

PART THREE

OPERATION

GENERAL INSTRUCTIONS

28.—**Cleaning**—After the installation is completed, all parts on the engine should be carefully cleaned to remove dirt, grit, and foreign matter.

29.—**Oiling**—Read the foregoing chapter on Lubrication carefully and inspect each part to see that it is properly oiled and that both lubricators and also the two oil cases on the governor are filled with the correct lubricating oil. See lubrication chart on page 9.

30.—**Removing Air from Fuel Lines**—Before starting a new engine and whenever fuel lines are disconnected or the fuel drained from the engine thereafter, all air must be removed from the fuel lines. To do this disconnect the union nuts at each fuel nozzle. Work each fuel pump by hand until a solid stream of fuel without air bubbles is obtained. If pumps do not pump fuel, loosen the hexagon caps over the pump valves and tighten again when the fuel appears at the nozzles.

31.—**Priming the Cylinders before Starting**—Read paragraph 30 above. To prime the engine before starting, press each fuel pump primer cap down hard three or four times as far as the plunger will go. Note the pressure required on each pump to force the fuel through the nozzles. Prime only enough to insure satisfactory starting. Too much priming will cause the engine to speed up and race when started. If the engine has been running and is still warm, little or no priming is required. See paragraph 79, page 29.

32.—**Compressed Air**—Compressed air for the first start can usually be obtained by filling the small tank at a local garage or other source, and with large engines especially, the shipyard supply can be used. Before using hand driven emergency compressors, a small amount of oil should be poured in the cylinder above the piston. Pump the small air tank up to 150 lbs. pressure and proceed to start the engine.

After the first start is made, the starting air is supplied by the compressor on the engine, and it should not be necessary to again resort to the auxiliary compressor, except in case of emergency. Remember, use compressed air only for starting. Do NOT use oxygen or acetylene or anything of like nature under any conditions.

33—Cleaning Air Lines—Disconnect air inlet copper tube on the air distributor and blow all dirt out of pipes with air pressure.

34—Heating Engines not Equipped with Electric Starting—Open flap doors on cylinder head cap and turn fume manifold down into position. Fill small torch fuel tank with kerosene or fuel oil and open air connection to tank and torches. To start torches first open slightly the air valve (nearest operator). Then while the fuel valve is being opened slightly, light with match or hand torch and adjust to blue flame. When firing tube is bright red, engine is ready to start. After the engine is started, turn torches off by first closing the fuel valve and then the air valve. Also close all valves on torch tank. Leave fume manifold down.

35—Electric Starting—Before closing switches, always see that there is a small spark at the point of contact. This indicates that current is flowing and that the plugs and connections are in good order. Prime the engine before closing the switches. After the current has been on for about thirty seconds, proceed to start the engine according to directions for starting.

The exact length of time the current should be on before starting varies and must be determined by the operator. In cold weather more priming and a greater length of time will be required. Leave the plugs on for a minute or two until the engine fires regularly. Pull in the clutch and put the engine under load as soon as possible. With large engines especially it is good practice to run at half speed or so at the dock for a short time before casting off, to warm up the engine and see that everything is working properly. If one of the cylinders does not fire properly, the corresponding switch should be thrown in again for a short time. Do not continue to pump fuel into a cylinder if it does not fire. Shut off the fuel pump and allow the plug to heat. The trouble may be due to a low battery charge or a loose or corroded connection.

36—Barring Engine Over by Hand—Do not insert the bar in flywheel to turn engine over by hand without first moving throttle lever 303 Fig. 12, , page 27 forward to closed position to shut off the fuel. Before starting two cylinder engines, flywheel must be barred over until No. 1 piston is slightly over center. To do this turn flywheel until the flywheel key on the crankshaft is slightly over top center towards the starboard (to start ahead). An arrow, located on the rim of the flywheel, may be brought in line with the

pointer, which is attached to the governor oil case. **Caution!** Do not forget to remove turning bar.

37—Before Starting Any Engine—First go over the engine carefully, see that all parts are properly oiled, lubricators filled, nozzles spraying fuel, clutch lever in neutral, air damper lever up, air inlet valves in rear of each cylinder open and valve stems free to move in and out. Open main throttle lever, open auxiliary control, open fuel valves from tanks, open sea cock, and don't forget to turn hand cranks on each lubricator at least forty times. **CAUTION:** After starting a new engine for the first time or when starting one on which the pistons just have been pulled, stop the engine after ten or fifteen minutes running. Take off the crankcase plates and feel of the crank pin bearings to make sure they are cool.

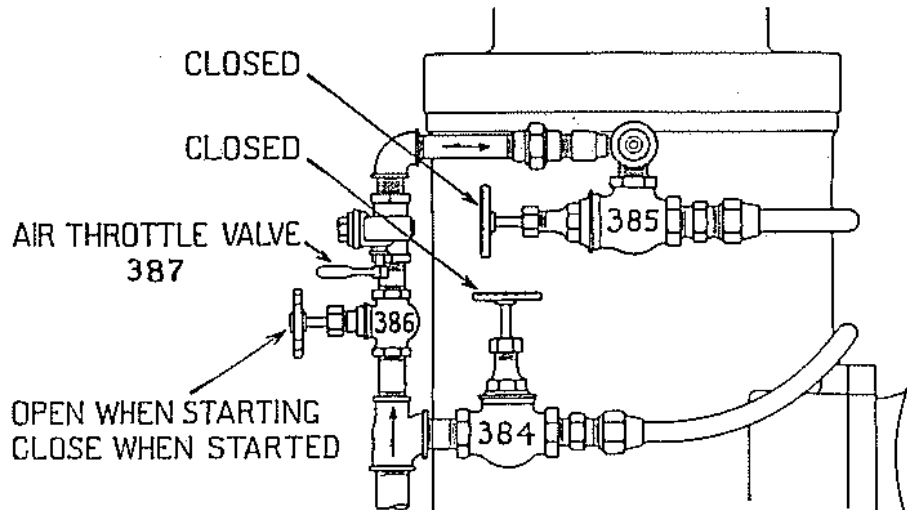


Fig. 1—Valves Set for Emergency Air Starting System.
(Also for starting two cylinder engines without air distributor)

When starting with the emergency system or when starting two cylinder engines not equipped with an air distributor, the air valves should be set as shown above. For starting directions refer to paragraph 38 below and paragraph 45 on page 15.

38—Starting Two Cylinder Engines Not Equipped with Air Distributor—Read paragraph 37 above; then proceed as follows:

1. Bar engine over to starting position. **CAUTION:** see paragraph 36, page 11.
2. Close electric switches or start torches.
3. Prime engine. See paragraph 31, page 10.
If starting with electric plugs, prime engine before closing switches.
4. Open air valve 386 shown on Fig. 1 above.

5. Give air throttle valve 387, shown on Fig. 1, page 12 a quick pull.
6. After engine is started, follow instructions in paragraph 41, page 14.

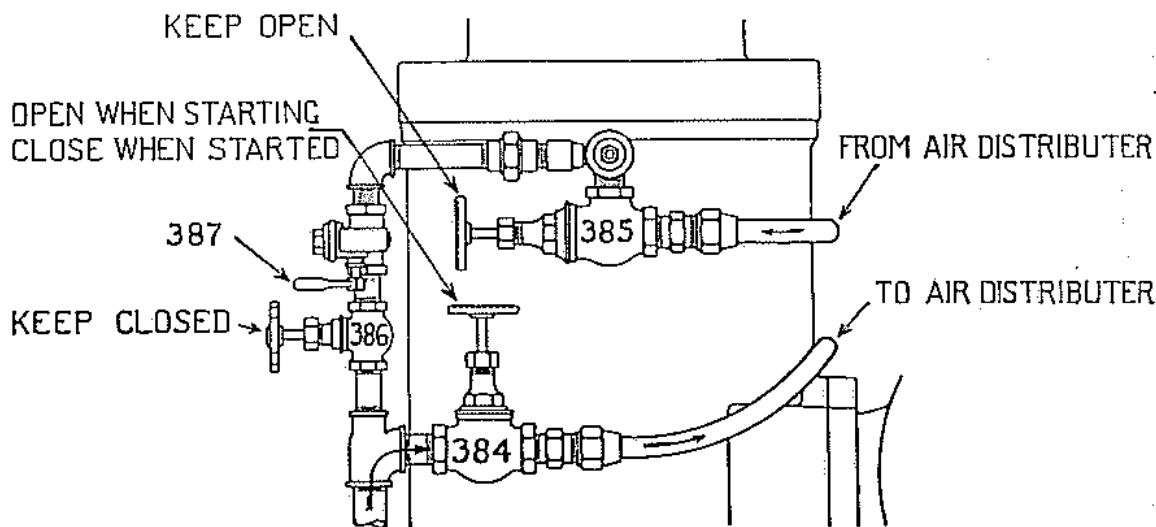


Fig. 2—Valves Set for Starting with Air Distributor.

In starting all three and four cylinder engines and also two cylinder engines equipped with air distributors, the air valves should be set as shown above. For starting directions refer to paragraphs 39 and 40 below.

39—Starting Two Cylinder Engines Equipped with Air Distributor—Read paragraph 37, page 12.

1. Bar engine over to starting position. See paragraph 36, page 11. Usually this is not necessary after engine is well limbered up.
2. Close electric switches or start torches.
3. Prime engine. See paragraph 31, page 10.
If starting with electric plugs, prime engine before closing switches.
4. Set air valves in accordance with Fig. 2 above.
5. Open air throttle valve to turn engine over.
6. After engine starts, follow instructions in paragraph 41, page 14.

40—Starting Three and Four Cylinder Engines—Read paragraph 37, page 12.

1. Close electric switches or short torches.

2. Prime engine. See paragraph 31, page 10.
If starting with electric plugs, prime engine before closing switches.
3. Open air valve 384 shown on Fig. 2, page 13.
4. Move air starting lever on air distributor forward from its central or stop position.
5. After engine is started, follow instructions in paragraph 41 below.

41—After Engine is Started:

1. Immediately close air damper shown on Fig. 6, page 20 to choke engine and prevent racing due to priming. Open to running position as soon as engine has burned the priming charge.
2. Adjust auxiliary throttle hand wheel shown on Fig. 12, page 27 to speed desired and put timing lever 304 shown on Fig. 12, page 27 ahead in correct ahead running position. Make sure cooling water is passing through engine.
3. Open switches and make sure each cylinder is firing.
4. "Pull in clutch" and get engine under load as soon as possible. Under ordinary conditions it is good practice to run the engine with clutch in at one-half or three-quarter speed at the dock for a few minutes to warm up and see that everything is in working order.
5. Close main air valves 384 and 386 shown on Fig. 2, page 13.
6. After starting a new engine for the first time, run the engine slowly for ten or fifteen minutes. Then stop and feel of the connecting rod bearings, as explained in the last part of paragraph 37.

42—To Slow Down:

1. Move auxiliary throttle hand wheel shown on Fig. 12, page 27 forward until desired speed is reached—tighten in position by turning clamping wheel to right.
2. Close air damper shown on Fig. 6, page 20 slightly.

43—To Run Neutral or Idle:

1. Place auxiliary throttle hand wheel shown on Fig. 12, page 27 in position for speed desired.
2. Put air damper lever Fig. 6, page 20 down to partially closed position, or lower, wherever engine runs best.
3. If engine misfires with timing lever 304 Fig 12, page 27 in normal running position, advance to idling position. Under certain conditions and with certain grades of fuel it may be necessary to place the timing lever in the center of the quadrant or a little aft of center when idling.
4. If cooling water is very cold, close sea cock slightly to keep cylinder heads warm when idling. Open again when running under load.

44—Reversing on Compressed Air: (Applies to 3 and 4 cylinder engines only).

1. Open air lines and valves to air starter as shown on Fig. 2, page 13. See that air inlet valves at the rear of each cylinder are open (with locking wheels forward).
2. Bring throttle lever 303 shown on Fig. 12, page 27 forward on quadrant to stop engine.
3. When engine stops open throttle and move air starter lever on air distributor aft for astern running (move forward for ahead running).
4. If full power is required astern, the timing lever 304 shown on Fig. 12, page 27 should be moved aft of central position.
5. Control speed of the engine with auxiliary throttle hand wheel shown on Fig. 12, page 27.

45—Emergency Starting System—At any time if necessary, all three and four cylinder engines (also two cylinder engines equipped with air distributor) may be started without using the air distributor by following the method used in starting two cylinder engines not having air distributors. See paragraph 38, page 12 and Fig. 1, page 12.