TECHNICAL BULLETIN

T-014

INSTALLATION INFORMATION FOR ONAN ELECTRIC GENERATING PLANTS

SEPTEMBER 1964

Onan

DIVISION OF STUDEBAKER CORPORATION
MINNEAPOLIS, MINNESOTA 55414
Printed in U.S.A.

CONTENTS

INSTALLATION INFORMATION FOR ONAN ELECTRIC GENERATING PLANTS

SCOPE. - Information in this bulletin is based on extensive tests under favorable operating conditions. Use this bulletin as a general guide. Deviate from these recommendations to meet specific installation requirements.

Abide by codes of agencies having jurisdiction over the installation and operation of internal combustion engines (see bibliography for a list of reference publications).

LOCATION. - Plant location is decided chiefly by related systems, such as ventilation, cooling, wiring, fuel, and exhaust. Provide adequate access for service and repair. Locate the plant near the main power fuse box.

Wooden floors on which installations are made should be covered with sheet metal extending 12" beyond the extremeties of the plant. Provide adequate lighting facilities around the plant.

Protect plants from adverse weather. Avoid locations where ambient temperature extremes prevail. Special starting aids are available to ensure dependable starting at low ambient temperatures. City water cooling systems are available for more effective cooling at high ambient temperatures.

MOUNTING. - Mount the generating plant on a substantial, level base. Secure units not mounted on skids. Skid mounted units should be secured if on raised foundations. Foundations facilitate service and repair and protect the unit from seepage.

Foundations for small units may be of poured concrete with anchored mounting bolts. Steel beam sections make an acceptable alternate.

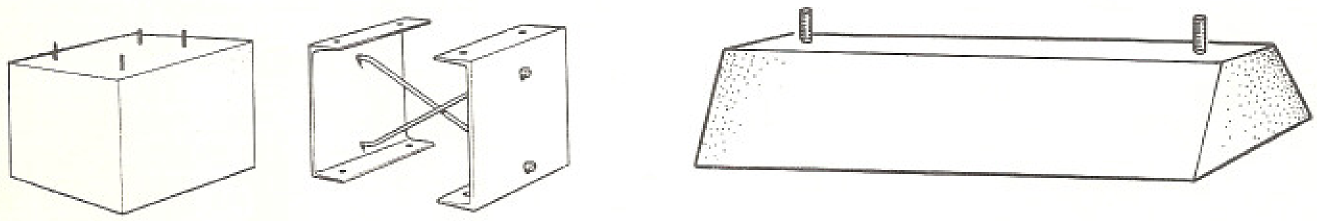


Figure 1

Mounting large units on foundations is optional but recommended. Two or three tapered concrete blocks can be used in preference to a solid concrete pad. Tapered blocks if made high enough and placed crosswise of the plant will permit easy removal of the engine oil pan.

Outline drawings with mounting hole dimensions are available for all Onan plants.

VIBRATION DAMPERS. - Provisions for isolating vibration are available on all Onan units. The type mounting cushion supplied with all J-line units is shown in Figure 2. In Figure 3 is an optional type. A pad type vibration mount for large, skid-mounted units is shown in Figure 4.

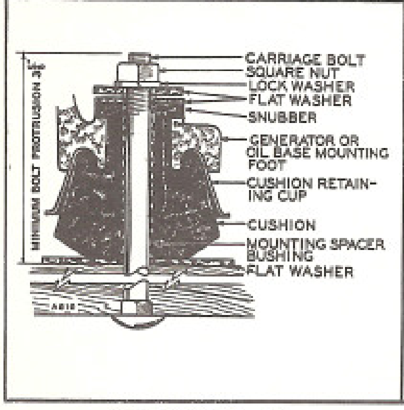


Figure 2

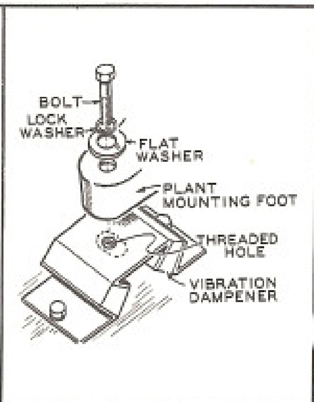


Figure 3

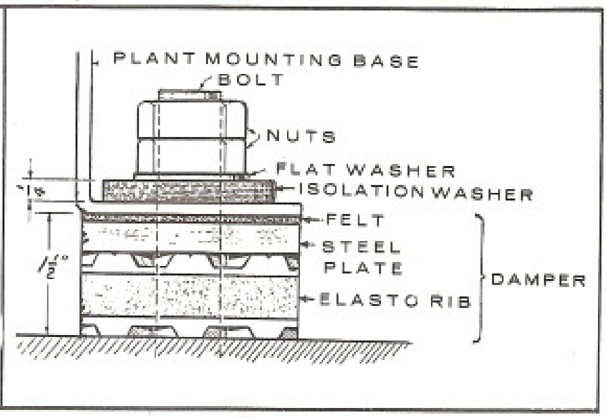


Figure 4

EXHAUST SYSTEM. - Exhaust from internal combustion engines is poisonous. Pipe exhaust gases outside. Exhaust pipes must not terminate near inlet vents nor combustible materials.

If exhaust gases are piped into a chimney, the point of entry must be above flues and vents.

Exhaust pipes must not come closer than 9" to combustible materials. Protect walls and partitions through which exhaust pipes pass with an approved thimble, Figure 5.

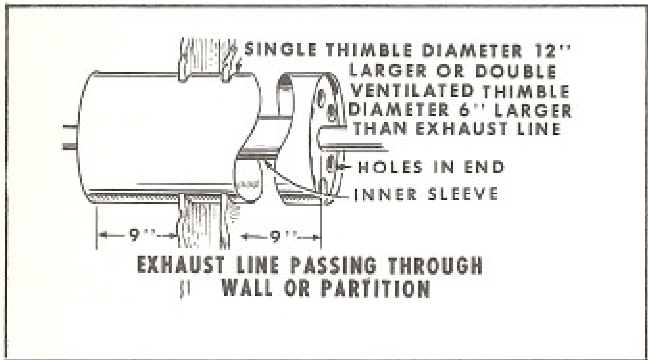


Figure 5

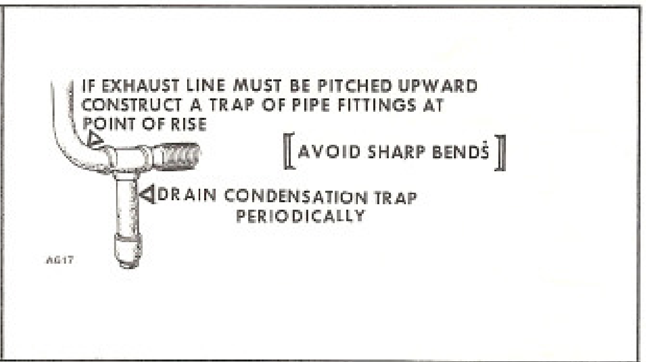


Figure 6

Pitch exhaust pipes downward, or install a condensate trap at the point where a rise in the exhaust system begins, Figure 6.

Avoid sharp bends. Use sweeping, long radius elbows. Use a section of seamless, flexible tubing between the engine and any rigid piping to restrict vibration. Increase pipe 1 size for each additional 10 foot span.

Exhaust pipes should be of wrought iron or steel. The pipes should have adequate support and sufficient strength to withstand severe service.

Exhaust pipes should be as short and have as few fittings as possible. The values below represent the number of feet of straight pipe to which the various kinds and sizes of fittings are equivalent. These values must be added to the total length of straight pipe to determine whether an increase in pipe size is necessary.

TABLE 1 - EQUIVALENTS OF FITTINGS TO STRAIGHT PIPE

TYPE OF FITTING	SIZE OF FITTING								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
	EQUIVALENCE TO STRAIGHT PIPE IN FEET								
STANDARD ELL	.84	1.2	1.6	2.2	2.6	3.6	4.4	5.7	7.9
LONG RADIUS ELL	.41	.57	.77	1.1	1.3	1.7	2.2	2.8	3.9
MEDIUM RADIUS ELL	.52	.73	.98	1.4	1.6	2.2	2.8	3.6	5.0
STANDARD TEE	1.7	2.3	3.1	4.4	5.2	7.1	8.7	11.4	15.8

MUFFLERS. - Cool mufflers collect undesirable carbon residues. Install mufflers as close as practicable to the engine. Mufflers within air outlet ducts must be wrapped with asbestos to prevent "hot spots" from forming on the ducts. Increase duct size by an amount equal to the radial cross section of the muffler installtion. The three muffler classifications for units rated 50 kw and larger, are listed in the following table.

TABLE 2 - PHYSICAL CHARACTERISTICS OF MUFFLERS

MODELS	INDUSTRIAL	RESIDENTIAL	CRITICAL
DWJ	47" lg x 10" od 52 pounds 155P481	47" lg x 10" od 52 pounds 155P481	48" lg x 12" od 57 pounds 155P188
KB, DFA DFJ		48" lg x 12" od 52 pounds 155P632	54" lg x 14" od 102 pounds 155P191
KR, DFB DFC	43" lg x 12" od 97 pounds 155P604	52" lg x 14" od 115 pounds 155P642	66" lg x 14" od 135 pounds 155P605
WA, WB DFD	49" lg x 14" od 120 pounds 155P606	59" lg x 16" od 165 pounds 155P645	77" lg x 16" od 215 pounds 155P598
DFE, DFK	55" lg x 16" od 160 pounds 155P720	72" lg x 18" od 225 pounds 155P651	96" lg x 18" od 310 pounds 155P650
DWF	66" lg x 20" od 270 pounds 155P616	84" lg x 24" od 400 pounds 155P636	108" lg x 24" od 515 pounds 155P649

VENTILATION. - A ventilating system must be designed and installed to provide enough fresh air at the generating plant for efficient cooling and combustion. In addition to removing engine heat and replacing combustion air, heat produced by the generator and other equipment in the same general area has to be removed by the ventilating system. When designing the system, consider prevailing wind direction, ambient temperature, sound principles of duct design, and all other factors that might influence air flow and circulation.

Generally, there has to be an inlet and an outlet in the room for circulation. These vents must be so arranged in the room that air cannot escape without first passing through the immediate area of the installation. The outlet should be slightly higher than the inlet to allow for convection.

Vents must be large enough to provide the required volume/time of air. If free air flow is in any way inhibited by louvers or screens, the vents must be increased in area 1/4 to 1/2 times. Wind may also restrict free air flow if it prevails directly into the outlet vent. However, unless the wind blows with some regularity directly into the vent, consider this factor to be of only marginal importance.

Control of air flow to maintain a desirable temperature range can be done with thermostatic shutters. They regulate air flow during operation and close at shut-down. Closing at shut-down is especially important in cold climates where the natural draining of cold air into the outlet duct can lower the ambient temperature below a safe level for all engines, particularly diesels.

Of vital importance is avoiding a situation that leads to recirculation of cooling air. If inlet air is $10^{O}F$ above ambient, there is a good chance cooling air is re-circulating. Take positive steps during installation planning to avoid this problem. For units with radiators, a duct should be installed between the radiator and outlet vent. The duct must be at least as large as the exposed area of the radiator; see Table 4. Use a duct with as few bends as possible. If bends are needed, make them gradual so air will be able to flow against only a minimum restriction. If there is any question about flow restrictions, static pressure in the duct can be checked with a manometer. The maximum tolerable pressure is about 1/2" water.

TYPES OF COOLING SYSTEMS — Although the basic need for air circulation is common to all generating plants, there are differences in the way each need is satisfied.

There are 2 general types of cooling systems for internal combustion engines — air and water — and within each general classification there are several variations.

AIR COOLING SYSTEMS — All engines require air to some extent, but in this classification are included only engines that depend entirely on air for cooling. Onan has air cooled plants ranging in output capacity from 500 watts to 15, 000 watts. Their air flow and vent size requirements are in Table 3.

When the demand for an air cooling system that would adapt well to compartment installations was met with a vacuum type of cooling system, the more conventional

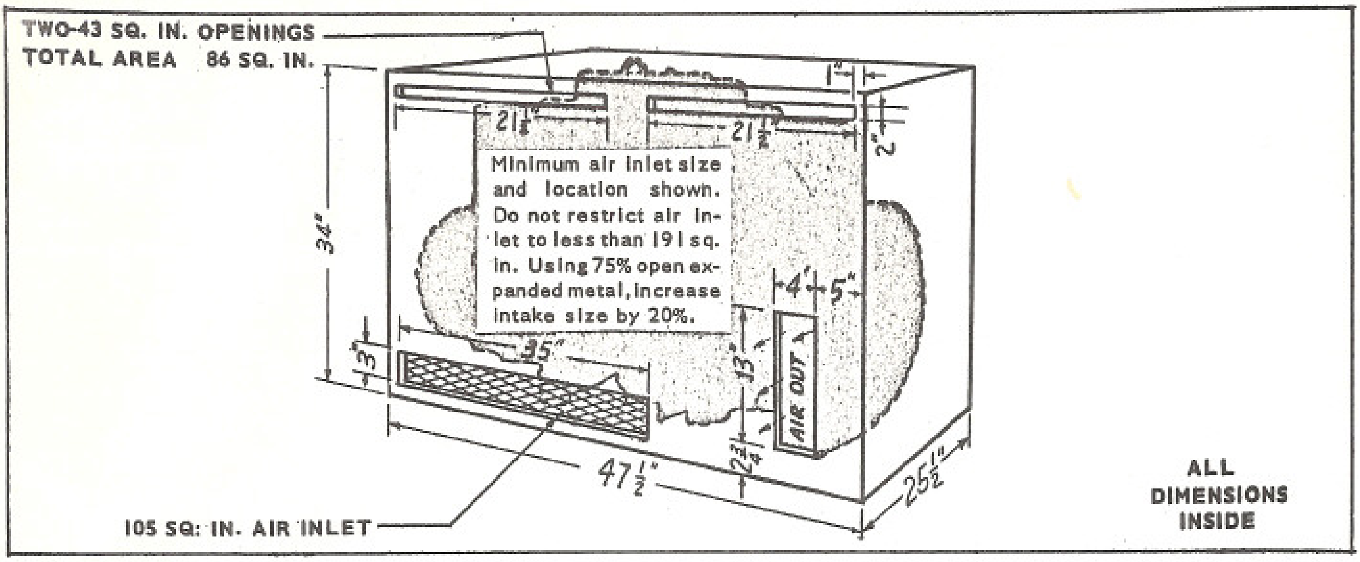


FIG. 7 - TYPICAL ENCLOSURE DIMENSIONS FOR JB VACU-FLO PLANT

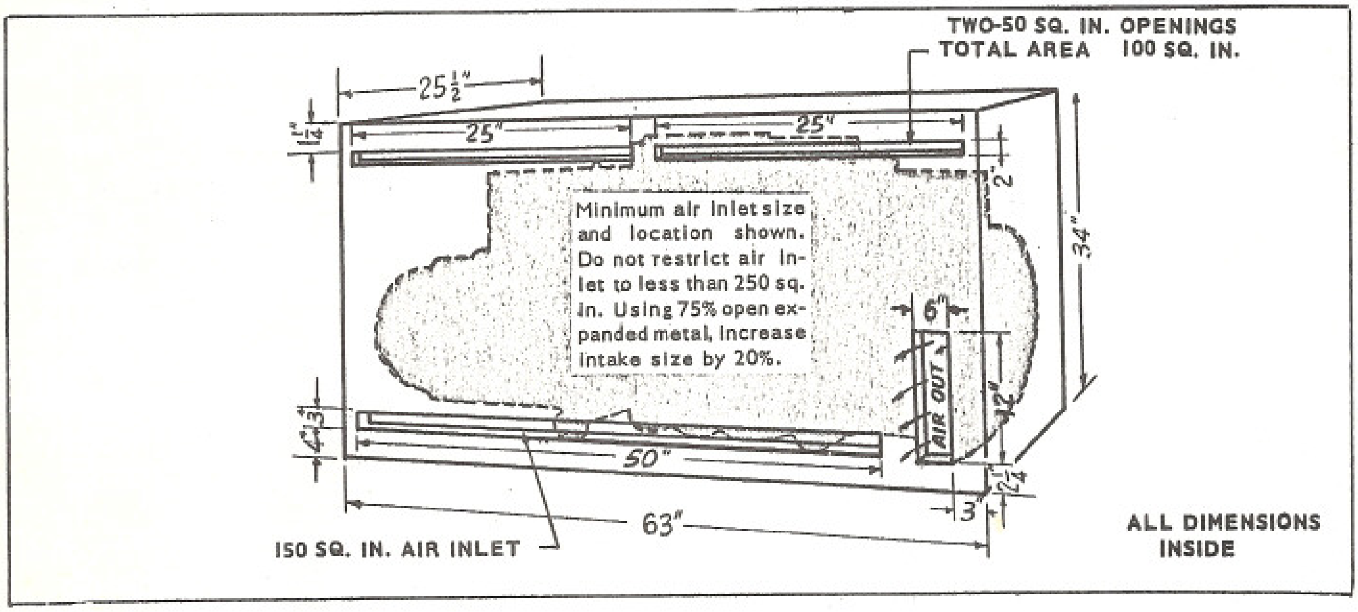


FIG. 8 - TYPICAL ENCLOSURE DIMENSIONS FOR JC VACU-FLO PLANT

type was given the designation of pressure cooling. Here is how the 2 types work:

VACU-FLO COOLING — A centrifugal fan in a scroll housing pulls cooling air in at the generator. As the air flows through the generator and around cooling fins, it picks up the excess heat of combustion and the heat produced by the generator in normal operation. This heated air is then forced from a single discharge, either into a duct or away from the installation area.

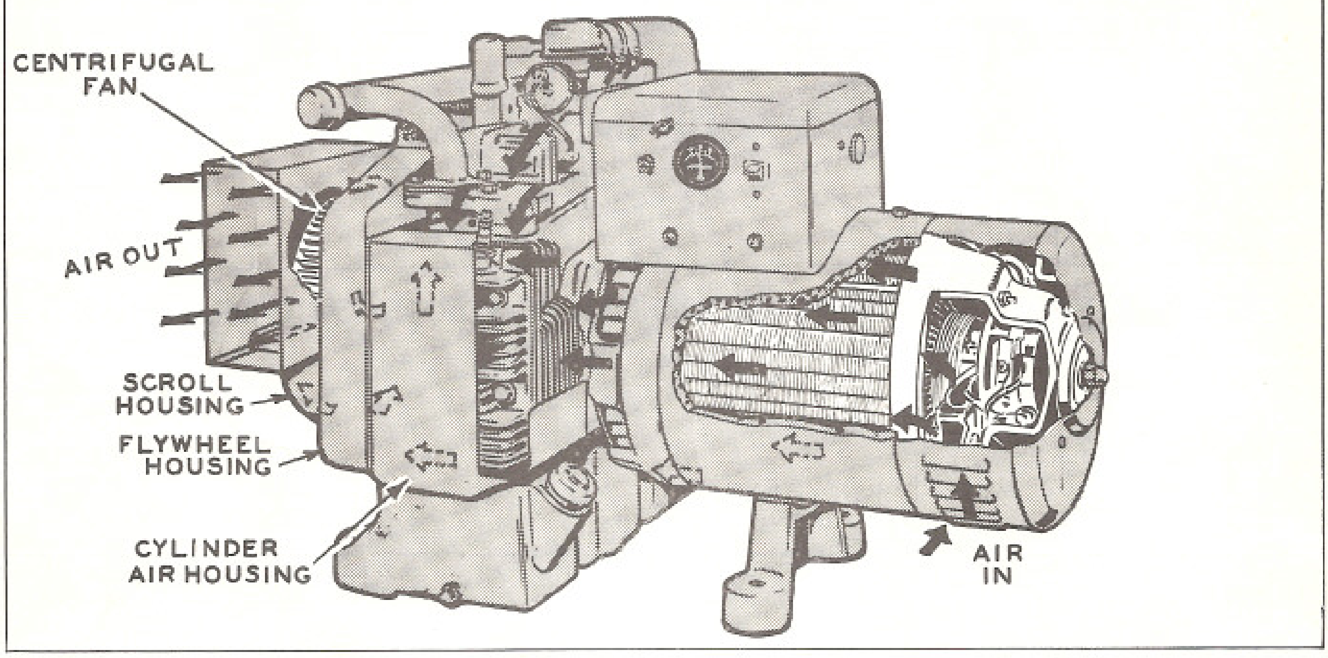


Figure 9 - Vacu-Flo Cooling

The centrifugal fan, if given an adequate source, is capable of easily moving the required volume of air. When a duct is used between the scroll discharge and the outlet vent, its free area must be at least as large as the scroll discharge. The radial cross sectional area of the duct must be increased if air flow is restricted by bends, long runs, screens, or the exhaust pipe. Exhaust pipes run inside vacu-flo ducts should be covered with asbestos tape to confine exhaust heat to the exhaust pipe. Ducts may not be needed if natural circulation is adequate, unless air conditioning is involved. Screen used to cover vents must be 1/4" mesh or larger.

PRESSURE COOLING — Instead of being pulled over the generator and engine, as with Vacu-Flo, cooling air with this type is forced or pushed around the engine and cooling fins. There is a blower for the engine, inside a blower housing, and a separate blower for the generator. Vent sizes and air flow requirements are in Table 3. The relative location of the inlet and outlet vents, as well as vent sizes, should be well planned, taking into account all the factors that might influence air flow.

The "J" line of engines with pressure type cooling have provisions for attaching a duct to the air outlet side of the engine. If such a duct is used, the outlet vent should be at least as large as the radial cross section of the duct. If a long duct (over 8 ft.) is used or if there are more than two 90° bends, increase the duct size so that the static pressure does not exceed 1/2" water column.

TABLE 3 - AIR COOLED PLANTS

PLANT MODEL	RPM	PRESSURE AIR (cfm)	PRESSURE INLET VENT (sq. ft)	PRESSURE OUTLET VENT (sq. ft)	VACU-FLO AIR (cfm)	VACU-FLO INLET VENT (sq. ft)
AJ-AK	1800	115	1	2	180	1/4
AJ-AK	2400	138	1	2	240	1/2
AJ-AK	3600	224	1-1/2	2-1/2	370	1/2
LK	1800	300	1	2	450	1
CCK	1800	500	2-1/2	5	750	1
3JA	1800	400	2-1/2	*1/2	--	--
5JB	1800	600	3-1/2	*1/2	600	1-1/3
705JB	1800	600	3-1/2	*1/2	600	1-1/3
10, 15JC	1800	900	5	*1	1600	1-3/4
3DJA	1800	400	2-1/2	*1/2	--	--
6DJB	1800	600	3-1/2	*1/2	--	--
12DJC	1800	800	5	*1	--	--

* - Area of outlet duct. When a long duct (over 8 ft.) is used or if there are more than two 90° bends, increase the duct size so that the static pressure does not exceed 1/2" water column.

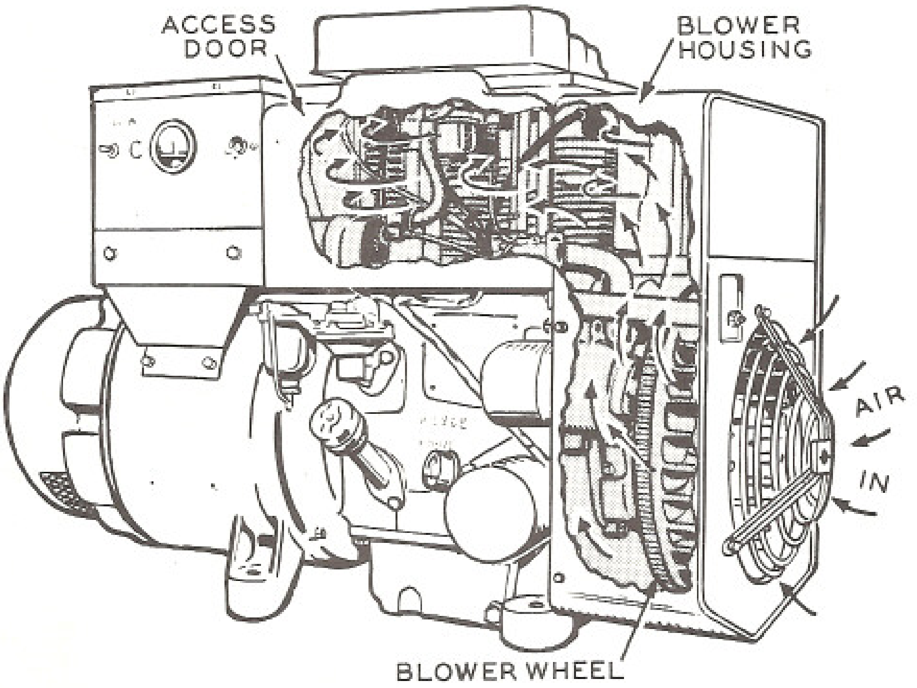


Figure 10 - Pressure Cooling

WATER COOLING SYSTEM — Engines with this general type of cooling system have jackets or chambers surrounding each cylinder. A liquid coolant enters the water jacket under pressure and on its way to the outlet absorbs heat from the cylinders. By the time it reaches the outlet, the coolant temperature has risen about 10°F. Water cooling systems are designed so the inlet and outlet temperature differential is maintained at a desirable level, usually not more than 10°F.

At the outlet, the coolant may enter a radiator or heat exchanger, be tempered in a standpipe, or it may be dumped into a drain. The type of system used may be determined by such factors as initial cost, operating cost, space, ambient temperature, ventilation, noise, and availability of chemically satisfactory water. Each type of system will be considered separately, as follows:

RADIATOR COOLING — A radiator is comprised of small finned tubes through which engine coolant passes. These tubes provide a relatively large surface area for transfer of heat from the coolant to the air stream. The air stream in the case of Onan plants is produced by a pusher type radiator fan. Cooling air is drawn over the engine and pushed through the radiator, either into a duct or toward the outlet vent. Refer to Table 4 for air flow, radiator area, and radiator capacity.

If a duct is used, as is recommended to prevent recirculation around the radiator, it should be as large as the open area of the radiator. If no duct is used, the outlet vent should be twice the size of the radiator and the plant should be as close as practical to the vent.

TABLE 4 - RADIATOR COOLED PLANTS

PLANT MODEL	RADIATOR CAPACITY (gallons)	RADIATOR AREA *(inches)	AIR FLOW (cfm)	PLANT MODEL	RADIATOR CAPACITY (gallons)	RADIATOR AREA *(inches)	AIR FLOW (cfm)
RDJC	3	19 x 17	2750	DFJ	10.9	30 x 27	10,600
RJC	3	19 x 17	2750	KR	10	28 x 27	15,500
HC	2.6	19 x 17	4000	DFB	21.7	31 x 34	13,400
HQ	2.6	19 x 17	4000	WA	18	32 x 36	16,500
DEC	4	22 x 27	3870	DFC	21.7	31 x 34	13,400
DEF	4.5	22 x 27	5070	WB	29	34 x 47	27,100
EC	5	23 x 22	6500	DFD	21.7	31 x 34	13,400
EF	6	23 x 22	6140	DFE	21.7	34 x 40	16,510
KB	10	28 x 27	16,000	DFK	18	44 x 41	18,750
DWJ	12	24 x 28	6600	DWF	28	43 x 57	28,500

* - First dimension is the radiator width; all dimensions nominal.

CITY WATER COOLING — There are several types of water cooling systems that use an outside source of water as the dissipating medium. The water is not recirculated. Pipe sizes, water flow, and air flow requirements are in Table 5. Although classified as city water cooling systems, each type is not dependent on city water, only an adequate source of water. Note the vacuum relief valve in Figure 24; it's used to eliminate the siphoning effect caused by a long discharge line.

A. STANDPIPE - Water heated during circulation through the engine mixes with fresh "city" water in a tempering tank. The hottest water rises and drains from an overflow near the top of the tank. Overflow water is piped to a suitable drain.

Rate of flow can be controlled by a hand valve or an automatic valve. A solenoid shut-off valve is coordinated with the plant ignition system. The hand valve must be adjusted during the initial run to permit only as much water as is needed for adequate cooling to enter the tempering tank.

B. HEAT EXCHANGER - The heat exchanger consists of a number of tubes encased in a closed chamber. Engine coolant circulates through the tubes. Fresh "city" water under pressure is piped into the chamber where it absorbs heat from the engine coolant. Engine coolant and "city" water do not mix.

Rate of flow is controlled by a hand valve or an automatic valve. A solenoid shut-off valve is coordinated with the plant ignition system. The hand valve must be adjusted during the initial run to permit only as much water as is needed for adequate cooling to enter the chamber.

C. DIRECT FLOW - There is no intermediate tank or chamber in this system. "City" water flows directly to the water jacket of the engine. A sufficient, constant pressure is needed to force water through the engine to the outlet.

A solenoid shut-off valve is coordinated with the plant ignition system. A lock shield supply valve, furnished but not installed, is hand adjusted to control water rate-of-flow to provide proper cooling with the minimum flow of water.

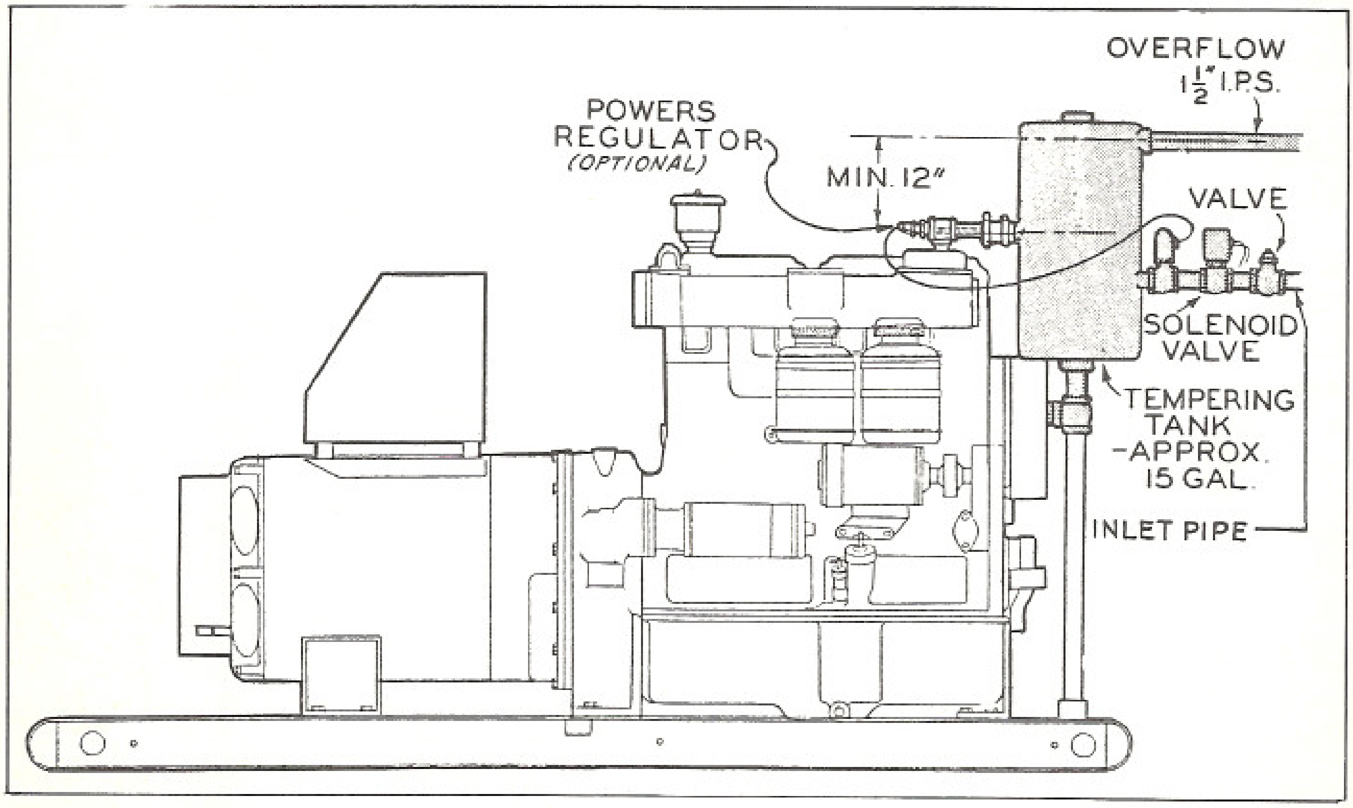


Figure 11 - Standpipe

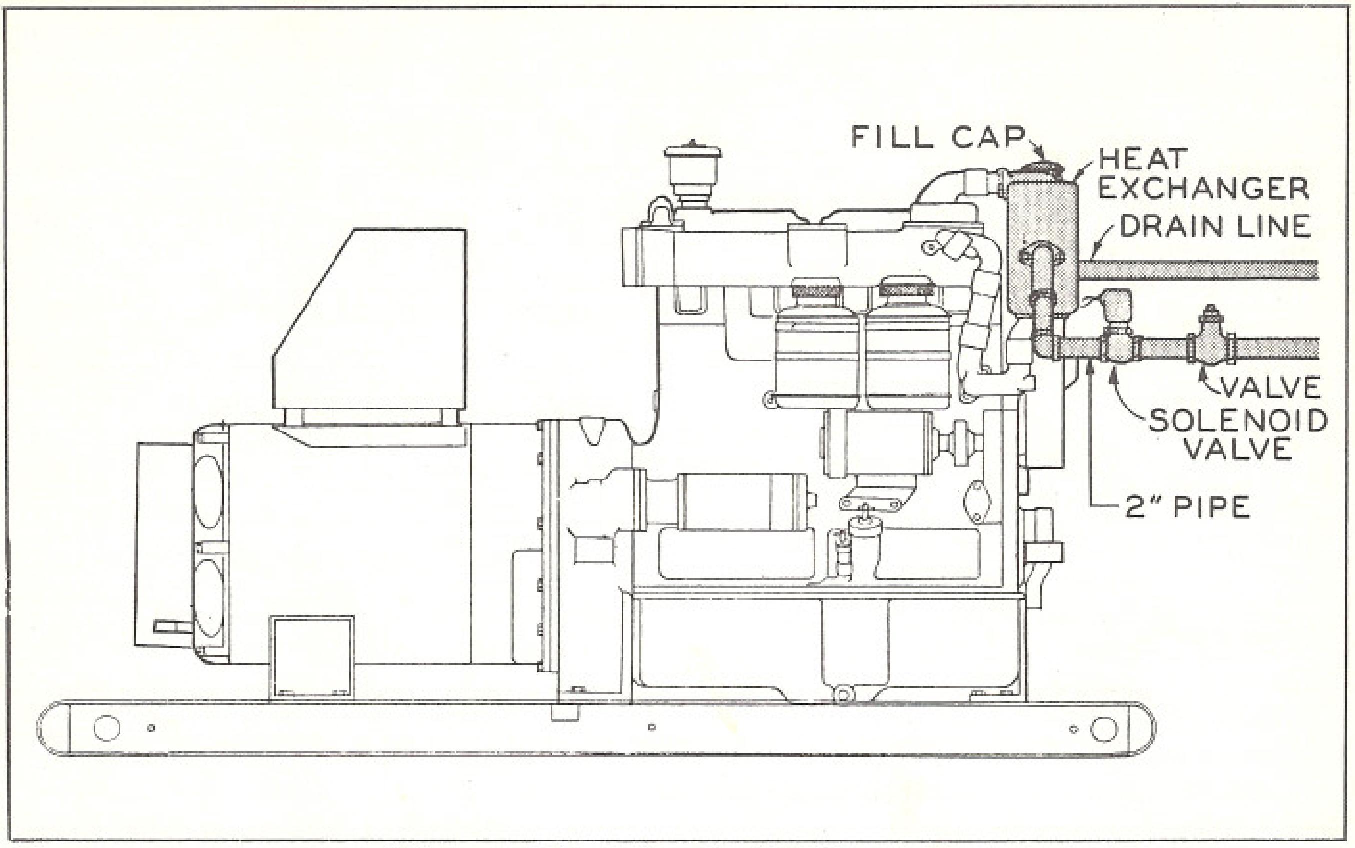


Figure 12 - Heat Exchanger

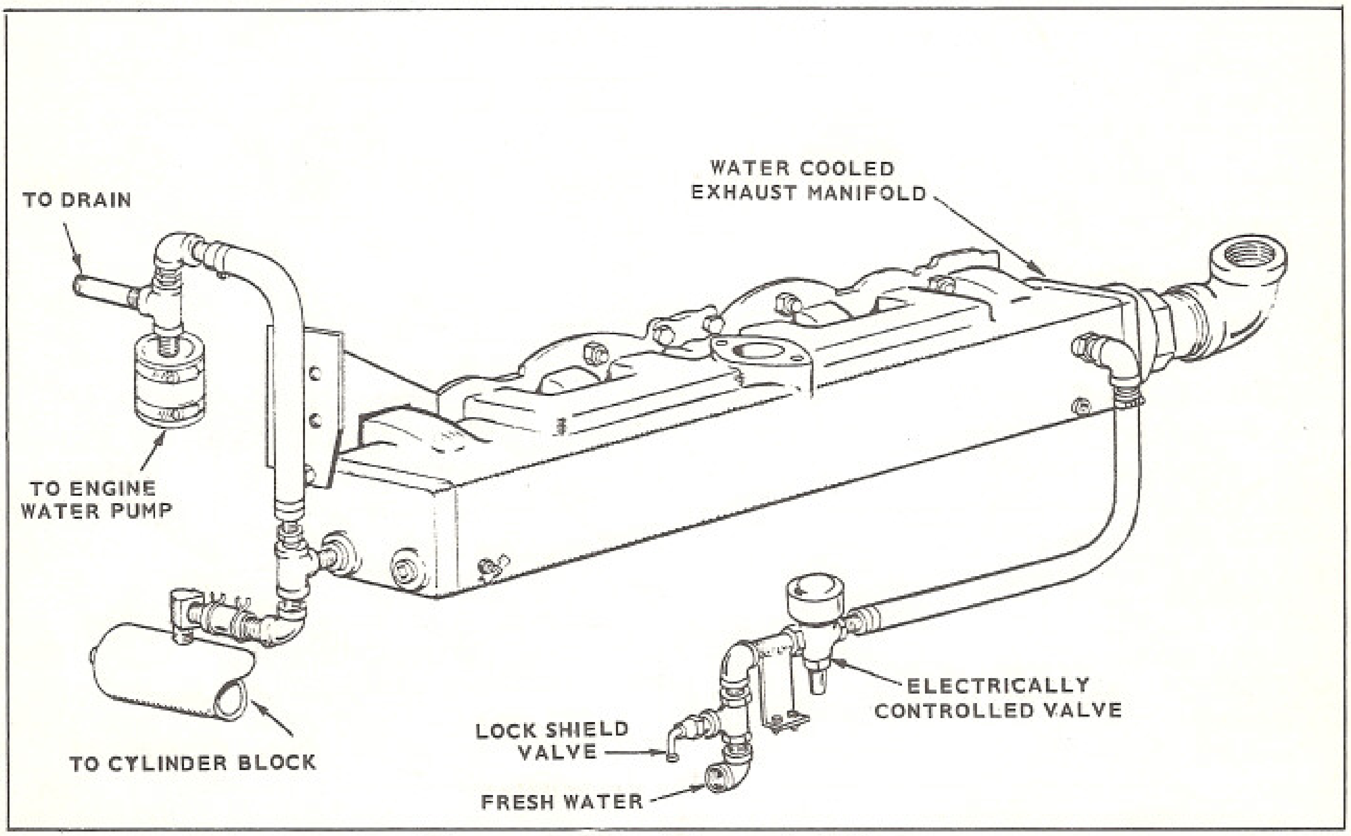


Figure 13 - Direct Flow

TABLE 5 - CITY WATER COOLED PLANTS

		WATER FLOW (gpm) AND PIPE SIZES (in.)									
	AIR	STAND PIPE AND DIRECT					HEAT EXCHANGER				
	FLOW	Inlet	Outlet				Inlet	Outlet			
MODEL	(CFM)	Pipe Size		40°F	60°F	80°F	Pipe Size		40°F	60°F	80°F
12RDJC	685	3/8	3/8	2.3	2.8	3.5	3/8	3/8	2.7	3.6	5.4
10, 15RJC	685	3/8	3/8	2.3	2.8	3.5	3/8	3/8	2.7	3.6	5.4
10HC	1000	1/2	1/2	1.9	2.4	3.2	3/4	1	4	4.8	6
15HC	1000	1/2	1/2	1.9	2.4	3.2	3/4	1	10	12	15
10HQ	1000	1/2	1/2	1.9	2.4	3.2	3/4	1	4	4.8	6
15HQ	1000	1/2	1/2	1.9	2.4	3.2	3/4	1	10	12	15
30EC	1175	1/2	1/2	3.5	4.4	5.9	1/2	1-1/2	13.3	16	20
45EF	1550	1/2	1/2	4.5	5.7	7.3	1/2	1-1/2	13.3	16	20
60DWJ	1875	3/4	1-1/2	5.6	6.6	7.8	3/4	1-1/2	17	23	34
55KB	4000	3/4	1-1/2	6.1	7.25	9.1	3/4	1-1/2	13.3	16	20
65KB	4000	3/4	1-1/2	7.1	8.5	10.7	3/4	1-1/2	13.3	16	20
70DFJ	2650	3/4	1-1/2	7.7	9.2	11.5	3/4	1-1/2	19	30	38
85KR	3875	3/4	1-1/2	8.8	11.6	14.5	2	2	18.3	24	30
85DFB	3350	3/4	1-1/2	9.6	10.9	13.6	1-1/4	1-1/2	13	19	27
115WA	4125	3/4	1-1/2	12.0	14.4	18.0	1-1/2	1-1/2	75	90	112
115DFC	3350	1-1/4	1-1/2	11.6	13.9	17.4	2	2	14	21	29
140WB	6775	1-1/4	1-1/2	15	18	22.5	2	2	57	70	88
140DFD	3350	1-1/4	1-1/2	13.9	16.7	20.9	2	2	18	30	65
170WB	6775	1-1/4	1-1/2	17.8	21.4	26.7	2	2	57	70	88
170DFE	4038	1-1/4	1-1/2	17.0	20.4	25.5	2	2	40	72	148
200DFK	4688	1-1/4	1-1/2	12.2	14.5	17.7	2-1/2	2-1/2	45	60	85
230DWF	7125	1-1/4	1-1/2	23.8	28.5	35.6	2-1/2	2-1/2	96	114	140

REMOTE RADIATOR — Locating the radiator some distance from the engine may be desirable to overcome installation or cooling problems. A special radiator, sized for the engine, is used to get the proper cooling characteristics. If practicable, the radiator should be installed at engine level (definitely not below) to limit water head-pressure on engine gaskets. If the radiator is installed more than 15 feet above the engine, a "hot well" tank must be used as shown. In most cases, an electric booster pump is used in addition to the engine driven water pump.

Remote radiators for all Onan models 25KW and larger are available from Perfex Corporation, Milwaukee, Wisconsin; see Table 6. Described as Perfex Pak Water Coolers, type DDV, they have a steel frame, motor driven fan, fan shroud and guard, filler neck and pressure cap, air vent trap, and high top tank (for surge).

The motor, suitable for outdoor use, is single speed and 3 phase, with the fan directly mounted on the motor shaft. A single phase motor is available at a higher price. Power for the motor comes directly from the ac output of the generating plant.

The "hot well" tanks must be purchased locally — they are not available from either Onan or Perfex. Capacity of the tank should be equal to the combined capacity of the radiator and piping, plus an additional 5 gallons. During shut-down, the coolant will drain from the radiator and pipes into the "hot well" tank. During operation, only the extra 5 gallons will be in the tank. The extra water is needed to insure a continuous flow and to help temper the cool inlet water. A vertical baffle in the tank, rising from near the bottom to near the top, divides the tank into a cool side and a hot side. The baffle reduces turbulence and prevents recirculation during operation. There is free circulation during shut-down. For more detailed information, get in touch with an Onan representative.

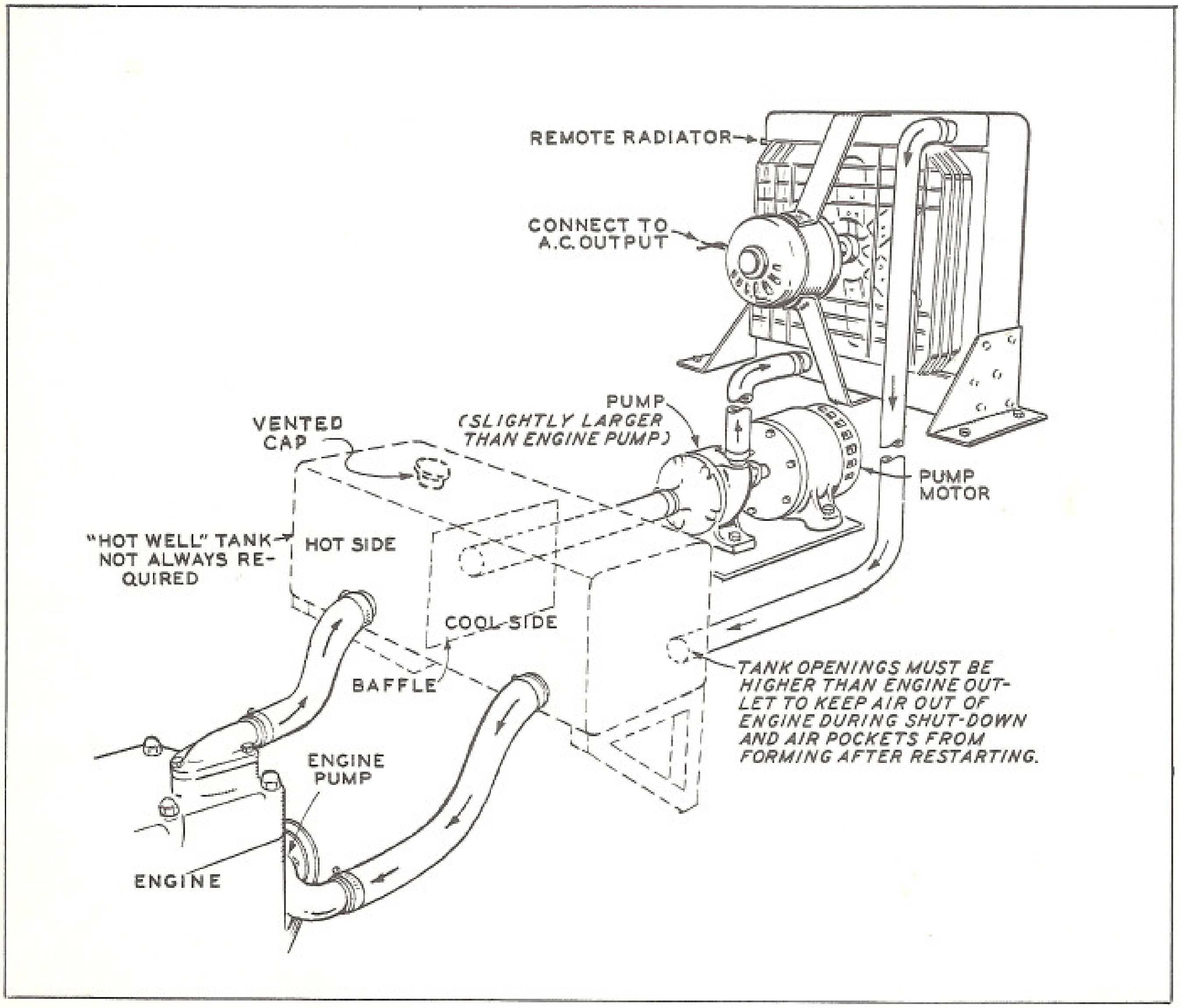


Figure 14 - Remote Radiator

TABLE 6 - REMOTE RADIATORS

PLANT MODEL	RADIATOR MODEL ★	RADIATOR DIMENSIONS L	W	D	FAN MOTOR H.P.
30EC					
WET*	25-596-1P	32	26	20	3/4
DRY*	25-596-1P	32	26	20	3/4
45EF					
WET	35-596-1P	37	32	21	1-1/2
DRY	25-596-1P	32	26	20	1
55KB					
WET	35-596-1P	37	32	21	2
DRY	35-596-1P	37	32	21	1-1/2
60DWJ					
WET	45-596-1P	43	35	22	3
DRY	35-596-1P	37	32	21	2
65KB					
WET	45-596-1P	43	35	22	3
DRY	35-596-1P	37	32	21	1-1/2
70DFJ					
WET	45-596-1P	43	35	22	2
DRY	35-596-1P	37	32	21	1-1/2
85KR					
WET	60-596-1P	49	42	26	5
DRY	45-596-1P	43	35	22	3

PLANT MODEL	RADIATOR MODEL	RADIATOR DIMENSIONS L	W	D	FAN MOTOR H.P.
85DFB					
WET	45-596-1P	43	35	22	3
DRY	35-596-1P	37	32	21	2
115WA					
WET	75-596-1P	56	48	28	5
DRY	60-596-1P	49	42	26	5
115DFC					
WET	60-596-1P	49	42	26	5
DRY	45-596-1P	43	35	22	3
140WB					
WET	75-594-1P	56	48	28	7-1/2
DRY	60-596-1P	49	42	26	5
140DFD					
WET	75-594-1P	56	48	28	7-1/2
DRY	60-596-1P	49	42	26	3
170WB					
WET	75-596-1P	56	48	28	7-1/2
DRY	75-594-1P	56	48	28	7-1/2
170DFE					
WET	75-596-1P	56	48	28	7-1/2
DRY	75-594-1P	56	48	28	7-1/2
200DFK					
WET	75-596-1P	56	48	28	7-1/2
DRY	75-596-1P	56	48	28	5
230DWF		§	§	§	
WET	U-13006-596-2P				10

★ - Perfex numbers; also include radiator dimensions and fan h.p.
* - Refers to the type of exhaust manifold
§ - Obtain this and other information from the Perfex Corporation

FUEL TANK LOCATION. - Consider individual requirements and pertinent codes. Fuel pump lift influences fuel tank location, Table 7. Lifting capabilities are reduced by elbows and bends in the fuel line. Great lateral distances also have a limiting effect. Underwriter approved fuel tanks from 55 to 560 gallon capacity are available at Onan. Onan tanks can accommodate a fill pipe, a vent pipe, a drop tube, and two return lines.

Generally, fuel tanks should have the capacity to sustain full load operation for 36 hours without refueling. They should not be installed near exhaust pipes. Fuel tanks may be installed above or below ground. Gravity feed of fuel is permitted only from integral tanks of 25 gallons and less. Use a siphon break to overcome this restriction.

ANTI-SIPHON. - Fuel from the supply tank fills a void created in the vacuum pipe by the engine fuel pump. The vacuum pipe should be about 4 times greater in diameter than the line leading from the fuel tank to the vacuum pipe. The smaller line can be 5/16" copper tubing. The vacuum pipe would then be 1-1/4". Refer to Figure 16 for details.

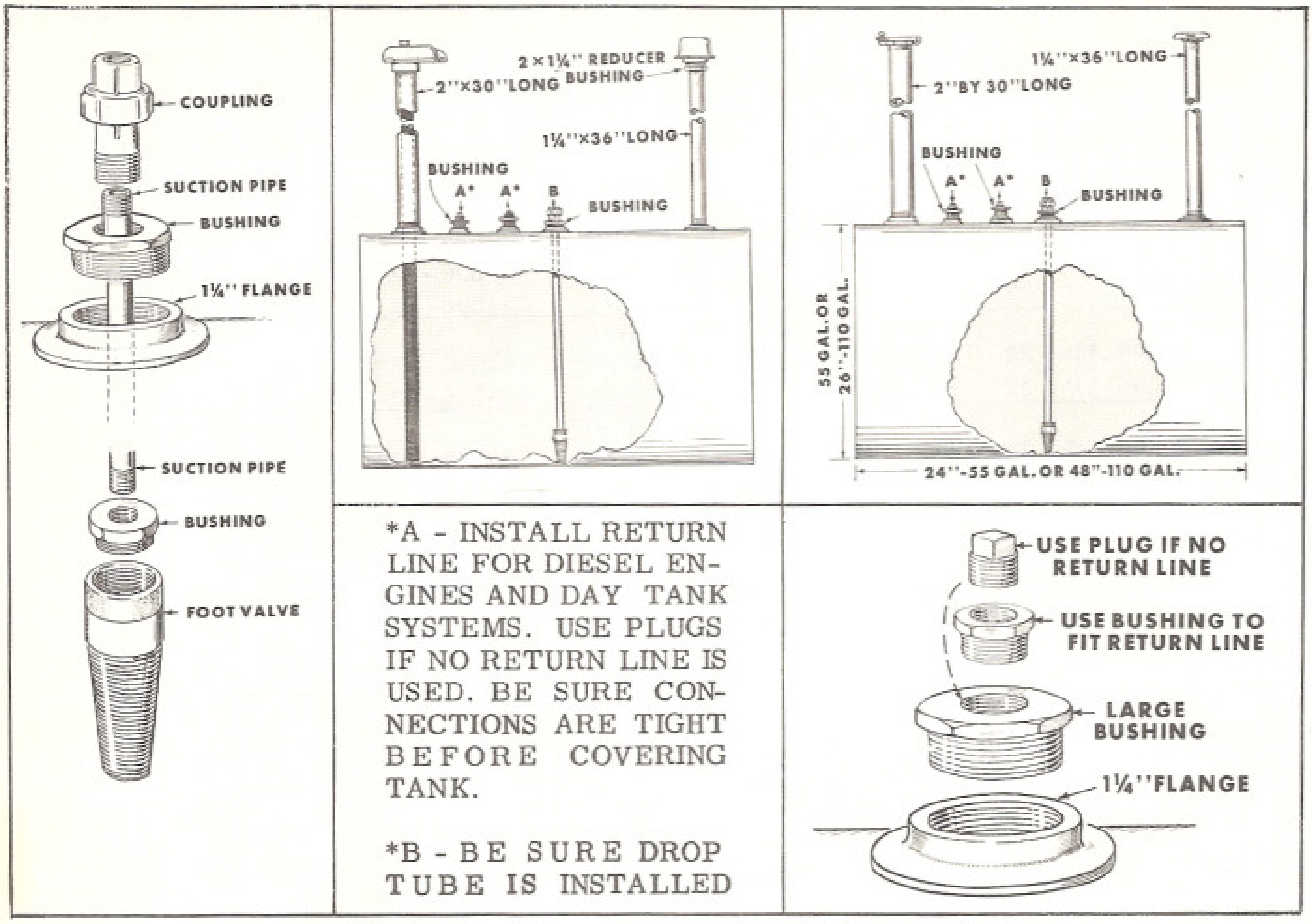


Figure 15 - Fuel Tank Features

DAY TANK. - Installations which demand quick, dependable starting through automatic controls must have a means of keeping the fuel system primed. A day tank mounted on or near the unit provides a small supply of fuel for immediate use by the engine. Refer to Figure 17.

Day tanks for gasoline systems have a 1 or 2 quart capacity. Tanks for larger units are pressurized by using a restricted bushing in the return line. The return line also serves as a vent. A solenoid valve is used at the outlet to the carburetor.

Diesel installations have day tanks of from 8 to 60 gallon capacity.

FLOAT TANK: DIESEL. - Gravity feed of fuel to some diesel engines is undersirable. Where fuel tanks must be situated above the fuel injector return, a float tank can be used as an intermediary between the main fuel supply and engine. A float switch in the intermediate tank controls fuel flow from the main tank. The maximum allowable fuel head is 25 feet.

TRANSFER TANK: DIESEL. - The ability of fuel transfer pumps to move fuel is limited by lateral and vertical distances. A fuel transfer tank and auxiliary fuel pump can be used to overcome certain limitations. A fuel transfer tank is installed within range of the engine driven fuel pump. An electric booster pump, installed close to the supply tank, pumps fuel to the transfer tank. The booster pump is usually controlled by a float switch in the transfer tank. The transfer tank must not be mounted on the engine. Refer to Figure 18.

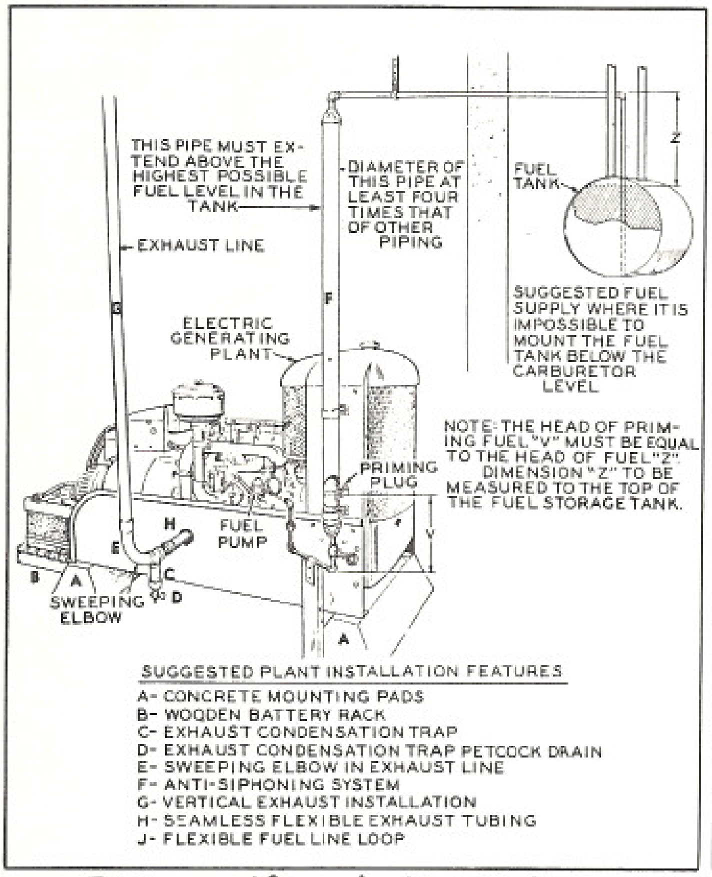


Figure 16 - Anti-siphon

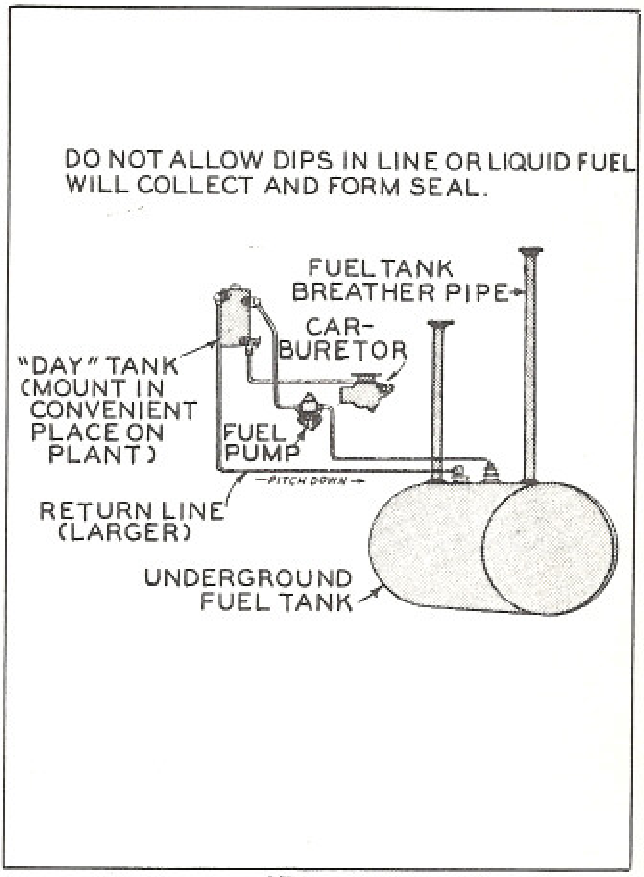


Figure 17 - Day Tank

TABLE 7 - FUEL CONSUMPTION AND PUMP LIFT

PLANT MODEL	GAL/ HR.	LIFT	NO. CYL.	PLANT MODEL	GAL/ HR.	LIFT	NO. CYL.
07AK	.23	4	1	60KB	8.0	6	8
1AJ	.29	4	1	85KR	9.8	6	8
105AK	.53	4	1	115WA	17.6	6	6
205AJ	.54	4	1	170WB	23.0	6	6
2LK	.42	4	1	3DSL	.37	4	1
3CCK	.57	4	2	3DJA	.36	6	1
3JA	.50	8	1	6DRN	.70	4	2
305CCK	.70	4	2	6DJB	.66	6	2
5CCK	.88	4	2	12DJC	1.33	6	4
5JB	.74	8	2	30DEC	2.65	12	4
5CW	1.2	6	2	45DEF	3.3	12	6
705JB	1.05	8	2	55DFA	5.0	12	4
705CW	1.5	6	2	60DWJ	5.0	12	6
10CW	1.8	6	2	70DFJ	6.0	8	4
10JC	1.5	8	4	85DFB	6.8	8	6
10HC	1.7	6	4	115DFC	8.9	8	6
15JC	2.25	8	4	140DFD	12.6	8	6
15HQ	1.7	6	4	175DFE	14.0	8	6
30EC	3.5	6	6	200DFK	15.0	8	6
45EF	5.9	6	8	230DWF	20.0	12	6

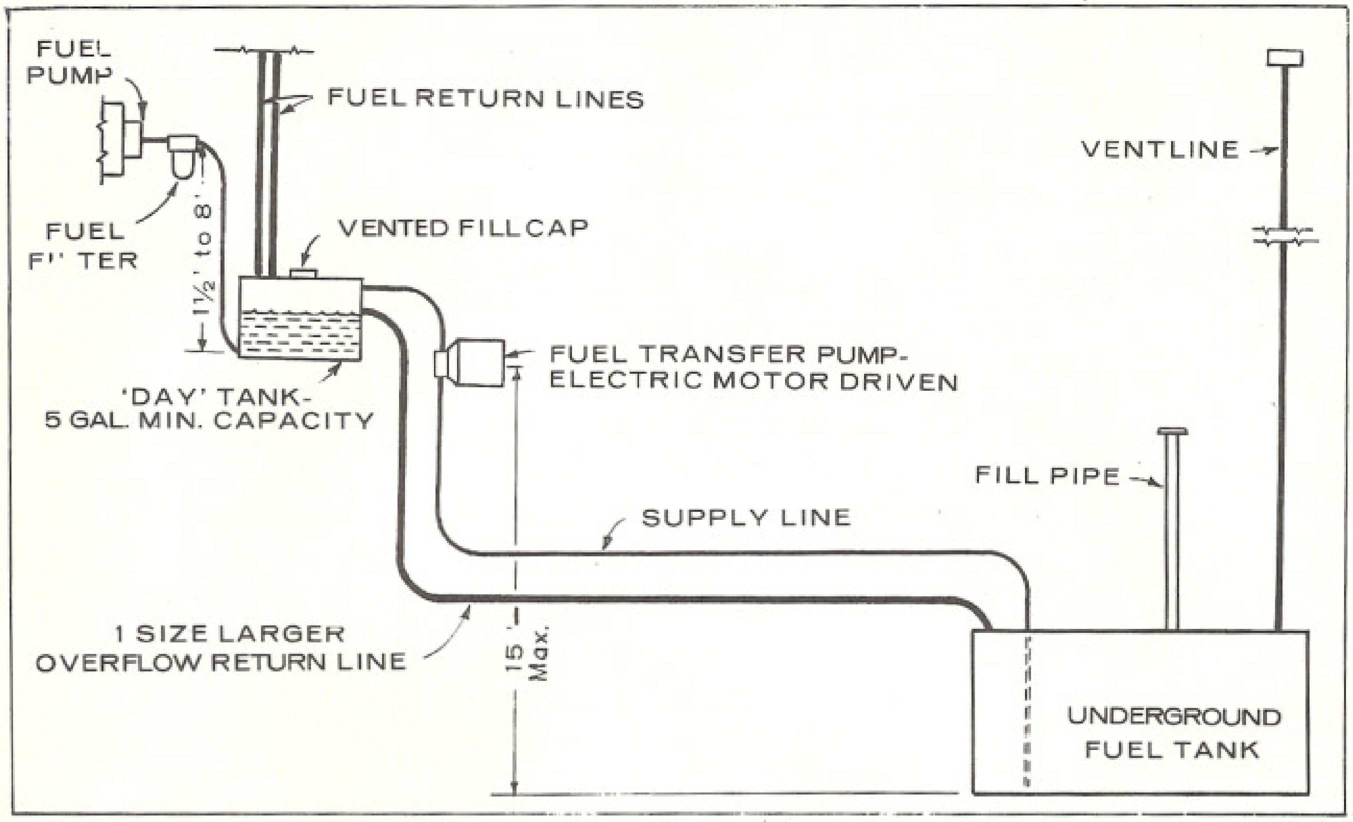


Figure 18 - Transfer Tank

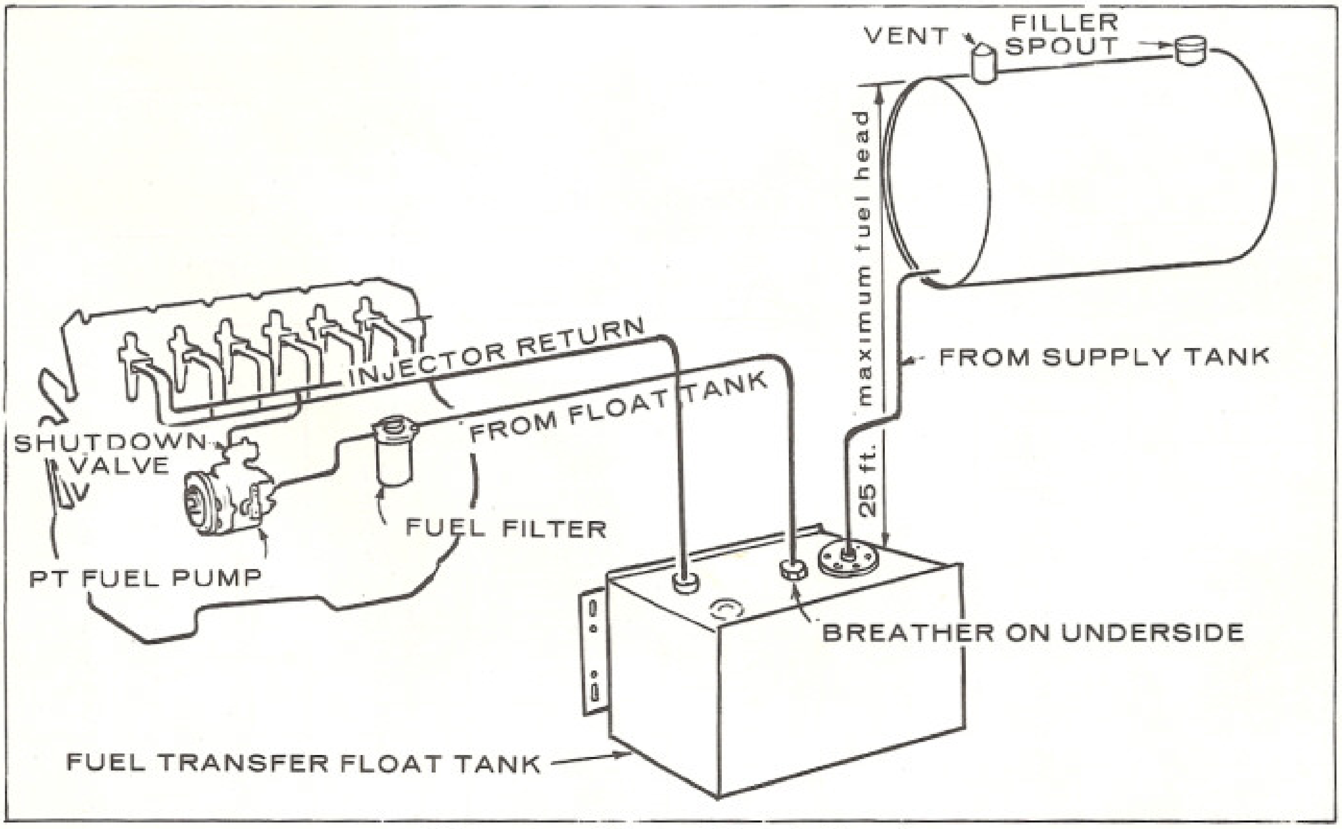


Figure 19 - Float Tank

BATTERY. - Mount the battery on a wooden or metal platform near the unit but not beneath the generator. Use cables of proper length and size to limit voltage drop. Coat battery terminal connections with grease to prevent corrosion. Check the electrolyte level periodically. Run the engine immediately after adding water to the battery during cold weather.

Trickle chargers are recommended for units which are run too seldom to maintain batteries in a fully charged condition. Trickle chargers reduce utility voltage to 20 volts. Full wave rectification converts the power to dc. The dc is fed through a resistor, a charge rate rheostat, a milliammeter, into the battery at the rate of 50 to 200 milliamperes.

WIRING. - All wiring must be in accordance with pertinent electrical codes. Wires must be of adequate size, properly insulated and supported in an approved manner. Wires are easily run in any direction. They should not be run so as to interfere with plant service.

LOAD TRANSFER CONTROLS. - Onan LT series load transfer controls range from 10 to 600 amperes capacity. The transfer switch within the control is mechanically and electrically interlocked. Both line and standby cannot be connected to the load simultaneously.

Transfer switches in the smaller controls are electrically held to the load side. Transfer switches in the larger controls are mechanically held to the load side.

Mount the control on an outside wall near the electrical load. Refer to Onan technical bulletin T011 for detailed information.

BIBLIOGRAPHY

NBFU pamphlet no. 30, "Storage, Handling, and Use of Flammable Liquids"
NBFU pamphlet no. 37, "Installation and Use of Internal Combustion Engines"
NBFU pamphlet no. 54, "Installation of Gas Piping and Gas Appliances in Buildings"
NBFU pamphlet no. 58, "Storage and Handling of Liquefied Petroleum Gases"
NBFU pamphlet no. 70, "1953 National Electrical Code"
National Building Code 1949, Amendments 1952
Building Code Standards for Heat Producing Appliances etc. 1949
Fire Prevention Code 1953

TYPICAL INSTALLATIONS

The illustrations which follow represent the types of generating plants available at Onan. Installation precepts conveyed by the illustrations are presented with the thought that they will be applied in accordance with the requirements of individual installations, and not exactly as portrayed.

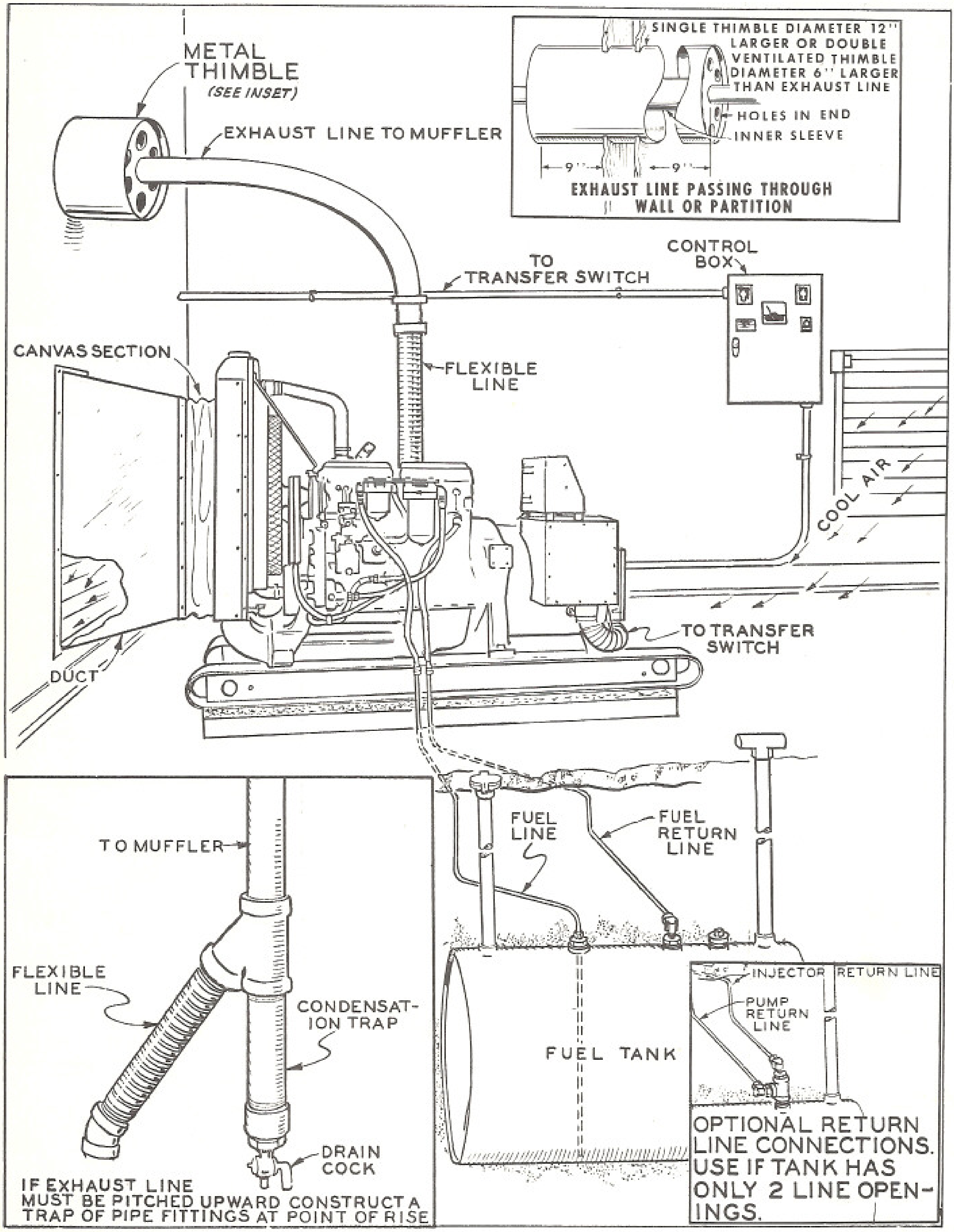


Figure 20 - Typical Installation (Diesel)

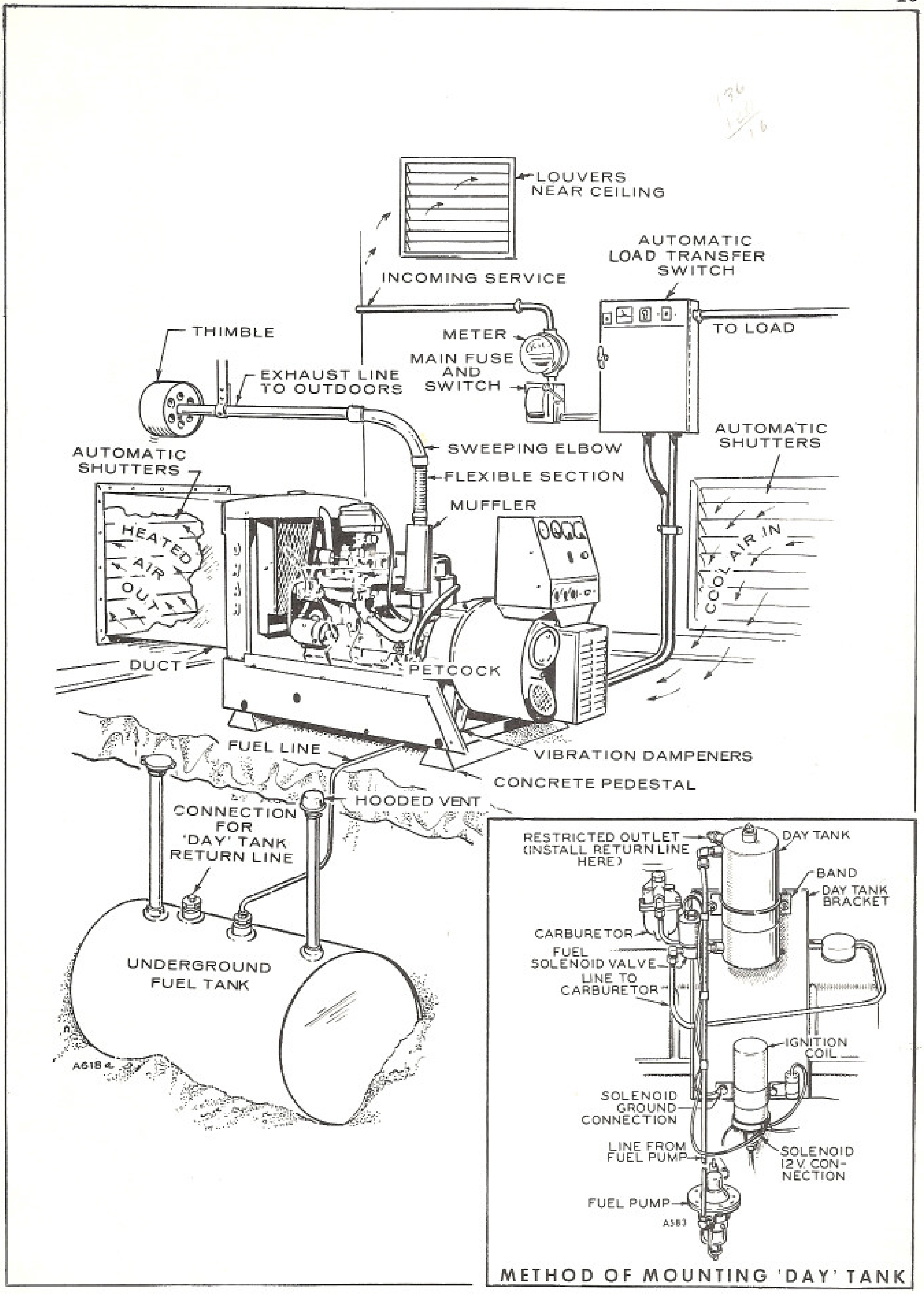


Figure 21 - Typical Installation (Gasoline)

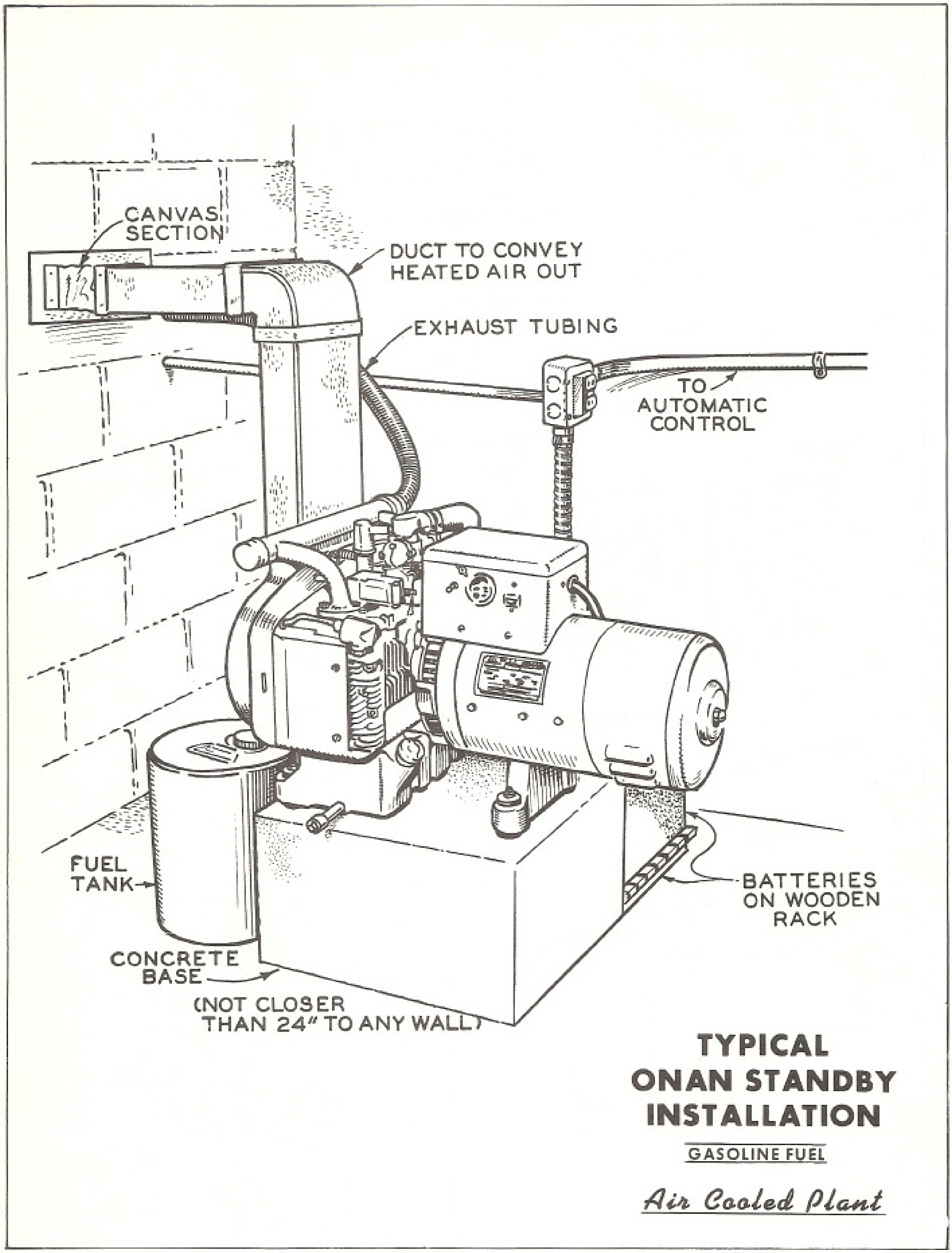


Figure 22 - Typical Installation (Vacu-flo)

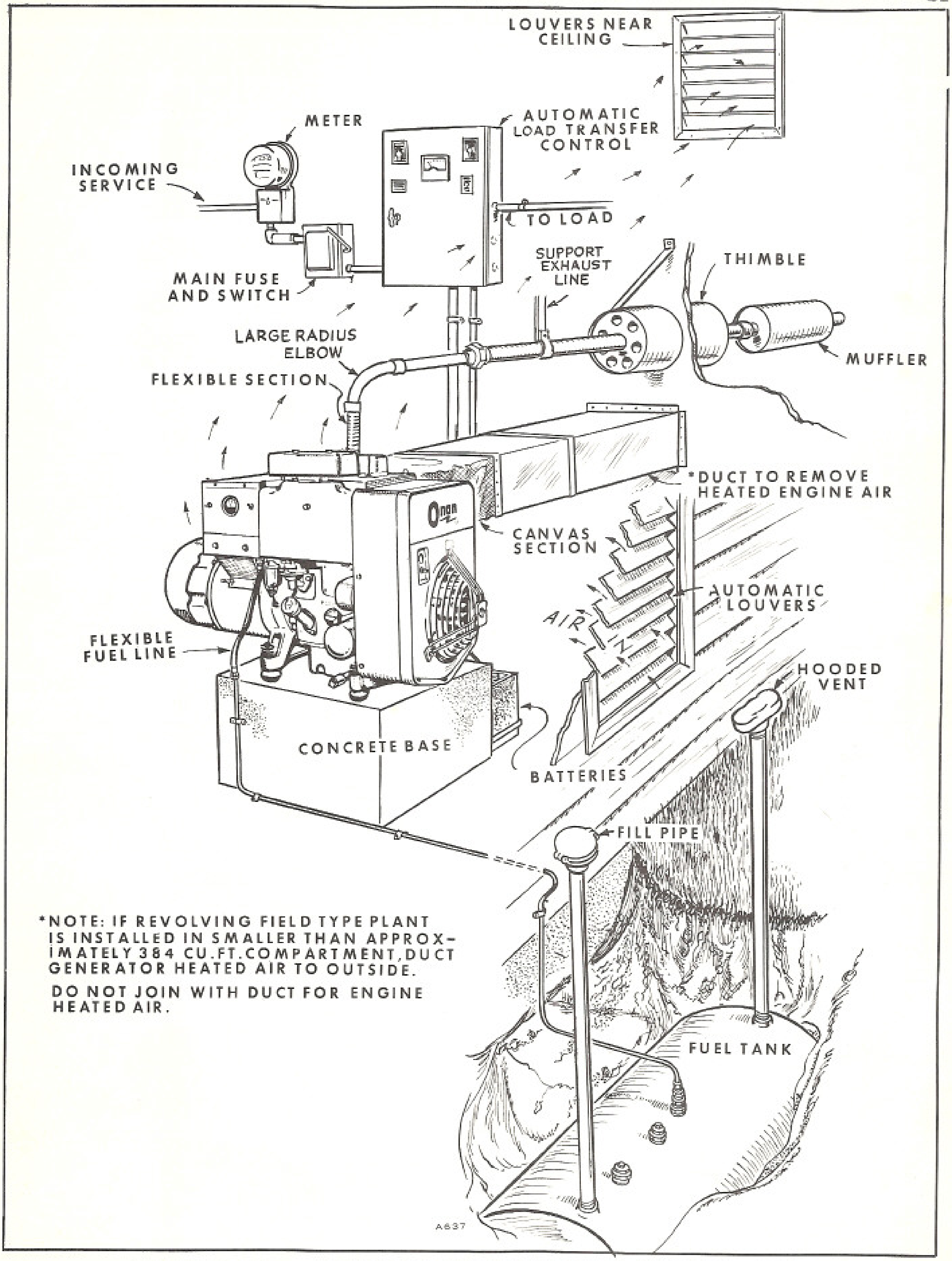
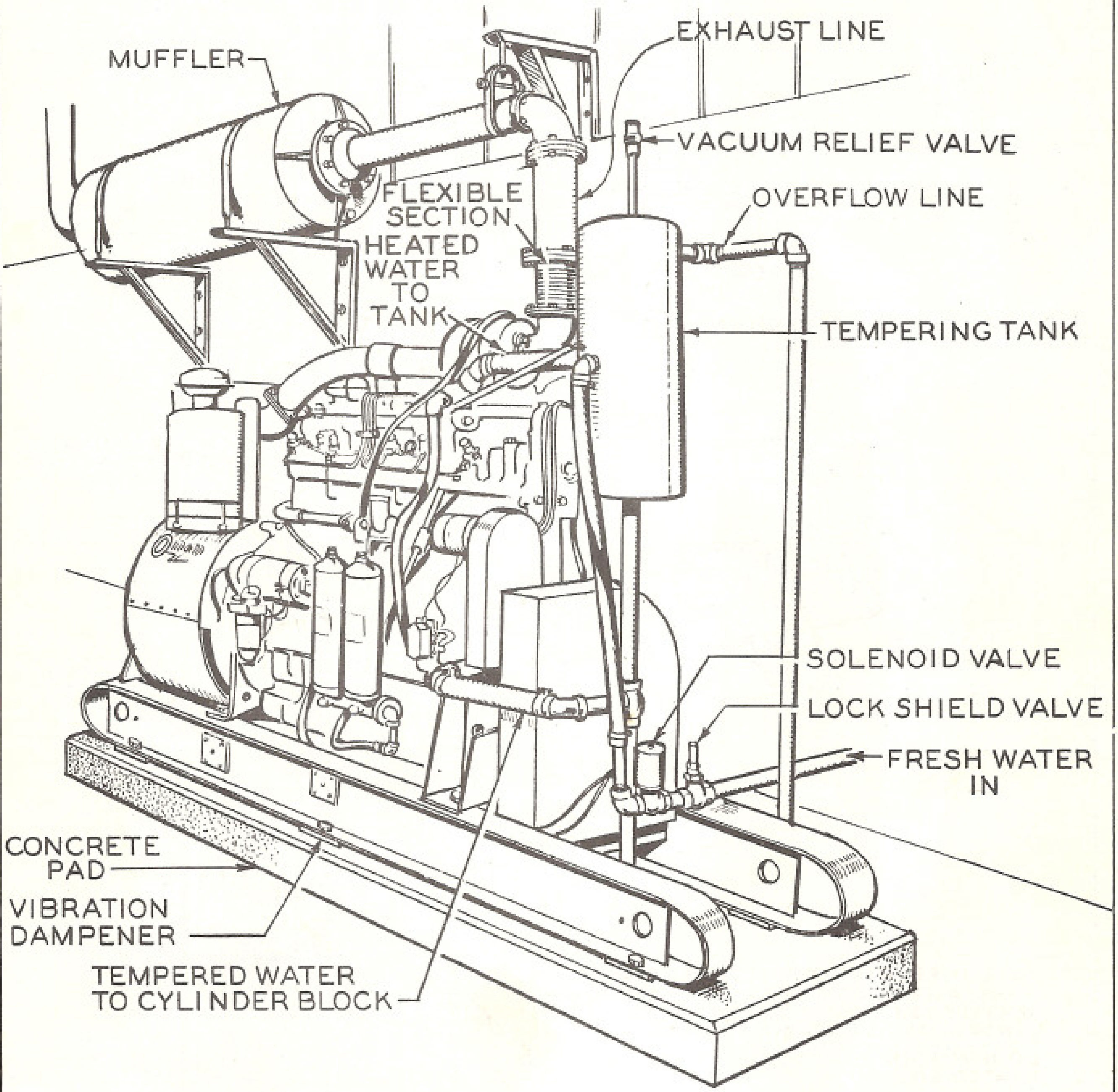


Figure 23. - Typical Installation (Pressure)



SEE FIGURES 18, 19, AND 20
FOR FUEL SYSTEM IDEAS

Figure 24 - Typical Installation (Standpipe)