	831C-RB3	2	SLEEVE - Fuel Pump Crosshead	
S-878	85	831D-RB31	2	GUARD - Crosshead Oil	
	86	C-8126	2	PLUG - Fuel Pump Crosshead	

2L 534

PP. HAND SEE

PP. ROT. SEE

NAME HIGH PRESSURE FUEL PUMP GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

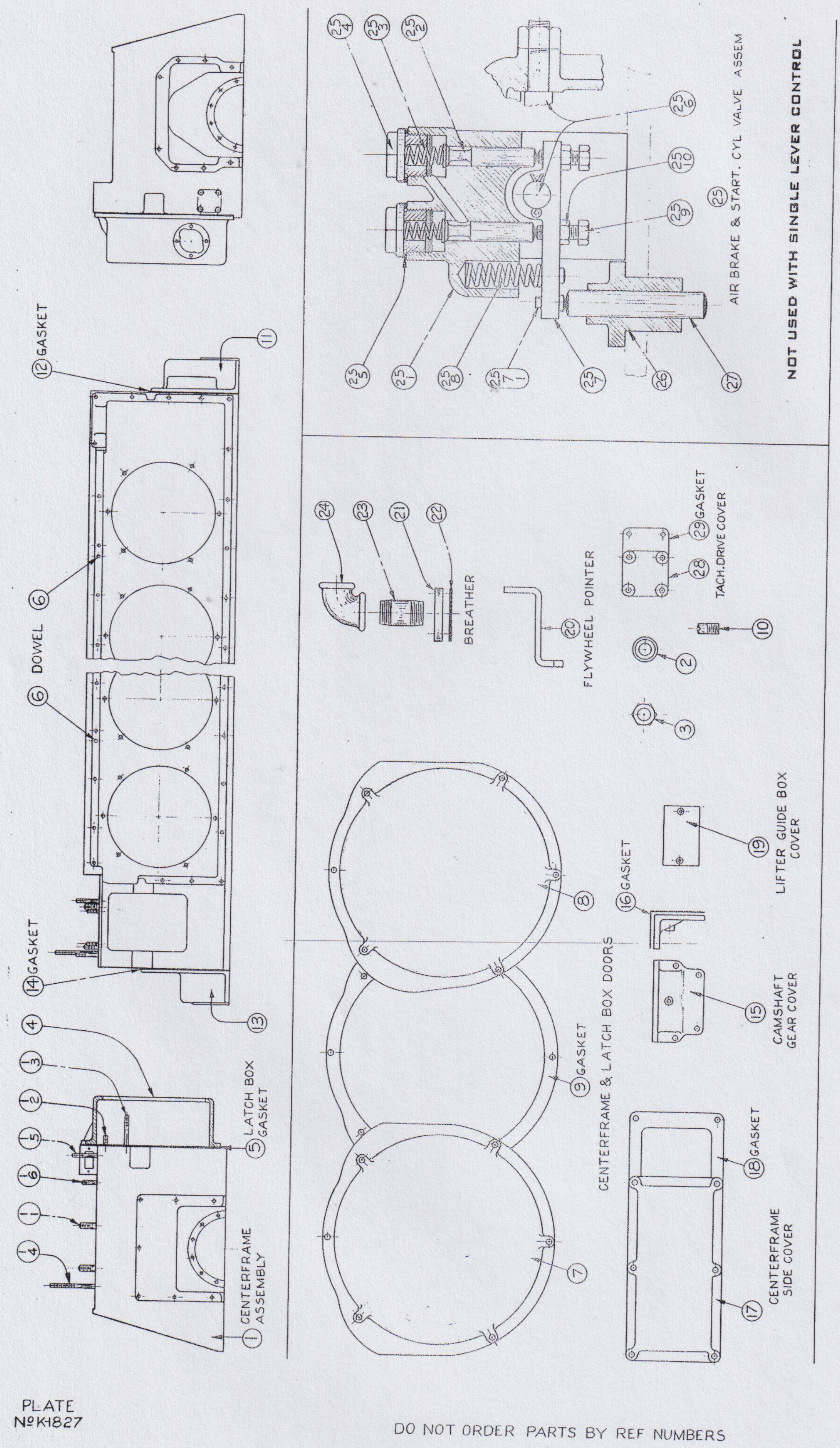


PLATE
Nº K-1827

DO NOT ORDER PARTS BY REF NUMBERS

TO ___ TYPED BY MED DATE 4-17-41 ISSUED BY ___ DATE ___ CHKD. ___ APRVD. ___

CHANGES:
5-28-41 Line 8 Part No. Was S-975
9-4-41 Line 9 Drg. No. Was 2696
1-7-42 Lines 9 & 10 No. Req'd. Was 11 & 1 Resp.
2-1-43 Removed Part No. F-3881 - Added Lines 44-45-46

2L577

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-1827

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1		X2780	1	CENTERFRAME ASSEMBLY	
2		2		S-2707	4	WASHER - Base to Centerframe Stud	
3		3			4	NUT -- 1 1/4-7-NC-Hex. - (St.)	
4		4		K-1959	1	BOX - Latch	
5							
6					39	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
7					39	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
8		6			2	TAPER PIN (Dowel) -- #7 x 1 Lg. - (St.)	
9	F-6578	7		692-03	10	DOOR - Centerframe & Latch Box (Round)	
10		8		C-1074	2	DOOR - Centerframe (Round) (Exh. Side - Ends)	
11	S-1126	9		692A-03	12	GASKET - Round Door to Centerframe & Latch Box	
12					60	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
13		10		S-3183	12	PIN - Dowel (Round Door)	
14		11		W-3	1	COVER - Centerframe Fwd. End (& Crank. Brg.)	
15		12		W-9	1	GASKET - Cover to Centerframe & Base	
16		13		W-7	1	COVER - Centerframe Aft. End (& Crank. Brg.)	
17		14		W-10	1	GASKET - Cover to Centerframe & Base	
18					24	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
19					24	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
20		15		F-3762	1	COVER - Camshaft Gear	
21		16		C-3249	1	GASKET - Cover to Centerframe	
22					6	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
23					6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
24	F-2954	17		696-03	1	COVER - Centerframe Side (Ex. Side - Fwd.)	
25		18		F-2955	1	GASKET - Cover to Centerframe	
26					6	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
27					6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
28		19		C-9155	1	COVER - Centerframe End (Lifter Guide Box)	
29					2	MACHINE SCREW--5/16-18 x 5/8 Lg.-Flat Hd.-(St.)	
30		20		2C1288	1	POINTER - Flywheel	
31					2	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
32					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
33	C-460	21		779	1	FLANGE - Breather Pipe	
34		22		S-2336	1	GASKET - Flange to Centerframe	
35					2	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
36					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
37		23			1	NIPPLE -- 2 x 6 Lg. - (W.I.)	
38		24			1	ELBOW -- 2 Std. - (M.I.)	
39		28		C-8979	1	COVER - Tachometer Drive Hole	
40		29		C-7527	1	GASKET - Tachometer Drive Hole Cover	
41					4	CAPSCREW -- 3/8-16-NC x 7/8 Lg. - (St.)	
42					4	LOCKWASHER -- 3/8 SAE Reg. - (St.)	
43							
44		5A		F-6928	1	GASKET - Latch Box (Aft End Sect.)	
45		5B		F-6929	1	GASKET - Latch Box (Gov. End Sect.)	
46		5C		F-6930	2	GASKET-Latch Box (Upper & Lower Horizontal	
47						Strips)	
48							
49							
50							

FOR OPP. HAND SEE 2L1242
FOR OPP. ROT. SEE

NAME CENTERFRAME & COVERS GROUP - - - - - (SINGLE LEVER CONTROL)
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 2-3 10-39

RA
S TO — TYPED BY GB — DATE 12-21-43 — CHKD [illegible] — DATE 1-27-44 — ISSUED BY [illegible] — APRVD.

Retyped from 2-19-43(no changes)
3 10-24-44 No. of Sheets Was 2

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L580 SHEET 1 OF 3

PLATE NO.

ASSEM. DRWG. NO. A-238 --W-1506

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
1					---- Base to Sump Pump (Suct. Line) ----
2				1	STREET ELL -- 1 Std. - (M.I.)
3				1	NIPPLE -- 1 x 2 1/2 Lg. - (W.I.)
4	2C160		2C160-P1	1	UNION ELBOW
5				1	PIPE -- 1 x 17 Lg.(Thr'd. 2 Ends)-(W.I.)
6	2C160		2C160-P1	1	UNION ELBOW
7				1	NIPPLE -- 1 x 4 1/2 Lg. - (W.I.)
8				1	TEE -- 1 Std. - (M.I.)
9				1	PIPE PLUG -- 1 Std. - (C.I.)
10				1	CLOSE NIPPLE -- 1 Std. - (W.I.)
11					---- Press. Pump to Four Way Cock (At Cooler)----
12				1	CLOSE NIPPLE -- 1 Std. - (W.I.)
13				1	ELBOW -- 1 Std. - 45° - (M.I.)
14				1	NIPPLE -- 1 x 2 1/2 Lg. - (W.I.)
15	2C165		2C165-P1	1	UNION TEE
16				1	PIPE PLUG -- 1 Std. - (C.I.)
17				1	PIPE -- 1 x 38 Lg.(Thr'd. 2 Ends)-(W.I.)
18				1	TEE -- 1 1/4 x 3/4 x 1 Std. Reducing - (M.I.)
19				1	CLOSE NIPPLE -- 3/4 Std. - (W.I.)
20				1	TEE -- 3/4 x 3/4 x 1/2 Std. Reducing - (M.I.)
21				1	CLOSE NIPPLE -- 3/4 Std. - (W.I.)
22			PG21L 3/4	1	RELIEF VALVE
23				1	PIPE -- 1 1/4 x 22 Lg.(Thr'd. 2 Ends) -(W.I.)
24	2C160		2C160-P1 1/4	1	UNION ELBOW
25				1	CLOSE NIPPLE -- 1 1/4 Std. - (W.I.)
26	C-9055		C-9055-P1 1/2	1	COCK - Four Way
27				4	REDUCING BUSHING -- 1 1/2 x 1 1/4 Std.-(C.I.)
28					---- Four Way Cock to Man. Connect. at Base ----
29				1	CLOSE NIPPLE -- 1 1/4 Std. - (W.I.)
30	2C160		2C160-P1 1/4	1	UNION ELBOW
31				1	NIPPLE -- 1 1/4 x 4 Lg. - (W.I.)
32				1	ELBOW -- 1 1/4 Std. - (M.I.)
33				1	PIPE -- 1 1/4 x 48 Lg.(Thr'd. 2 Ends)-(W.I.)
34	2C160		2C160-P1 1/4	1	UNION ELBOW
35				1	PIPE--1 1/4 x 34 1/2 Lg.-(Thr'ds 2 Ends)(W.I.)
36				1	STREET ELL -- 1 1/4 Std. -(M.I.)
37	2C160		2C160-P1 1/4	1	UNION ELBOW
38					---- Four Way Cock to Cooler (Cool. In.) ----
39				1	PIPE -- 1 1/4 x 18 Lg.-(Thr'ds. 2 Ends)-(W.I.)
40				1	ELBOW -- 1 1/4 Std.-(M.I.)
41				1	NIPPLE -- 1 1/4 x 2 1/2 Lg.-(W.I.)
42	2C160		2C160-P1 1/4	1	UNION ELBOW
43				1	CLOSE NIPPLE -- 1 1/4 Std. (W.I.)
44				1	REDUCING BUSHING--1 1/2 x 1 1/4 Std.(C.I.)
45					---- Four Way Cock to Cooler (Cool. Out.) ----
46				1	CLOSE NIPPLE -- 1 1/4 Std. - (W.I.)
47	2C160		2C160-P1 1/4	1	UNION ELBOW
48				1	CLOSE NIPPLE -- 1 1/4 Std. - (W.I.)
49				1	REDUCING BUSHING -- 1 1/2 x 1 1/4 Std. (C.I.)
50					---- CONTINUED ON SHEET NO. 2 ----

2L580 SHEET 1 OF 3

OPP. HAND SEE

NAME LUBE OIL PIPING GROUP

OPP. ROT. SEE

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

240 REV. 5-42 1M TRANS. 1M BOND

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. — MATTOON, ILL.

TRA...ES TO | TYPED BY BW | DATE 10-24-44 | CHKD. [illegible] | DATE 10-24-44 | ISSUED BY [illegible] | APRVD.

73 Revised and Retyped from 12-11-43
74 4-22-49 Line 24 was PG42

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. **2L580** SHEET 2 OF 3

ASSEM. DRWG. NO. A-238 -- W-1506

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
1					---- CONTINUED FROM SHEET NO. 1 ----
3					---- Lube Man. Inlet Pipe to Fwd. Cam Brg. ----
4	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
5				1	TUBE -- 1/4 O.D. x .030 x 120 Lg.-(S.D. Cop.)
6	C-9809		C-9809-P 1/4	1	TEE - Tube
7				1	TUBE -- 1/4 O.D. x .030 x 13 Lg.-(S.D. Cop.)
8	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
9					---- Cam. Brg. Line Tee to Gov. Body ----
10				1	TUBE -- 1/4 O.D. x .030 x 17 Lg.-(S.D. Cop.)
11	C-9804		C-9804-P 1/4	1	ELBOW - Tube
12	C-9832		C-9832-P 1/4	1	ELBOW - Tube
13				1	TUBE -- 1/4 O.D. x .030 x 12 Lg.-(S.D. Cop.)
14	C-9830		C-9830-P 1/4	1	CONNECTOR - Tube
15					---- Lube Man. Inlet Pipe to Press. Gage ----
16	C-9804		C-9804-P 1/4	1	ELBOW - Tube
17				1	TUBE -- 1/4 O.D. x .030 x 60 Lg.-(S.D. Cop.)
18	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
19					---- Reduc. Tee to Relief Valve to Filter ----
20	C-9801		C-9801-P 5/8	1	CONNECTOR - Tube
21				1	TUBE -- 5/8 O.D. x .049 x 42 Lg. - (H.D. Cop.)
22	C-9801		C-9801-P 5/8	1	CONNECTOR - Tube
23				1	REDUCING BUSHING -- 1 x 1/2 Std.-(C.I.)
24			3A1872	1	OIL FILTER
25				2	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)
26				2	LOCKWASHER -- 1/2 SAE Reg. - (St.)
27					---- Filter to Camshaft Aft Brg. ----
28				1	REDUCING BUSHING -- 1 x 3/8 Std. - (C.I.)
29	C-9804		C-9804-P 1/2	1	ELBOW - Tube
30				1	TUBE -- 1/2 O.D. x .049 x 11 Lg.-(H.D.Cop.)
31	C-9801		C-9801-P 1/2	1	CONNECTOR - Tube
32				1	TEE -- 3/8 Std. -- (M.I.)
33				1	REDUCING BUSHING -- 3/8 x 1/8 Std. - (C.I.)
34	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
35				1	TUBE -- 1/4 O.D. x .030 x 29 Lg.-(S.D. Cop.)
36	C-9804		C-9804-P 1/4	1	ELBOW - Tube
37					---- Pipe Tee to Transfer Pump Bearing ----
38				1	REDUCING BUSHING -- 3/8 x 1/8 Std. -- (C.I.)
39	C-9808		C-9808-P 1/4	1	TEE - Tube
40				1	TUBE -- 1/4 O.D. x .030 x 4 Lg. - (S.D. Cop.)
41	C-9808		C-9808-P 1/4	1	TEE - Tube
42				1	COUPLING -- 1/8 Std. Pipe -- (M.I.)
43				1	CLOSE NIPPLE -- 1/8 Std. -- (W.I.)
48					---- CONTINUED ON SHEET NO. 3 ----

2L580 2 OF 3

OR OPP. HAND SEE

OR OPP. ROT. SEE

NAME LUBE OIL PIPING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

M 240 REV. 12-43 1M TRANS.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

XTRA COPIES TO ______ TYPED BY BW DATE 10-24-44 CHKD. MEO DATE 10-24-44 ISSUED BY [signature] APRVD. ______

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. **2L580** SHEET 3 OF 3

ASSEM. DRWG. NO. A-238 -- W-1506

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME
1					---- CONTINUED FROM SHEET NO. 2 ----
2					
3	---- Tube Tee at Trans. Pump to Pump Housing and Press. Pump ----				
4				1	TUBE -- 1/4 O.D. x .030 x 5 Lg. -- (S.D.Cop.)
5	C-9808		C-9808-P 1/4	1	TEE - Tube
6				1	TUBE(To Press.Pump-Outside)-1/4 O.D. x .030
7					x 8 Lg. -- (S.D. Cop.)
8	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
9			---- Bottom of Pump Housing (Inside) to Sump Pump ----		
10	C-9808		C-9808-P 1/4	1	TEE - Tube
11				1	TUBE -- 1/4 O.D. x .030 x 12 Lg. -- (S.D. Cop.)
12	C-9804		C-9804-P 1/4	1	ELBOW - Tube
13			---- Tube Tee to Press. Pump Bearing (Inside) ----		
14				1	TUBE -- 1/4 O.D. x .030 x 7 Lg. -- (S.D. Cop.)
15	C-9801		C-9801-P 1/4	1	CONNECTOR - Tube
16	---- Tube Tee (at 3/8 Pipe Tee) to Fuel Pump Crank Bearing ----				
17				1	TUBE -- 3/8 O.D. x .030 x 8 Lg. -- (S.D. Cop.)
18	C-9804		C-9804-P 1/4	1	ELBOW - Tube

2L580 3 of 3

FOR OPP. HAND SEE ______

FOR OPP. ROT. SEE ______

NAME LUBE OIL PIPING GROUP

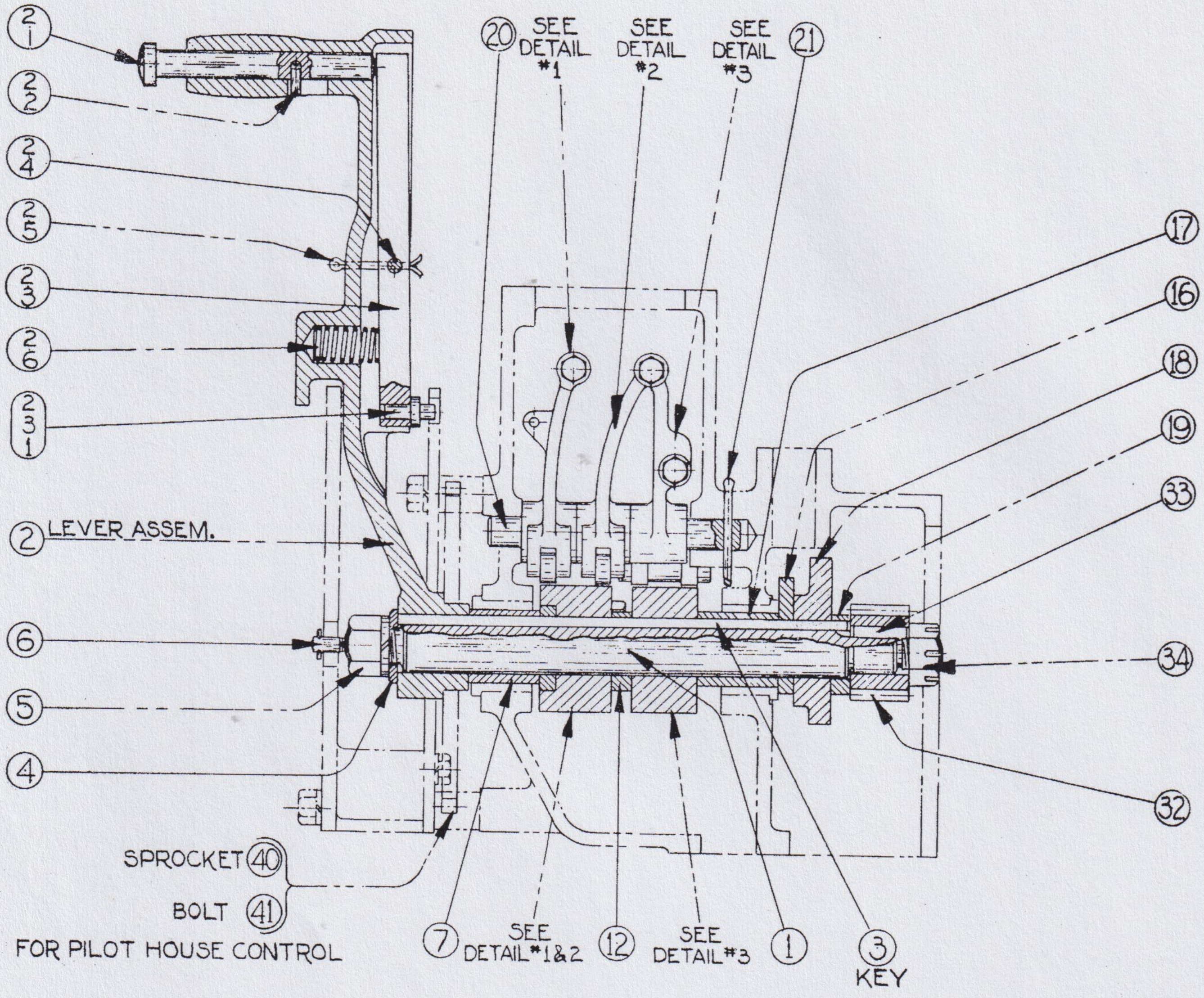
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

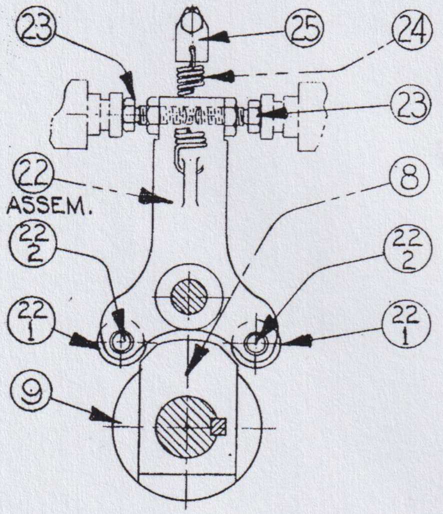
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV. 12-43 IN TRANS.

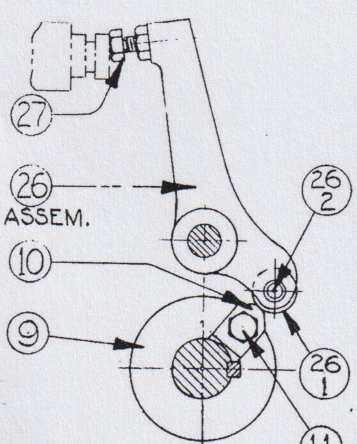
PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

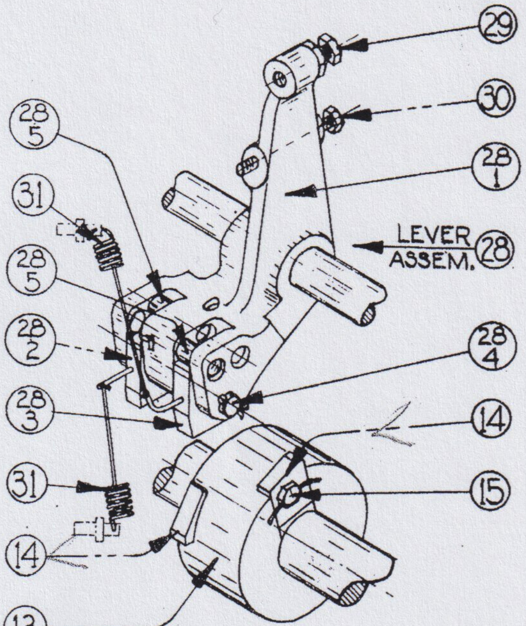




AIR CYL. CONTROL
DETAIL No.1



FLY. BRAKE CONTROL
DETAIL No.2



AIR START. VALVE CONTROL
DETAIL No.3

PLATE
No. W-1858

DO NOT ORDER PARTS BY REF. No.

TRA...
...ES TO

TYPED BY MED DATE 5-12-41 ISSUED BY [initials] DATE 5-12-41 CHKD. [initials] APRVD.

#1 1-20-42 Added Lines 46 to 49 Incl.
#2 6-12-46 Line 7 Added Part No.
#3 1/4/52 Line 7 removed Part No.

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L601

PLATE NO. W-1858

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1		F-6548	1	SHAFT - Engine Control Lever & Cam	
2	F-6507	2		X3268	1	LEVER ASSEM. - Engine Control Hand	
3	C-6706	3		C-6706L10 1/4	1	KEY - Lever & Cams to Shaft	
4		4		S-3205	1	WASHER - Hand Lever Retainer	
5		5			1	NUT -- 3/4-10-NC-Hex. - - (St.)	
6					1	LOCKWASHER -- 3/4 SAE Reg. - - (St.)	
7		6			1	ALEMITE FITTING #A-336	
8		7		2C2238	1	SPACER - Hand Lever to Air Cyl. Cam	
9		8		2C2239	1	CAM - Air Cylinder Control	
10		9		2C2212	1	HUB - Air Brake Cam	
11		10		2C2241	1	TOE - Air Brake Cam	
12	C-2406	11		C-2406L 3/4	1	CAPSCREW - Toe to Hub	
13					1	WIRE -- #16 Ga. x 6 Lg. - (St.)	
14		12		2C2265	1	SPACER - Air Cyl. Cam to Air Start. Cam	
15		13		2C2213	1	HUB - Air Starting Cam	
16		14		2C2242	2	TOE - Air Starting Cam	
17	C-2406	15		C-2406L 3/4	2	CAPSCREW - Toe to Hub	
18					2	WIRE -- #16 Ga. x 6 Lg. - (St.)	
19		17		2C2264	1	SPACER - Air Start. Cam to Fuel Cut-out Cam	
20		16		2C2240	1	CAM - Fuel Cut-out	
21		18		2C2191	1	CAM - Governor Control	
22		19		2C2265	1	SPACER - Gov. Control Cam to Gear	
23							
24		20		2C2210	1	SHAFT - Air Valve Control Lever	
25		21			1	COTTER PIN -- 1/4 x 2 1/4 Lg. - (St.)	
26	F-6497	22		X3271	1	LEVER ASSEM. - Air Cyl. Control	
27	2C2197	23		2C2197L1	2	SCREW - Lever Adjusting	
28					2	HALF NUT -- 3/8-16-NC-Hex. - (St.)	
29		24		2C2279	1	SPRING - Air Cyl. Control Lever	
30		25		2C2280	1	CLIP - Spring Anchor	
31					1	CAPSCREW -- 1/4-20-NC x 1/2 Lg. - (St.)	
32	F-6504	26		X3272	1	LEVER ASSEM. - Air Brake Control	
33	2C2197	27		2C2197L1	1	SCREW - Lever Adjusting	
34					1	HALF NUT -- 3/8-16-NC-Hex. - - (St.)	
35	F-6546	28		X3273	1	LEVER ASSEM. - Air Start. Valve Control	
36	2C2197	29		2C2197L1	1	SCREW - Lever Adjusting	
37	2C2197	30		2C2197L2 1/2	1	SCREW - Lever Stop	
38					2	HALF NUT -- 3/8-16-NC-Hex. - (St.)	
39		31		2C2340	2	SPRING - Air Start. Valve Lever	
40							
41		32		2C2231	1	GEAR - Latch Shaft Interlock Drive	
42	C-7104	33		C-7104L1 1/4	1	KEY - Gear to Shaft	
43		34			1	SLOTTED NUT -- 3/4-10-NC-Hex. - (St.)	
44					1	COTTER PIN -- 1/8 x 1 1/2 Lg. - (St.)	
45							
46		40		F-6545	1	SPROCKET - Remote Control	
47	C-2708	41		C-2708L2 1/4	2	BOLT - Sprocket to Hand Lever	
48					2	NUT -- 1/2-13-NC-Hex. - - (St.)	
49					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
50							

2L601

FOR OPP. HAND SEE 2L1246
FOR OPP. ROT. SEE

NAME ENGINE CONTROL GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 2-0 10-39

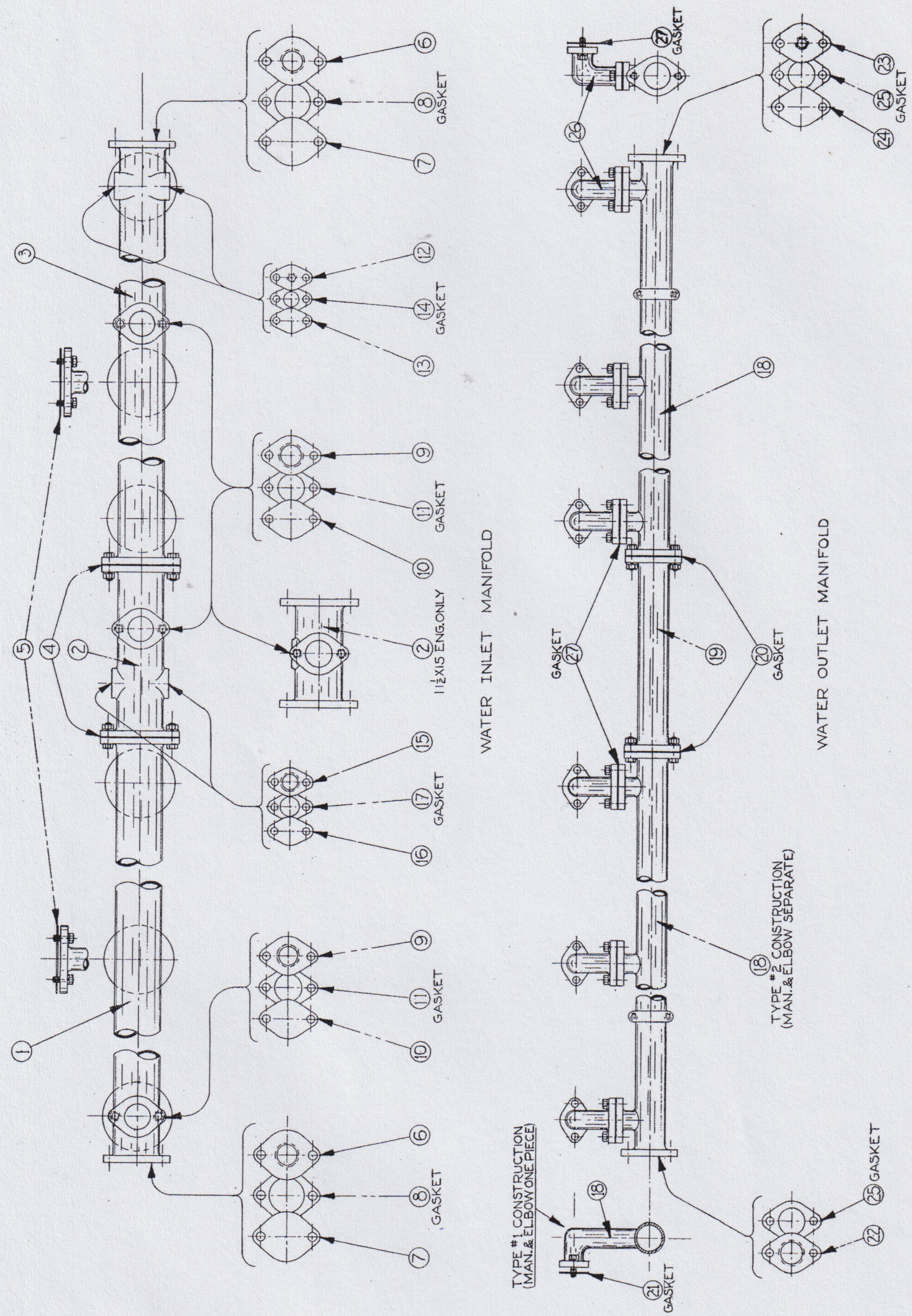


PLATE
No. K-1924-(ED. 2)

DO NOT ORDER PARTS BY REF. NUMBERS

XTRA
ES TO

TYPED BY MED DATE 6-17-41 ISSUED BY DATE CHKD. APRVD. 5

CHANGES

2L623

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-1924 (ED 2)

DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
	1		F-2995	1	MANIFOLD - Water Inlet (Fwd. Sect.)	
C-424	2		783-06	1	MANIFOLD - Water Inlet (Center Sect.)	
	3		F-2996	1	MANIFOLD - Water Inlet (Aft Sect.)	
	4		C-443	2	GASKET - Center to End Section	
				4	CAPSCREW -- 5/8-11-NC x 2 1/4 Lg. - (St.)	
				4	NUT -- 5/8-11-NC-Hex. - - (St.)	
				4	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
S-1619	5		605A-N	6	GASKET - Manifold to Cylinder	
				24	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
				24	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
	6		2C2062	2	FLANGE - Man. End - (Bilge &Circ. Pump Pipes)	
	8		S-924	2	GASKET - Flange to Manifold	
				4	CAPSCREW -- 5/8-11-NC x 1 1/2 Lg. - (St.)	
				4	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
C-5135	9		787-B	1	FLANGE - Manifold Water Inlet (Center)	
C-1118	10		787	2	FLANGE - Manifold Water Inlet (Blind)	
	11		S-1005	3	GASKET - Flange to Manifold	
				6	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
				6	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
	12		C-1051	1	FLANGE - Air Comp. Pipe	
C-3419	13		784	1	FLANGE - Air Comp. Pipe (Blind)	
	14		S-994	2	GASKET - Flange to Manifold	
				4	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
				4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
C-817	15		785-B	1	FLANGE - Spray Valve Cooling Pipe	
C-488	16		785	1	FLANGE - Spray Valve Cooling Pipe (Blind)	
	17		S-2334	2	GASKET - Flange to Manifold	
				4	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
				4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
	18		F-6562	2	MANIFOLD - Water Outlet (End Sect.)	
	19		2C2395	1	MANIFOLD - Water Outlet (Center Sect.)	
	20		S-1005	2	GASKET - Center to End Section	
				4	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
				4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
C-5135	22		787-B	1	FLANGE - Manifold Outlet Pipe	
	23		C-5268	1	FLANGE - Man. End - (Air Comp. Pipe)	
	25		S-1005	2	GASKET - Flange to Manifold	
				4	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
				4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
	26		2C2396	6	ELBOW - Cyl. Head Out. to Manifold	
	27		S-2334	12	GASKET - Elbow to Head & Manifold	
				24	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
				24	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	

2L623

OPP. HAND SEE

OPP. ROT. SEE

NAME WATER MANIFOLD GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

M. NO. 240

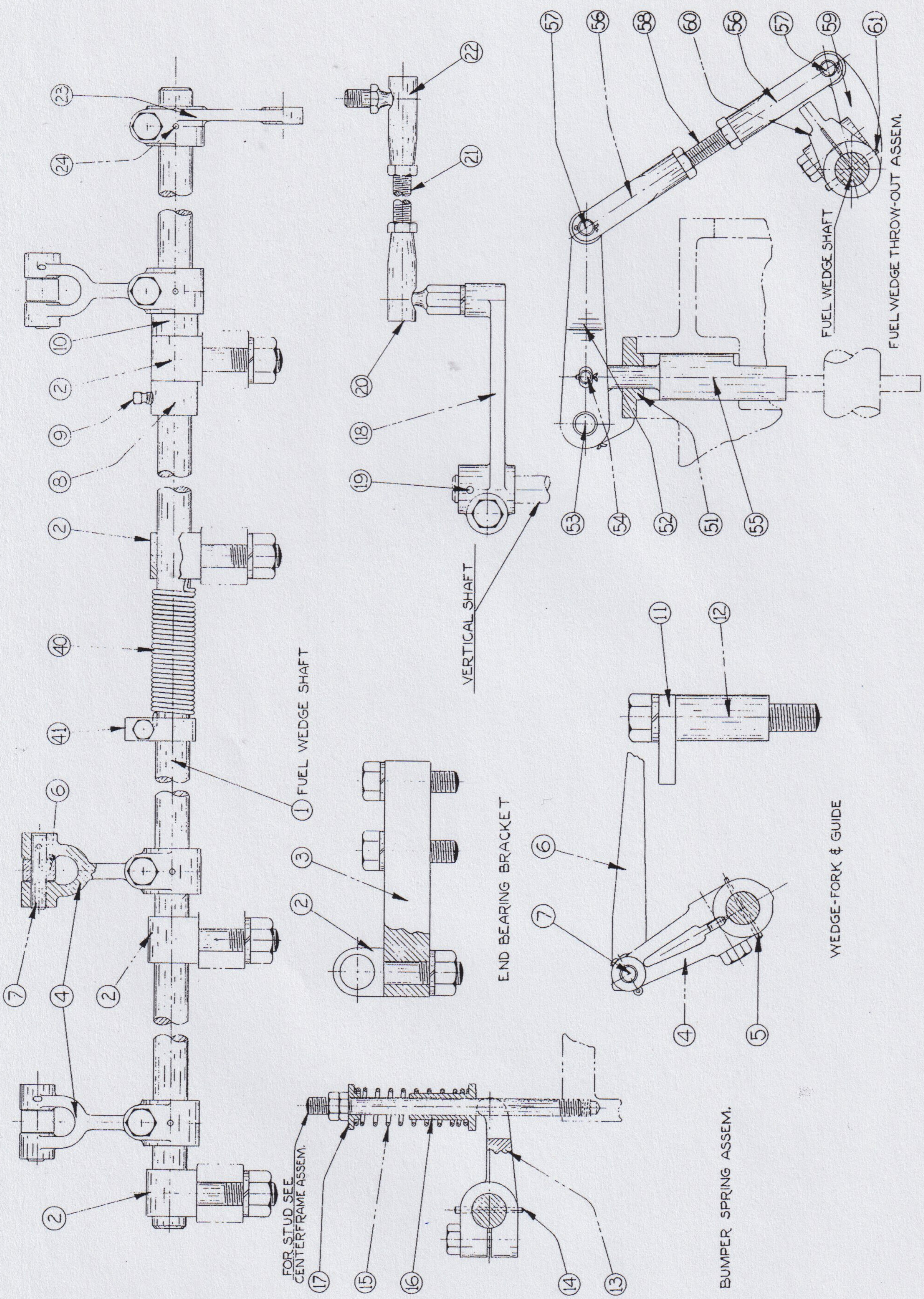


PLATE No.
K-2043

DO NOT ORDER PARTS BY REF. NUMBERS

TRA... ES TO — TYPED BY DLB DATE 1-26-45 CHKD. DATE ISSUED BY APRVD.

Retyped from 9-2[redacted]1 (No Changes)
#1

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-2043 — 2L676

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		51	2C2188	1	BRACKET - Wedge Throw-out Lever	
2				2	CAPSCREW -- 3/8-16-NC x 7/8 Lg. - (St.)	
3				2	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
4		52	F-6547	1	LEVER - Wedge Throw-out	
5		53	2C2208	1	PIN - Lever to Bracket	
6				1	COTTER PIN -- 1/8 x 1 1/4 Lg. - (St.)	
7	2C2260	54	2C2260L1 5/8	1	PIN - Lever to Plunger	
8				2	COTTER PIN -- 3/32 x 5/8 Lg. - (St.)	
9		55	2C2214	1	PLUNGER - Wedge Throw-out	
10		56		2	ROD-END -- 3/8 SAE Std. - Adjustable -- (St.)	
11		57		2	PIN - Rod-End -- 3/8 SAE Std. - (St.)	
12				2	COTTER PIN -- 3/32 x 5/8 Lg. - (St.)	
13		58	2C2250	1	ROD - Wedge Throw-out	
14				2	HALF NUT -- 3/8-24-NF-Hex. - - (St.)	
15		59	2C2590	1	LEVER - Wedge Throw-out - (Floating)	
16		60	2C2589	1	LEVER - Wedge Throw-out - (Clamped)	
17				1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
18		61		1	TAPER PIN -- #3 x 1 1/2 Lg. - - (St.)	

2L676

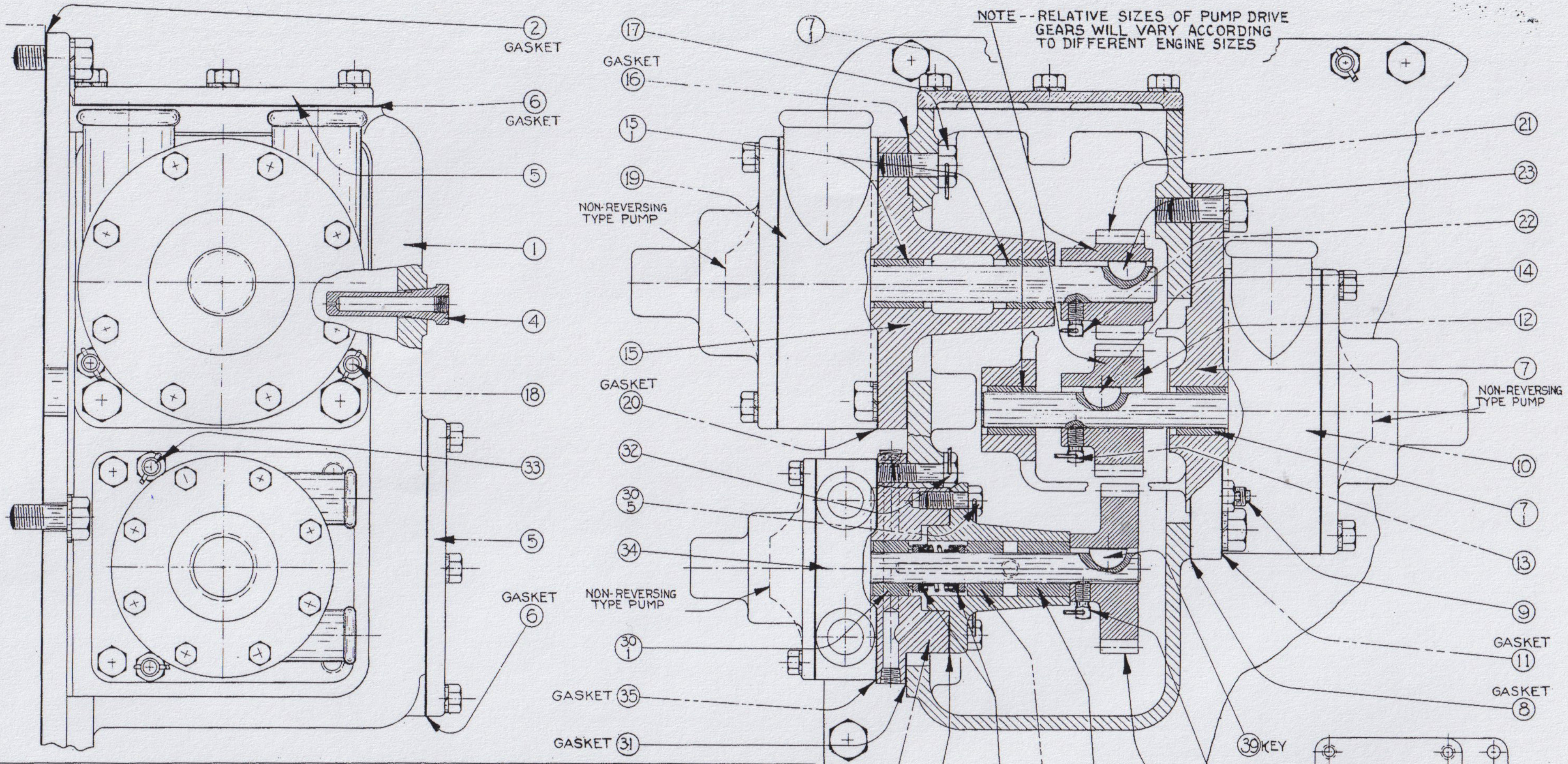
FOR OPP. HAND SEE
FOR OPP. ROT. SEE

NAME FUEL WEDGE THROW-OUT GROUP
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.



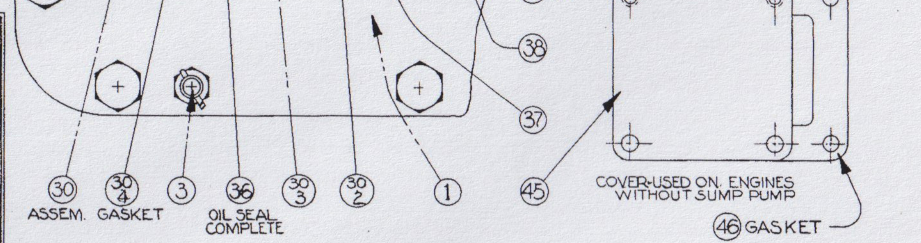
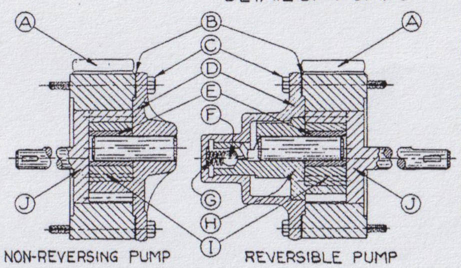


PLATE
No K-2036-(ED.3)

DO NOT ORDER PARTS BY REF No.

DETAIL OF PUMPS



REF. No	PART NAME	PUMP No. C-9289-P	PUMP No. C-9290-P	PUMP No. 2C37-P	PUMP No. 2C47-P	PUMP No. 2C121-P	PUMP No. 2C122-P	PUMP No. 2C151-P	PUMP No. 2C152-P
A	HOUSING	C-9289-P1	C-9290-P1	2C47-P1	2C47-P1	2C122-P1	2C122-P1	2C151-P1	2C68-P1
B	GASKET	C-8193	C-8193	C-9849-P	C-9849-P	C-9849-P	C-9849-P	C-9849-P	C-9849-P
C	CAPSCREW	1/4-20×2 1/4	1/4-20×2 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×3 1/4	5/16-18×2 1/2
D	COVER	C-9289-P2	C-9290-P2	2C47-P2	2C47-P2	2C122-P2	2C122-P2	2C151-P2	2C68-P2
E	BUSHING	C-9290-P3	C-9290-P3	2C47-P3	2C47-P3	2C47-P3	2C47-P3	2C68-P3	2C68-P3
F	STEEL BALL		9/16 DIA.	9/16 DIA.	9/16 DIA.			9/16 DIA.	
G	SPRING		C-9290-P4	2C47-P4	2C47-P4			2C151-P4	
H	CARRIER & PIN		C-9290-P5	2C47-P5	2C47-P5			2C151-P5	
I	IDLER & BUSHING	C-9290-P6	C-9290-P6	2C47-P6	2C47-P6	2C47-P6	2C47-P6	2C68-P6	2C68-P6
J	ROTOR & SHAFT	C-9290-P7	C-9290-P7	2C37-P7	2C47-P7	2C37-P7	2C47-P7	2C151-P7	2C152-P7

NOTE - ORDER PUMP PARTS AS PER ABOVE PART NUMBERS
THESE PARTS ARE NOT LISTED ON GROUP SHEET
PARTS NOT LISTED ARE NOT SOLD INDIVIDUALLY

EXTRA COPIES TO ______ TYPED BY EJC DATE 3/4/52 CHKD ______ ISSUED BY ______ DATE ______

Retyped from copy dated 10/10/41. No changes.

#4

CHANGES

2L 705

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-2036 (Ed 2)

DRWG. NO.	REF. NO.	PART NO.	NO REQ'D.	PART NAME	ASSEM. DRWG. NO.
2C2479	30	X3362	1	ADAPTOR ASSEM. - Fuel Transfer Pump	
	31	2C1216	1	GASKET - Adaptor to Housing	
C-2406	32	C2406L1 1/4	2	CAPSCREW - Adaptor to Housing	
			1	WIRE - #16 Ga. x 10 Lg. (St.)	
			2	CAPSCREW - 3/8 -16-NC x 1 1/4 Lg. (St.)	
			2	LOCKWASHER - 3/8 SAE Reg. (St.)	
			1	PIPE PLUG - 1/8 Std. (C.I.)	
C-8265	33	C-8265L1	2	PIN - Adaptor to Housing Dowel	
C-9290	34	C9290-P	1	PUMP - FuelTransfer	
	35	C-8193	3	GASKET - Pump to Adaptor	
			8	CAPSCREW - 1/4-20-NC x 2 Lg. (St.)	
			8	LOCKWASHER - 1/4 SAE Reg. (St.)	
2C2478	36	2C2478-P	1	OIL SEAL	
	37	2C1214	1	GEAR - Transfer Pump Drive	
	38	2C2502	1	SETSCREW - Gear to Pump Shaft	
	39		1	WOODRUFF KEY - 1/8 x 3/4 Std. (St.)	
			1	WIRE - #16 Ga. x 7 Lg. (St.)	

2L 705

...P. HAND SEE

...PP. ROT. SEE

NAME FUEL TRANSFER PUMP GROUP 13 x 16

ORIGINALLY ISSUED FOR 6 CYL. 11 1/2 x 15 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.
ENGINE DIVISION SPRINGFIELD, OHIO

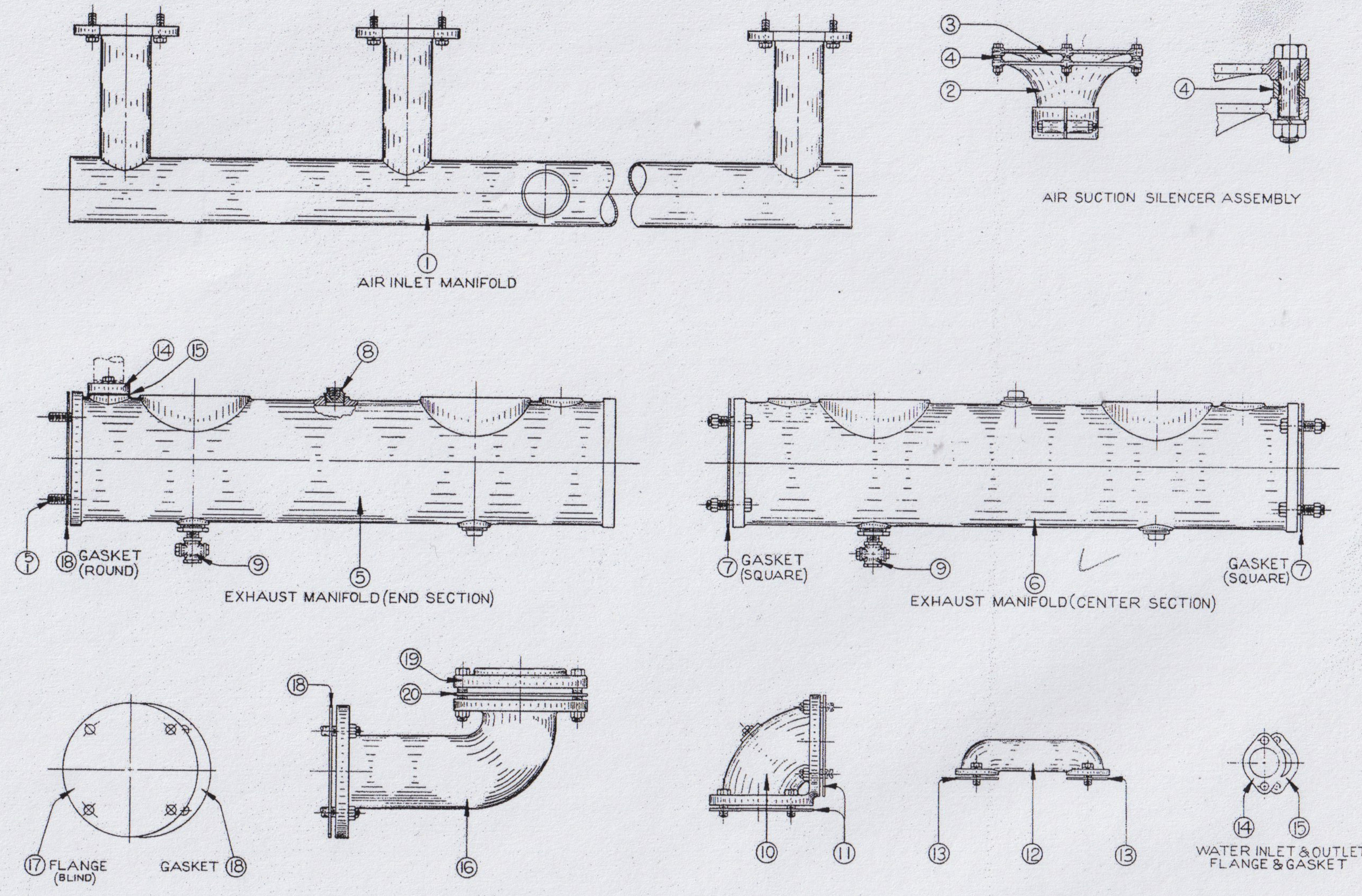


PLATE
No. K-1883

DO NOT ORDER PARTS BY REF. NUMBERS

RA... TS TO ...

TYPED BY MED DATE 10-17-41 ISSUED BY [illegible] DATE 10-20-41 CHKD. [illegible] APRVD.

CHANGES: 5-19-42 Line 27 No. Req'd. was 24 - Removed Line 28

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L719

PLATE NO. K-1883

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	W-1935	1		X3373	1	MANIFOLD ASSEM. - Air Inlet	
2					24	CAPSCREW -- 5/8-11-NC x 1 3/4 Lg. - (St.)	
3					24	LOCKWASHER -- 5/8 SAE Reg. - - (St.)	
4		2		F-3861	2	SILENCER - Air Suction	
5		3		F-2207	2	CONE - Air Suction Silencer	
6		4		2C1330	8	SPACER - Silencer Cone	
7					8	CAPSCREW -- 3/8-16-NC x 1 3/4 Lg. - (St.)	
8					8	NUT -- 3/8-16-NC-Hex. - - (St.)	
9					8	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
10					2	CAPSCREW(Clamp)--1/2-13-NC x 4 1/4 Lg.-(St.)	
11					2	NUT -- 1/2-13-NC-Hex. - - (St.)	
12							
13							
14		5		X2418	2	MANIFOLD ASSEM. - Exhaust (End Section)	
15		6		F-1280	1	MANIFOLD - Exhaust (Center Section)	
16		7		C-393	2	GASKET - Manifold Center to End Section	
17					8	CAPSCREW -- 3/4-10-NC x 3 Lg. - (St.)	
18					8	NUT -- 3/4-10-NC-Hex. - - (St.)	
19		8		C-3288	2	PLUG - Pipe (Water Header Support)	
20					4	PIPE PLUG -- 1 1/2 Std. - - (C.I.)	
21					3	REDUCING BUSHING -- 1 1/2 x 1/2 Std. - (C.I.)	
22					3	CLOSE NIPPLE -- 1/2 Std. - - (Brass)	
23	C-9053	9		C-9053-P 1/2	3	COCK - Exhaust Manifold Drain	
24	F-2975	10		398-R10	6	ELBOW - Cyl. Head Exhaust Outlet	
25					6	PIPE PLUG -- 1/2 Std. - - (C.I.)	
26	S-919	11		760A-R10	12	GASKET - Elbow to Manifold & Cyl. Head	
27					48	CAPSCREW -- 5/8-11-NC x 1 3/4 Lg.-(St.)	
28							
29	C-385	12		4095	2	PIPE - Water By-Pass	
30		13		S-1005	4	GASKET - By-Pass Pipe to Manifold	
31					8	CAPSCREW -- 1/2-13-NC x 1 1/4 Lg. - (St.)	
32					8	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
33	C-5135	14		787-B	2	FLANGE - Exh. Man. Water Inlet & Outlet	
34		15		S-1005	2	GASKET - Flange to Manifold	
35					4	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
36					4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
37		16		S-2328	1	ELBOW - Exh. Manifold Exhaust Outlet	
38		17		C-1104	1	FLANGE - Exhaust Manifold End (Blind)	
39		18		C-391	2	GASKET - Elbow & Flange to Manifold	
40					8	NUT -- 3/4-10-NC-Hex. - - (St.)	
41		19		C-6412	1	FLANGE - Exhaust Outlet Pipe	
42		20		C-391	1	GASKET - Flange to Elbow	
43					4	CAPSCREW -- 3/4-10-NC x 3 Lg. - (St.)	
44					4	NUT -- 3/4-10-NC-Hex. - - (St.)	
45							
46							
47							
48							
49							
50							

2L719

FOR OPP. HAND SEE

FOR OPP. ROT. SEE

NAME INLET & EXHAUST MANIFOLD GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM NO. 24... 10-39

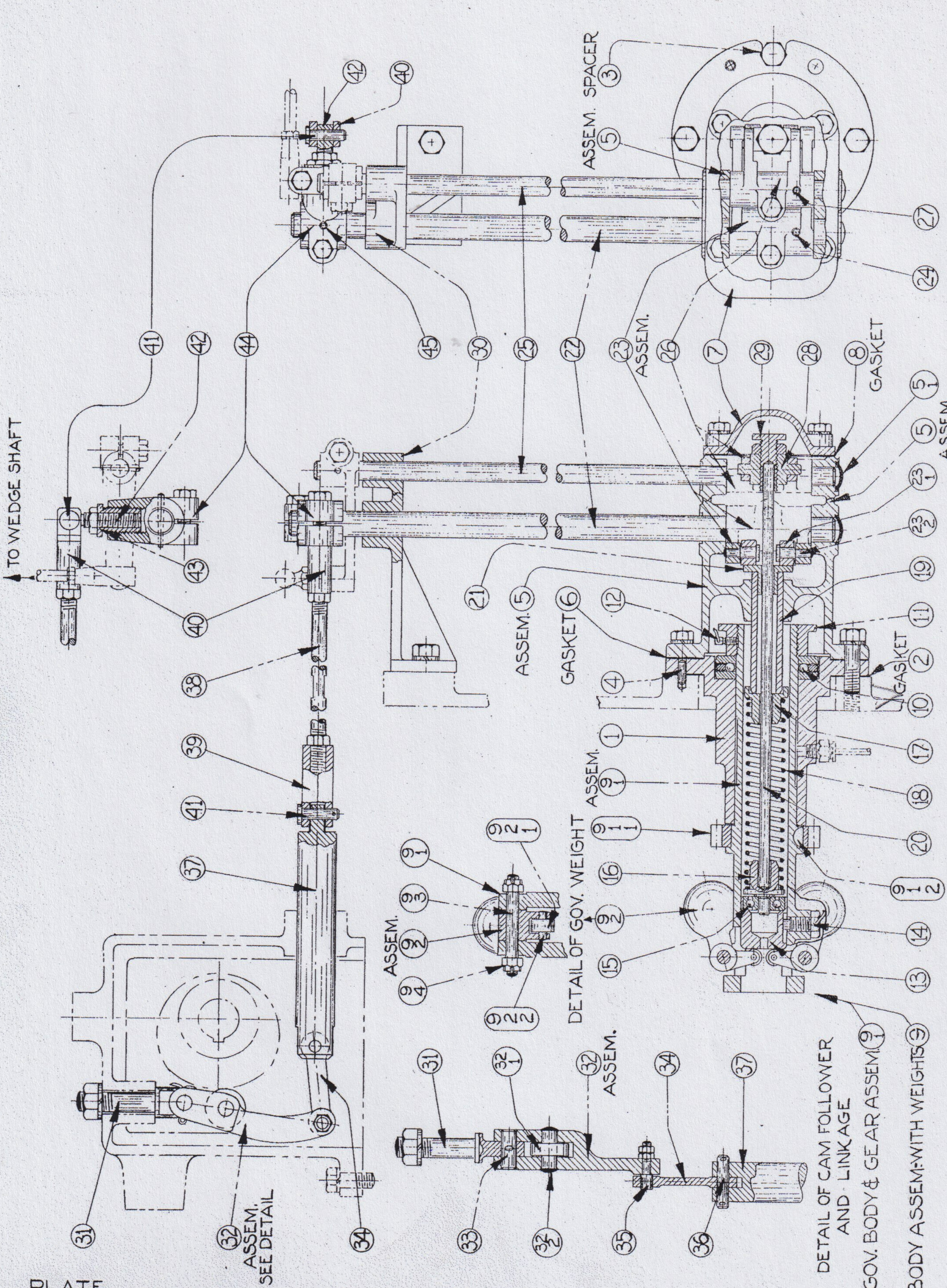


PLATE
No. W-1934

DO NOT ORDER PARTS BY REF. No.

TO TYPED BY MED DATE 10-30-41 ISSUED BY DATE CHKD. APRVD.

CHANGES: 9-27-45 Line 21 Part No. was 2C2439-P

2L733 SHEET 1 OF 2

PLATE NO. W-1934

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1		1		W-1865	1	BEARING - Governor	
2		2		C-73	1	GASKET - Bearing to Latch Box	
3					2	CAPSCREW -- 1/2-13-NC x 1 3/4 Lg. - (St.)	
4					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
5		3		S-1814	2	SPACER - Bearing to Latch Box Capscrew	
6	C-7972	4		C-7972L 3/4	2	PIN - Bearing to Latch Box Dowel	
7		5		X3388	1	HOUSING ASSEM. - Governor End	
8					2	PIPE PLUG -- 1/4 Std. - - (C.I.)	
9		6		C-73	1	GASKET - Housing to Gov. Bearing	
10					2	CAPSCREW(Hous. to Brg.)--3/8-16-NC x 1 Lg.-(St.)	
11					2	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
12					2	CAPSCREW(Hous. & Brg. to Latch Box)--1/2-13-NC	
13						x 1 3/4 Lg.-(St.)	
14		7		2C2499	1	COVER - Governor End Housing	
15		8		2C2500	1	GASKET - Cover to Housing	
16					4	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
17					4	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
18							
19							
20		9		X3330	1	GOVERNOR ASSEMBLY	
21	2C193	10		2C193-P25	1	BEARING - Ball Thrust	
22		11		2C2445	1	COLLAR - Governor & Bearing Retainer	
23		12		2C2502	1	SETSCREW - Collar Retainer	
24					1	WIRE -- #16 Ga. x 10 Lg. - (St.)	
25		13		2C2428	1	CAGE - Thrust Quill Bearing	
26		14		2C2434	1	SCREW - Brg. Cage Guide	
27					1	WIRE -- #16 Ga. x 6 Lg. - (St.)	
28	2C2422	15		2C2422-P	1	BALL BEARING - Thrust Quill	
29		16		2C2425	1	GUIDE - Governor Spring (Weight End)	
30		17		2C2427	1	GUIDE - Governor Spring	
31		18		2C2423	1	SPRING - Governor	
32		19		2C2429	1	SLEEVE - Gov. Spring Control	
33		20		2C2638	1	QUILL - Gov. Weight Thrust	
34		21		2C2430	1	WASHER - Thrust Sleeve & Quill Guide	
35	C-9217	22		C-9217L20 1/2	1	SHAFT - Gov. Control Vertical	
36	2C2435	23		X3331	1	LEVER ASSEM. - Governor Control	
37					1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
38		24			1	TAPER PIN -- #3 x 1 3/4 Lg. - (St.)	
39	C-6623	25		C-6623L19 3/4	1	SHAFT - Wedge Shaft Control (Vertical)	
40		26		2C2436	1	LEVER - Wedge Shaft Control (Lower)	
41					1	CAPSCREW -- 3/8-16-NC x 1 Lg. - (St.)	
42		27			1	TAPER PIN -- #3 x 1 1/4 Lg. - (St.)	
43		28		2C2437	1	BLOCK - Wedge Shaft Control Lever	
44		29		2C2438	1	SCREW - Thrust Quill Adjusting	
45					1	HALF NUT -- 5/8-18-NF-Hex. - - (St.)	
46		30		W-1933	1	BEARING - Vertical Shaft	
47					2	CAPSCREW -- 1/2-13-NC x 1 Lg. - (St.)	
48					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
49							
50						-------- CONTINUED ON SHEET NO. 2 ----	

OPP. HAND SEE 2L1248

OPP. ROT. SEE

NAME GOVERNOR & CONTROL GROUP - - - -(SINGLE LEVER CONTROL)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L733 SHEET 1 OF 2

TO

TYPED BY MED DATE 10-29-41 ISSUED BY DATE CHKD. APRVD.

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L733 SHEET 2 OF 2

PLATE NO. W-1934

DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
					-------- CONTINUED FROM SHEET NO. 1 -----	
					---------- Gov. Control Linkage from Cam to Vertical Shaft --	
	31		2C2507	1	FULCRUM - Gov. Cont. Cam Follower	
				1	NUT -- 5/8-18-NF-Hex. - - (St.)	
				1	LOCKWASHER -- Type 11 Shakeproof - 5/8 - (St.)	
2C2508	32		X3332	1	FOLLOWER ASSEM. - Gov. Cont. Cam	
	33		2C2208	1	PIN - Follower to Fulcrum	
				1	COTTER PIN -- 1/8 x 1 1/2 Lg. - (St.)	
	34		2C2203	1	LINK - Gov. Cont. Follower	
	35		2C2249	1	PIN - Link to Follower	
				2	HALF NUT -- 5/16-24-NF-Hex. - (St.)	
2C2244	36		2C2244L1 5/8	1	PIN - Link to Gov. Cont. Rod Shaft	
				2	COTTER PIN -- 3/32 x 5/8 Lg. - (St.)	
	37		2C2440	1	SHAFT - Link to Control Rod	
	38		2C2630	1	ROD - Gov. Control	
	39		2C2628	1	ROD-END - Gov. Control Rod (Cam End)	
	40		2C2442	1	ROD-END - Gov. Control Rod (Vert. Shaft End)	
				1	HALF NUT -- 1/2-13-NC-Hex. (L.H. Thr'd.)-(St.)	
				1	HALF NUT -- 1/2-20-NF-Hex. - - (St.)	
	41		C-3363	2	PIN - Rod-End	
				2	COTTER PIN -- 1/16 x 5/8 Lg. - (St.)	
	42		2C2629	1	EYE - Control Lever	
	43		2C2631	1	SLEEVE - Eye Adjusting	
				1	HALF NUT--1/2-13-NC(L.H. Thr'd.)-Hex. -(St.)	
	44		2C2632	1	LEVER-Gov. Cont. (Upper Lever on Vert. Shaft)	
				2	CAPSCREW(Clamp)--3/8-16-NC x 1 1/4 Lg. -(St.)	
	45			1	TAPER PIN -- #3 x 1 3/4 Lg. - (St.)	

2L733 2 OF 2

OPP. HAND SEE 2L1248

OPP. ROT. SEE

NAME GOVERNOR & CONTROL GROUP - - - - - -(SINGLE LEVER CONTROL)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FM NO. 249 10-39

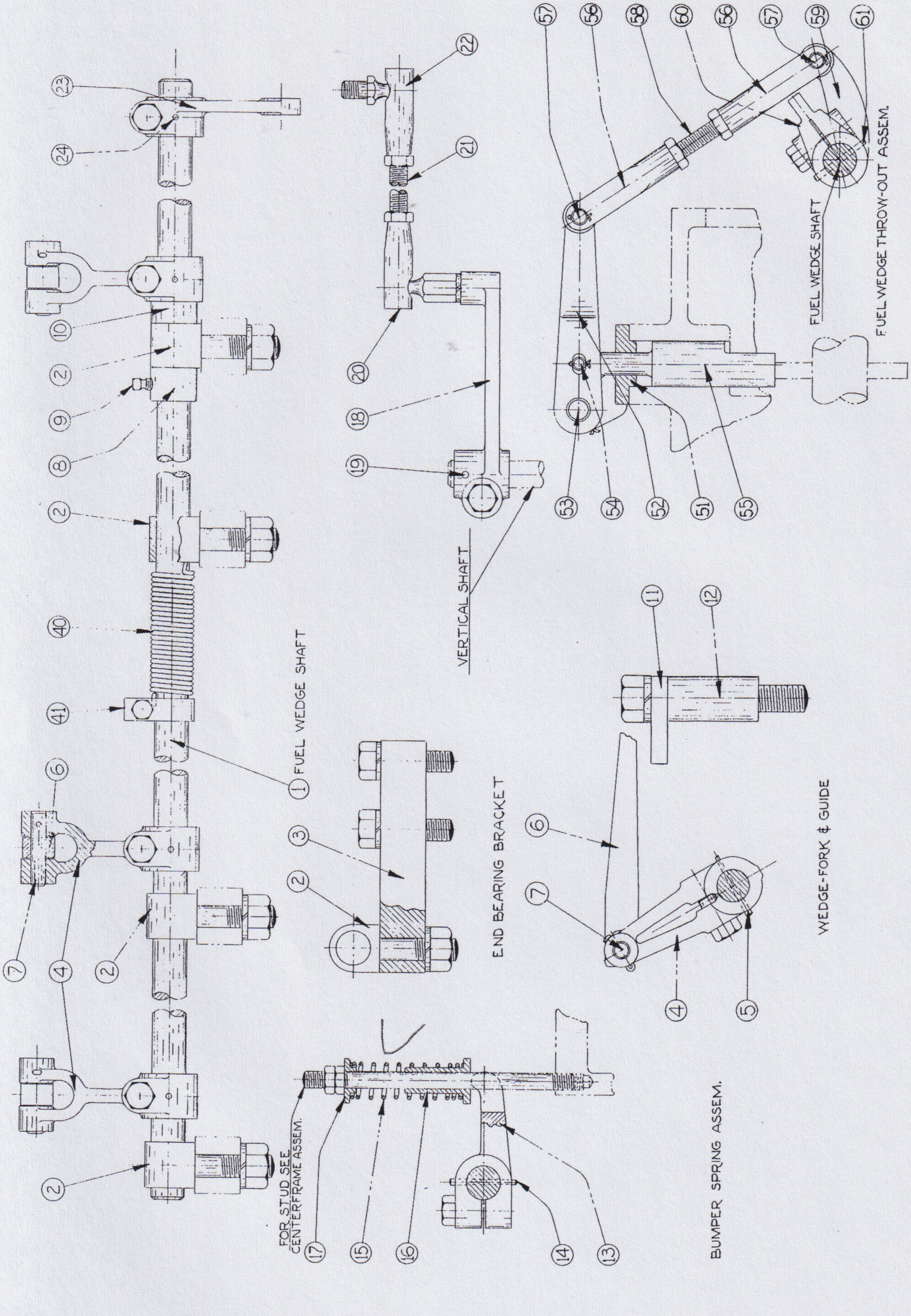


PLATE No.
K-2043

DO NOT ORDER PARTS BY REF. NUMBERS

S TO. TYPED BY MED DATE 10-29-41 ISSUED BY DATE 11-4-41 CHKD. APRVD.

#1 4-28-42 Revised
7-29-42 Lines 19 & 20 No. Req'd. was 6

CHANGES

2L734

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. K-2043

LINE NO.	DRWG. NO.	REF. NO.	*	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	2C2069	1		2C2069L142¼	1	SHAFT - Fuel Wedge	
2		2		C-4364	7	BEARING - Wedge Shaft	
3					7	NUT -- 1/2-13-NC-Hex. - - (St.)	
4					7	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
5		3		C-3385	1	BRACKET - Wedge Shaft End Brg.	
6					2	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St.)	
7					2	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
8		4		2C2615	6	FORK - Fuel Wedge	
9					6	CAPSCREW -- 3/8-16-NC x 1 Lg. - (St.)	
10		5			6	TAPER PIN -- #3 x 1 1/2 Lg. - (St.)	
11	F-897	6		1132-E	6	WEDGE - Fuel	
12	S-752	7		1132A-E	6	PIN - Fuel Wedge to Fork	
13					6	COTTER PIN -- 1/8 x 1 Lg. - (St.)	
14		8		C-7549	1	COLLAR - Fuel Wedge Shaft Retainer	
15		9			1	SETSCREW--1/4-20-NC x 1/2 Lg.-Sq.Hd.-Cup Pt(St)	
16		10		2C2587	1	SPACER - Fuel Wedge Shaft	
17		11		C-3383	1	GUARD - Fuel Wedge Shaft (Pump End)	
18		11		2C2296	1	GUARD - Fuel Wedge Shaft (Gov. End)	
19	S-2004	12		1141-E	7	SPACER - Fuel Wedge Shaft Guard	
20					7	CAPSCREW -- 5/8-11-NC x 4 1/2 Lg. - (St.)	
21		13		2C2588	1	FORK - Wedge Shaft Bumper Spring	
22					1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
23		14			1	TAPER PIN -- #3 x 1 1/2 Lg. - (St.)	
24		15		S-2632	1	SPRING - Wedge Shaft Bumper	
25		16		S-2631	1	GUIDE - Wedge Shaft Bumper Spring	
26		17		C-97	1	WASHER - Bumper Spring Retainer	
27					2	HALF NUT -- 3/8-24-NF-Hex. - - (St.)	
30						------------- Vertical Shaft to Wedge Shaft Linkage ----	
31		18		2C2636	1	LEVER - Wedge Shaft Control (On Vert. Shaft)	
32					1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
33		19			1	TAPER PIN -- #3 x 1 1/4 Lg. - (St.)	
34		20		C-8409	1	JOINT - Ball & Socket	
35					1	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
36		21		C-4514	1	ROD - Wedge Shaft Control	
37					2	HALF NUT -- 3/8-24-NF-Hex. - - (St.)	
38		22		C-8410	1	JOINT - Ball & Socket	
40					1	LOCKWASHER -- 3/8 SAE Reg. - - (St.)	
		23		2C2808	1	LEVER - Wedge Shaft Control (On Wedge Shaft)	
42					1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
43		24			1	TAPER PIN -- #3 x 1 1/2 Lg. - (St.)	

2L734

OPP. HAND SEE

OPP. ROT. SEE

NAME FUEL WEDGE SHAFT & CONTROL GROUP-(SINGLE LEVER CONTROL)

ORIGINALLY ISSUED FOR 6 Cyl. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR THIS GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

TYPED BY GF DATE 2-28-47 CHKD. [illegible] ISSUED BY [illegible] DATE 3-7-47

Retyped from 1-6-45 (no changes)

CHANGES

2L678

PLATE No. SEE WEDGE SHAFT

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
C-43	40	1135-E-L.H.	1	SPRING - Fuel Wedge Shaft	
	41	C-8170	1	CLAMP - Wedge Shaft Spring	
			1	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. -- (St.)	

OPP. HAND SEE 2L677

FOR OPP. ROT. SEE

NAME FUEL WEDGE SHAFT SPRING GROUP

ORIGINALLY ISSUED FOR

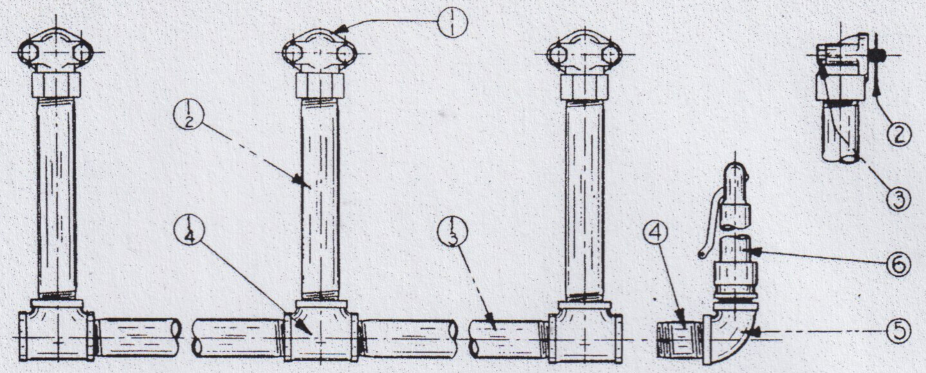
FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

2L678

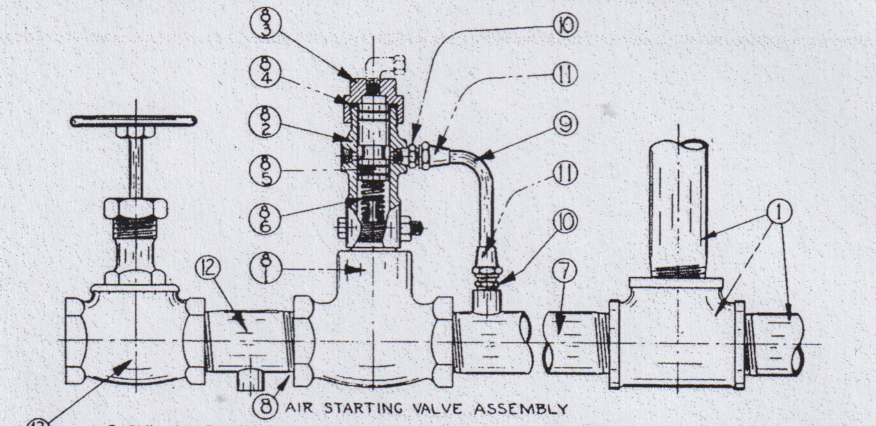
PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

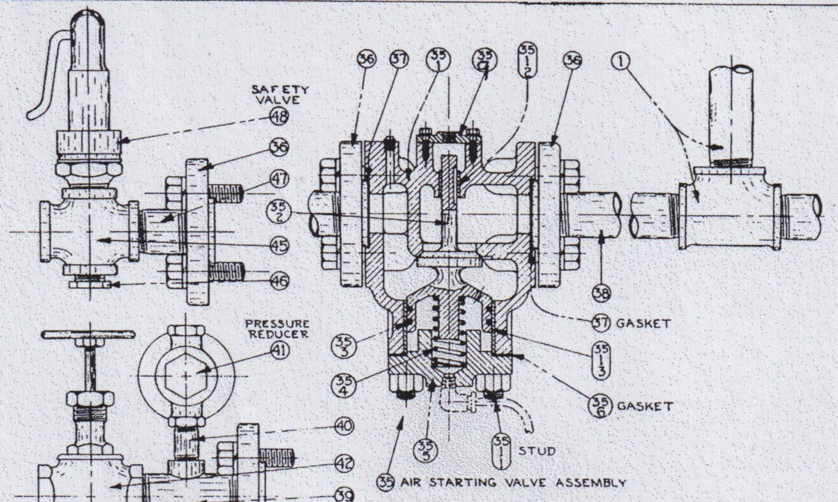
FORM 240 REV. 1/46 2M TRANS.
PRINTED IN U.S.A.



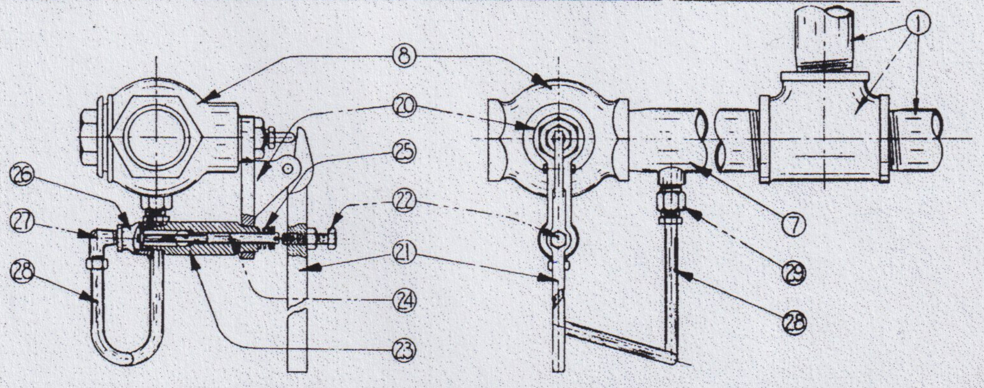
① MANIFOLD ASSEM.-(LESS VALVES)- MARINE & STAT. ENG.



6 CYL MARINE ENGINE VALVE ARRANGEMENT HANDWHEEL CONTROL TYPE



6 CYL. MARINE ENGINE VALVE ARRANGEMENT
SINGLE LEVER CONTROL TYPE



VALVE ARRANGEMENT FOR ALL STAT AND 3 AND 4 CYL. MARINE ENGINES

PLATE
No. W-1624-(ED 2)

DO NOT ORDER PARTS BY REF. NUMBERS

...S TO | TYPED BY MED | DATE 7-25-42 | CHKD. [illegible] | DATE 7-31-42 | ISSUED BY [illegible] | APRVD. [illegible]

CHANGES

1 4-28-44 Line 3 Length was 3½" Lg.

2L1027

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. W-1624 (Ed 2)

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	F-6035	1	X1391	1	MANIFOLD ASSEM. - Air Starting	
2	S-922	2	577A-J	6	GASKET - Manifold to Cyl. Head	
3		3		12	CAPSCREW -- 5/8-11-NC x 3 1/4 Lg.-(St.)	
4		4		1	CLOSE NIPPLE -- 1 1/2 Std. - (W.I.)	
5		5		1	ELBOW -- 1 1/2 x 1 1/4 Std. Reducing - (M.I.)	
6	C-9800	6	C-9800-P1 1/4	1	SAFETY VALVE -- (350 Lbs)	
7						
8		35	X3358	1	VALVE ASSEM. - Air Starting	
9		36	2C2633	2	FLANGE - Start. Valve Inlet & Outlet	
10		37	2C2634	2	GASKET - Flange to Valve	
11				8	CAPSCREW -- 3/4-10-NC x 2 Lg.-(St.)	
12		38		1	NIPPLE(Valve to Man.)--1 1/2 x 6 1/2 Lg.(W.I.)	
13	2C3177	39	X3573	1	NIPPLE ASSEM. - Start. Valve to Globe Valve	
14	C-9046	42	C-9046-P1 1/2	1	GLOBE VALVE	

OPP. HAND SEE

OPP. ROT. SEE

NAME AIR STARTING MANIFOLD GROUP - - - (SINGLE LEVER CONTROL)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L1027

RA CMI
ES TO

TYPED BY DLB DATE 1-29-45 CHKD M.E.D. DATE 2-13-45 ISSUED BY M.E.D. APRVD.

Retyped from 7-25-42 (No Changes)
#3

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. **2L1028**

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME — ASSEM. DRWG. NO. A-250 RH -- F-7188 LH
1					---- Air Start. Man. to Control Hous. Valves ----
2				1	NIPPLE -- 3/8 x 3 Lg. - (W.I.)
3				1	ELBOW -- 3/8 Std. - (M.I.)
4	C-9801		C-9801-P 1/2	1	CONNECTOR - Tube
5				1	TUBE -- 1/2 O.D. x .049 x 130 Lg. - (H.D. Cop.)
6	C-9809		C-9809-P 1/2	1	TEE - Tube
7				1	TUBE -- 1/2 O.D. x .049 x 27 Lg.-(H.D. Cop.)
8				1	TUBE -- 1/2 O.D. x .049 x 39 Lg.-(H.D. Cop.)
9	C-9804		C-9804-P 1/2	2	ELBOW - Tube
10					
11					---- Cont. Valve to Fwd. End of Rev. Cyl. ----
12	C-9801		C-9801-P 1/2	1	CONNECTOR - Tube
13				1	TUBE -- 1/2 O.D. x .049 x 82 Lg.-(H.D. Cop.)
14	C-9804		C-9804-P 1/2	1	ELBOW - Tube
15				1	REDUCING BUSHING -- 1/2 x 3/8 Std. - (C.I.)
16					
17					---- Cont. Valve to Aft. End of Rev. Cyl. ----
18	C-9801		C-9801-P 1/2	1	CONNECTOR - Tube
19				1	TUBE -- 1/2 O.D. x .049 x 87 Lg.-(H.D. Cop.)
20	C-9805		C-9805-P 1/2	1	ELBOW - Tube
21				1	NIPPLE -- 3/8 x 2 Lg. - (W.I.)
22				1	REDUCING BUSHING -- 1/2 x 3/8 Std. - (C.I.)
23					
24					---- Cont. Valve to Fly. Brake ----
25				1	REDUCING BUSHING -- 3/8 x 1/4 Std. - (C.I.)
26	C-9801		C-9801-P 3/8	1	CONNECTOR - Tube
27				1	TUBE -- 3/8 O.D. x .035 x 155 Lg.-(S.D. Cop.)
28	C-9804		C-9804-P 3/8	1	ELBOW - Tube
29					
30					---- Eng. Cont. Valve to Valve on Start. Man. ----
31	C-9804		C-9804-P 3/8	1	ELBOW - Tube
32				1	TUBE -- 3/8 O.D. x .035 x 153 Lg.-(S.D. Cop.)
33	C-9804		C-9804-P 3/8	1	ELBOW - Tube
34					
35					---- Start. Man. Valve Bleeder ----
36				1	CLOSE NIPPLE -- 3/4 Std. - (W.I.)
37	2C160		2C160-P 3/4	1	UNION ELBOW
38					
39					
40			2C2413	1	CLAMP - Tube
41			2C2402	1	CLAMP - Tube
42			2C2403	4	CLAMP - Tube
43			S-1495	1	CLAMP - Tube
44				1	MACHINE SCREW--1/4-20 x 3/8 Lg.-Rnd.Hd. (St.)
45				1	NUT -- 1/4-20-NC-Hex. - (St.)
46					
47					
48					
49					
50					

2L1028

FOR OPP. HAND SEE

FOR OPP. ROT. SEE

NAME AIR PIPING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

FORM 240 REV. 12-43 1M TRANS

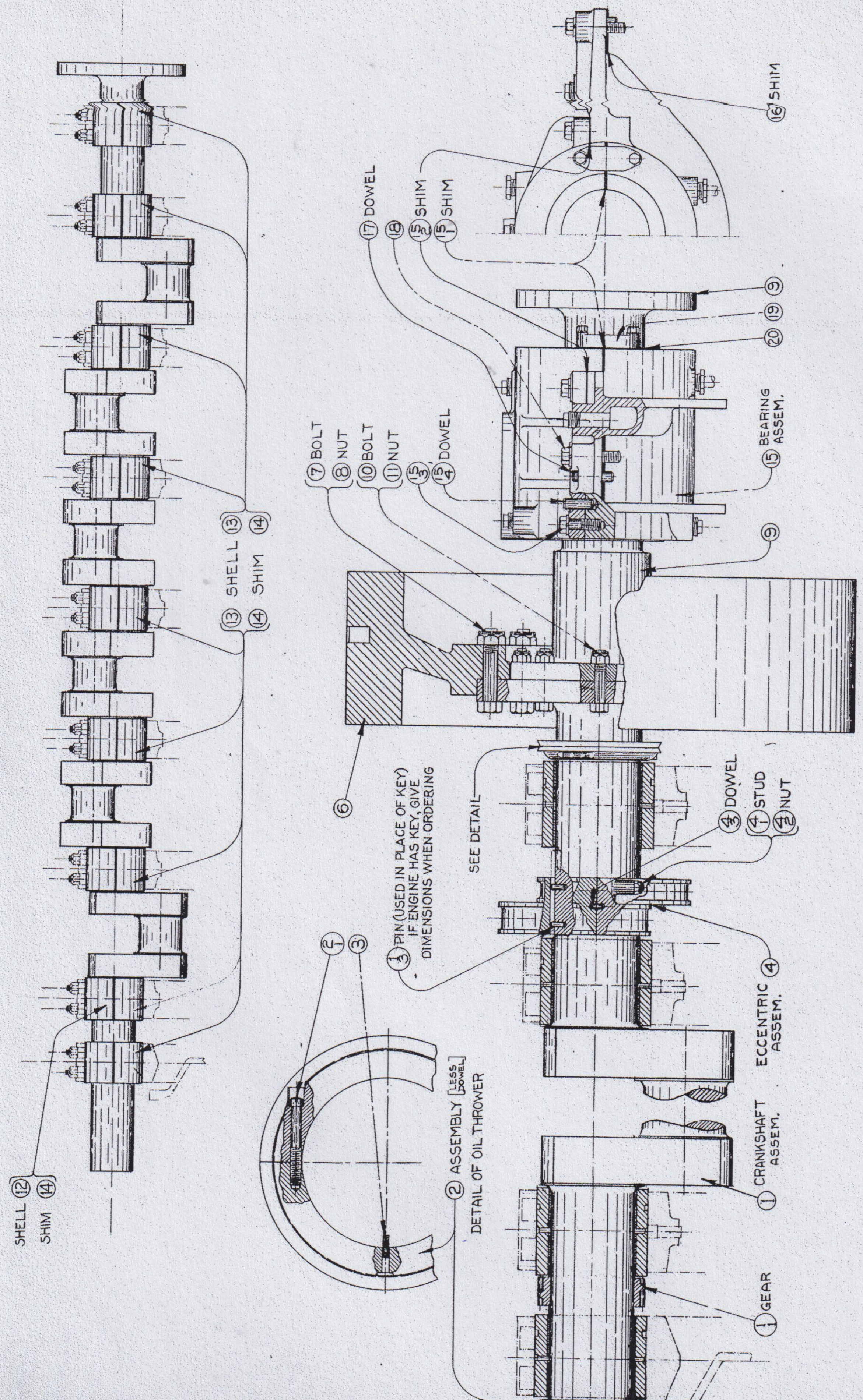


PLATE
No. K-1839 (ED.3) DO NOT ORDER PARTS BY REFER. No.

RA PIES TO ______ TYPED BY DLC DATE 4-29-49 CHKD. ______ ISSUED BY ______ DATE ______

#1 Retyped from 9-21-42 (no changes)

CHANGES

2L1072

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. K-1839 (Ed 3)

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
	1	X2779	1	CRANKSHAFT ASSEMBLY	
W-1373	2	X499	2	THROWER ASSEM. - Crankshaft Oil	
	3	S-2827	2	PIN - Oil Thrower to Crankshaft Dowel	
W-314	4	X530	1	ECCENTRIC ASSEM. - Air Comp. & Water Pump	
	6	W-321	1	FLYWHEEL	
C-2620	7	C-2620L6 1/2	8	BOLT - Flywheel to Crankshaft	
	8		8	CASTLE NUT -- 1 1/4-12-NF-Hex. - (St.)	
			8	COTTER PIN -- 3/16 x 2 1/4 Lg. - (St.)	
	9	W-1426	1	SHAFT - Thrust	
C-2616	10	C-2616L4 3/4	8	BOLT - Thrust Shaft to Crankshaft	
	11		8	CASTLE NUT -- 1-14-NF-Hex.- (St.)	
			8	COTTER PIN -- 1/8 x 1 3/4 Lg. - (St.)	
	12	F-3746	2	SHELL - Crankshaft Bearing (Fwd. End.)	
F-2532	13	646-03	16	SHELL - Crankshaft Bearing	
C-6370	14	720A-03-A	18	SHIM - Crankshaft Bearing- (1/16)	
C-6370	14	720A-03-B	36	SHIM - Crankshaft Bearing - (1/32)	
C-6370	14	720A-03-D	90	SHIM - Crankshaft Bearing - (.010)	
C-6370	14	720A-03-E	72	SHIM - Crankshaft Bearing - (.003)	
2C135	15	2C135P	1	BEARING - Thrust	
C-8699	16	C-8699-B	4	SHIM - Bearing to Base - (1/32)	
C-8699	16	C-8699-D	10	SHIM - Bearing to Base - (.010)	
C-8699	16	C-8699-E	8	SHIM - Bearing to Base - (.003)	
C-6386	17	C-6386L3 1/4	2	PIN - Thrust Brg. to Base Dowel	
	18		6	CAPSCREW -- 1-8-NC x 3 3/4 Lg. - (St.)	
			6	LOCKWASHER -- 1 SAE Reg. - (St.)	
			4	PACKING (Thrust Brg.) --Garlock #90VS ((or Eq) 3/8 Sq. x 24 Lg.	

2L1072

FOR OPP. HAND SEE ______

FOR OPP. ROT. SEE ______

NAME CRANKSHAFT FLYWHEEL & THRUST BEARING GROUP -(KINGSBURY)

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY No. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV 12-4 M TRANS
PRINTED IN U.S.A.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

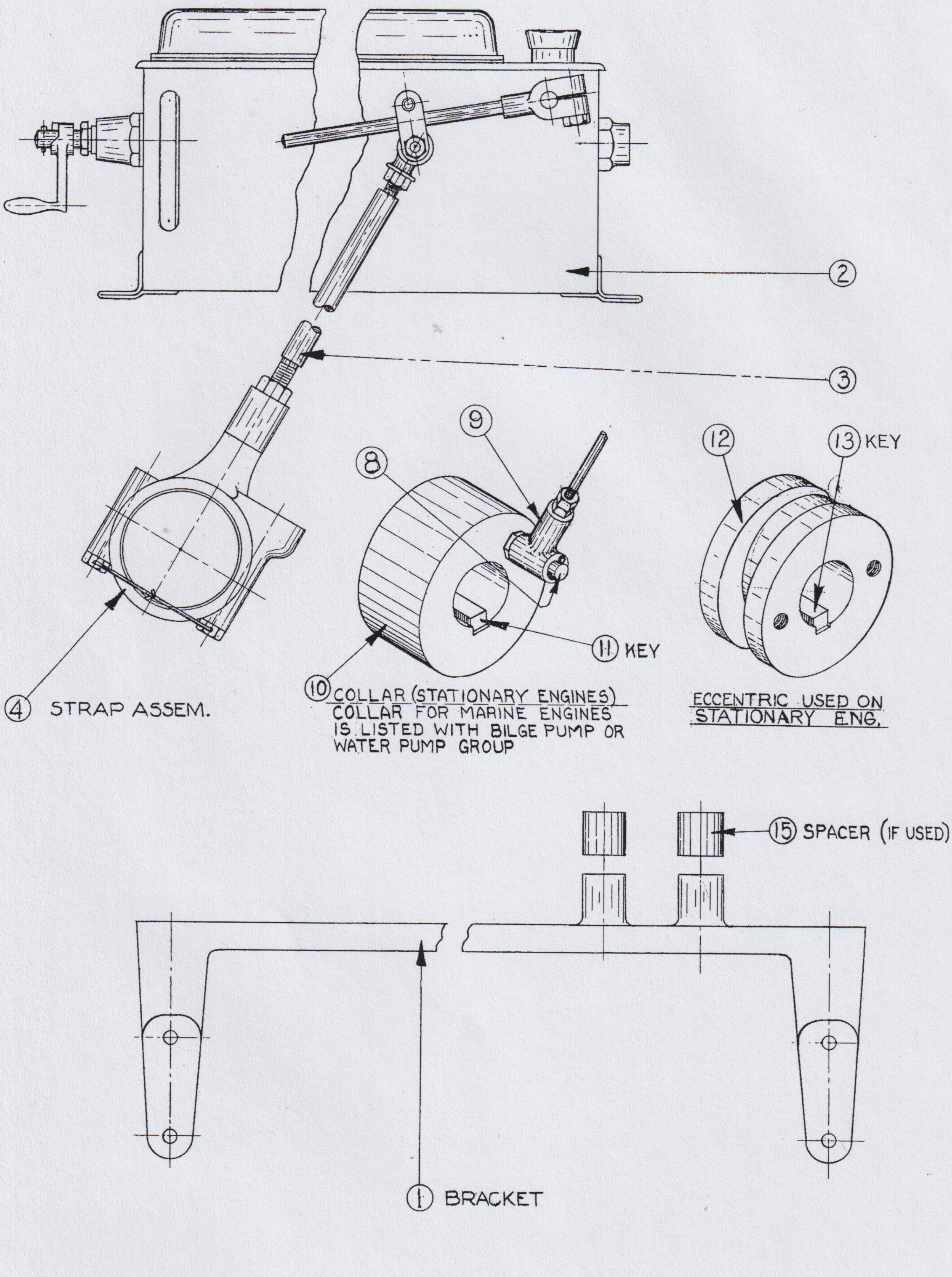


PLATE
No.W-1746 (ED 3)

DO NOT ORDER PARTS BY REF. NUMBERS

1 6-21-43 Added Line 15
Line 4 part number added 1-3-44
#3 Line 13 Added Drwg. No. 4-2-46

CHANGES

TYPED BY MED DATE 9-21-42 CHKD. M.E.B. DATE 9-21-42 ISSUED BY M.E.B. APRVD.

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L1073
PLATE NO. W-1746

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	W-168	1	1061-P4	1	BRACKET - Lubricator	
2				4	CAPSCREW -- 1/2-13-NC x 3 1/2 Lg.-(St.)	
3				4	LOCKWASHER -- 1/2 SAE Reg. - - (St.)	
4	F-7148	2	F-7148-P12	1	LUBRICATOR -- Madison Kipp - R.H. Side Drive -	
5					12 Feed	
6				4	CAPSCREW -- 3/8-16-NC x 1 1/4 Lg. - (St.)	
7				4	NUT -- 3/8-16-NC-Hex. - - (St.)	
8				4	LOCKWASHER -- 3/8 SAE Reg. - (St.)	
9				4	PLAIN WASHER -- 3/8 SAE Std. - (St.)	
10		3	2C2035	1	ROD - Lubricator Drive	
11				1	NUT -- 1/2-20-NF-Hex. - (St.)	
12				1	NUT -- 3/8-16-NC-Hex. - (St.)	
13	F-6940	4	X498	1	STRAP ASSEM. - Lub. Drive Eccentric	
14				1	WIRE -- #16 Ga. x 9 Lg. - (St.)	
15	C-8477	15	C-8477L1 1/4	4	SPACER - Lub. Bracket to Cyl.	
16			---- Lubricator		Piping - (Cam Side) ----	
17				1	TUBE(Cyl #1)--1/4 ODx .030x 24 Lg.-(S.D. Cop.)	
18				1	TUBE(Cyl #2)--1/4 ODx .030x 46 Lg.-(S.D. Cop.)	
19				1	TUBE(Cyl #3)--1/4 ODx .030x 68 Lg.-(S.D. Cop.)	
20				1	TUBE(Cyl #4)--1/4 ODx .030x 90 Lg.-(S.D. Cop.)	
21				1	TUBE(Cyl #5)--1/4 ODx .030x 112 Lg.-(S.D. Cop.)	
22				1	TUBE(Cyl #6)--1/4 ODx .030x 134 Lg.-(S.D. Cop.)	
23	C-9832		C-9832-P 1/4	6	ELBOW - Tube	
24			---- Lubricator		Piping - (Exhaust Side) ----	
25				1	TUBE(Cyl #1)--1/4 ODx .030x 34 Lg.-(S.D. Cop.)	
26				1	TUBE(Cyl #2)--1/4 ODx .030x 56 Lg.-(S.D. Cop.)	
27				1	TUBE(Cyl #3)--1/4 ODx .030x 78 Lg.-(S.D. Cop.)	
28				1	TUBE(Cyl #4)--1/4 ODx .030x 100 Lg.-(S.D. Cop.)	
29				1	TUBE(Cyl #5)--1/4 ODx .030x 122 Lg.-(S.D. Cop.)	
30				1	TUBE(Cyl #6)--1/4 ODx .030x 144 Lg.-(S.D. Cop.)	
31	C-9832		C-9832-P 1/4	6	ELBOW - Tube	
32						
33			---- Lubricator		Oil Tube Clamps ----	
34			S-1492	4	CLAMP - (2 Tube)	
35			S-1493	4	CLAMP - (3 Tube)	
36			S-1494	4	CLAMP - (4 Tube)	
37			S-1495	4	CLAMP - (5 Tube)	
38			S-1496	7	CLAMP - (6 Tube)	
39				23	MACHINE SCREW--1/4-20 x 5/8 Lg.-Rnd. Hd.-(St.)	
40				23	NUT -- 1/4-20-NC-Hex. - (St.)	
41						
42						
43			---- Governor		Oil Tube ----	
44				1	TUBE--1/4 O.D. x .030 x 14 Lg.-(S.D. Cop.)	
45	C-9832		C-9832-P 1/4	1	ELBOW - Tube	
46				1	OIL CUP--1/8 Hinged Lid-Gits 802 or Eq.(St)	
47						
48						
49						
50						

2L

OPP. HAND SEE 2L1143
OPP. ROT. SEE

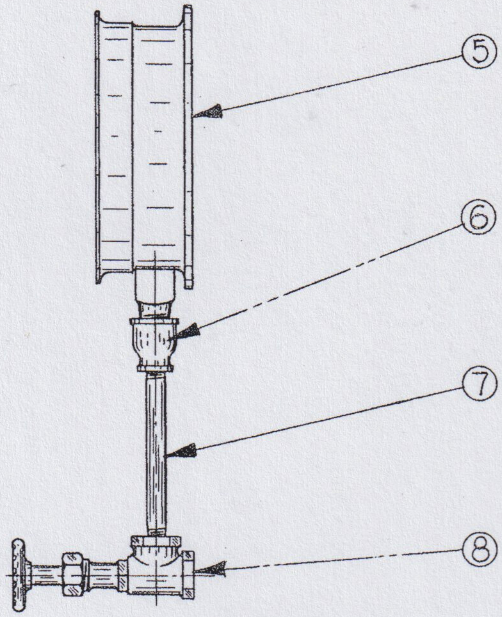
NAME LUBRICATOR & PIPING GROUP
ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SH

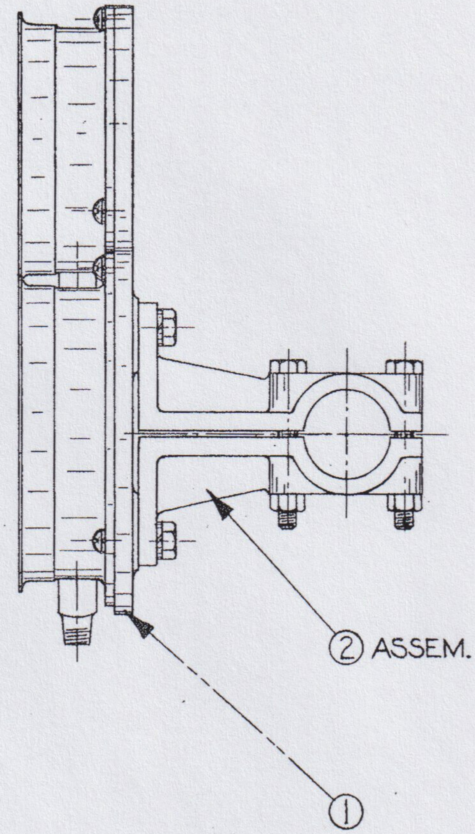
240 REV. 5-42 1M TRANS. 1M BOND

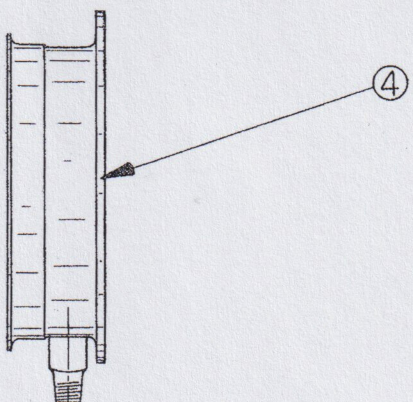
PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE
OAKLAND, CALIF. MATTOON, IL

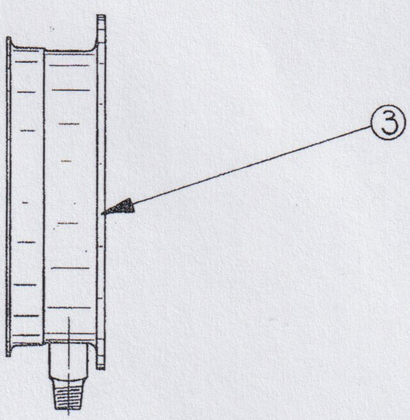


LUBE PRESSURE GAGE





AIR PRESSURE GAGE



FUEL PRESSURE GAGE

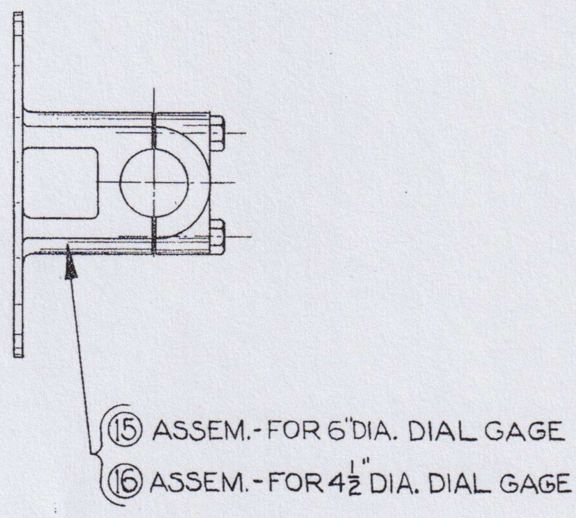


PLATE
No. W-1747

DO NOT ORDER PARTS BY REF. NUMBERS

…A
…ES TO

TYPED BY MED DATE 9-21-42 CHKD M.E.G. DATE 9-24-42 ISSUED BY M.E.G. APRVD.

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

2L1075

PLATE NO. W-1747

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
		F-6609	1	BRACE - Gage Board	
		2C1784	2	WASHER - Gage Board Brace(Used under Cyl. Hold-down Nut)	
	1	W-1996	1	BOARD - Gage	
			1	CAPSCREW(Board to Brace)--3/8-16-NC x 1 Lg.-(St.	
			1	PLAIN WASHER -- 3/8 SAE Std. - (St.)	
			1	LOCKWASHER -- 3/8 SAE Reg. - (St.)	
C-9030	2	X2377	2	BRACKET ASSEM. - Gage Board Support	
			4	CAPSCREW -- 3/8-16-NC x 7/8 Lg.-(St.)	
			4	LOCKWASHER -- 3/8 SAE Reg. - (St.)	
2C2622	3	1217-E	1	GAGE - Fuel Pressure -- 10,000 Lb. - 6" Dial	
	4	937-E	1	GAGE - Air Pressure -- 300 Lb. -- 6" Dial	
	5	1087-E	1	GAGE - Lube Pressure -- 60 Lb. -- 4 1/2" Dial	
			9	MACHINE SCREW -- 1/4-20 x 5/8 Lg.-Rnd. Hd.-(St.)	
			9	LOCKWASHER -- 1/4 SAE Reg. - (St.)	
				---- Lube Oil Gage Connecting Fittings ----	
	6		1	REDUCER (Bell) -- 1/4 x 1/8 Std. - (M.I.)	
	7		1	NIPPLE -- 1/8 x 4 Lg. - (W.I.)	
C-9847	8	C-9847-P 1/8	1	ANGLE VALVE (Needle Point)	

…OR OPP. HAND SEE

NAME PRESSURE GAGE GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

…OR OPP. ROT. SEE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

…ORM 240 REV. 2 1M TRANS. 1M BOND

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L1075

EXTRA COPIES TO | TYPED MED | DATE 9-21-42 | CHKD M.E.D. | DATE 9-21-42 | ISSUED BY M.E.D. | APRVD

#1 5-12-43 Changed Mat'l. Brass to Galv.

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE
* INDICATES PART NOT SERVICED INDIVIDUALLY

PLATE NO. 2L1076

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1					---- Bilge Pump to Water Inlet Man. ----	
2				1	NIPPLE -- 2 x 5 1/2 Lg. - - (Galv. Iron)	
3				1	TEE -- 2 Std. - (M.I.)(Galv.)	
4				1	NIPPLE -- 2 x 2 1/2 Lg. - (Galv. Iron)	
5	C-5135		787-B	1	FLANGE - Air Chamber	
6			F-2827	1	CHAMBER - Air	
7				1	PIPE PLUG -- 1 Std. - (C.I.)(Galv.)	
8			S-1005	1	GASKET - Flange to Air Chamber	
9				2	CAPSCREW -- 1/2-13-NC x 2 Lg. - (St.)	
10				2	NUT -- 1/2-13-NC-Hex. - (St.)	
11				2	LOCKWASHER -- 1/2 SAE Reg. - (St.)	
12				1	NIPPLE -- 2 x 3 1/2 Lg. (Galv. Iron)	
13				1	ELBOW -- 2 Std. - 45° - (M.I.)(Galv.)	
14				1	CLOSE NIPPLE -- 2 1/2 Std. - (Galv. Iron)	
15	C-9054		C-9054-P2	1	COCK - Three Way	
16				1	NIPPLE -- 2 x 5 Lg. - (Galv. Iron)	

FOR OPP. HAND SEE

FOR OPP. ROT. SEE

NAME WATER PIPING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

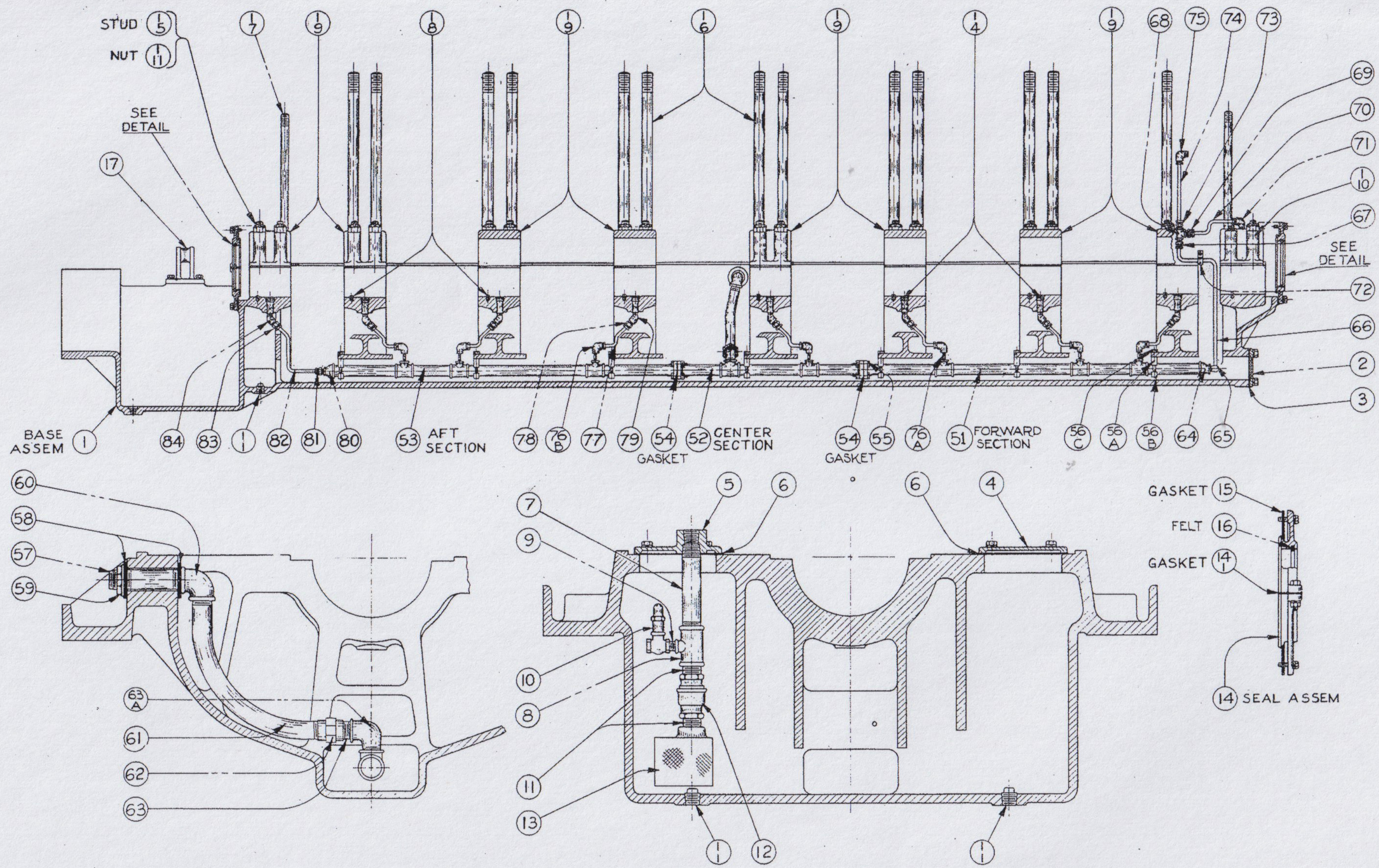
240 REV. 5-42 1M TRANS 1M BOND

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

2L1076

PLATE



STUD 1/5
NUT 1/11
SEE DETAIL
17
1/7
1/9
1/8
1/6
1/4
68
75
74
73
69
70
71
1/10
67
SEE DETAIL
72
66
2
3
BASE ASSEM 1
84
83
1/1
82
81
80
53 AFT SECTION
78
76 B
77
79
54 GASKET
52 CENTER SECTION
54 GASKET
55
76 A
51 FORWARD SECTION
56 C
56 A
56 B
64
65
60
58
57
59
63 A
61
62
63
7
9
10
8
11
13
5
6
6
4
12
GASKET 15
FELT 16
GASKET 14/1
14 SEAL ASSEM

TYPED BY ABC DATE 5-21-46 CHKD. ISSUED BY DATE

Retyped from 12-17-42 (no change)

CHANGES

2L1108

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-2019

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME — ASSEM. DRWG. NO. K-2001
1	F-6222	51	X3047	1	MANIFOLD ASSEM. - Lube Oil (Fwd. End Sect.)
2	F-6586	52	X3321	1	MANIFOLD ASSEM. - Lube Oil (Center Sect.)
3	F-6132	53	X2776	1	MANIFOLD ASSEM. - Lube Oil (Aft End Sect.)
4		54	2C1299	2	GASKET - Manifold Flange
5	C-2508	55	C-2508L2	8	BOLT - Manifold Flange
6				8	CASTLE NUT -- 1/2-20-NF-Hex. - - (St.)
7				2	WIRE -- #16 Ga. x 10 Lg. - - (St.)
8		56A	2C2484	7	SPACER - Lube Manifold
9		56B	2C2485	7	CLAMP - Lube Manifold
10	C-2408	56C	C-2408L4	14	CAPSCREW - Clamp to Base
11				7	WIRE -- #16 Ga. x 6 Lg. - - (St.)
12			---- Base to Man. Oil Line (Man. Inlet) ----		
13		57	C-6430	1	NIPPLE - Lube Oil Connect. (Thru Base)
14		58	C-8184	2	WASHER - Lube Oil Nipple Seal
15	C-5145	59	367-7	1	LOCKNUT - Lube Oil Nipple
16		60		1	ELBOW -- 1 1/4 Std. - (M.I.)
17		61		1	PIPE -- 1 1/4 x 18 1/2 Lg. (Thr'd. 2 Ends) (W.I.)
18	2C157	62	2C157P1 1/4	1	UNION
19		63		1	CLOSE NIPPLE -- 1 1/4 Std. - (W.I.)
20		63A		1	STREET ELL -- 1 1/4 Std. - (M.I.)
21			---- Manifold to Fwd. Crank. Brg. ----		
22		64		1	REDUCER (Bell) -- 1 1/4 x 1/2 Std. - (M.I.)
23	C-9804	65	C-9804P 5/8	1	ELBOW - Tube
24		66		1	TUBE -- 5/8 O.D. x .049 x 30 Lg.-(H.D. Cop.)
25	C-9801	67	C-9801P 5/8	1	CONNECTOR - Tube
26		68		1	TEE -- 1/2 x 3/8 x 3/8 Std. Reducing - (M.I.)
27	C-9801	69	C-9801P 1/2	1	CONNECTOR - Tube
28		70		1	TUBE -- 1/2 O.D. x .049 x 18 Lg. - (H.D. Cop.)
29	C-9804	71	C-9804P 1/2	1	ELBOW - Tube
30		72	2C1332	1	CLAMP - Tube
31				1	CAPSCREW -- 1/4-20-NC x 1/2 Lg. - - (St.)
32				1	LOCKWASHER -- 1/4 SAE Reg. - - (St.)
33			---- Fwd. Bearing Reduc. Tee to Int. Gear ----		
34	C-9801	73	C-9801P 1/2	1	CONNECTOR - Tube
35		74		1	TUBE -- 1/2 O.D. x .049 x 14 Lg. - (H.D. Cop.)
36	C-9801	75	C-9801P 1/2	1	CONNECTOR - Tube
37				1	TEE -- 3/8 Std. - (M.I.)
38				1	CLOSE NIPPLE -- 3/8 Std. - (W.I.)
39			---- Manifold to Int. Crank. Brgs. ----		
40		76A		7	NIPPLE -- 3/8 x 1 3/4 Lg. - (W.I.)
41	C-9805	76B	C-9805P 1/2	7	ELBOW - Tube
42		77		7	TUBE -- 1/2 O.D. x .049 x 9 Lg. - (H.D. Cop.)
43	C-9801	78	C-9801P 1/2	7	CONNECTOR - Tube
44		79		7	STREET ELL -- 3/8 Std. - 45° - (M.I.)
45			---- Manifold to Aft. Crank. Brg. ----		
46		80		1	REDUCER (Bell) -- 1 1/4 x 3/8 Std. - (M.I.)
47	C-9801	81	C-9801P 1/2	1	CONNECTOR - Tube
48		82		1	TUBE -- 1/2 O.D. x .049 x 14 Lg. - (H.D. Cop.)
49	C-9801	83	C-9801P 1/2	1	CONNECTOR - Tube
50		84		1	STREET ELL -- 3/8 Std. - 45° - (M.I.)

2L1108

OPP. HAND SEE
OPP. ROT. SEE

NAME LUBE OIL MANIFOLD & BASE PIPING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

FORM 240 REV. 1/46 2M TRANS. PRINTED IN U.S.A.

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

ZA
COPIES TO

TYPED BY ABC DATE 7-24-46 CHKD. CAB ISSUED BY CAB DATE 7-29-46

Retyped from 12-17-42 (no changes)
#2

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. 2L1109

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
		F-6911	1	MANIFOLD - Latch Shaft Oil (Fwd. Sect.)	
		F-6910	1	MANIFOLD - Latch Shaft Oil (Aft Sect.)	
			2	PIPE CAP -- 1/8 Std. - (M.I.)	
		S-2810	5	CLAMP - Manifold	
C-2404		C-2404L 1/2	5	CAPSCREW -- Clamp to Latch Box	
			5	LOCKWASHER -- 1/4 SAE Reg. - - (St.)	
			5	WIRE -- #16 Ga. x 6 Lg. - - (St.)	
		---- Int. Gear Tee to Latch Shaft Fwd. Manifold ----			
			1	REDUCING BUSHING -- 3/8 x 1/8 Std. - (C.I.)	
C-9801		C-9801P 1/4	1	CONNECTOR - Tube	
			1	TUBE -- 1/4 O.D. x .030 x 32 Lg. - (S.D. Cop.)	
C-9805		C-9805P 1/4	1	ELBOW - Tube	
	---- Lube Oil Line (On Exh. Side of Eng.) to Aft Manifold ----				
		NOTE:- Location of this connection to Lube Pressure Line on Exhaust Side of Engine will vary & therefore Tube length given below is maximum that will be required.			
			1	REDUCING BUSHING -- 1/2 x 1/8 Std. - (C.I.)	
C-9804		C-9804P 1/4	1	ELBOW - Tube	
			1	TUBE -- 1/4 O.D. x .030 x 50 Lg. - (S.D. Cop.)	
C-9805		C-9805P 1/4	1	ELBOW - Tube	
		C-3865	1	NIPPLE (Thru Latch Box)	
			1	LOCKNUT -- 1/8 Std. Pipe - (M.I.)	
		C-5919	1	GASKET - Locknut	
			1	ELBOW -- 1/8 Std. - (M.I.)	

2L1109

OPP. HAND SEE

OPP. ROT. SEE

NAME LATCH SHAFT OIL PIPING GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

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OAKLAND, CALIF. MATTOON, ILL.

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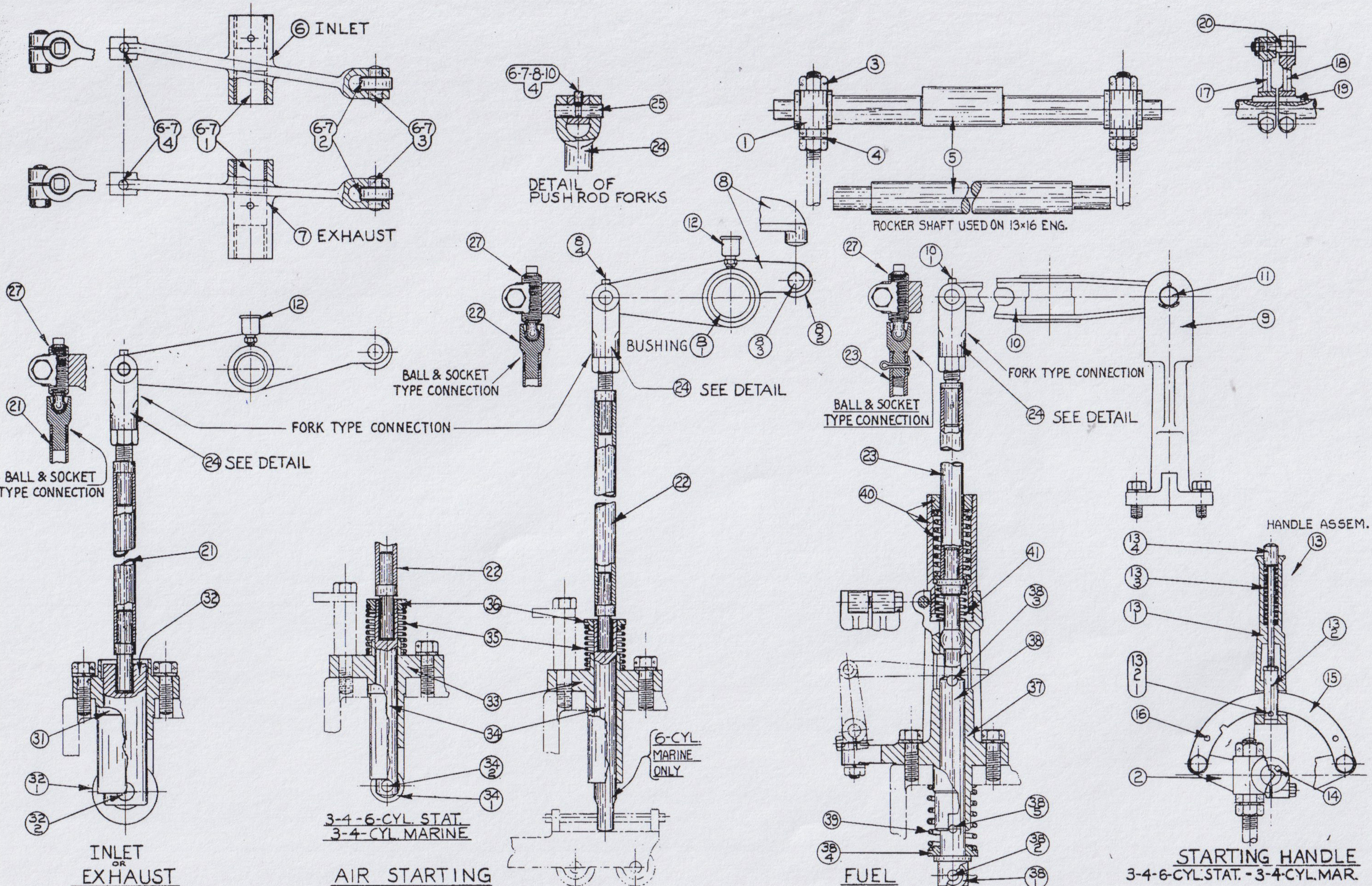
INLET
EXHAUST
DETAIL OF PUSH ROD FORKS
ROCKER SHAFT USED ON 13×16 ENG.
BALL & SOCKET TYPE CONNECTION
FORK TYPE CONNECTION
SEE DETAIL
BUSHING
6-CYL. MARINE ONLY
HANDLE ASSEM.
3-4-6-CYL. STAT.
3-4-CYL. MARINE
INLET OR EXHAUST
AIR STARTING
FUEL
STARTING HANDLE
3-4-6-CYL. STAT. - 3-4-CYL. MAR.

TYPED BY BJR DATE 12-31-48 CHKD [signature] ISSUED BY [signature] DATE 1-17-49

CHANGES: 8 12-31-48 Retyped & changed 888-C3 to 3A1738.

L-6919

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-1926

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
C-7988	31	529-C	2	GUIDE - In. & Exh. Valve Lifter	
			4	CAPSCREW -- 5/8-11-NC x 1 3/4 Lg. -- (St.)	
			4	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
C-8465	32	X1211	2	LIFTER ASSEM. - In. & Exh. Valve	
2C2536	33	599-E6	1	GUIDE - Air Start. Valve Lifter	
			1	CAPSCREW -- 5/8-11-NC x 1 3/4 Lg. -- (St.)	
			1	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
2C2535	34	594-E6	1	LIFTER - Air Start. Valve	
	35	3A1738	1	SPRING - Air Start. Valve Lifter	
C-7987	36	594A-E	1	COLLAR - Valve Lifter Spring Retainer	
	37	W-140	1	GUIDE - Fuel Spray Valve Lifter	
			2	CAPSCREW -- 5/8-11-NC x 1 3/4 Lg. -- (St.)	
			2	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
			1	CAPSCREW (Clamp) -- 1/2-13-NC x 2 Lg. -- (St.)	
E-3770	38	X553	1	LIFTER ASSEM. - Fuel Spray Valve	
	39	C-3291	1	SPRING - Fuel Spray Valve Lifter	
C-1932	40	X490	1	SPRING ASSEM. - Spray Valve Push-Rod Buffer	
	41	C-1933	1	SPRING - Spray Valve Push-Rod	

NAME VALVE LIFTER & GUIDE GROUP

ORIGINALLY ISSUED FOR 6 CYL. 7½x10½ to 13x16 - R.H.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

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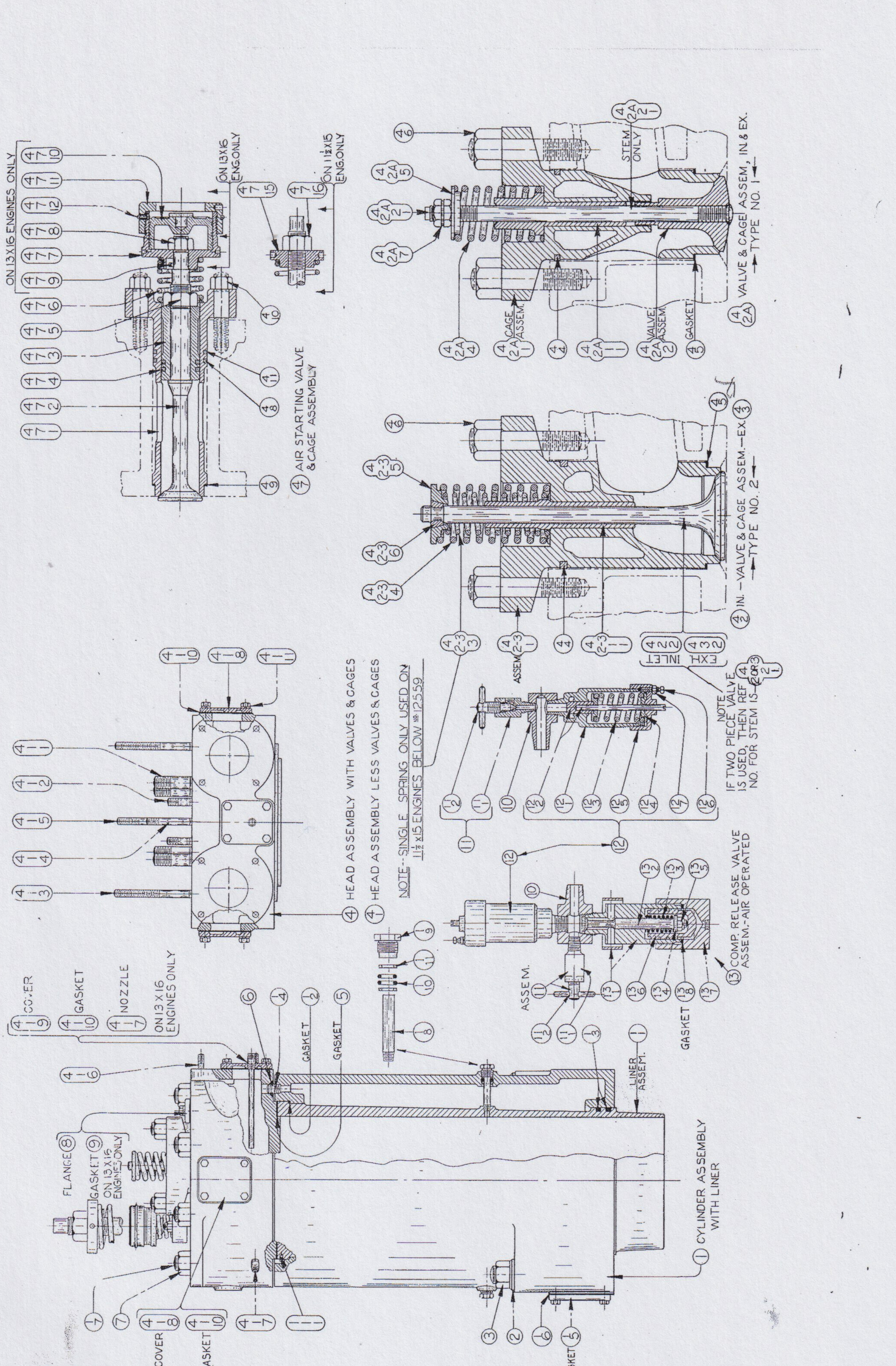


PLATE
No.K-1890 (ED-4)

DO NOT ORDER PARTS BY REF. NUMBERS

EXTRA COPIES TO ______ TYPED BY NLB DATE 12-8-53 CHKD ______ ISSUED BY JLS DATE ______

Retyped from sheet dated 4-27-49.

CHANGES

L9776

ALWAYS GIVE PART NUMBER — PART NAME — ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE NO. K-1890 (Ed 3)

LINE NO	DRWG. NO	REF. NO	PART NO.	NO REQ'D	PART NAME	ASSEM. DRWG. NO.
1		1	X1283	1	CYLINDER ASSEMBLY	
2		1A	2C3308	1	GASKET - Cylinder to Centerframe	
3	2C2458	2	753A-FB4	4	WASHER - Cyl. to Centerframe Stud	
4		3		4	NUT - 1-3/4-5-NC-Hex. - (St.)	
5						
6		4	X2810	1	HEAD ASSEM. - Cylinder	
7		5	C-3957	1	GASKET - Head to Cylinder	
8	S-929	6	610A-03	8	GROMMET - Cyl. to Head Water By-Pass Pipe	
9		7		8	NUT -1-1/2-6-NC-Hex. - (St.)	
10	C-488	8	785	1	FLANGE - Cyl. Head Water Outlet Hole (Blind)	
11		9	S-2334	1	GASKET - Flange to Cyl. Head	
12				2	CAPSCREW -1/2-13-NC x1-1/4 Lg. - (St.)	
13				2	LOCKWASHER - 1/2 SAE Reg. - (St.)	
14						
15	S-2097	10	1196-E2	1	PLUG - Comp. Relief & Safety Valve Adapter	
16	C-354	11	G1197-E1	1	VALVE ASSEM. - Compression Release (Snifter)	
17	S-3340	12	X204	1	VALVE ASSEM.- Cyl. Pressure Relief Safety	

L9776

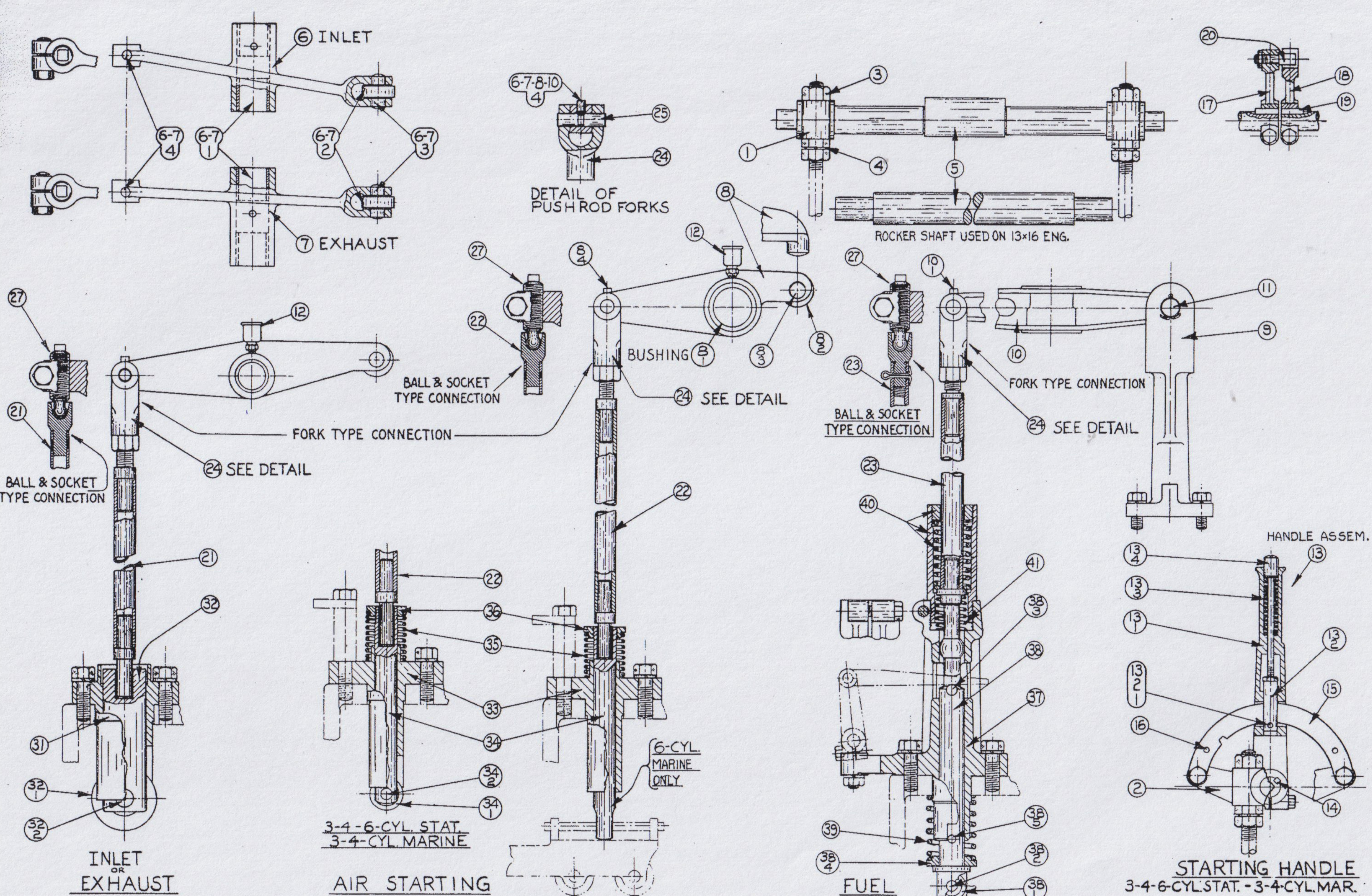
NAME CYLINDER & HEAD GROUP

ORIGINALLY ISSUED FOR 13 x 16 MARINE - STAT.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

THE NATIONAL SUPPLY CO.


INLET
EXHAUST
DETAIL OF PUSH ROD FORKS
ROCKER SHAFT USED ON 13×16 ENG.
BUSHING
SEE DETAIL
BALL & SOCKET TYPE CONNECTION
FORK TYPE CONNECTION
HANDLE ASSEM.
6-CYL. MARINE ONLY
3-4-6-CYL. STAT.
3-4-CYL. MARINE
INLET OR EXHAUST
AIR STARTING
FUEL
STARTING HANDLE
3-4-6-CYL.STAT. - 3-4-CYL.MAR.

OFFICE TO　TYPED BY DLC　DATE 4-29-49　CHKD.　ISSUED BY　DATE

Retyped from 9-14-43 (No Changes)
#2

CHANGES

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

L-9777

PLATE No. K-1926

DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
	1	C-3418	2	BEARING - Valve Rocker Shaft	
	3		4	NUT -- 3/4-10-NC-Hex. - (St.)	
	4		4	DRAKE LOCKNUT -- 3/4-10-NC-Hex. - (St.)	
	5	C-1951	1	SHAFT - Valve Rocker	
	6	X520	1	ROCKER ASSEM. - Inlet Valve	
	7	X518	1	ROCKER ASSEM. - Exhaust Valve	
	8	X522	1	ROCKER ASSEM. - Air Start Valve	
	9	F-2919	1	STAND - Fuel Spray Valve Rocker	
			1	NUT -- 5/8-11-NC-Hex. -- (St.)	
			1	LOCKWASHER -- 5/8 SAE Reg. -- (St.)	
			1	CAPSCREW -- 1/2-13-NC x 1 1/2 Lg. - (St)	
			1	LOCKWASHER -- 1/2 SAE Reg. -- (St.)	
	10	X494	1	ROCKER ASSEM. - Fuel Spray Valve	
S-2448	11	873-H	1	PIN - Spray Valve Rocker to Stand	
			2	COTTER PIN -- 3/32 x 1 1/4 Lg. - (St.)	
	12		3	OIL CUP --Bowen No. 5 - Hinged Lid-1/8 P.T.(St.)	
C-3257	21	X535	2	PUSH-ROD ASSEM. - Inlet & Exhaust Valve	
C-3256	22	X534	1	PUSH-ROD ASSEM. - Air Starting Valve	
C-3255	23	X536	1	PUSH-ROD ASSEM. - Fuel Spray Valve	
C-281	24	526-R	4	FORK - Push Rod to Rocker Connecting	
			4	NUT -- 3/4-16-NF-Hex. - - (St.)	
S-748	25	527-E1	4	PIN - Push-Rod Fork to Valve Rocker	

OP. HAND SEE

OP. ROT. SEE

NAME VALVE ROCKER & PUSH-ROD GROUP

ORIGINALLY ISSUED FOR 6 CYL. 13 x 16 MARINE

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF.　MATTOON, ILL.

M 240 REV. 12-43 1M TRANS.
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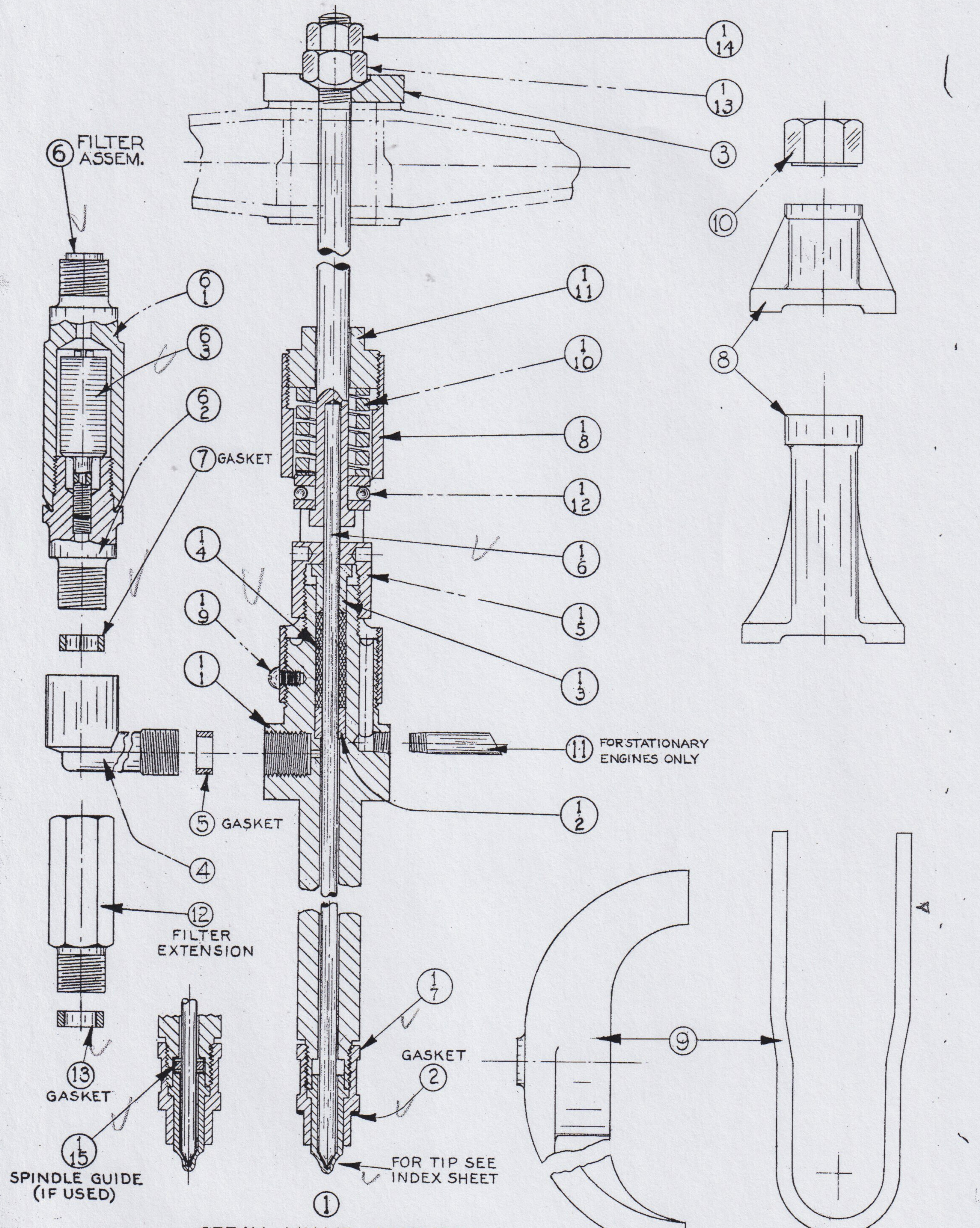


-SPRAY VALVE ASSEMBLY-
LESS TIP

PLATE

Retyped from 9-10-43 (no changes)
#2

TYPED BY ABC DATE 3-27-46 CHKD. ISSUED BY DATE

CHANGES

L-9778

ALWAYS GIVE PART NUMBER—PART NAME—ENGINE NUMBER
FOR STD. HARDWARE WITHOUT PART NUMBER GIVE DESCRIPTION AND SIZE

PLATE No. W-1596

LINE NO.	DRWG. NO.	REF. NO.	PART NO.	NO. REQD.	PART NAME	ASSEM. DRWG. NO.
1	W-1978	1	X3417	1	VALVE ASSEM. - Fuel Spray	
2	S-923	2	860-E	1	GASKET - Spray Valve to Cyl. Head	
3		4	C-3231	1	CONNECTION - Spray Valve Fuel Filter	
4	S-928	5	861A-E	1	GASKET - Filter Connection to Spray Valve	
5		12	C-3235	1	EXTENSION - Spray Valve Filter Connection	
6	S-928	13	861A-E	1	GASKET - Extension to Connection	
7	F-1981	6	X71	1	FILTER ASSEM. - Spray Valve Fuel	
8	S-928	7	861A-E	1	GASKET - Filter to Extension	
9	C-287	8	855-FXC4	1	BRIDGE - Spray Valve Retainer	
10		9	C-3230	1	CLAMP - Spray Valve Bridge	
11	C-278	10	855A-FXC4	1	NUT - Spray Valve Bridge Clamp Retainer	
12	C-179	3	877-E	1	COLLAR - Horseshoe (Spray Valve to Rocker)	

APP. HAND

NAME FUEL SPRAY VALVE GROUP

ORIGINALLY ISSUED FOR 13 x 16 MAR.

FOR TOTAL REQUIREMENTS PER ENGINE MULTIPLY NO. REQ'D GIVEN ABOVE BY NO. REQ'D FOR GROUP GIVEN ON INDEX SHEET

PARTS LIST

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIF. MATTOON, ILL.

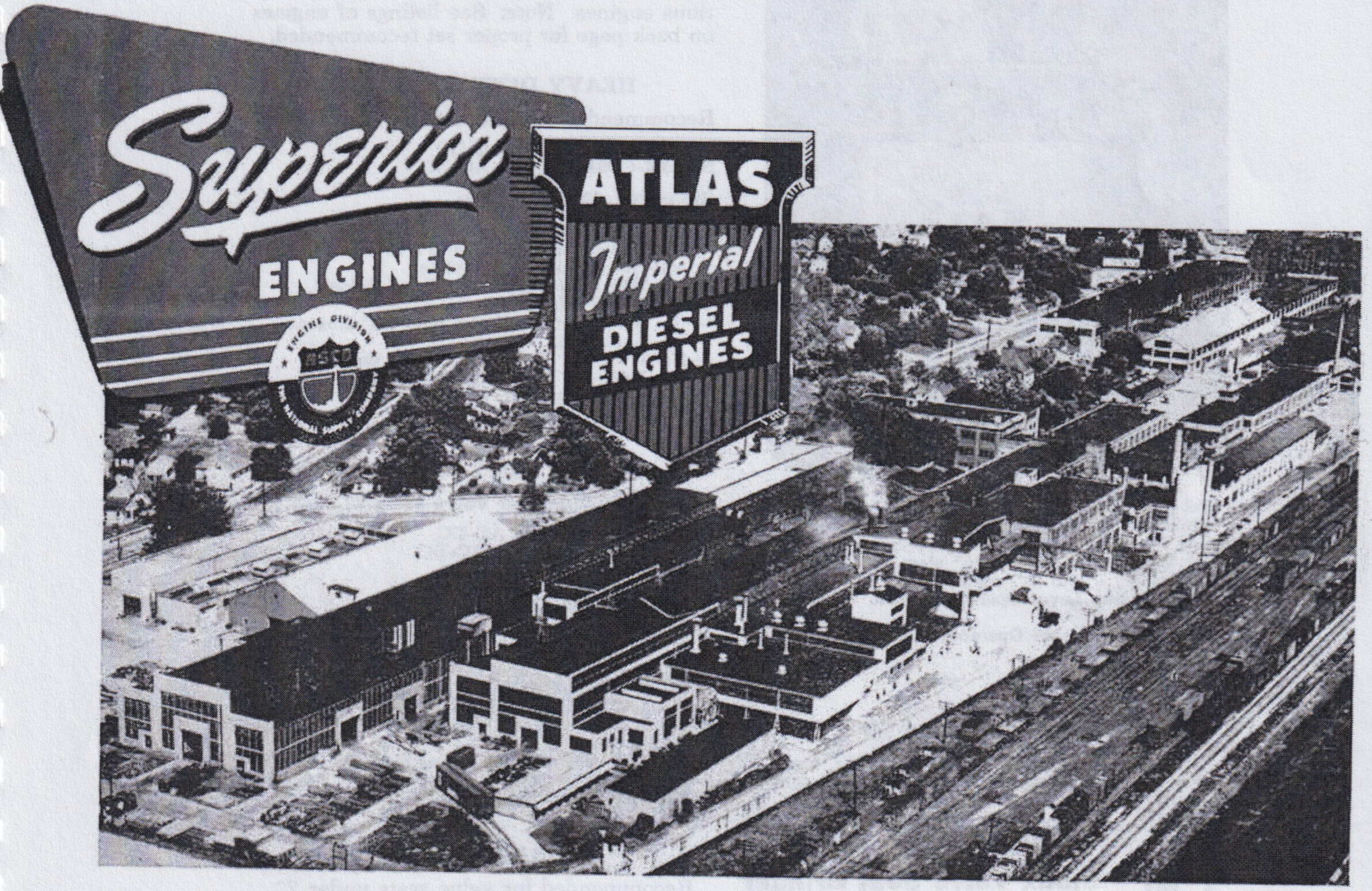
L-9778

SIOUX VALVE SERVICE EQUIPMENT

Approved by

THE NATIONAL SUPPLY CO.

FOR SUPERIOR AND ATLAS ENGINES



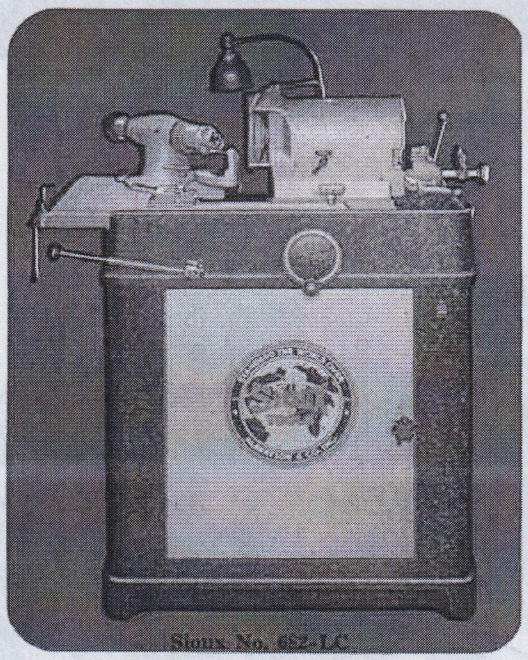
Manufactured by

ALBERTSON & CO., INC.

SIOUX CITY 2, IOWA, U.S.A.

SIOUX TOOLS
STANDARD THE WORLD OVER

Sioux Valve Face Wet Grinding Machine
National Supply No. BM-6476



Sioux No. 682-LC

Wet grinding built in. Reduces wheel dressing to a minimum. Eliminates heat and distortion, producing finest finish and factory precision.

- For valves with 7/16" to 1¼" stem and up to 6" diameter, 15° to 90° angle.
- Quick Acting Lever Operated Chuck, 5/16" to ¾" capacity.
- Quick Acting Lever Operated Chuck 7/16" ot 1¼" capacity.
- Automatic Chuck Stop.
- 1 horsepower motor.
- Micrometer graduated feed.
- 8" grinding wheel for grinding valve face
- 7" cup wheel for grinding valve end.
- Removable coolant tank for easy cleaning, 4 gallon capacity. Pump mounted in tank, self-priming.
- Machine is 32" long and 19" wide.

No. 641-B—Flexible Plastic Cover for No. 682.

Sioux Valve Seat Grinder

Basic Sets listed at right. Auxiliary Tool Kits on following page.

NOTE: Correct Auxiliary Tool Kit must be added to recommended basic set to make complete valve seat grinding set.

Dressing Grinding Wheel

Grinding Seat

Sioux Valve Seat Grinding Sets
For National Supply Co. Engines

Large valve seat grinding wheels require a slower driving unit than do the smaller wheels.

Listed here are three Basic Sets, to which special kits of pilots and grinding wheels must be added as recommended for the various engines. Note: See listings of engines on back page for proper set recommended.

HEAVY DUTY BASIC SET
Recommended for Valve Seats 3" and over

No. BM-6309—115 volt AC-DC.
No. BM-6309A—220 volt AC-DC.

Sioux No. 1780 Includes:

1—No. 1770—H. D. Driver, 4000 R.P.M.
1—No. 1772—Dressing Tool with 1772-B Pilot, Guard and Driver Support, complete.
2—No. 1703-BB-5—Grinding Wheel Holders.
1—No. 1682-3—Holder Clamp.
1—No. X-826—Dial Indicator with 3½" finger.
1—No. X-812—Pin.
1—No. 1442—3¾" Special Lifting Spring.
1—No. 1442—5½" Special Lifting Spring.
1—No. 1703-8—Spanner Wrench.
1—No. 1779—Metal Box.

HEAVY DUTY BASIC SET
Recommended for valve seats 2" to 3"

No. BM-6451—115 volt AC-DC.
No. BM-6451A—220 volt AC-DC.
No. BM-6451B—32 volt DC.

Sioux No. 1777 Includes:

1—No. 1705—Driver, 8000 R.P.M.
1—No. 1772—Dressing Tool with guard, with 1718-B Pilot.
2—No. 1703-BB—Grinding Wheel Holders.
1—No. 1682-3—Holder Clamp.
1—No. X-826—Indicator with 3½" finger.
1—No. X-812—Pin.
1—No. 1442—3¾" Special Lifting Spring.
1—No. 1442—5½" Special Lifting Spring.
1—No. 1779—Metal Box.

BASIC SET
Recommended for valve seats under 2"

No. BM-6452—115 volt AC-DC.
No. BM-6452A—220 volt AC-DC.
No. BM-6452B—32 volt DC.

Sioux No. 1752 Includes:

1—No. 1710—High Speed Driver, 12000 R.P.M.
2—No. 1702-BB—Ball Bearing Wheel Holder.
1—No. 1713—Sioux Dressing Tool.
1—No. X-811—Pin.
1—No. X-825—Indicator.
1—No. 1757—Metal Box.

Shipping weight 54 lbs.

Albertson & Company, Inc.
SIOUX CITY 2, IOWA, U.S.A.

PRICE LIST

SIOUX VALVE SERVICE TOOLS

For National Supply Co. Superior and Atlas Engines

No.	Price
BM-6308	$ 35.10
BM-6309	258.95
BM-6309A	258.95
BM-6451	218.30
BM-6451A	218.30
BM-6451B	218.30
BM-6452	131.60
BM-6452A	131.60
BM-6452B	131.60
BM-6453	22.30
BM-6454	25.30
BM-6455	85.60
BM-6455A	85.60
BM-6455B	85.60
BM-6456	36.30
BM-6457	24.40
BM-6458	37.30
BM-6459	59.00
BM-6459A	59.00
BM-6459B	59.00
BM-6460	20.90
BM-6461	28.30
BM-6462	39.30

No.	Price
BM-6463	$ 43.50
BM-6464	59.00
BM-6464A	59.00
BM-6464B	59.00
BM-6465	30.00
BM-6466	35.00
BM-6467	21.00
BM-6468	27.80
BM-6469	28.30
BM-6470	27.40
BM-6471	14.00
BM-6472	26.90
BM-6473	29.00
BM-6475	21.00
BM-6476	1185.00
BM-6477	27.80
BM-6478	39.00
BM-6479	32.40

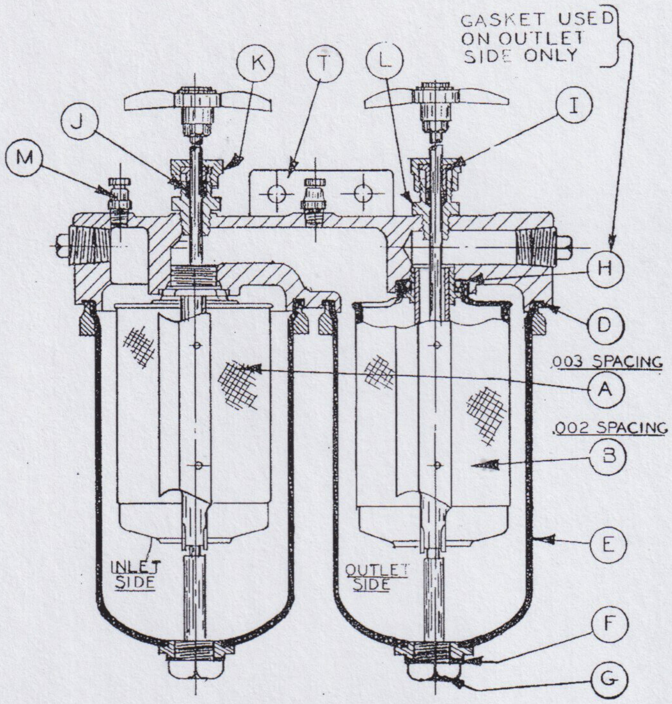
PRICES ARE NET TO USER AND SUBJECT TO CHANGE WITHOUT NOTICE

ALBERTSON & COMPANY, Inc.

Sioux City 2, Iowa, U. S. A.

D.W.V.—FORM 198-PL—11-6-53—2M

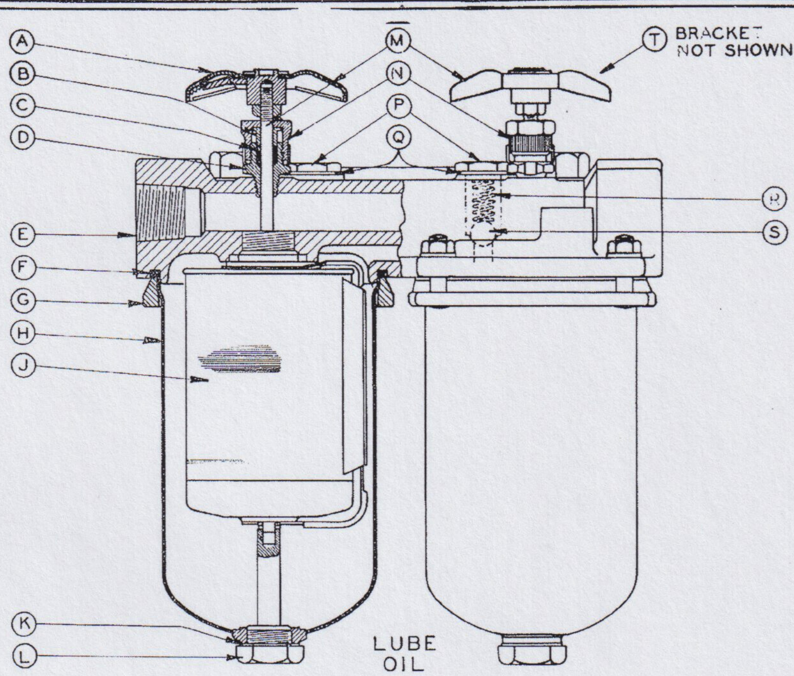
PRINTED IN U.S.A.



REF. NO.	NO. REQ.	NAME	PART NO.
A		ELEMENT & KNIFE ASSEM.	F-6418 P1
B	1	ELEMENT & KNIFE ASSEM.	F-6418 P2
D	2	GASKET	F-6418 P3
E	2	SUMP TANK	F-6418 P4
F	2	GASKET	F 6418 P5
G	2	PLUG	F-6418 P6
H	1	GASKET	F-6418 P7
I	2	GLAND	F-6418 P8
J	2	PACKING	F-6418 P9
K	2	CAP	F-6418 P10
L	2	PLUG	F-6418 P11
M		VENT	F-6418 P13
T	1	BRACKET	F-6418 P12

COMPLETE FILTER PART No. F-6418P

—FUEL OIL—



REF. LET.	NO. USED	NAME	A.I.D.E. CO. PART NO.
A	2	HANDLE ONLY	3A1872P1
B	2	GLAND	F-6418P8
C	2	PACKING	F-6418P9
D	2	PLUG	F-6418P11
E	1	HEAD	3A1872P5
F	2	GASKET	F-6418P3
G	2	RING	3A1872P7
H	2	SUMP TANK	F 6418P4
J	2	ELEMENT & KNIFE ASSEM	F-6418P1

REF. LET.	NO. USED	NAME	A.I.D.E. CO. PART NO.
K	2	GASKET	F-6418P5
L	2	PLUG	F-6418P6
M	2	HANDLE & STEM	3A1872P12
N	2	PACKING NUT	F-6418P10
P	2	SCREW	3A1872P14
Q	2	GASKET	3A1872P15
R	2	SPRING	3A1872P16
S	2	BALL	3A1872P17
T	1	MOUNT. BRACKET	F-6418P12

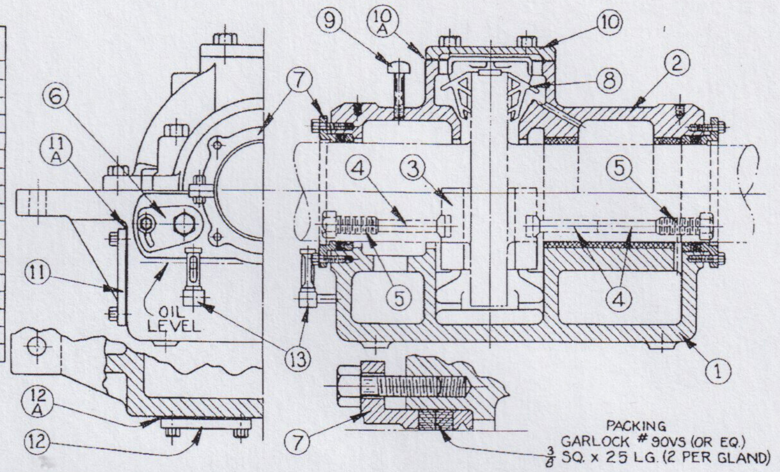
—COMPLETE FILTER PART No 3A1872—

—NOTE—

BOTH FILTERS SHOWN ABOVE MAY NOT NECESSARILY BE USED.
CHECK INDEX SHEET OR GROUP LISTS FOR PART No. OF FILTERS.

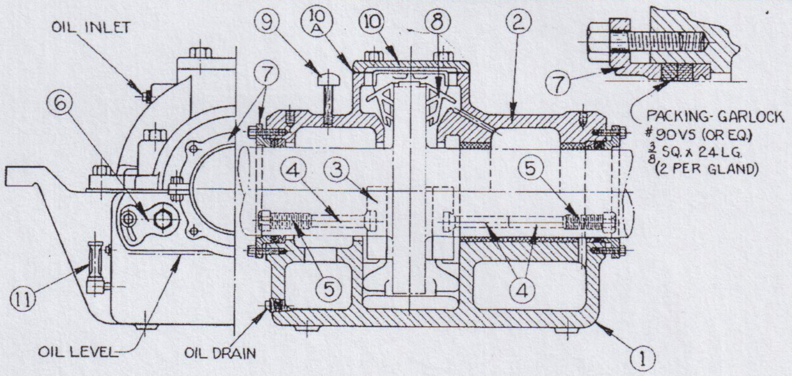
REF. NO.	NO. REQ.	PART
1	1	HOUSING - LOWER HALF
2	1	HOUSING - UPPER HALF
3	4	SHOE ASSEMBLY
4	6	THRUST PIN
5	4	JACK SCREW
6	4	LOCK WRENCH
7	2	PACKING GLAND ASSEM.
8	1	OIL SCRAPER
9	3	AIR VENT
10	1	TOP COVER PLATE
10A	1	GASKET
11	2	SIDE COVER PLATE
11A	1	GASKET
12	2	END COVER PLATE
12A	1	GASKET
13	1	OIL GAUGE

BEARING COMPLETE
PART NO. C-9229-P



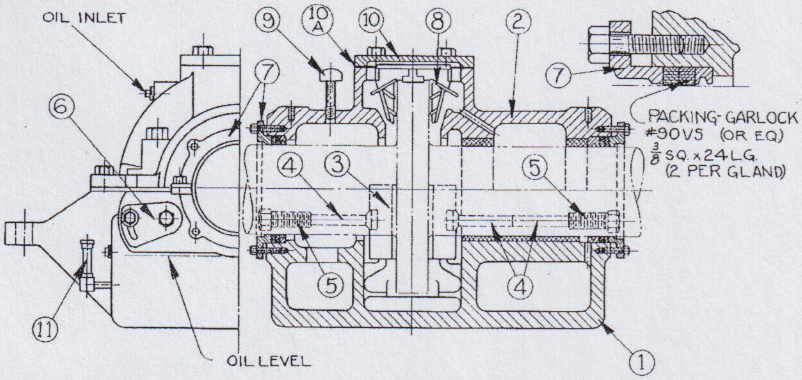
REF. NO.	NO. REQ.	PART
1	1	HOUSING - LOWER HALF
2	1	HOUSING - UPPER HALF
3	4	SHOE ASSEMBLY
4	6	THRUST PIN
5	4	JACK SCREW
6	4	LOCK WRENCH
7	2	PACKING GLAND ASSEM.
8	1	OIL SCRAPER
9	3	AIR VENT
10	1	TOP COVER PLATE
10A	1	GASKET
11	1	OIL GAUGE

BEARING COMPLETE
PART NO. 2C135-P



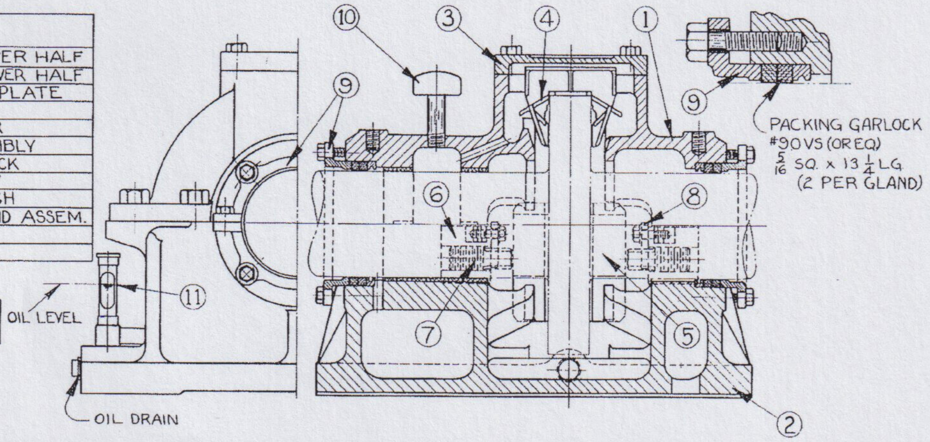
REF. NO.	NO. REQ.	PART
1	1	HOUSING - LOWER HALF
2	1	HOUSING - UPPER HALF
3	4	SHOE ASSEMBLY
4	6	THRUST PIN
5	4	JACK SCREW
6	4	LOCK WRENCH
7	2	PACKING GLAND ASSEM.
8	1	OIL SCRAPER
9	1	AIR VENT
10	1	TOP COVER PLATE
10A	1	GASKET
11	1	OIL GAUGE

BEARING COMPLETE
PART NO. 2C140-P



REF. NO.	NO. REQ.	PART
1	1	HOUSING - UPPER HALF
2	1	HOUSING - LOWER HALF
3	1	TOP COVER PLATE
4	1	OIL SCRAPER
5	4	SHOE ASSEMBLY
6	4	THRUST BLOCK
7	4	JACK SCREW
8	4	LOCK WRENCH
9	2	PACKING GLAND ASSEM.
10	1	AIR VENT
11	1	OIL GAUGE

BEARING COMPLETE
PART NO. 2C169-P



KINGSBURY THRUST BEARINGS

NOTE —— WHEN ORDERING PARTS
1. GIVE PART NUMBER OF COMPLETE BEARING AS LISTED ON GROUP SHEET
2. GIVE REF. NUMBERS & NAMES OF PARTS REQUIRED FROM PROPER TABULATION ABOVE

PLATE No.
K-2140 (ED. 2)

SIOUX TOOLS
STANDARD THE WORLD OVER

SIOUX AUXILIARY TOOL KITS

The following auxiliary tool kits include grinding wheels and pilots as needed for each engine. Below is listed the number of each kit and what they contain. Also Kits for Air Starter valves. Note: See listings of engines on back page for proper kits recommended.

Kit No.	Pilots	Grinding Wheels
BM-6308	TSA-751—12 "x5½" TSA-753—12 "x5½" TSA-755—12 "x5½"	K- 57-WS K- 59-WS K-117-WS K-119-WS 3¼"-45° 3½"-45°
BM-6453	TS-631—11½"x5½" TS-633—11½"x5½" TS-635—11½"x5½"	K- 59-WS—3½"-45° K-119-WS— "
BM-6454	TSA-688—13 "x7 " TSA-690—13 "x7 " TSA-692—13 "x7 "	K- 59-WS—3½"-45° K-119-WS— "
BM-6456	TSA-751—12 "x5½" TSA-753—12 "x5½" TSA-755—12 "x5½"	K- 59-WS K- 61-WS K-119-WS K-121-WS 3½"-45° 3¾"-45°
BM-6457	TSB-688—12½"x6 " TSB-690—12½"x6 " TSB-692—12½"x6 "	K- 55—3"-45° K-115— "
BM-6458	TS-1001—10⅝"x5 " TS-1003—10⅝"x5 " TS-1005—10⅝"x5 "	K- 59-WS—3½"-45° K-119-WS— "
BM-6460	TSA-626—11 "x5 " TSA-628—11 "x5 " TSA-630—11 "x5 "	K- 46-#3—2½"-45° K-106-#3— "
BM-6461	TSE-751—12½"x6 " TSE-753—12½"x6 " TSE-755—12½"x6 "	K- 59-WS—3½"-45° K-119-WS— "
BM-6462	TSC-876—12½"x6½" TSC-878—12½"x6½" TSC-880—12½"x6½"	K- 59-WS K- 63-5-WS K-119-WS K-123-5-WS 3½"-45° 4"-45°
BM-6463	TS-1126—12 "x5 " TS-1128—12 "x5 " TS-1130—12 "x5 "	K- 65-5-WS—4¼"-45° K-125-5-WS "
BM-6465	TSD-875—15 "x7 " TSD-877—15 "x7 " TSD-879—15 "x7 "	K- 63-5-WS—4"-45° K-123-5-WS— "
BM-6466	TSD-875—15 "x7 " TSD-877—15 "x7 " TSD-879—15 "x7 "	K- 68-5-WS—4¾"-45° K-128-5-WS— "
BM-6467	TS-626—11½"x5½" TS-628—11½"x5½" TS-630—11½"x5½"	K- 51—2¾"-45° K-111— "
BM-6468	TSF-751—14½"x7¼" TSF-753—14½"x7¼" TSF-755—14½"x7¼"	K- 57-WS—3¼"-45° K-117-WS "
BM-6469	TSD-751—13½"x6¾" TSD-753—13½"x6¾" TSD-755—13½"x6¾"	K- 59-WS—3½"-45° K-119-WS— "
BM-6470	TSD-626—14 "x7 " TSD-628—14 "x7 " TSD-630—14 "x7 "	K- 51 K- 55 K-111 K-115 2¾"-45° 3"-45°
BM-6471	TS-313— 8⅜"x5 " TS-314— 8⅜"x5 " TS-315— 8⅜"x5 "	SK- 3—1⅝"-45° SK-73— "

Kit No.	Pilots	Grinding Wheels
BM-6472	TS-501-3—11 "x5 " TS-502-3—11 "x5 " TS-503-3—11 "x5 "	K- 46-#3, K-111 K-106-#3, K- 51 2½"-45° 2¾"-45°
BM-6473	TSA-751—12 "x5½" TSA-753—12 "x5½" TSA-755—12 "x5½"	K- 61-WS—3¾"-45° K-121-WS— "
BM-6475	TSD-626—14 "x7 " TSD-628—14 "x7 " TSD-630—14 "x7 '	K- 51—2¾"-45° K-111— "
BM-6477	TSA-751—12 "x5½" TSA-753—12 "x5½" TSA-755—12 "x5½"	K- 57-WS—3¼"-45° K-117-WS
BM-6478	TSE-1001—14½"x6½" TSE-1003—14½"x6½" TSE-1005—14½"x6½"	K- 65-5-WS—4¼"-45° K-125-5-WS— "
BM-6479	TS-563—11 "x5 " TS-564—11 "x5 " TS-565—11 "x5 " TS-566—11 "x5 "	K-455—3"-30° K-525— " K- 49—2⅝"-45° K-109— "

Kits for Air Starter Valves

BM-6455—115 Volt.
BM-6455-A—220 Volt.
BM-6455-B—32 Volt.

Includes:

1—No. 1710 Driver, 12,000 R.P.M.
2—No. 1702-BB—Wheel Holders.
1—No. 1772-A—Pilot.
1—No. X-825-A—Sleeve.
1—No. X-811—Pin.
1—No. SK-5—1⅜"-45° Grinding Wheel
1—No. SK-75—1⅜"-45° Grinding Wheel.
1—No. TSG-750-2—Special Pilot.

BM-6459—115 Volt.
BM-6459-A—220 Volt.
BM-6459-B—32 Volt.

Includes:

1—No. 1710—Driver, 12,000 R.P.M.
1—No. K-17-3—1¾"-45° Grinding Wheel.
1—No. K-87-3—1¾"-45° Grinding Wheel
1—No. TSA-937—Special Pilot.

BM-6464—115 Volt.
BM-6464-A—220 Volt.
BM-6464-B—32 Volt.

Includes:

1—No. 1710—Driver, 12,000 R.P.M.
1—No. K-21-3—1⅞"-45° Grinding Wheel.
1—No. K-91-3—1⅞"-45° Grinding Wheel.
1—No. TSF-1000—Special Pilot.

FOR NATIONAL SUPERIOR AND ATLAS ENGINES

SIOUX TOOLS

STANDARD THE WORLD OVER

Listing of Engines and Basic Sets with Auxiliary Kits needed for each Model Engine. Number.

(Note: Where there are no model numbers, bore and stroke are substituted for identification.)

Model No. Superior Engines	Basic Set Numbers Sioux	National	For Regular Valves Auxiliary Kit No.	For Air Starter Valves Auxiliary Kit No.
6-G-510	1780	BM-6309	BM-6453	
PTD, 40	1780	BM-6309	BM-6454	BM-6455
PTG	1780	BM-6309	BM-6456	BM-6455
44	1780	BM-6309	BM-6456	
PTL, 40-LX	1780	BM-6309	BM-6457	BM-6455
LO, LOC, LP, LPC, KN, KNA, KNB, 60	1780	BM-6309	BM-6458	BM-6459
VDHA, GI,	1777	BM-6451	BM-6460	
VDMA, VDMB, VDMS,	1780	BM-6309	BM-6461	BM-6455
VDMD	1780	BM-6309	BM-6462	BM-6455
VDSS, VDST, 80, VDSB, VGST, VDSC,	1780	BM-6309	BM-6463	BM-6464
65	1780	BM-6309	BM-6478	
Model No. Atlas Engines				
1558, 58	1780	BM-6309	BM-6465	
2124, 75, 76 and 12½x16	1780	BM-6309	BM-6466	
327, 5¾x8, 6x8, 6¼x8, 6½x8, 282	1777	BM-6451	BM-6467	
763, 48 and 8½x12	1780	BM-6309	BM-6468	
1125, 55	1780	BM-6309	BM-6469	
464	1780	BM-6309	BM-6470	
Atlas Jr.	1752	BM-6452	BM-6471	
253	1777	BM-6451	BM-6472	
668, 45, 46	1780	BM-6309	BM-6473	
528, 38	1777	BM-6451	BM-6475	
8x9½, 8½x9½, 3" Int. Valve	1780	BM-6309	BM-6308	
8x9½, 8½x9½ 668 industrial	1780	BM-6309	BM-6477	
35	1780	BM-6309	BM-6479	

ALBERTSON & CO., INC.

SIOUX CITY 2, IOWA, U.S.A.

D.W.V.—FORM 198—11-6-53—2M