SERVICE MANUAL

FOR

ABC "90" SERIES

OIL BURNERS

ABC® OIL BURNERS

AUTOMATIC BURNER CORPORATION—1823 CARROLL AVE., CHICAGO, ILL., 60612

T1 1/65

FOREWORD

The information in this manual has been compiled to assist the installer and serviceman in locating and correcting service problems with our "90" series burners. These burners are equipped with 3450 r.p.m. motors and pumps and are supplied in four categories as listed below.

#1 Models 92, 95, 96, 97 and 98 with one stage firing and without flame retention.

#2 Models 92A, 92C, 93C, 94C, 95A, 95A-300, 96A, 97A, 98A, 930 and 970 with one stage firing and with flame retention.

#3 Models 96A-T and 97A-T with two stage firing and with flame retention. These models provide a low fire start and high fire operation without a change in combustion air between the first and second stages.

#4 Models 96A Hi-Lo, 97A Hi-Lo, 98A Hi-Lo and 99A Hi-Lo with two stage firing and flame retention. These models provide a low fire start and high fire operation with an increase of combustion air for the second stage. In addition these can be operated on either high or low fire by the use of a high fire controller. The high fire controller is used in some installations where some heat is needed in the boiler at all times. The burner is started with the main switch and the low fire comes on. A limit control (high fire controller) in the second stage or high fire circuit will then operate the high fire as required. If more heat is required then the low fire will supply, the high fire will come on until the limit control is satisfied. The high fire will then shut down and the burner will operate on low fire until the high fire limit control again calls for heat.

The burners listed in category #1 are for use in conventional boilers and furnaces with a satisfactory stack or chimney and are not intended for pressure firing. All of the other models can be fired with draft over the fire or with pressure in the firebox ranging from .05" on draft gauge for the lower firing rates on Models 92A, 92C, 93C and 94C up to 1.0" on draft gauge on the Hi-Lo models.

A forced draft burner supplies all the air for combustion and can be fired in a boiler or furnace with natural draft, induced draft or with no draft.

Pressure firing is a term used when there is pressure in the firebox during the burner operation. The pressure is produced by the resistance through the boiler or furnace and the combustion air supplied by the burner.

The manufacturers of boilers and furnaces who have designed their units for pressure firing and have selected "ABC 90 Series" burners have tested them for operation and performance. Their recommendations as to burner specifications for the installations should be followed carefully.

It is important that the service man and the installer have the instruments listed on the following page for the proper servicing, testing and adjustment of these burners.

CO_2 Test Instrument
Smoke Tester
Draft Gauge (inclined tube .0 to 1.0 inch)
Pressure Gauge
Vacuum Gauge
Combination Voltmeter and Ammeter
Flame Mirror

1 - AIR FOR COMBUSTION

It is necessary to have sufficient outside air for combustion supplied to the boiler or furnace room.

When operating on a natural draft system this would require an air inlet opening of twice the cross sectional area of the flue pipe. If the unit is operated under a forced draft condition, provide an air inlet opening three times the cross sectional area of the flue pipe. The air inlet opening should be located at a point where it cannot be covered with snow and where it cannot be obstructed in any other manner. Mechanical devices such as movable louvres should not be used. Never use a door that can be closed for the air inlet, or rely on cracks under doors or cracks around loose window frames.

If lack of combustion air is suspected, close the door to the boiler or furnace room and operate the burner for at least 30 minutes. If the flame appears to become gassy and tends to snuff out, insufficient combustion air is the cause and corrective measures must be taken to provide the proper amount of air.

2 - AIR SHUTTER ADJUSTMENT FOR HI-LO BURNERS

The first stage is set first. De-energize the second stage (high fire) by moving the toggle switch to the "off" position before making the first stage air adjustments. This switch is located either on the control panel or on the junction box.

The first stage (low fire) air on 97A Hi-Lo and 98A Hi-Lo burners is adjusted with the lower shutter by means of the adjustment lever on the air inlet housing. The first stage air on Models 96A Hi-Lo and 99A Hi-Lo burners is adjusted with a screw in the upper shutter.

The second stage (high fire) air for all of these models is adjusted by moving the hydraulic cylinder up or down as required to obtain a flame that is stable and spinning approximately 1/2" ahead of the spinner (check this by use of a flame mirror) and with a CO_2 reading of 11.0% to 12.5%.

Too much air on the first stage will occasionally cause hard (rough) lighting. Adjust the first stage (low fire) shutter until the lighting becomes smooth. Check the smoke at this time and if the smoke spot is darker than #2 on the Bacharach scale, loosen the set screw that locks the drawer assembly in position and move the assembly forward slightly until the fire is spinning about 1/2" ahead of the spinner. In some units it is impossible to observe this, and it is necessary to rely on the CO_2 instrument and the smoke tester. The CO_2 on the first stage fire should be 10.5 to 12.0 percent and the smoke should be no darker than #2 on the Bacharach scale.

After setting the first stage to a satisfactory fire, energize the second stage by moving the toggle switch to the "on" position. Adjust the hydraulic cylinder up or down for the second stage combustion air to a smoke test sample between zero and #1. At this setting the CO_2 reading should be between 11.0 and 12.5 percent.

After satisfactory combustion and lighting are achieved, make sure that the screws securing the cylinder for the second stage and the lock nuts on the first stage adjustment are tight.

3 - BLOWER WHEELS (FANS) - VIBRATION

If undue vibration is detected in the burner, it could be caused by the blower wheel being out of balance. Check to determine if any foreign matter has been drawn into the burner and lodged in the blower wheel. If not, replace the blower wheel. Remove the motor from the burner and run it without the blower wheel to determine if there is any undue vibration. Replace the motor if the operation is not smooth. When installing a new blower wheel in the burner, it is very important that it be secured tightly to the motor shaft.

The 1/4 H. P. motors on Model 92, 92A, 92C and 94 have one flat on the shaft. The 1/3 H. P. motors on Models 95, 95A, 95A-300, 96 and 96A have two flats. The 1/2 H. P. motors on Models 97, 97A, 96A-T, 96A Hi-Lo, the 3/4 H. P. motors on Models 98 and 98A, the 1 H. P. motors on Models 97A-T and 97A Hi-Lo, the 2-3/4 H. P. motors on Model 98A Hi-Lo, and the 3-1/2 H. P. motor on Model 99A Hi-Lo have one flat and a keyway.

The replacement blower wheel must be located on the motor shaft so that the set screws bear on the center of the flat on the 1/4 and 1/3 H. P. motors. On the 1/2, 3/4, 1, 2-3/4 and 3-1/2 H. P. motors the key will locate the blower wheel on the shaft. Make sure that the set screws on blower wheels are securely tightened. There should be adequate clearance on both sides of the blower wheel in the housing.

The blower wheels used in the 90 series burners are dynamically balanced for operation at 3450 r.p.m. and any replacement should be an exact duplicate of the original.

4 - DRAFT

When firing a natural draft boiler or furnace it is very important that a constant draft over the fire is maintained. At least .02 inches on the draft gauge.

The 90 series burner (except those listed in category #1 on page 1) are designed for firing against pressure in the firebox. but operate just as satisfactorily in a natural draft installation. If the draft loss in the heating unit is so high that it is impossible to obtain .02" of draft over the fire with a CO_2 reading of 10.0 to 11.0 percent, check the unit manufacturers data for correct chimney height, firing rate and draft loss. High draft loss (if not built into the unit) may indicate soot in the flue ways, low CO_2 , or air leaks in the unit.

When firing the unit with pressure in the firebox, refer to the manufacturers data for the correct firing rate and pressure.

It is important that the vent or chimney be located so as to be free of downdrafts. Forced draft burners can operate with back pressure in the boiler and flue pipe, but strong surges

of down draft can cause the fire to become smoky and erratic. After a shut-down the heat in the combustion area could damage the burner if it is forced back through the burner by down-drafts. It may be necessary to increase the height of the vent or chimney above the building and in some instances install a dutch cap or similar appliance to prevent down-drafts.

5 - FUEL SYSTEM

All Hi-Lo burners must be installed with two oil lines to the oil tank. The A-T burners, which are low fire start burners and all of the one stage firing burners can be installed with a single line if no lift from the oil tank is involved. If a long single line is used, it should be large enough in diameter so that the vacuum reading on the fuel unit is no more than 10 inches. If the oil tank is below the level of the burner, use a two line system.

If two or more burners are piped to a common suction line, each burner must have its own check valve.

On Model 95A-300 burners the pressure is usually set at 200 p. s. i. but this can vary from 150# to 250# p. s. i.

If the pressure gauge on the fuel unit shows the 100 p. s. i. cannot be obtained the fuel unit should be replaced. The quick cut off pumps used on Models 92, 92A, 92C, 93C and 94C should never be adjusted above 100 p. s. i.

A pressure gauge and a vacuum gauge should be used if a fuel unit problem is suspected. If the pressure is excessive, such as 125# to 150# (except on 95A-300) check the flame base at the "A" or "C" head spinner. The base of flame should spin approximately 1/2" off the spinner. Excessive pressure may cause the flame to lift away from the spinner. The pressure should be maintained between 100# and 125# except on the 95A-300.

Refer to the fuel unit manufacturers data for the proper vacuum for the installation. If the vacuum reads higher than the calculated vacuum (see manufacturers instructions) check for restrictions in the oil line, excessively long lines, closed tank valve, kinked copper tubing, plugged oil filter, frozen oil line, undersized oil line, excessive oil lift or a restricting check or foot valve. If the vacuum reads low, look for air leaks in the suction line, valve fittings or fuel unit. On a gravity flow installation, no vacuum will be shown on the gauge except where there are restrictions caused by a closed valve, plugged oil filter, kinked, undersized, or excessively long suction line.

All restrictions must be eliminated and undersized or excessively long lines replaced with lines of a greater diameter so that the vacuum reading will be no more than 10 inches.

A singing sound in the fuel unit may indicate air in the suction line. Excessively high vacuum can also cause noise in the fuel unit. Air in the suction line can cause delayed lighting. This condition will in time coat the photocell with carbon and safety shut-downs may result.

If it is suspected that the oil is returning to the tank after shut-down, inspect for leaks in the suction line and check valve. If the check valve is not seating properly and there is a slight air leak in the suction line the oil will flow back to the oil tank. On the next start up of the burner, there will be a delay in the oil delivery while the pump is lifting the oil from the tank. Repair any air leaks and replace the check valve if necessary.

6 - IGNITION PROBLEMS

Hard (rough) lighting can be caused by ignition problems. Check the transformer for adequate spark. Check for a spark by momentarily short circuiting the transformer across the terminals by use of a screwdriver with an insulated handle. A 3/4" long spark should be obtained. If there is no spark or if the spark was weak (less than 1/2 inch) replace the transformer. Check the spark gap with the dimensions in the installation manual. Start the burner and check the spark at the same time by using a flame mirror. If the burner is installed in a pressurized unit the pyroglass inspection port, which will normally be located in the rear of the boiler, should be used for inspecting the spark.

With standard control systems (where pre-purge is not used) the spark should appear immediately when the burner starts. If a delay is detected, check the power supply to the burner. When a condition of this type is suspected, the best check is to have a voltage recorder connected to the burner for a period of 48 hours. This will indicate any voltage drop during that period. Voltage drops are usually caused by undersized wiring or a long run from the burner to the source of power. If delayed ignition is not corrected it could cause an explosion.

Check the drawer assembly for possible high voltage leaks in the insulators. If in doubt change the electrode assemblies. Check the electrode springs and points for adequate clearance to the ground. Check for carbon on the electrode points. Check all dimensions on the drawer assembly according to the dimensions shown in the manual and reset if necessary.

Some burners will be supplied with a set of wide arc electrodes. The gap between the bends in the electrode tips should be 1/16 to 3/32. The flared out portion of the tips should be set at 1/8 to 3/16.

If the spinner is not correctly positioned in relation to the stabilizer ring, hard lighting could occur. This is usually caused when the spinner is positioned too far back inside the stabilizer ring. To correct this condition, loosen the set screw that locks the drawer assembly in place and move the assembly forward in steps of 1/16 of an inch until the lighting is smooth and the flame is spinning approximately 1/2" ahead of the spinner.

Be sure to tighten the set screw after making this adjustment and check the electrode springs from the electrodes to the transformer, making sure there is adequate clearance to a ground and there is no possibility of a short circuit.

If a Hi-Lo burner is in question, make sure that the oil lines from the valve cluster to the drawer assembly are in the proper positions. The first stage is always connected to the lower oil pipe. The oil line from the normally closed port on the three way valve is connected to the upper oil pipe (second stage).

If the fire tends to blow out and hard lighting persists, check the setting of the air shutters. See air shutter adjustment for Hi-Lo burners for details - section #2 of this manual.

If the fire is clean with no smoke while in operation, but the heating unit continues to become coated with soot, check for short cycles on the burner. A delay valve will act as an instantaneous valve while hot. Short cycling will eventually cause hard lighting due to carbon on the spinner and nozzles. Under these conditions the limit control on the heating unit should be set with a greater differential to allow the delay valve to cool enough for proper operation.

7 - INSTRUMENTS

In most forced draft units it is impossible to view the flame satisfactorily so instruments must be used to properly adjust the flame.

Do not attempt to obtain a higher percentage of CO_2 than a clean fire will give. Keeping the heating surface of the unit clean is more important than securing a higher percentage of CO_2. Set the flame at no more than #2 on the Bacharach scale.

8 - NOZZLES

Use only the nozzles recommended by the boiler or furnace manufacturer for they are of the proper type, capacity and spray angle, and these nozzles should give the best performance in each burner and unit combination under normal conditions.

However, because of the great variation in fuel oils in different localities normal conditions do not always apply. Nozzles will not always deliver the gallons per hour or the spray angle with which they are marked, and in some instances nozzles other than those furnished as original equipment could give better performance.

The nozzles used should give smooth lighting and be able to produce a CO_2 reading of 10.5 to 12.5 percent with no more than a #2 smoke.

It is recommended on Hi-Lo burners that 2/3 of the total input of the boiler or furnace be installed on the first stage. On A-T burners use 75% of the total input on the first stage.

Do not attempt to install the nozzles through the choke (end cone). It is impossible to get a tight joint between the nozzles and the adapters unless two wrenches are used. Remove the drawer assembly from the burner and then remove the spinner before installing the nozzles.

9 - VALVE CLUSTER AND HYDRAULIC CYLINDER ON HI-LO BURNERS

If the piston in the oil cylinder will not retract, loosen the 3/16 flare nut at the bottom of the cylinder. This will relieve the oil pressure in the cylinder. If the piston does not retract, replace the cylinder. If the piston does retract, replace the 3-way valve.

If the first stage fails to operate, check the first stage valve. This is the valve adjacent to the burner housing. This can be checked by removing the cover from the junction box to which the valves are attached and checking the electric circuit to the valve. If checking with the voltmeter or a test lamp shows that current is going to the valve coil, and the valve does not open after 10 seconds, replace the valve.

If the second stage fails to operate, make sure that the toggle switch (high fire) is in the "on" position and that the circuit is completed through the switch. Determine if the three-way valve is in the proper position with the N. C. (normally closed) port connected to the second stage oil pipe. With the burner operating on the first stage, check the electric circuits in the junction box, to the two-way valve and the three-way valve on the second stage. If checking with the voltmeter or a test lamp shows that current is going to the valve coils loosen the flare nut on the discharge side of the two-way valve. If no oil is discharged after 10 seconds, the valve must be replaced. If oil is discharged, tighten the flare nut and loosen the flare nut at the N. C. (normally closed) port of the three-way valve. If no oil is discharged, replace the three-way valve. If oil is discharged, check for a plugged nozzle.

On standard control systems where pre-purge is not required, the two-way valves are of the delay type. If controls providing pre-purge are used, an instantaneous valve is used on the first stage.

If safety shut downs are common with an installation of Hi-Lo or A-T burners check the timing of the delay on the first stage valve. On burners with one stage firing check the timing of the delay on the valve. If the delay amounts to more than 10 to 12 seconds under normal temperature conditions of 60 to 80 degrees F replace the valve. Low ambient temperature at the burner can cause unusually long delays in the opening of the valve. High ambient temperature at the burner will shorten the delay in the opening of the valve and may cause hard starting.

If the low ambient and high ambient temperature conditions cannot be corrected by the proper ventilation of the boiler or furnace room, the burner should be replaced with one having a programming control that is not affected by temperature.

ATTACHMENTS

Webster literature on fuel units showing the pump model numbers and oil line and vacuum data.

Sundstrand pump data.

Schematic drawing of the oil system on A-T and Hi-Lo burners.

Schematic Drawing Showing Direction Of The Oil Flow Through The Valves On A-T Burners

1 - Pump
2 - First Stage Oil Valve (Delayed)
3 - First Stage Nozzle(s)
4 - Second Stage Oil Valve (Delayed)
5 - Second Stage Nozzle(s)

#2 - First Stage Valve Instantanious When Controls With Pre-Purge Are Used.

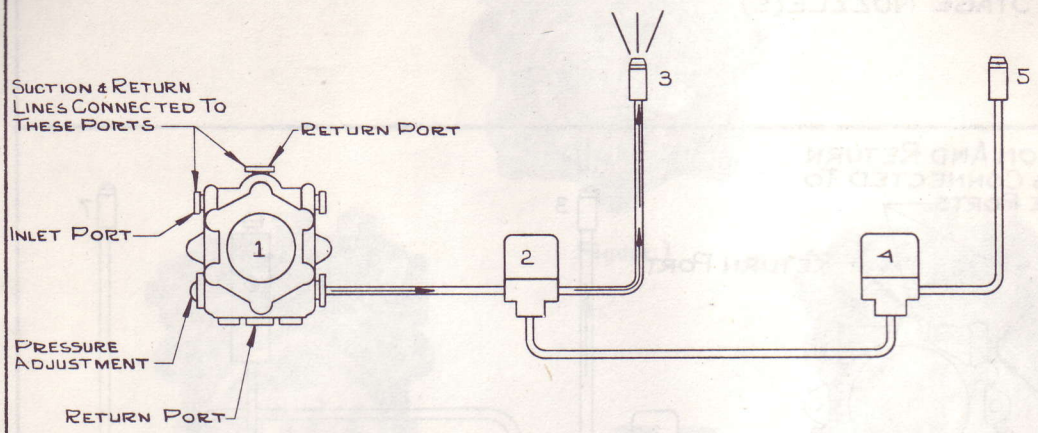


Diagram. No 1

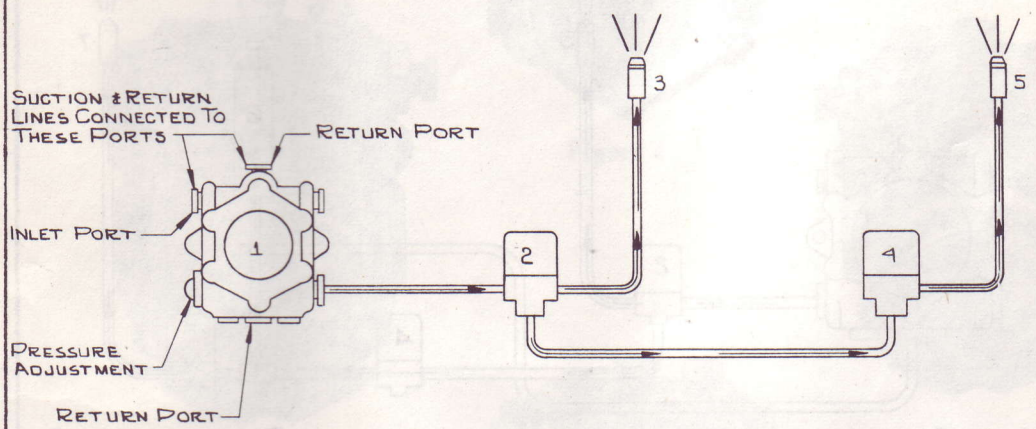


Diagram No. 2

Schematic Drawing Showing Direction Of Oil Flow On Hi-Lo Burner Assy's.

1. Pump
2. First Stage Delayed Oil Valve {*2 Valve - Instantaneous When Controls With Prepurge Are Used.
3. First Stage Nozzle(s)
4. Second Stage Delayed Oil Valve.
5. Second Stage - Three Way - Instantaneous Oil Valve.
6. Damper Operating Cylinder.
7. Second Stage Nozzle(s)

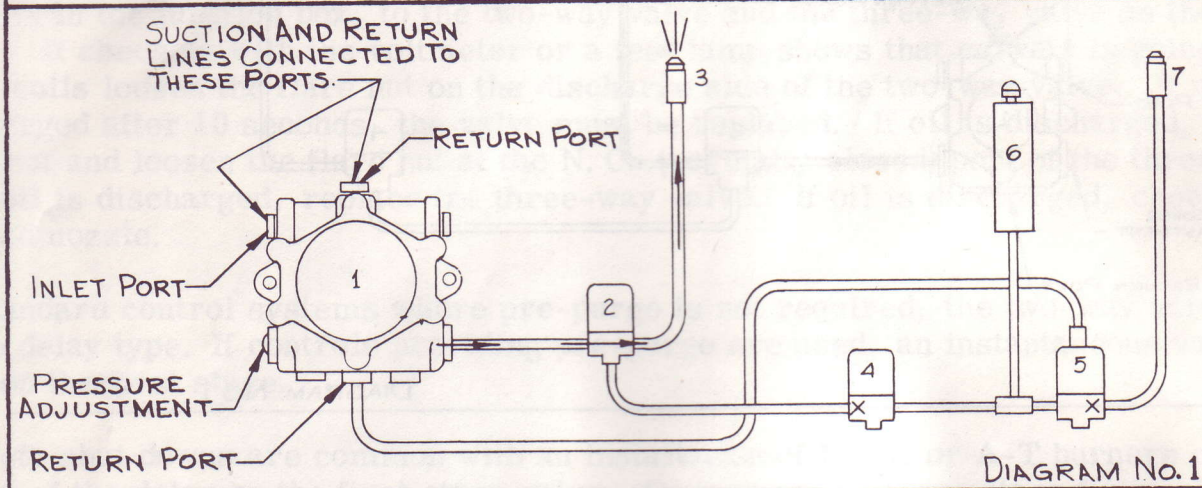


Diagram No. 1

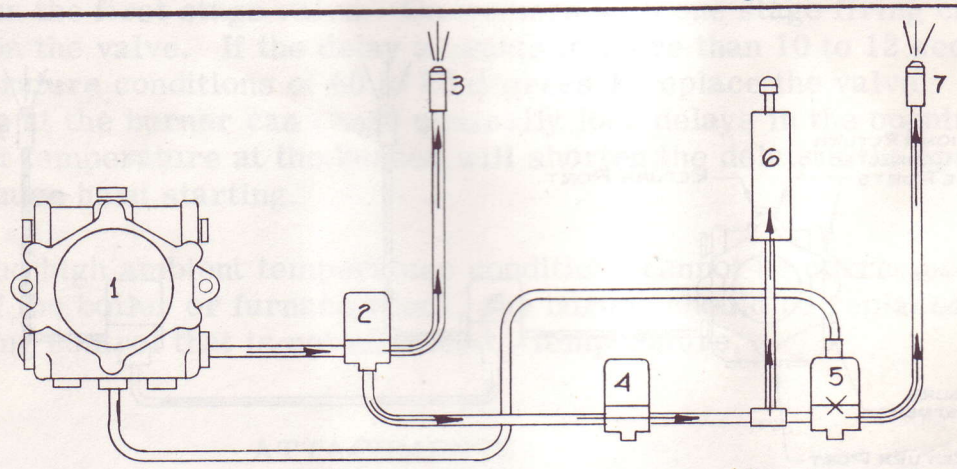


Diagram No. 2

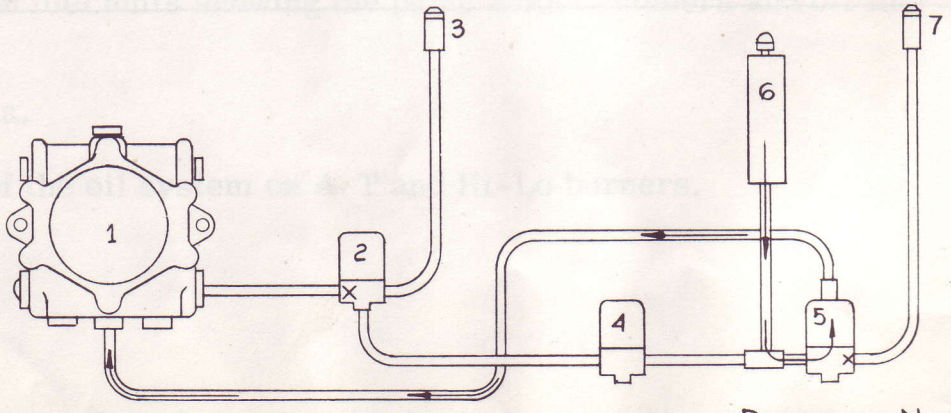


Diagram No. 3

COMMUNICATIONS DIVISION
WEBSTER ELECTRIC COMPANY, INC.
Racine, Wisconsin 53403

servicesaver fuel units
installation and maintenance manual

bulletin FU60-9
AUG.66

FUEL-UNITS

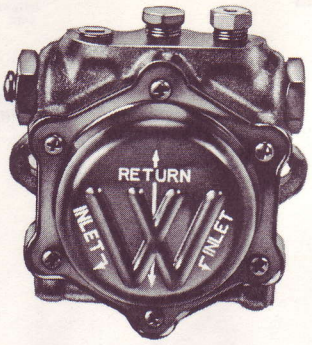


Figure 1

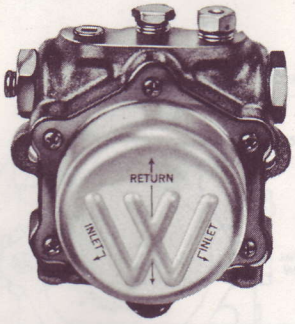


Figure 2

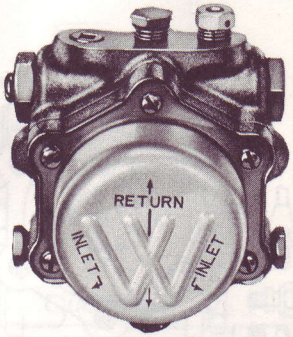


Figure 3

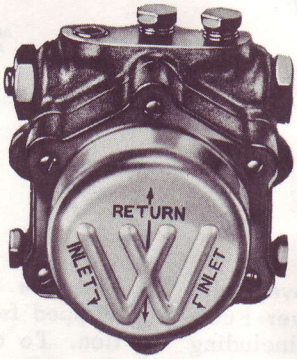


Figure 4

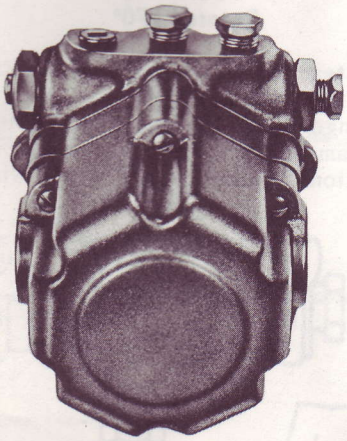


Figure 7

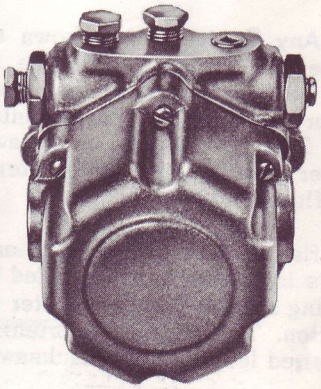


Figure 6

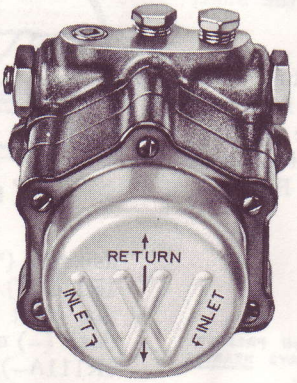
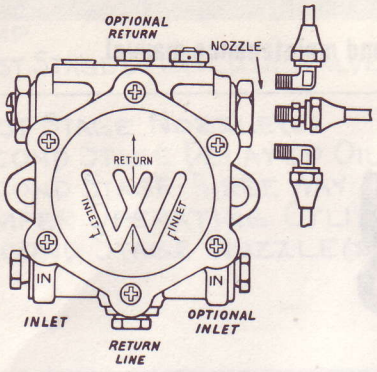


Figure 5

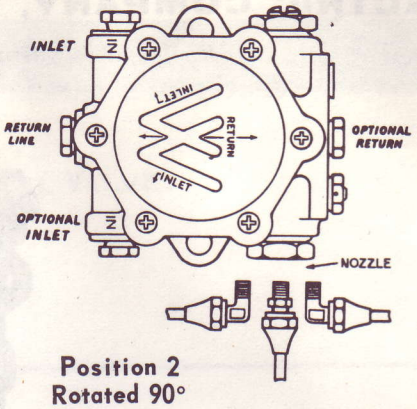
A STA-RITE INDUSTRY

Litho in U.S.A.

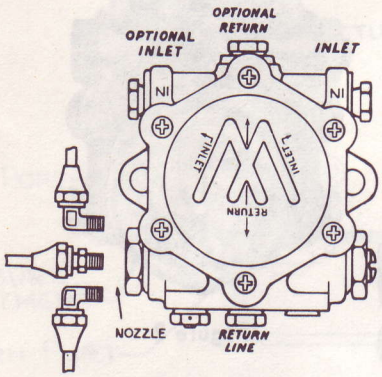
MOUNTING INSTRUCTIONS



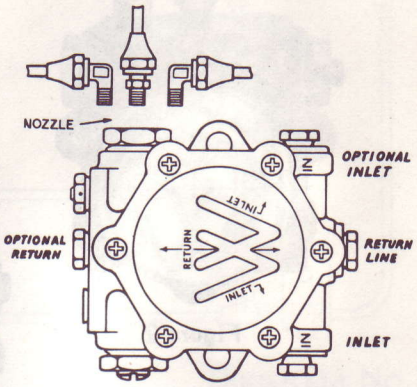
Position 1



Position 2
Rotated 90°



Position 3
Rotated 180°

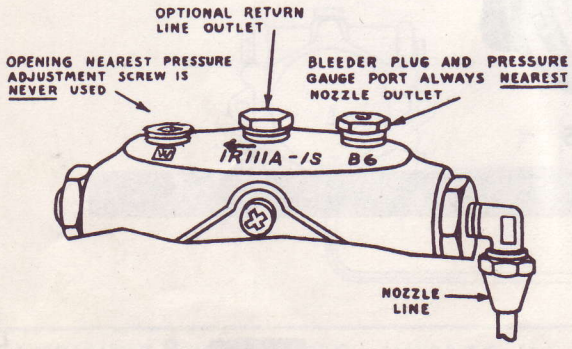


Position 4
Rotated 270°

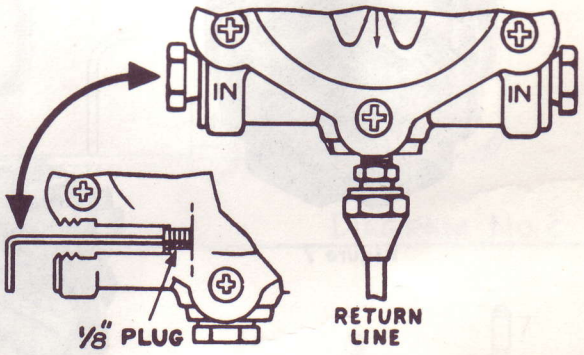
Mount In Any Position: As shown above, Webster Single and Two-Stage Service Saver Fuel-units may be mounted in any position, including shaft up or shaft down. When mounting units in Positions 2 or 4, use the set screws found on many burner housings, or use Webster's universal mounting flange A43Q7.

The long flat shaft that is standard on all Service Saver units is specially constructed with a hardened bearing surface but with softer metal on the drive portion. This permits shortening the shaft to any desired length with a hacksaw.

Pump rotation is always determined when looking at the shaft end of the unit and is indicated by an arrow stamped on the top of the casting, as shown below. Styles A and D Service Saver units are for clockwise rotation; Styles B and C, for counter-clockwise rotation.

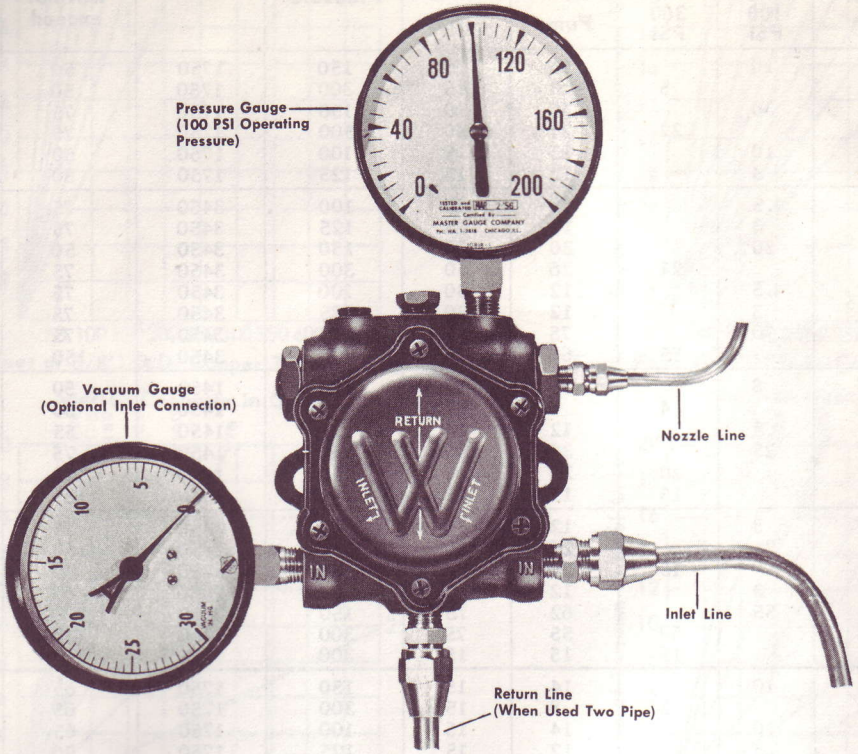


Two-pipe System: Servicesaver Fuel-Units, are shipped from the factory set for one pipe operation. To change to a two-pipe system, refer to the coding stamped on the top of the unit to determine location for the bypass plug. When an



asterisk (*) appears in the code number (Example: 1R111A*), the bypass plug should be inserted in the inlet on the right side of the unit. When a dash (–) at the left of the code number (Example: 1R111A–), the bypass plug should be inserted in the inlet on the left side of the unit as shown above.

To accomplish the changeover, insert the 1/8" pipe plug furnished with each Servicesaver Fuel-unit into the correct inlet opening, tighten securely with a 3/16" Allen wrench and attach the return line, as shown.



Vacuum Data: Before removing a fuel-unit from an oil burner, a check should be made with vacuum and pressure gauges if you suspect fuel-unit trouble.

The vacuum gauge should be applied to the inlet port ("IN") opposite the inlet port being used, or inserted in the inlet line with a "TEE".

On installations where the oil tank is below the fuel-unit, the gauge reading should show the amount of vacuum **(approximately 1" vacuum per 12" of vertical lift, plus the tube loss of total run).** (See chart, Page 4).

NOTE:

1. The viscosity chosen for the above figures is 50 SSU at 68° F. The above losses will be reduced at lower viscosities.

2. The gravity chosen is 40° API (60° F.) at 68°F. which gives a specific gravity of 0.822. Gravity of No. 2 oils varies from 30° to 45° API.

3. Even though a fuel-unit is capable of a very high vacuum, this has very little to do with the maximum advisable lift because of the volatility of the oil under vacuum, which varies with different oils. Under certain conditions, installations as high as 28 feet have operated satisfactorily with a two-stage unit, but generally high lifts should be avoided on any liquid having volatile fractions. When the combined vertical lift and the equivalent losses through the tubing add up to 15" vacuum or more, use of a Webster booster unit is advisable.

If the vacuum gauge reads higher than the calculated vacuum, look for restriction in the suction line . . . a closed tank valve, kinked copper tubing, plugged filter, sticking foot or check valve, frozen oil line, undersized oil line, or excessive oil lift. On the other hand, if the gauge reading is below the calculated vacuum look for air leaks in in the lines, valve, fittings, or fuel-unit.

On gravity fed jobs where the oil tank is above the fuel-unit, vacuum should read zero except when restrictions are apparent such as closed shut-off valve, clogged filter, kinked line, etc. Any of these restrictions should be eliminated.

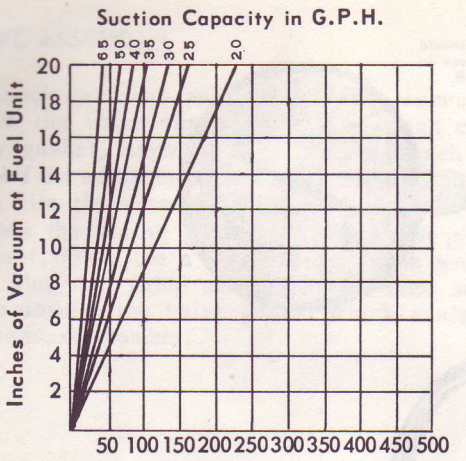
Relation between vacuum and vertical lift 40° API all at 68° F.

Ins. of Vacuum	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
lift	1'4"	2'9"	4'1"	5'6"	6'10"	8'3"	9'7"	11'0"	12'4"	13'9"	15'1"	16'6"	17'10"	19'3"	20'7"	22'0"	23'4"	24'9"	26'1"	27'6"

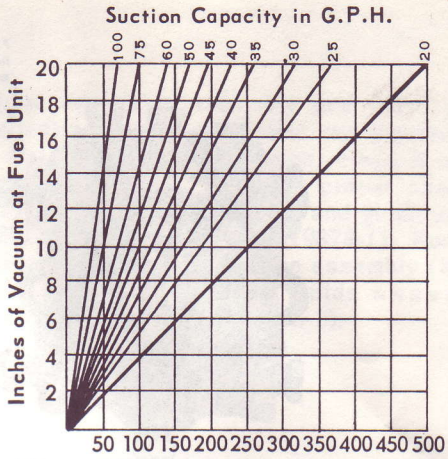
	Type	See Fig. No.	Webster Recommended Max. Fire Size in G.P.H.		Underwriters Max. Ratings in G.P.H.		Max. Gage Port Pressure	Speed in R.P.M.	At 100 PSI Wattage will not exceed	Suction Capacity in G.P.H.
			100 PSI	300 PSI	Pump	Filter				
Single Stage Ratings	X 1R111	1	10	5	14	15	150	1750	50	20
	1R121	1			8	15	300	1750	50	20
	1R213	2	30		30	30	150	1750	75	50
	1R223	2		22	27	30	300	1750	75	50
	1R151	1	10		15	15	100	1750	50	20
	1R162	1	3		12	15	125	1750	50	35
	21R150	1	4.5		12	15	100	3450	75	30
	21R160	1	3		12	15	125	3450	75	30
	21R211	1	30		30	30	150	3450	50	40
	21R221	1		21	26	30	300	3450	75	40
	21R251	1	4.5		12	30	100	3450	75	40
	21R261	1	3		12	30	125	3450	75	40
	21R613	3	70		75	75	150	3450	75	100
	21R623	3		55	65	75	300	3450	150	100
	31R111	1	8	4	11	15	150	1450	50	20
	31R121	1			6	15	300	1450	50	20
	31R162	1	3		12	15	125	1450	55	30
	31R213	2	25		30	30	150	1450	75	40
	31R223	2		20	25	30	300	1450	75	40
	XX 31RR121	1		15	15	15	300	1450	125	20
	41R160	1	3		12	15	125	2850	55	25
	41R211	1	21		26	30	150	2850	60	40
	41R221	1		15	20	30	300	2850	60	40
	41R261	1	3		12	30	125	2850	60	40
	41R613	3	55		62	75	150	2850	120	80
	41R623	3		50	55	75	300	2850	120	80
	XX 41RR121	1		15	15	15	300	2850	240	40
Two Stage Ratings	X 2R111	2	10	5	14	15	150	1750	65	35
	2R121	2			8	15	300	1750	65	35
	2R151	2	10		14	15	100	1750	65	35
	2R162	2	3		12	15	125	1750	70	35
	2R213	3	30		30	30	150	1750	90	50
	2R223	3		22	30	30	300	1750	90	50
	2R233	3			30	30	20	1750	65	50
	2R243	3			30	30	45	1750	65	50
	2R253	3	30		30	30	100	1750	90	50
	2R343	3			45	45	45	1750	65	50
	2R616	5	65		65	75	150	1750	130	100
	2R618		75		110	75	150	1750	180	120
	2R626	5		55	65	75	300	1750	130	100
	2R628			75	100	75	300	1750	180	120
	2R636	5			70	75	25	1750	130	100
	2R656	5	65		65	75	100	1750	130	100
	XX 2RR221	6		15	20	30	300	1750	150	40
	XX 2RR313	6	40		45	45	150	1750	200	70
	XX 2RR323	6		40	45	45	300	1750	200	70
	XX 2RR626	7		85	90	90	300	1750	290	125
	22R120	2		15	15	15	300	3450	85	30
	22R150	2	4.5		12	15	100	3450	85	30
	22R160	2	3		12	15	125	3450	85	30
	22R211	2	30		30	30	150	3450	90	50
	22R221	2		20	25	30	300	3450	90	50
	22R251	2	4.5		12	30	100	3450	90	50
	22R261	2	3		12	30	125	3450	90	50
	22R613	4	75		75	75	150	3450	180	100
	22R623	4		50	55	75	300	3450	180	100
	XX 22RR311	6	35		40	45	150	3450	300	70
	XX 22RR321	6		35	40	45	300	3450	300	70
	XX 22RR623	6		85	90	90	300	3450	400	125
	32R111	2	8	4	14	15	150	1450	65	30
	32R121	2			6	15	300	1450	65	30
	32R162	2	3		12	15	125	1450	60	30
	32R213	3	30		30	30	150	1450	90	40
	32R223	3		20	25	30	300	1450	90	40
	32R616	5	60		65	75	150	1450	130	100
	32R626	5		50	55	75	300	1450	130	100
	XX 32RR221	6		12	17	30	300	1450	125	30
	XX 32RR323	6		32	37	45	300	1450	165	60
	XX 32RR626	7		70	74	90	300	1450	240	100
	42R160	2	3		15	15	125	2850	65	25
	42R211	2	23		28	30	150	2850	75	40
	42R221	2		15	20	30	300	2850	75	40
	42R261	2	3		28	30	125	2850	75	40
	42R613	4	60		65	75	150	2850	180	80
	42R623	4		50	55	75	300	2850	180	80
	XX 42RR321	6		30	34	45	300	2850	250	40
	XX 42RR623	6		70	74	90	300	2850	365	100

X With slotted valve, deduct 4 G.P.H.
XX Heavy oil unit: 1000 SSU.

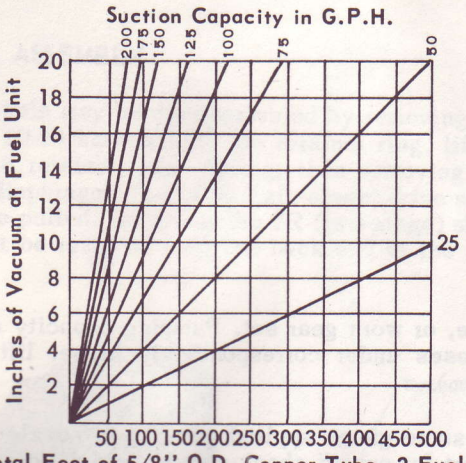
(NOTE) Oil burner nozzles are rated at 100 PSI. Any increase in fuel unit pressure over 100 PSI will increase the fire size above nozzle rating.



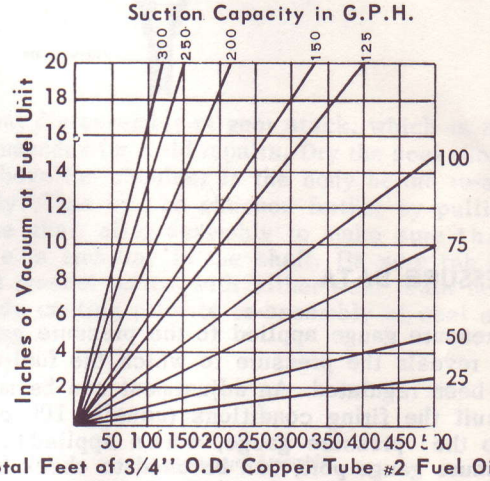
Total Feet of 3/8" O.D. Copper Tube #2 Fuel Oil



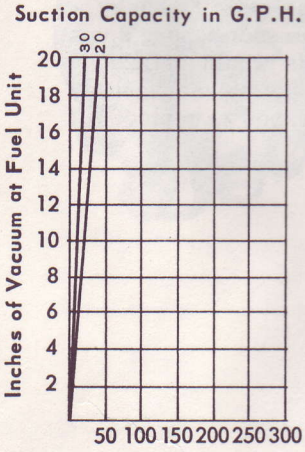
Total Feet of 1/2" O.D. Copper Tube #2 Fuel Oil



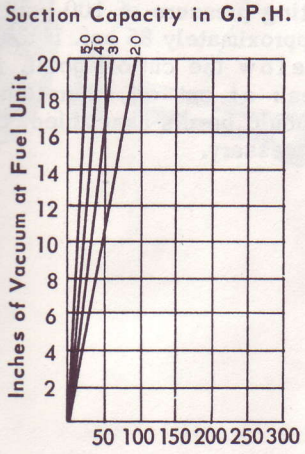
Total Feet of 5/8" O.D. Copper Tube #2 Fuel Oil



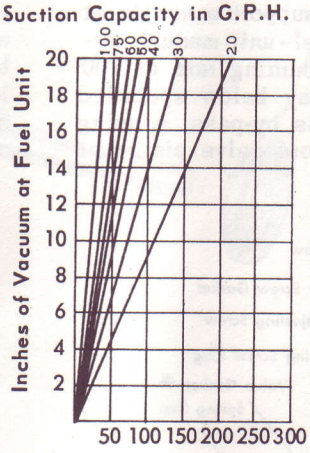
Total Feet of 3/4" O.D. Copper Tube #2 Fuel Oil



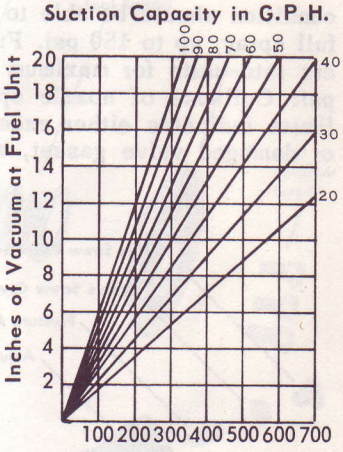
Total Feet of 1/2" O.D. Copper Tube - 1000 SSU Oil



Total Feet of 5/8" O.D. Copper Tube - 1000 SSU Oil



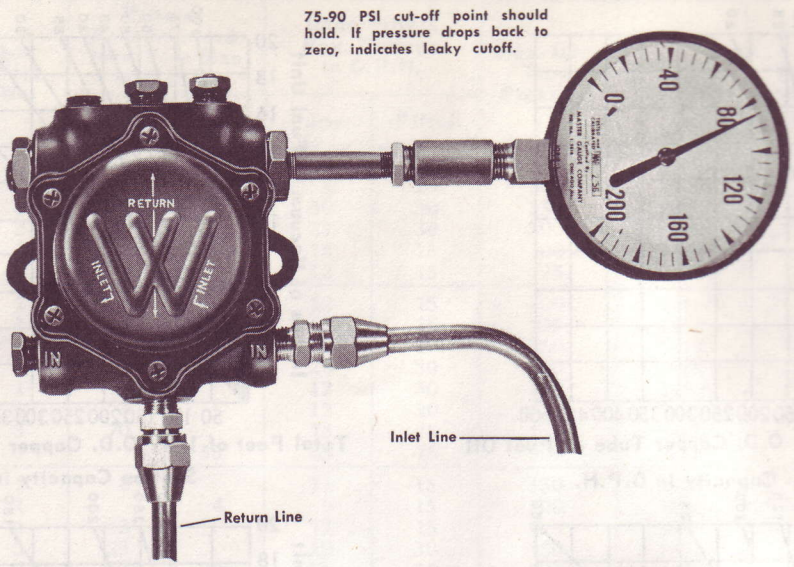
Total Feet of 3/4" O.D. Copper Tube - 1000 SSU Oil



Total Feet of 1" O.D. Copper Tube - 1000 SSU Oil

TO DETERMINE SUCTION LINE SIZE IN INSTALLATIONS USING WEBSTER FUEL - UNITS ON TWO-PIPE SYSTEMS

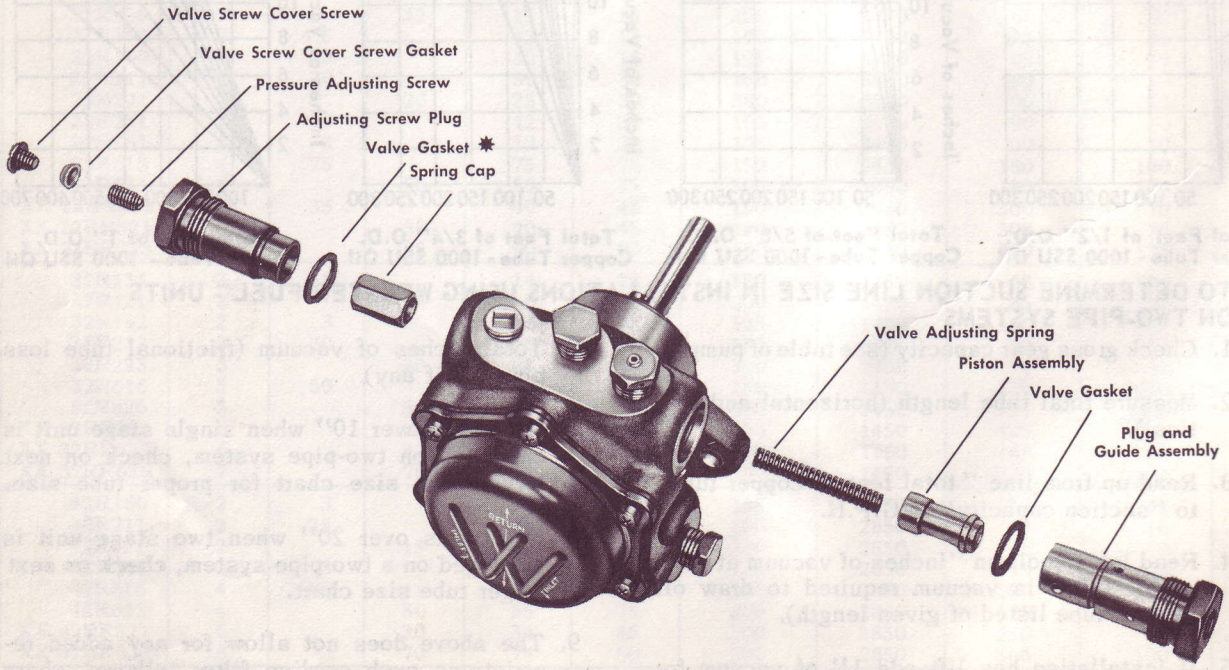
1. Check gross gear capacity (see table of pumps).
2. Measure total tube length (horizontal and vertical).
3. Read up from line "total feet of copper tube" to "suction capacity" in G.P.H.
4. Read left to column "inches of vacuum at fuel-unit". (This is vacuum required to draw oil through tube listed of given length).
5. If installation has lift add 1" of vacuum for every foot of lift.
6. Total inches of vacuum (frictional tube loss plus lift if any).
7. If total is over 10" when single stage unit is employed on two-pipe system, check on next larger tube size chart for proper tube size.
8. If total is over 20" when two stage unit is employed on a two pipe system, check on next larger tube size chart.
9. The above does not allow for any added restrictions such as line filter, elbows, sharp bends, check valves, etc.



PRESSURE DATA

A pressure gauge applied to the pressure gauge port reveals the pressure to which the fuel-unit has been regulated. An adjustment can be made to suit the firing conditions (usually 100 psi). Also the pressure gauge, when applied to the pressure gauge port, can be used to check fuel-unit efficiency. A unit in satisfactory operating condition should be able to support a nozzle at full spray, up to 150 psi. Fuel-unit manufacturers rate units for maximum burning rate at 100 psi. Collapse of nozzle spray below specified limits indicates either excess by-pass, missing or damaged valve gasket, worn valve piston or sleeve, or worn gear set. Pumping capacity also decreases under correspondingly higher lift (or vacuum).

A pressure gauge applied directly to nozzle outlet port for cut-off check should hold differential pressure on shut-down. For example, with operating pressure of 100 psi, the cut-off should be approximately 85 psi. If the pressure gauge drops below the cut-off point, this would indicate a leak at cut-off, therefore the valve assembly should be dis-assembled, cleaned or replaced if necessary.



✸ Not Used in Two Stage Units.

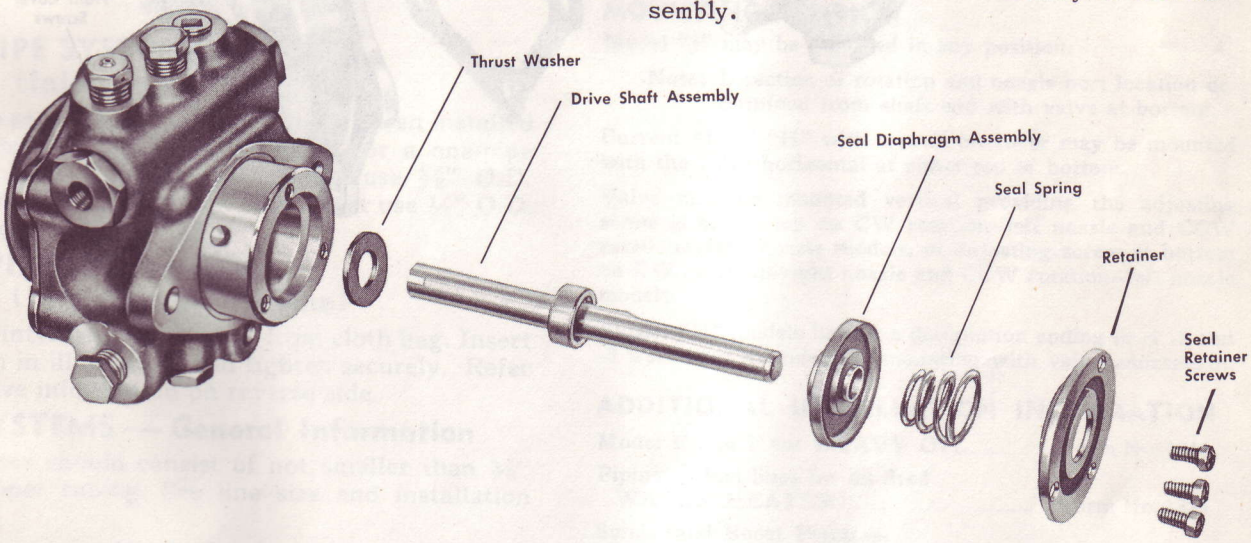
VALVE ASSEMBLY

To check pressure regulating valve assembly, remove the valve screw cover screw and cover screw gasket, insert a 1/8" Allen wrench and back off the adjusting screw until the valve spring guide hits the stop for minimum pressure. This relieves the spring pressure against the piston and seat. Then use a 1 inch box wrench and remove plug and guide assembly with care so as not to damage the valve gasket which seals off the pressure chamber.

The plug and guide assembly and valve piston and adjusting spring will come out together. Inspect the valve seat and piston, clean if necessary and/or replace. Standard piston assembly (25121) must be used with plug and guide assembly (25124) and spring cap (19878-1). For high capacity (no slot) units, piston assembly (25121) must be used with plug and guide assembly (25124-1) and spring cap (19878-1).

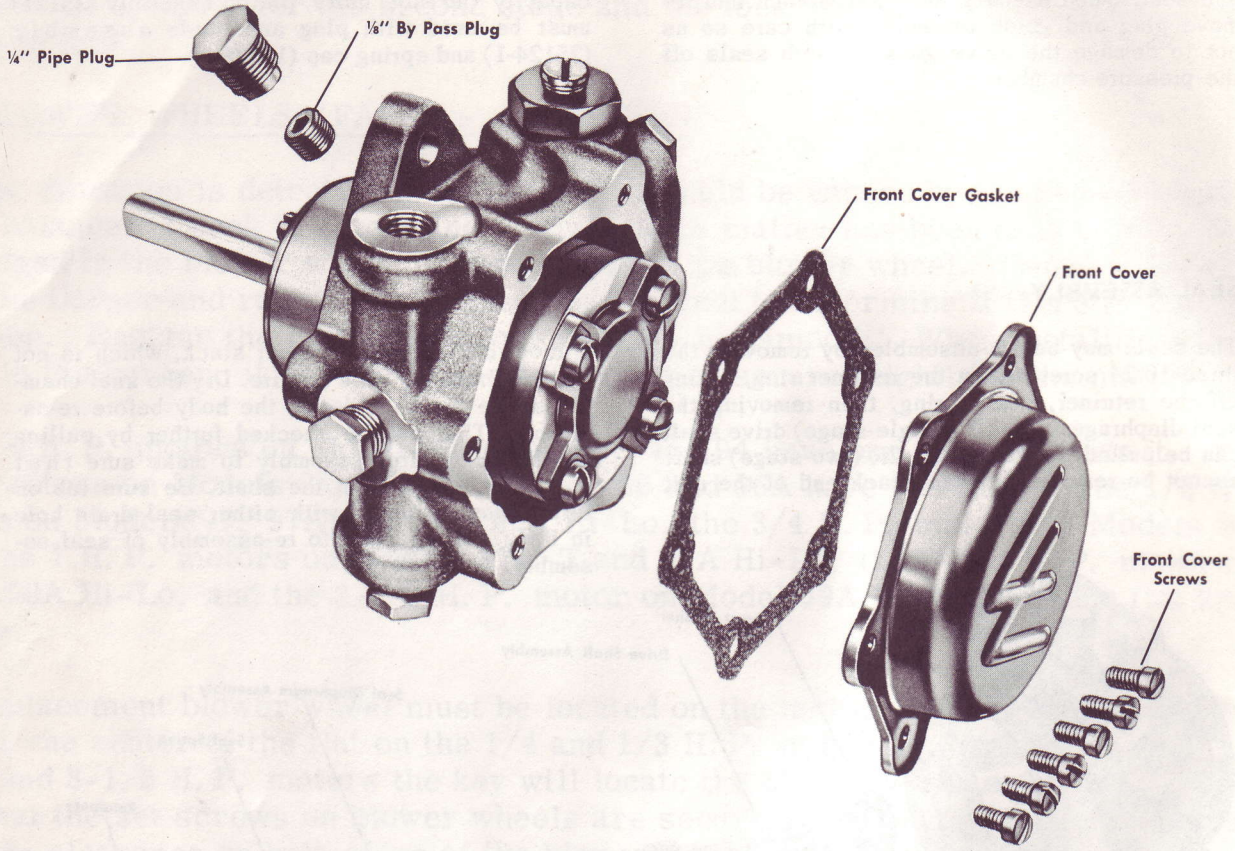
SEAL ASSEMBLY

The seals may be dis-assembled by removing the three 10-24 screws from the retainer ring, lifting off the retainer, seal spring, then removing the seal diaphragm. The 1R (single-stage) drive shaft can be pulled. However, the 2R (two-stage) shaft cannot be removed from the back end of the unit without dis-assembly of gear stack, which is not recommended for field repairs. Dry the seal chamber above the shoulder in the body before re-assembly. This can be checked further by pulling on the shaft after assembly to make sure that there is end-play in the shaft. Be sure tab on thrust washer mates with either seal drain hole in body casting prior to re-assembly of seal assembly.



FILTER ASSEMBLY

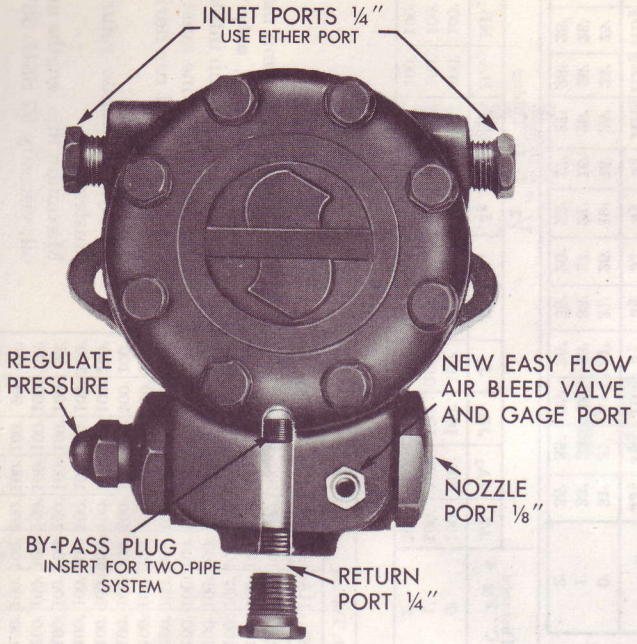
For checking, remove cover by taking out size 10-24 screws with screw driver. Wipe out cover if necessary and replace. (This operation should not be necessary until 5 or 6 years after unit is in operation because of effective self-cleaning of the rotary filter.)



IMPORTANT . . . INSTALLATION INFORMATION

SUNDSTRAND ROTA-ROLL® FUEL UNITS

MODEL J SINGLE STAGE AND MODEL H TWO STAGE



ONE-PIPE SYSTEM
(Inlet line only)

Check to see that by-pass plug has not been installed for two-pipe system. Units are set for a one-pipe system. Line length under 50 feet use ⅜" O.D. copper tubing. Line length 50-100 feet use ½" O.D. copper tubing.

TWO-PIPE SYSTEM
(Inlet and Return line)

Remove internal by-pass plug from cloth bag. Insert as shown in illustration and tighten securely. Refer to line size information on reverse side.

ALL SYSTEMS — General Information

1. Oil lines should consist of not smaller than ⅜" O.D. copper tubing. See line size and installation data.
2. Oil lines must be absolutely air tight. Check all connections and joints.
3. Return line pressure should not exceed 10 P.S.I.

AIR BLEED PROCEDURE WITH NEW EASY FLOW AIR BLEED VALVE

One-Pipe System

Start burner: Loosen Easy Flow Air Bleed Valve CCW just ¼ turn for fast purging.

For clean bleed in restricted spaces, an easily attached hose can be used to direct bleed oil into a container. A 3/16" I.D. hose can be slipped directly over end of valve.

Optional Procedure: On gravity feed systems, before starting burner, loosen unused intake port plug until there is a flow of oil from the port.

Two-Pipe Systems

Air bleeding is automatic. Opening Easy Flow Air Bleed Valve will allow oil to be pulled up faster.

MOUNTING POSITION

Model "J" may be mounted in any position.

Note: Direction of rotation and nozzle port location determined from shaft end with valve at bottom.

Current Model "H" with arrows on cover may be mounted with the valve horizontal at either top or bottom.

Valve may be mounted vertical providing the adjusting screw is at the top on CW rotation–left nozzle and CCW rotation–right nozzle models, or adjusting screw at bottom on CW rotation–right nozzle and CCW rotation–left nozzle models.

Earlier "H" models having a designation ending in -1 -2 and -3 were only intended for mounting with valve underneath.

ADDITIONAL INSTALLATION INFORMATION

Model E and F for HEAVY OIL	Form No. 1011
Piping of fuel lines for oil fired WATER HEATER	Form No. 1335
Sundstrand Boost Pump — SIMPLIFIED CIRCUIT	Form No. 450012
Sundstrand QUICK PURGE VALVE	Form No. 450015
Hum Eliminator for RETURN LINE	Form No. 450021

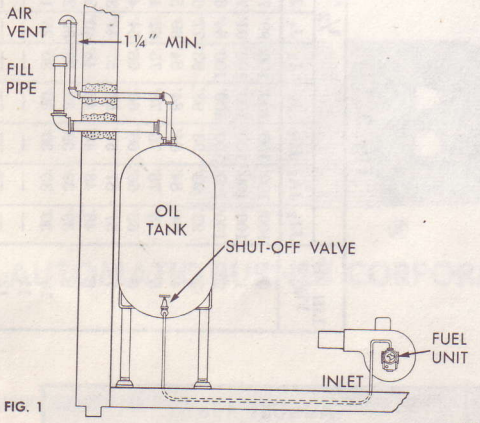


FIG. 1

ONE PIPE SYSTEMS

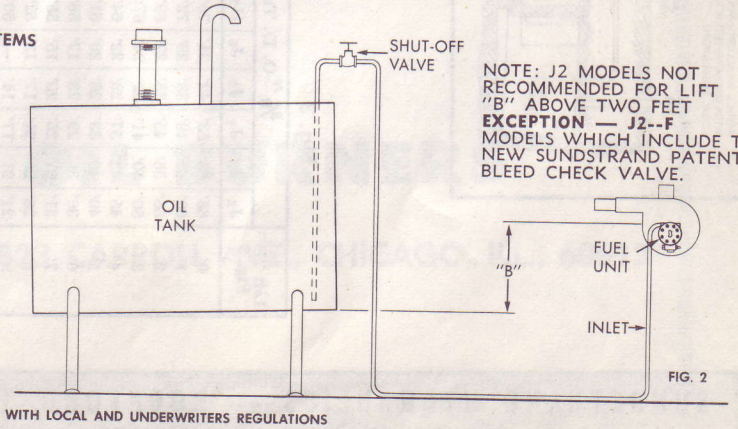


FIG. 2

INSTALL IN ACCORDANCE WITH LOCAL AND UNDERWRITERS REGULATIONS

SUNDSTRAND HYDRAULICS — ROCKFORD, ILLINOIS
DIVISION OF SUNDSTRAND CORPORATION
AUGUST 1967
FORM NO. 440041

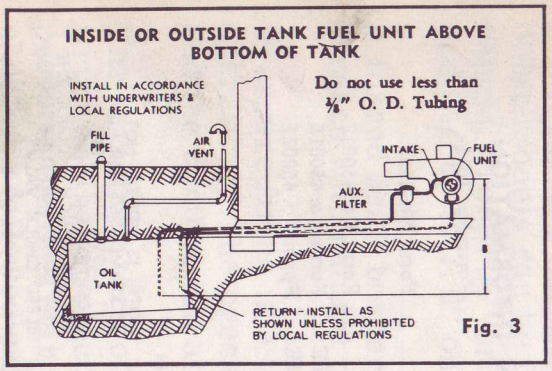


Fig. 3

TWO-PIPE INSTALLATION

MAXIMUM ALLOWABLE LENGTH OF EITHER INTAKE OR RETURN LINE IN FEET. (Includes horizontal and vertical run)

REFER TO CHARTS TO DETERMINE CORRECT LINE LENGTH AND SIZE

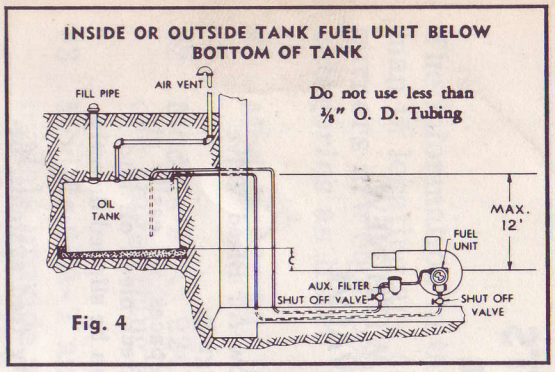


Fig. 4

Fig. 3 1725 RPM

Lift "B" Fig. 3	⅜" O. D. Tubing										½" O. D. Tubing											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0′	65′	65′	53′	42′	31′	75′	77′	75′	63′	55′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	73′
1′	60′	60′	49′	38′	29′	72′	74′	72′	61′	53′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	71′
2′	55′	55′	45′	35′	27′	69′	71′	70′	58′	51′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	68′
3′	50′	50′	41′	32′	24′	67′	69′	67′	56′	49′	100′	100′	100′	100′	96′	100′	100′	100′	100′	100′	100′	65′
4′	45′	45′	37′	29′	22′	64′	66′	64′	53′	47′	100′	100′	100′	100′	87′	100′	100′	100′	100′	100′	100′	63′
5′	40′	40′	33′	26′	20′	61′	63′	61′	51′	45′	100′	100′	100′	100′	78′	100′	100′	100′	100′	100′	96′	60′
6′	36′	36′	29′	23′	17′	58′	60′	58′	49′	43′	100′	100′	100′	90′	68′	100′	100′	100′	100′	100′	92′	57′
7′	31′	31′	25′	20′	15′	55′	57′	55′	46′	41′	100′	100′	99′	78′	59′	100′	100′	100′	100′	100′	87′	54′
8′	26′	26′	21′	17′	13′	52′	54′	53′	44′	39′	100′	100′	83′	66′	50′	100′	100′	100′	100′	100′	83′	51′
9′	21′	21′	17′	14′	—	50′	51′	50′	42′	37′	83′	83′	68′	53′	40′	100′	100′	100′	100′	100′	79′	49′
10′	16′	16′	13′	—	—	47′	48′	47′	39′	35′	64′	64′	52′	41′	31′	100′	100′	100′	100′	100′	74′	46′
11′	—	—	—	—	—	44′	45′	44′	37′	33′	—	—	—	—	—	100′	100′	100′	100′	100′	70′	43′
12′	—	—	—	—	—	41′	42′	41′	35′	31′	—	—	—	—	—	100′	100′	100′	100′	100′	65′	40′
13′	—	—	—	—	—	38′	39′	38′	32′	28′	—	—	—	—	—	100′	100′	100′	100′	100′	61′	37′
14′	—	—	—	—	—	35′	37′	36′	30′	26′	—	—	—	—	—	100′	100′	100′	100′	99′	56′	34′
15′	—	—	—	—	—	33′	34′	33′	28′	24′	—	—	—	—	—	100′	100′	100′	100′	91′	52′	32′

Fig. 4 1725 RPM

Distance "C" Fig. 4	⅜" O. D. Tubing											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0′	64′	64′	53′	41′	31′	75′	75′	70′	60′	51′	30′	20′
1′	69′	69′	57′	45′	34′	78′	78′	72′	62′	52′	31′	21′
2′	74′	74′	61′	48′	36′	80′	80′	75′	64′	54′	32′	22′

Distance "C" Fig. 4	½" O. D. Tubing											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	79′
1′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	82′
2′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	85′

Fig. 3 3450 RPM

Lift "B" Fig. 3	½" O. D. Tubing															⅝" O. D. Tubing														
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	100′	100′	100′	100′	100′	99′	77′	59′	100′	100′	100′	100′	100′	94′	81′	69′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
1′	100′	100′	100′	100′	100′	91′	72′	55′	93′	93′	93′	93′	93′	89′	77′	65′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
2′	100′	100′	100′	100′	100′	84′	66′	50′	88′	88′	88′	88′	88′	85′	73′	62′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
3′	93′	93′	93′	93′	93′	77′	60′	46′	83′	83′	83′	83′	83′	80′	69′	58′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
4′	84′	84′	84′	84′	84′	69′	54′	41′	78′	78′	78′	78′	78′	75′	64′	55′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
5′	75′	75′	75′	75′	75′	62′	48′	37′	73′	73′	73′	73′	73′	70′	60′	51′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
6′	66′	66′	66′	66′	66′	54′	42′	32′	69′	69′	69′	69′	69′	66′	56′	48′	100′	100′	100′	100′	100′	100′	100′	90′	100′	100′	100′	100′	100′	100′	100′	100′
7′	57′	57′	57′	57′	57′	47′	37′	28′	64′	64′	64′	64′	64′	61′	52′	44′	100′	100′	100′	100′	100′	100′	100′	78′	100′	100′	100′	100′	100′	100′	100′	100′
8′	48′	48′	48′	48′	48′	40′	31′	24′	59′	59′	59′	59′	59′	56′	48′	41′	100′	100′	100′	100′	100′	100′	100′	85′	65′	100′	100′	100′	100′	100′	100′	100′
9′	39′	39′	39′	39′	39′	32′	25′	19′	54′	54′	54′	54′	54′	52′	44′	38′	100′	100′	100′	100′	100′	100′	90′	69′	53′	100′	100′	100′	100′	100′	100′	100′
10′	30′	30′	30′	30′	30′	25′	19′	15′	49′	49′	49′	49′	49′	47′	40′	34′	83′	83′	83′	83′	83′	69′	53′	41′	100′	100′	100′	100′	100′	100′	100′	95′
11′	—	—	—	—	—	—	—	—	44′	44′	44′	44′	44′	42′	36′	31′	—	—	—	—	—	—	—	—	100′	100′	100′	100′	100′	100′	100′	86′
12′	—	—	—	—	—	—	—	—	39′	39′	39′	39′	39′	37′	32′	27′	—	—	—	—	—	—	—	—	100′	100′	100′	100′	100′	100′	90′	76′
13′	—	—	—	—	—	—	—	—	34′	34′	34′	34′	34′	33′	28′	24′	—	—	—	—	—	—	—	—	95′	95′	95′	95′	95′	91′	78′	67′
14′	—	—	—	—	—	—	—	—	29′	29′	29′	29′	29′	28′	24′	20′	—	—	—	—	—	—	—	—	82′	82′	82′	82′	82′	78′	67′	57′
15′	—	—	—	—	—	—	—	—	24′	24′	24′	24′	24′	23′	20′	17′	—	—	—	—	—	—	—	—	68′	68′	68′	68′	68′	65′	56′	48′

Fig. 4 3450 RPM

Distance "C" Fig. 4	⅜" O. D. Tubing															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	31′	31′	31′	31′	31′	25′	19′	15′	25′	25′	25′	25′	25′	23′	20′	17′
1′	33′	33′	33′	33′	33′	27′	21′	16′	26′	26′	26′	26′	26′	25′	22′	18′
2′	35′	35′	35′	35′	35′	29′	23′	17′	27′	28′	28′	28′	29′	26′	23′	19′

Distance "C" Fig. 4	½" O. D. Tubing															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	100′	100′	100′	100′	100′	99′	77′	59′	100′	100′	100′	100′	100′	94′	81′	69′
1′	100′	100′	100′	100′	100′	100′	83′	63′	100′	100′	100′	100′	100′	99′	85′	72′
2′	100′	100′	100′	100′	100′	100′	89′	68′	100′	100′	100′	100′	100′	100′	89′	76′

NOTES

More than one pump may be connected to a single intake line, **only** if bottom of supply tank is above pump intake ports and connecting tee. Intake line must be connected to bottom of tank and run horizontally below minimum fuel level.

Always terminate return line as shown in illustrations.

Maximum line lengths are calculated for fuel oil, viscosity 57 SSU, 35° API