LP-GAS VAPORIZER-MIXERS
PAM, PAMW AND M SERIES

DESCRIPTION AND OPERATION

CONTENTS

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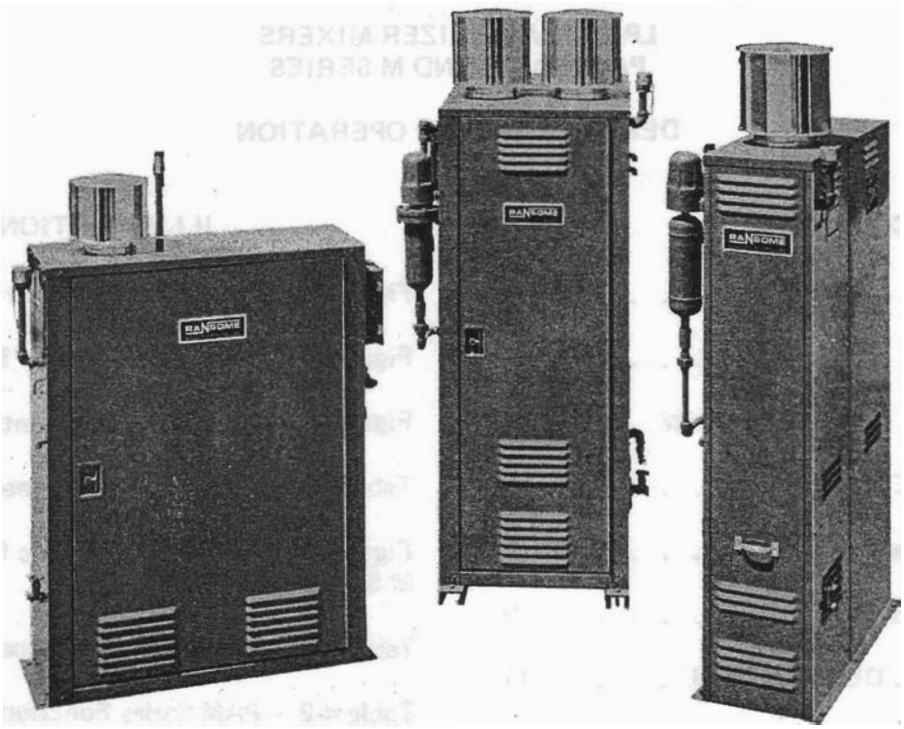


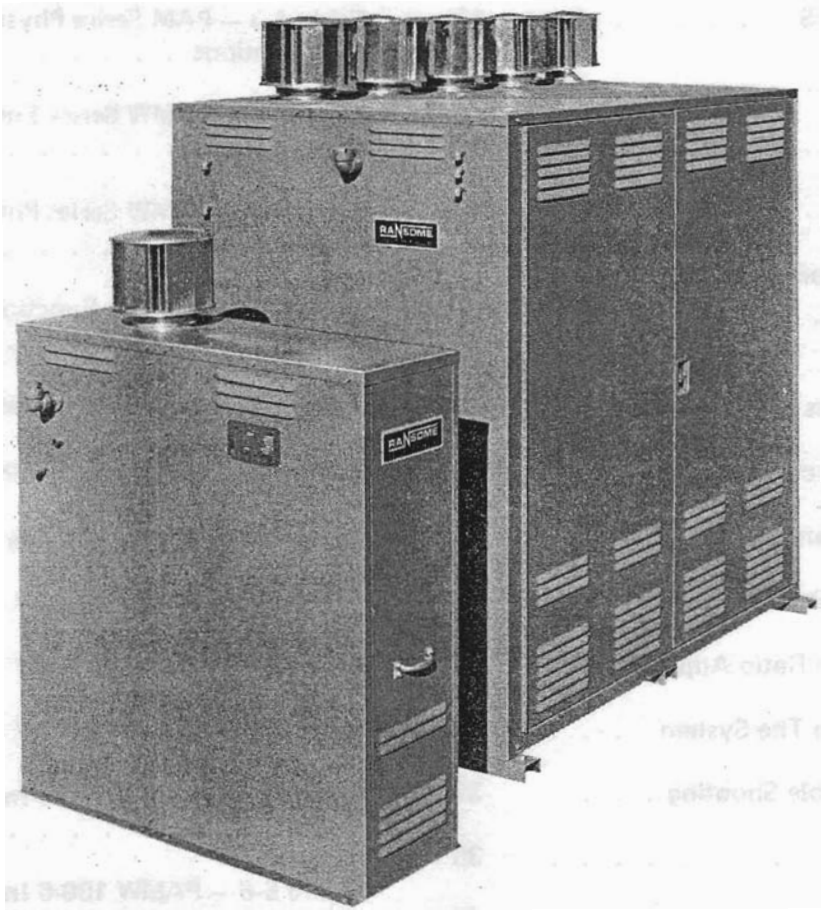


Figure 1-1 — Ransome Vaporizer Mixers

ILLUSTRATIONS PAGE

1. GENERAL

1.01 This manual provides a physical and functional description and operating theory necessary for effective use of Ransome LP-Gas Vaporizer-Mixers.

1.02 Ransome Vaporizer-Mixers provide an economical, dependable source of Propane-air mixture to replace natural gas for any industrial or commercial use up to 73,500 SCFH at as high as 30 PSI. These Mixers are supplied in three model series:

(a) PAM Series direct fired Vaporizer-Mixers,

(b) PAMW Series water bath Vaporizer-Mixers,

(c) M Series Mixers for applications where the user supplies the Vaporizer.

1.03 Ransome ST Series Surge Tanks compliment these systems and are available in three sizes:

(a) Model ST 250 — 250 gallons,

(b) Model ST 500 — 500 gallons,

(c) Model ST 750 — 750 gallons.

They are designed for ease of installation; mounted on a prepared concrete slab adjacent to the Vaporizer-Mixer and piped into the system.

1.04 Propane is a highly concentrated source of energy, with 2516 BTUs per Cubic Foot heat content and must be diluted with air to use as a substitute for natural gas. The Ransome Mixer blends in just the right amount of air for an equivalent mixture, providing the same heat input as natural gas. A mixture with a specific gravity of 1.31 (1480 BTU/Cu. Ft.) will match 0.6 specific gravity natural gas with approximately 1000 BTU/Cu. Ft. gross heat content.

1.05 Ransome PAM and PAMW Series Vaporizer-Mixers develop the heat required for vaporization through combustion of a small portion of the vapor generated. Operating under a temperature control, the burner functions on demand to create enough vapor to replace that being used. Vaporizer-Mixers consist of a Ransome RH or RW Series Vaporizer module mated to a Ransome Mixer module. The user will find detailed physical and functional descriptions for these Vaporizer modules in:

(a) RH Series Direct Fired LP-Gas Vaporizer Operation Manual A-01067-01,

(b) RW Series Water Bath LP-Gas Vaporizer Operation Manual A-01068-01.

1.06 Features of the PAM, PAMW and M Series Vaporizer-Mixers include:

- Exclusive Ransome GASONIC Venturis maintain close control of mixture at outlet

pressures as high as 30 PSI — *Up to 10 PSI without compressed air.*

- Safety interlocks to protect installation from damage or hazard due to excessive or insufficient temperatures and pressures.
- Simple electrical control system properly grounded and fused for long, dependable service life.
- Dual air valves on each Venturi prevent leakage of mixed gas into air inlet system.
- Multiple Venturis provide quieter operation with much smaller surge tanks than large, single Venturi systems.
- Gas-Air mixture is adjustable over a wide range to match natural gases with different specific gravities and heat contents.
- Same compact multiple tube Vaporizer construction as used in the RH and RW Series.
- All controls are located inside modular cabinets in a warm area for proper performance even in extreme weather conditions.
- Modular design provides maximum capacity in a compact, rectangular unit. For example, nearly 74,000 SCFH natural gas can be replaced by single PAM 1000-50, occupying less than 24 square feet.
- Models are available in a complete range of sizes from 6,000 to 50,000 SCFH mixed gas eliminating the need to buy more capacity than required.
- All sizes are capable of infinite turndown and will maintain a ready supply of mixed gas from zero load to full capacity. At zero load, only enough heat will be generated to maintain temperature and prevent condensation.
- All units built to FM and FIA specifications.

Options

1.07 For units to be installed at FIA-insured locations, specify Option A. All units are covered under FIA non-site approval program, but Ransome must submit documents for use by local FIA offices if user is actually FIA insured.

(a) Standard units, 5-10 PSI. Air supply is aspirated into the Venturi by pressure energy of the gas. No compressed air is required.

(b) High pressure air from a user-supplied blower, 11-30 PSI. These Ransome Mixers require clean, dry air at a constant pressure of approximately 2 PSI less than the mixed gas. The mixed gas pressure is specified on order. Option HB.

(c) High pressure air from user-supplied compressor or plant air, 11-30 PSI. These Ransome Mixers require clean, dry air at a minimum pressure of 20 PSI over mixed gas pressure. Option HP.

1.08 The Electric Pilot Reignitors protect the Vaporizer module pilots against unusually turbulent winds and eliminate the need for matches to start Vaporizer module. Option E.

1.09 The Control Panel provides the user with a key start and displays the cause of a safety shutdown to simplify servicing. Option C. It includes:

(a) Alarm lights for high and low Propane and mixed gas pressures,

(b) Alarm lights for high and low air pressure,

(c) Alarm lights for high vapor and mixed gas temperatures,

(d) Warning light for pilot outage,

(e) An alarm acknowledge switch.

Mixer systems equipped with the Built-In Specific Gravitometer option also include:

(f) Warning lights for high and low specific gravity.

1.10 Ransome Mixer systems equipped with the Built-In Specific Gravitometer give a continuous reading of the mixed gas specific gravity. High and low limit warning alarm contacts are furnished, e.g., to Control Panel option. The

cabinet is larger when optioned for the Specific Gravitometer. Option G.

1.11 All PAM, PAMW and M Series systems up to 10 PSI can be equipped with the Inlet Air Filter option. This includes a washable dry filter with housing, weather cap, mounting bracket and piping. Option F. If Option F is not selected, the user must use an equivalent filter to protect the air system from damage or malfunction due to foreign materials.

1.12 The Automatic Idle Attachment enables the Vaporizer module to operate on standby idle, even if the priming pump is shut off. It automatically prevents the module from making gas unless the inlet pressure is sufficient to provide a proper mixture while allowing the Vaporizer to operate. This attachment allows Mixer systems to be used with automatic load-limiting meter systems to keep natural gas usage within a daily allotment. Option S.

1.13 Class 1, Group D, Division 2 electrical wiring, Option X, should be specified for M Series Mixers in these applications:

(a) If the Mixer is mounted remote from a direct fired Vaporizer.

(b) If the Mixer is used in conjunction with an indirect fired Vaporizer.

How To Select A Vaporizer-Mixer

1.14 Determine the total amount of mixed gas required. Add up the maximum inputs of all the gas-using equipment in the system from the manufacturers' data plates or literature. This may be expressed in:

(a) Millions of BTU/hr.,

(b) Thousands of SCFH natural gas,

(c) Thousands of SCFH mixed gas.

Be sure this is correct. If in doubt, contact the manufacturers of the equipment. Refer to Tables 4-2, 4-4 and 4-6 to determine the appropriate Ransome model. Derating the load is not necessary, but it is wise to allow for future expansion when determining the maximum heat input.

1.15 Determine the desired pressure of the mixed gas.

(a) 10 PSI or less can be naturally aspirated. Specify the pressure needed from 5-10 PSI.

(b) 11-30 PSI will need an external air supply depending on which is available to the user. Option HB specifies the unit to be used with an external blower.

(c) Option HP specifies unit to be used with external compressor or plant air supply.

CAUTION

All Ransome RH and RW Vaporizers are capable of handling the fluctuating loads required of M Series Mixers. Users specifying Ransome M Series Mixers must be certain that if another make Vaporizer is used, it is capable of handling such surge loads.

2. PHYSICAL DESCRIPTION

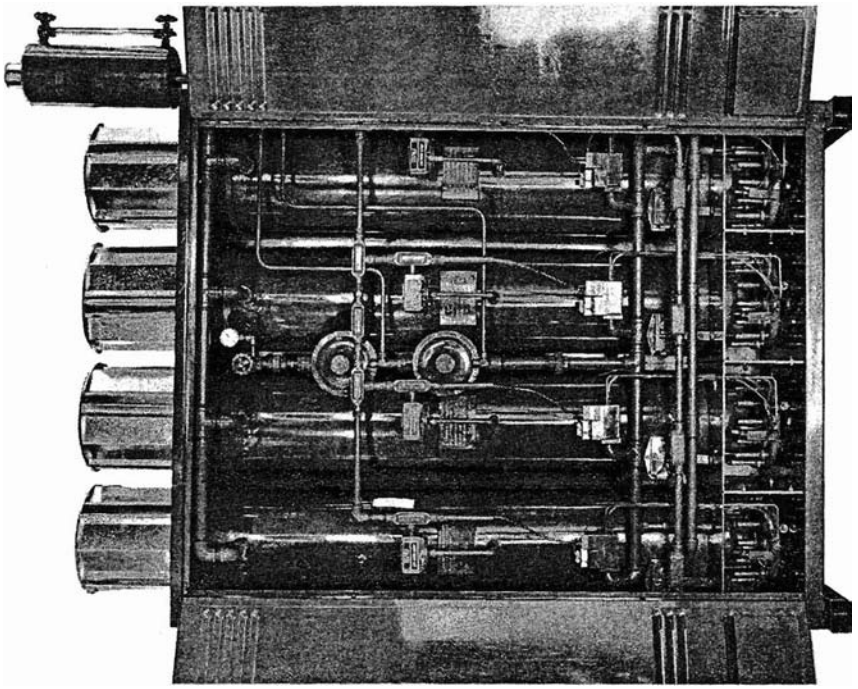
2.01 Each Ransome PAM, PAMW and M Series Mixer is similar in design and construction. They are designed for mounting on a concrete slab, outdoors, in varied weather conditions. The PAM and PAMW each consist of a Vaporizer module and a Mixer module. Both modules are housed inside of a 14-gauge, hot-rolled steel cabinet. A ceramic fiber insulation is provided between the Vaporizer Tube and the cabinet in direct fired models to minimize the heat loss.

2.02 This manual will limit its physical description to the Mixer Module or Ransome M Series. The Vaporizer is fully described in its respective Operation Manual.

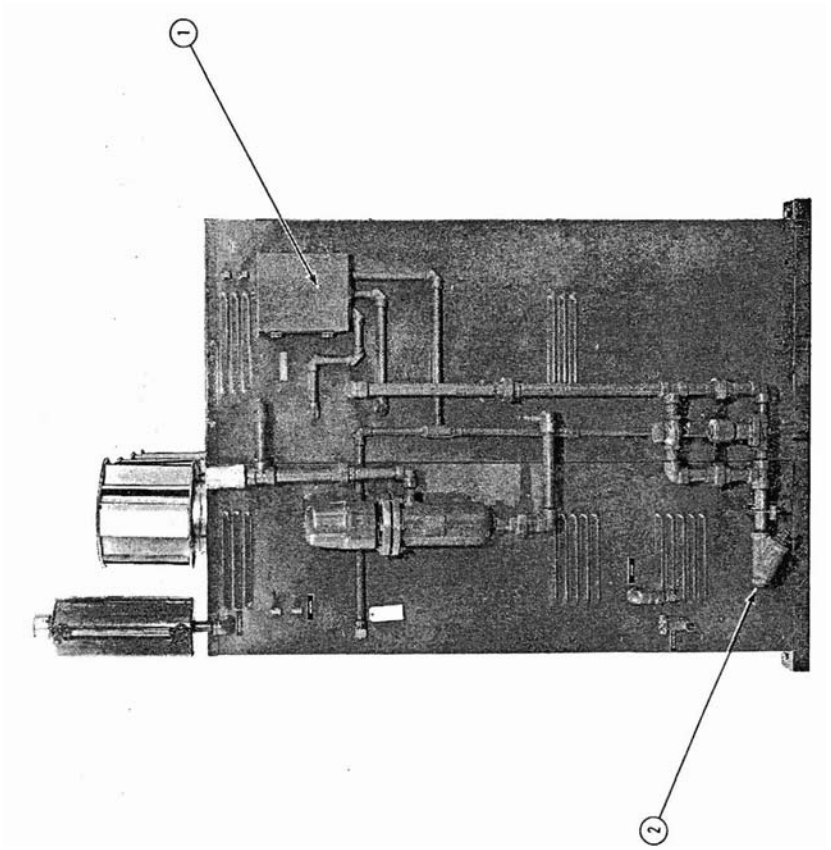
2.03 Figure 2-1 illustrates a typical Vaporizer-Mixer, Figure 2-2 illustrates the Mixer interior, and both include key number callouts for all major Mixer elements and controls. Associated Table 2-1 provides a cross reference for each callout, identifying the respective element as to function and/or description.

11-30 PSI Mixers

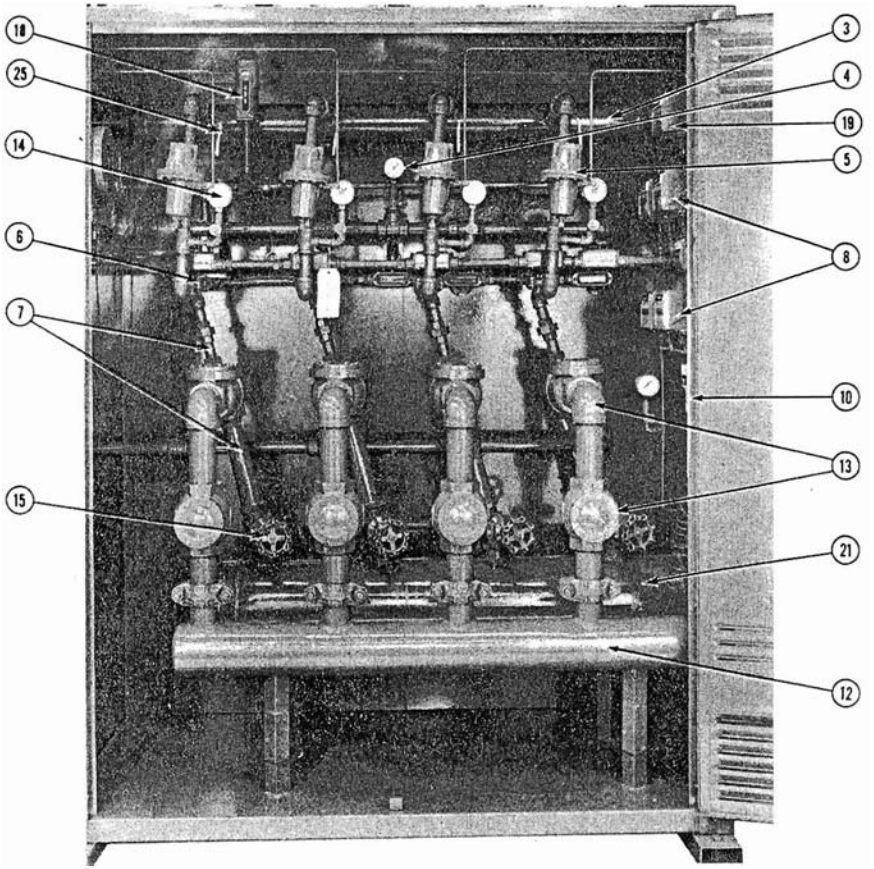
2.04 Vaporizer-Mixers optioned for a user-supplied blower (Option HB) are equipped with a Low Air Switch on the Air Inlet. The Interlock Circuit is interrupted if air pressure



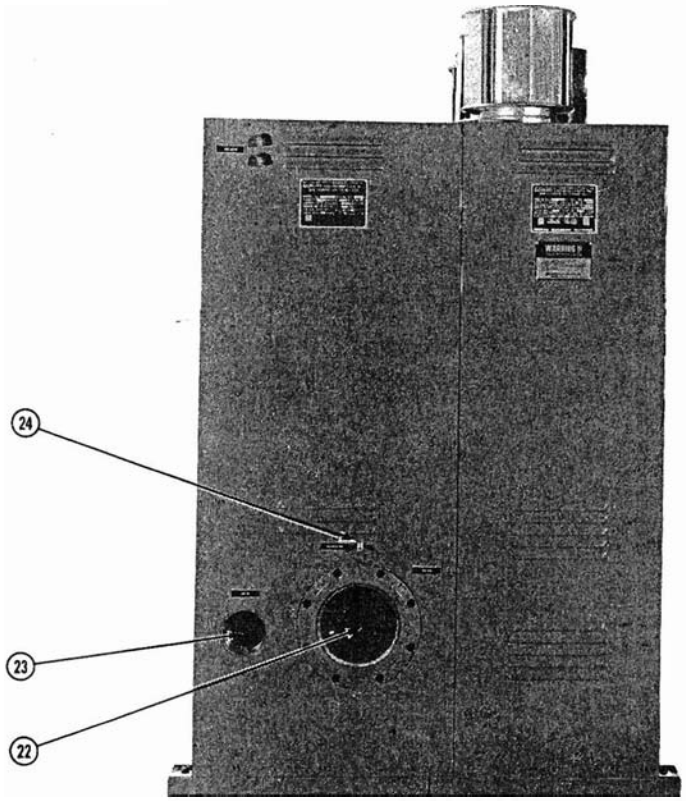
Vaporizer Module



LP-Gas Liquid Inlet

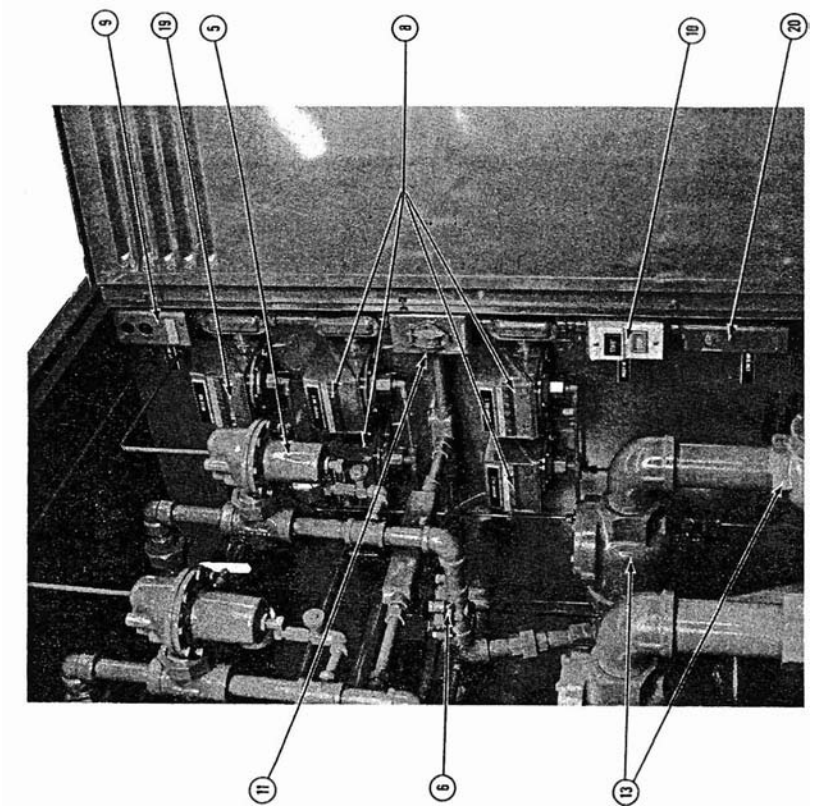


Mixer Module

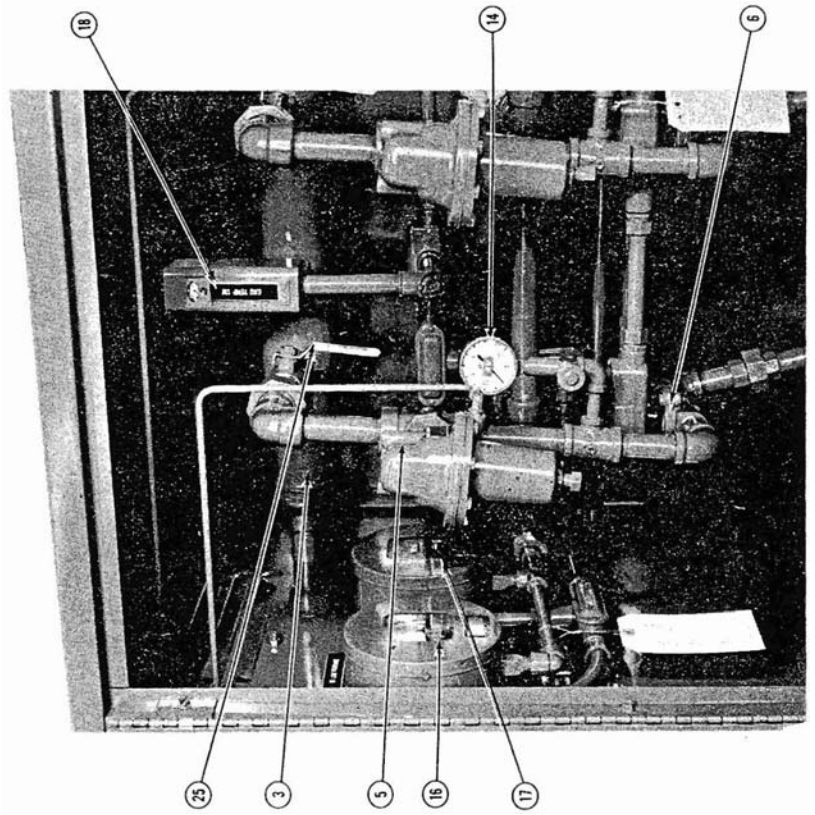


Mixed Gas Outlet

Figure 2-1 — Vaporizer Mixer Exterior



Right Side



Left Side

Figure Mixer Module Interior

falls below a preset value. An Air Solenoid Valve replaces one of the Air Back Check Valves and is operated each time the Gas Solenoid Valve is opened.

2.05 Vaporizer-Mixers optioned for the user to supply plant compressed air to the system (Option HP), are also equipped with the Low Air Interlock Circuit. In place of the two Air Back Check Valves are:

(a) One Air Back Check Valve,

(b) An Air Pressure Regulator,

(c) An Air Solenoid Valve.

The Air Pressure Regulator assures a uniform supply of air. The Air Solenoid Valve operates as described in paragraph 2.04.

Safety Interlock

2.06 Automatic shutdown protection is provided in Ransome Vaporizer-Mixer systems with a Safety Interlock Circuit and sensors at critical points.

(a) 117 Vac power interruption,

(b) High LP-Gas vapor pressure,

(c) Low LP-Gas vapor pressure,

(d) High LP-Gas vapor temperature,

(e) High-Low Mixer pressure,

(f) Low Mixer temperature,

(g) Low air pressure on models optioned for pressurized air.

Interruption of the Interlock Circuit results in the system being shut down. The solenoid-operated LP-Gas Inlet Valve on the Vaporizer module and the Gas Solenoid Valve in the Mixer module are closed. The interrupted interlock point is displayed on the optional Control Panel (Option C).

NOTE

PAM-120-6 and PAMW 045-2.7 are equipped with a non-solenoid internal ball float valve at the LP-Gas inlet. This valve is not controlled by the Safety Interlock Circuit.

Table 2-1 — Mixer Module Elements

Key	Element	Function
1	Electrical Junction Box	Installer's connection point for 117 Vac.
2	LP-Gas Liquid Inlet	Installer's connection point for LP-Gas liquid line from Storage Tank(s).
3	Vapor Header	Provides a chamber to transfer LP-Gas vapor from Vaporizer module to the individual Venturi.
4	Vaporizer Pressure Gauge	Displays the LP-Gas vapor pressure supplied to Mixer module by the Vaporizer.
5	Gas Pressure Regulator	Adjusts the inlet LP-Gas vapor pressure to the correct pressure for the Venturi Assembly.
6	Gas Solenoid Valve	Provides for automatically turning on the vapor supply to the Venturi Assembly on demand from the Operating Pressure Switch.

Table 2-1 — Mixer Module Elements (Continued)

Key	Element	Function
7	Venturi Assembly	Induces the flow of air into the LP-Gas vapor. Consists of an Air Chamber, Nozzle and Venturi.
8	Operating Pressure Switch	Monitors the pressure of the Gas-Air mixture in the Surge Tank. Furnishes 117 Vac to the Gas Solenoid Valve (and Air Back Check Valve on some models) when the mixed gas pressure drops below a factory set level.
9	Main Operating Relay Switch	Applies power to the system. Interlock switches interrupt this circuit and shut the system down.
10	Mixer Start-Stop Switch	Turns Mixer Module ON and OFF.
11	Convenience Receptical	Provides a three-wire, grounded, 117 Vac receptical for user's power tools.
12	Air Inlet Header	Provides a chamber to distribute air uniformly to each Venturi Assembly.
13	Air Back Check Valve	Prevents reverse flow of the Gas-Air mixture back out of the air inlet.
14	Venturi Pressure Gauge	Monitors the pressure of the LP-Gas at the output of the Gas Pressure Regulator.
15	Mixed Gas Shut Off Valve	Provides for shutting off mixed gas from individual Venturi Assembly. Used on multiple Venturi units only.
16	High Vapor Pressure Switch	Monitors pressure of Vapor Header. Interrupts the Interlock Circuit if pressure exceeds 230 PSI and shuts the system down. Factory set.
17	Low Vapor Pressure Switch	Monitors pressure of Vapor Header. Interrupts the Interlock Circuit if pressure drops below the minimum vapor inlet pressure to maintain the mixed gas pressure specified for the Mixer. For example, if minimum inlet pressure is 135 PSIG, this switch is set for 130 PSIG. Factory set.
18	High Vapor Temperature Switch	Monitors the temperature of Vapor Header. Interrupts the Interlock Circuit if temperature exceeds a predetermined value in the system and shuts the system down to protect the system from excessive temperatures. Factory set.
19	High-Low Mixer Pressure Switch	Monitors the Surge Tank pressure. Interrupts the Interlock Circuit if mixed gas pressure exceeds or drops below preset values and shuts the system down. Factory set.

Table 2-1 — Mixer Module Elements (Continued)

Key	Element	Function
20	Low Mixer Temperature Switch	Monitors the temperature of the Mixed Gas Header for a drop in temperature indicating the possibility of the presence of LP-Gas liquid. The Interlock Circuit is interrupted and the system is shut down. Factory set.
21	Mixed Gas Header	Provides for transferring all of the mixed gas from the Venturis to the Surge Tank.
22	Mixed Gas Outlet	Provides the connection point to the Surge Tank.
23	Air Inlet	Provides the connection point to the Air Inlet Filter, piping and bracket.
24	Mixed Gas Pressure Tap	Provides the connection point to sample mixed gas pressure in the Surge Tank.
25	Vapor Shut Off Valve	Provides for manually turning off the vapor supply to one Venturi.

3. FUNCTIONAL DESCRIPTION

3.01 Figure 3-1 illustrates the general schematic of the Mixer module and is functionally equivalent for all PAM, PAMW and M Series Mixers.

Mixer Operation

3.02 The Vapor Header is supplied vapor from the Vaporizer Outlet Line. Vapor pressure is reduced and regulated by the Gas Pressure Regulator. An electrically controlled Gas Solenoid Valve supplies vapor to the Venturi Assembly on demand from the Operating Pressure Switch which monitors the pressure within the Surge Tank.

3.03 When the pressure in the Surge Tank drops below a preset level, the Pressure Switch senses this drop and applies power to open the Gas Solenoid Valve.

3.04 LP-Gas vapor enters the Nozzle of the Venturi Assembly. The action of gas velocity from the Nozzle entering into the Venturi Assembly causes a drop in the pressure within the Air Chamber. This pressure drop causes the Air Shutters to open, permitting the air to rush in and mix with the LP-Gas vapor from the Nozzle. This results in a precise mixture of air and LP-Gas vapor being sent to the Mixed Gas Header and Surge Tank.

3.05 When the pressure within the Surge Tank rises to the desired pressure, the Pressure Switch senses the rise and disconnects the power to the Gas Solenoid Valve. The Gas Solenoid Valve shuts off the supply of LP-Gas vapor to the Nozzle completing the cycle. This operating cycle is repeated as needed to handle the load.

3.06 In multiple Venturi units, operating pressure switches are set so Venturis will be energized in sequence as required to handle the load.

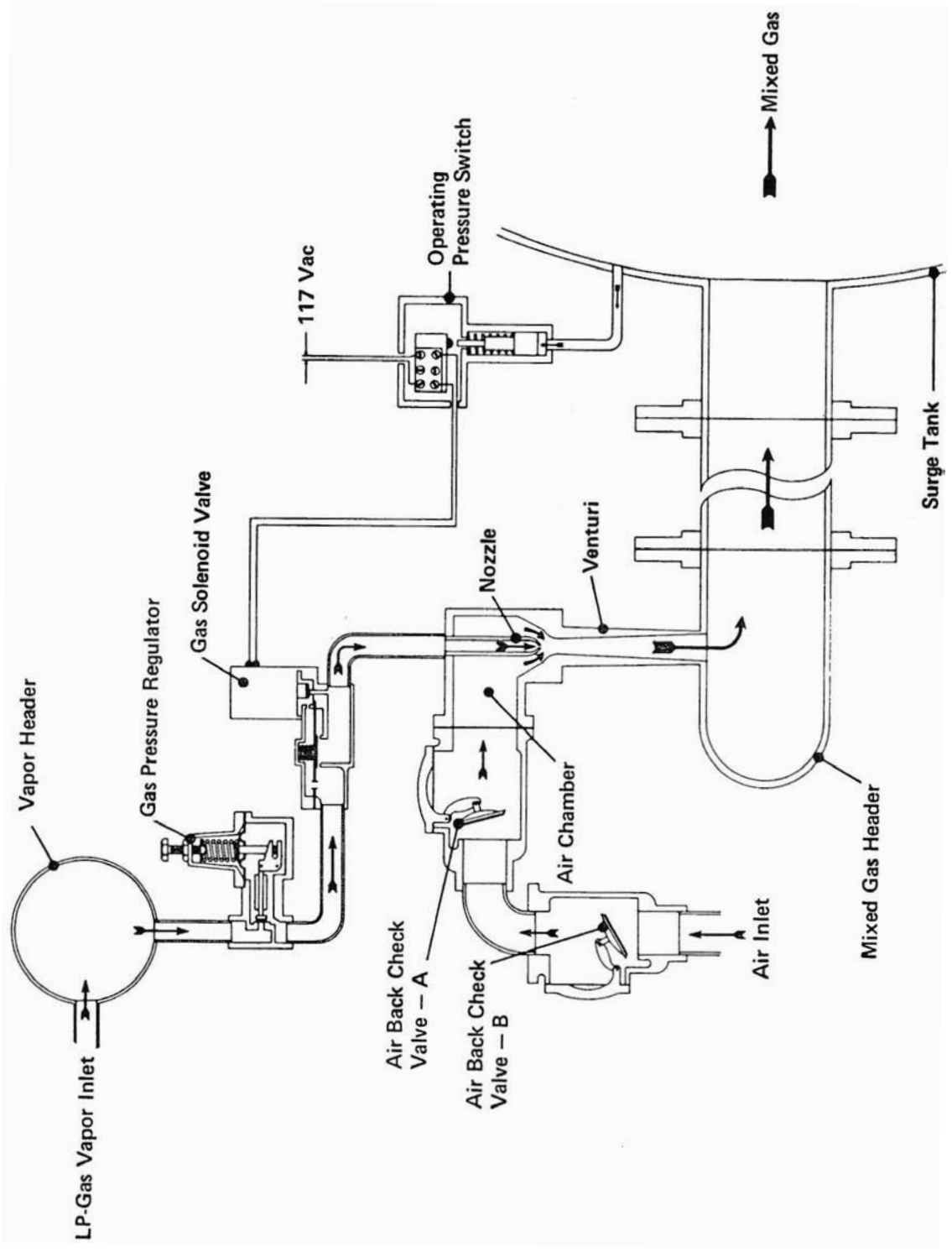


Figure General Schematic For M Series Mixer

4. SPECIFICATIONS

4.01 PAM Series Vaporizer-Mixers consist of a RH Series direct fired Vaporizer mated to a M Series Mixer.

(a) PAM 120-6 RH 120 and a M 6

(b) PAM 200-10 RH 200 and a M 10

(c) PAM 400-20 RH 400 and a M 20

(d) PAM 600-30 RH 600 and a M 30

(e) PAM 800-40 RH 800 and a M 40

(f) PAM 1000-50 RH 1000 and a M 50

4.02 PAMW Series Vaporizer-Mixers consist of a RW Series water bath Vaporizer mated to a M Series Mixer.

(a) PAMW 045-2.7 Special

(b) PAMW 100-6 RW 100 and a M 6

(c) PAMW 180-10 RW 180 and a M 10

(d) PAMW 360-20 RW 360 and a M 20

(e) PAMW 540-30 RW 540 and a M 30

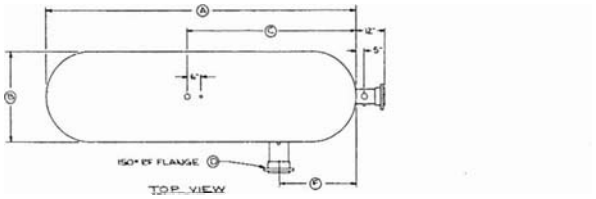
(f) PAMW 720-40 RW 720 and a M 40

(g) PAMW 900-50 RW 900 and a M 50

4.03 Table 4-1 tabulates the ST Series Surge Tanks suitable for use in Ransome Mixer **systems. The user will find all of these useful when** planning new installations. Tables 4-2 through 4-7 will provide the user with tabulated functional and physical specifications for the PAM, PAMW and M Series Vaporizer-Mixer systems.

Table 4-1 — Surge Tank Specifications

Model No.	Use With Mixer Suffix	Capacity (Gals)	Length (A)	O.D. (B)	End Of Tank To ℄ Relief Valve (C)	Inlet Flange Dia. (D)	Outlet Flange Dia. (E)	Flange To End (F)	Side Flange To ℄ (G)	℄ Side Flange To Base (H)	℄ End Flange To Base (I)	℄ Mounting Base (J)	℄ Mounting Base (K)	℄ Drain To End Of Tank (L)
ST 250	-2.7	250	83"	30 5/8"	41 1/2"	3"	3"	20 1/4"	28"	24"	17"	48"	13 1/4"	15"
ST 500	-6	500	93"	42"	46 1/2"	4"	4"	22"	36"	17"	22 3/4"	48"	22 1/2"	18"
ST 750	-10, -20 -30, -40 -50	750	141"	42"	70 1/2"	8"	6"	34 1/2"	36"	17"	22 3/4"	72"	22 1/2"	18"



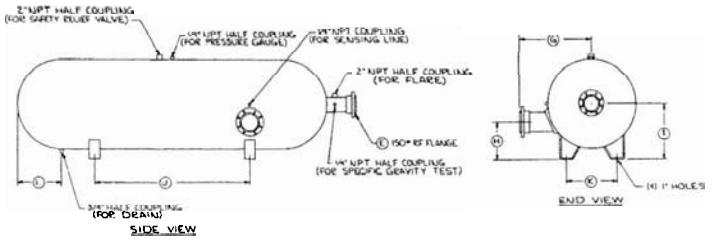


Table 4-2 – PAM Series Functional Specifications

Model	Millions of BTU/Hr.	Thousands of SCFH Natural Gas[2]	Thousands of SCFH Mixed Gas[3]	Air Required SCFM[4]
PAM 120-6	8.85	8.85	6	45
PAM 200-10	14.75	14.75	10	75
PAM 400-20	29.50	29.50	20	150
PAM 600-30	44.25	44.25	30	225
PAM 800-40	59.00	59.00	40	300
PAM 1000-50	73.75	73.75	50	375

NOTES:

1. Units may be paralleled to achieve greater capacities.
2. Natural Gas; SGU = 0.6, Gross Heat Content 1000 BTU/Cu. Ft.
3. Mixed Gas; Propane-Air, SGU = 1.31, Gross Heat Content 1480 BTU/Cu. Ft.
4. For 11-30 psi only.

Table 4-3 – PAM Series Physical Specifications

Model	Depth Inches	Width Inches	Height Inches	Shipping Weight Pounds	Connections	
					LP-Gas Inlet[1]	Mixed Gas Outlet[2]
PAM 120-6	47.25	14.125	48.50	720	3/4 in.	4 in.
PAM 200-10	47.25	14.125	67.50	1,450	3/4 in.	8 in.
PAM 400-20	48.50	28.00	69.50	2,125	1 in.	8 in.
PAM 600-30	48.50	42.00	69.50	2,760	1 in.	8 in.
PAM 800-40	48.50	56.00	69.50	3,400	1 in.	8 in.
PAM 1000-50	48.50	70.00	69.50	4,400	1 in.	8 in.

NOTES:

1. NPT
2. 150 # RF

Table 4-4 – PAMW Series Functional Specifications

Model	Millions of BTU/Hr.	Thousands of SCFH Natural Gas[2]	Thousands of SCFH Mixed Gas[3]	Air Required SCFM[4]	Water Bath Capacity Gallons
PAMW 045-2.7	3.99	3.99	2.7	--	6
PAMW 100-6	8.85	8.85	6.	45	6
PAMW 180-10	14.75	14.75	10.	75	10
PAMW 360-20	29.50	29.50	20.	150	20
PAMW 540-30	44.25	44.25	30.	225	30
PAMW 720-40	59.00	59.00	40.	300	40
PAMW 900-50	73.75	73.75	50.	375	50

NOTES:

1. Units may be paralleled to achieve greater capacities.
2. Natural Gas; SGU = 0.6, Gross Heat Content 1480 BTU/Cu. Ft.
3. Mixed Gas; Propane - Air, SGU = 1.31, Gross Heat Content 1480 BTU/Cu. Ft.
4. For 11-30 psi only.

Table 4-5 – PAMW Series Physical Specifications

Model	Depth Inches	Width Inches	Height Inches	Shipping Weight Pounds	Connections	
					LP-Gas Inlet[1]	Mixed Gas Outlet[2]
PAMW 045-2.7	18.37	49.37	54.19	870	3/4 in.	3 in.
PAMW 100-6	47.25	14.12	48.50	920	3/4 in.	8 in.
PAMW 180-10	47.25	14.12	67.50	1,800	3/4 in.	8 in.
PAMW 360-20	48.50	28.00	69.50	2,825	1 in.	8 in.
PAMW 540-30	48.50	42.00	69.50	3,810	1 in.	8 in.
PAMW 720-40	48.50	56.00	69.50	4,800	1 in.	8 in.
PAMW 900-50	48.50	70.00	69.50	6,150	1 in.	8 in.

NOTES:

1. NPT
2. 150 #RF

Table 4-6 — M Series Functional Specifications

Model	Millions of BTU/Hr.	Thousands of SCFH Natural Gas[2]	Thousands of SCFH Mixed Gas[3]	Air Required SCFM[4]	Vaporization Capacity[5]
M 6	8.85	8.85	6	45	100
M 10	14.75	14.75	10	75	180
M 20	29.50	29.50	20	150	360
M 30	44.25	44.25	30	225	540
M 40	59.00	59.00	40	300	720
M 50	73.75	73.75	50	375	900

NOTES:

1. Units may be paralleled to achieve greater capacity.
2. Natural Gas; SGU = 0.6, Gross Heat Content 1000 BTU/Cu. Ft.
3. Mixed Gas; Propane-Air, SGU = 1.31, Gross Heat Content 1480 BTU/Cu. Ft.
4. For 11-30 psi only.
5. GPH Propane.

Table 4-7 — M Series Physical Specifications

Model	Depth Inches	Width Inches	Height Inches	Shipping Weight Pounds	Connections	
					LP-Gas Inlet[1]	Mixed Gas Outlet[2]
M 6	26,875	14.125	48.50	290	1 in.	4 in.
M 10	26.875	14.125	67.50	600	1¼ in.	8 in.
M 20	26.0625	28.00	69.50	810	3 in.	8 in.
M 30	26.0625	42.00	69.50	1,020	3 in.	8 in.
M 40	26.0625	56.00	69.50	1,280	3 in.	8 in.
M 50	26.0625	70.00	69.50	1,540	3 in.	8 in.

NOTES:

1. NPT
2. 150 #RF

5. OPERATION

5.01 The intent of Part 5 is to give the LP-Gas user general information on installation and turn-on procedure for the Ransome PAM, PAMW and M Series Vaporizer-Mixers. Each user's application will differ slightly, but it is hoped the user will gain from these generalized instructions.

5.02 After consultation with the Ransome Sales and Service Engineer or Distributor, the user will make a plan for the LP-Gas storage, Vaporizer-Mixer and Surge Tank locations.

Inlet Pressure

5.03 A Ransome Vaporizer-Mixer is part of a complete system, all elements of which *must* be properly designed and installed before it can do its job. One of the most critical elements, and the most frequently neglected, is the pumping and bypass arrangement. Proper performance cannot be obtained unless this element of the installation supplies the required amount of LP-Gas liquid to the Vaporizer-Mixer at the correct pressure, especially in the coldest weather. Table 5-1 tabulates the inlet pressure for Ransome Vaporizer-Mixers.

5.04 A substantial amount of service calls experienced with Vaporizer-Mixer operation are caused by improper design or installation of the pumping element, which could have been easily prevented before the system is installed.

Table 5-1 – Minimum Inlet Pressures

Mixed Gas Pressure PSIG	Minimum Inlet Pressure Required PSIG	
	PAM, PAMW	M
5	90	80
6	100	90
7	120	110
8	135	125
9	140	130
10	145	135

5.05 The following procedure will assist the user in developing pump and piping requirements. Poor control of gas-air ratios and shut down of the Vaporizer-Mixer system by the Safety Interlock will result if this procedure is not followed.

Step	Procedure
1	Determine the correct inlet pressure. Refer to Table 5-1.
2	*Make sure* the elevation between the lowest liquid level in the LP-Gas Storage Tank and the pump centerline is sufficient to assure proper positive head. Some pump manufacturers recommend as much as four feet minimum.
3	*Make sure* the suction line is designed and built so the pressure drop at the maximum pump flow rate does not exceed positive head.
4	*Make sure* the Back-To-Tank Bypass Valve is designed and built for accurate, consistent, operation with minimum pressure buildup, e.g., 5 PSI. Differential pressure relief valves are not recommended for this application. A static pressure relief valve is recommended, e.g., Fisher Type 98H.
5	*Make sure* the pump discharge piping system to the Vaporizer is designed for minimum pressure drop at maximum flow, e.g., 5 PSI.

Step	Procedure
6	*Make sure* the pump(s) selected are capable of providing proper flow rate at maximum differential pressure required based on continuous service. The maximum differential pressure limitations on some pumps may require the use of *two pumps in series* for exceptionally cold weather applications.

5.06 It should be kept in mind there are no shortcuts for a safe, reliable LP-Gas system. Saving a few dollars by undersizing or using cut-rate components not capable of doing the job may result in the Vaporizer-Mixer being down when it is urgently needed.

Installation

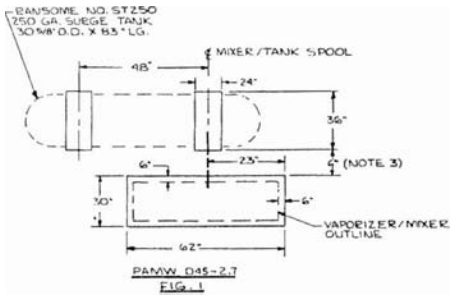
5.07 Figure 5-1 illustrates suggested foundations for Ransome Vaporizer-Mixers. Typical installations are shown in Figures 5-2 through 5-10. Each includes key number callouts for the desirable installation features. Table 5-2 tabulates the features and describes them in detail.

5.08 When the Ransome equipment arrives, examine the shipping container for obvious shipping damage. All claims for shipping damage should be made to the shipper, not to Ransome Gas Industries or the Distributor. Obvious workmanship problems or incomplete shipments should be immediately referred to Ransome Gas Industries (or Distributor) following the warranty service procedures described in Part 6. The shipment will include a Ransome Vaporizer-Mixer Test Report illustrated in Figure 5-11. This should be retained with the Operation Manual as part of the user's maintenance records.

Step	Procedure
1	Install Vaporizer-Mixer on a simple concrete pad. Refer to Figure 5-1.
2	Install 117 Vac, 60 Hz, single phase power for control and electric reignitor.
3	Provide an adequate supply of LP-Gas liquid to Vaporizer inlet. Refer to Table 5-1. Use a pressurizing pump if necessary. Refer to Paragraph 5.03.
4	Select a suitable Surge Tank and Trim. Refer to Table 4-1.
5	Connect the Mixer outlet to the Surge Tank.
6	Provide piping from the Surge Tank to the natural gas line tie in.

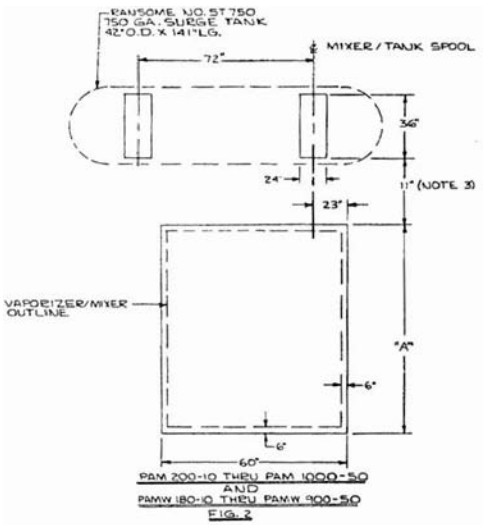
CAUTION

Only a trained, experienced vaporizer serviceman should inspect, test, start up or service Ransome equipment.



PAMW 045-2.7

FIG. 1



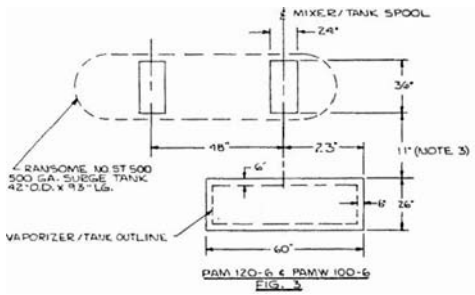
PAM 200-10 THRU PAM 1000-50
AND
PAMW 180-10 THRU PAMW 900-50

FIG. 2

FIGURE 2		
MODEL		PAD LGTHS
PAM	PAMW	"A"
200-10	180-10	26"
400-20	360-20	40"
600-30	540-30	54"
800-40	720-40	68"
1000-50	900-50	82"

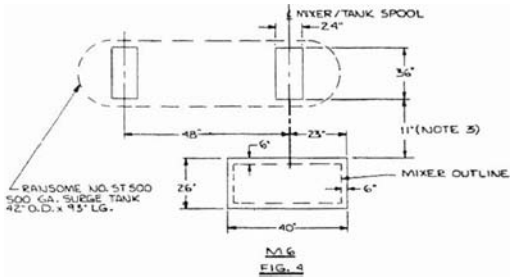
NOTES:

1. INSTALLATION MUST BE IN ACCORDANCE WITH NFPA PAMPHLET 58 AND ALL APPLICABLE STATE PROVINCIAL AND LOCAL CODES AND REGULATIONS.
2. ACTUAL DESIGN OF FOUNDATIONS INCLUDING CONCRETE SPECIFICATIONS, REINFORCEMENT, ETC. MUST BE IN ACCORDANCE WITH GOOD ENGINEERING PRACTICE, AND WITHIN LIMITATIONS IMPOSED BY SOIL CONDITIONS, FROST LEVELS, ETC.
3. IN CALIFORNIA A DISTANCE OF 5 FEET (MIN) IS REQUIRED BETWEEN THE VAPORIZER AND SURGE TANK.



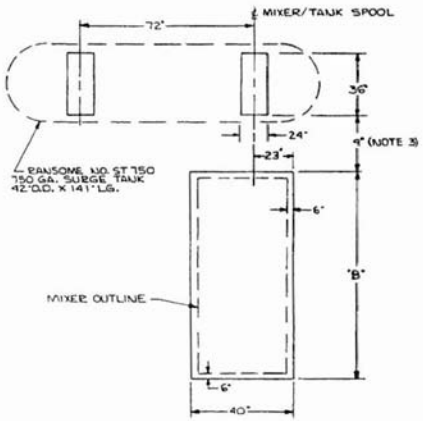
PAM 120-6 & PAMW 100-6

FIG. 3



M6

FIG. 4



M10 THRU M50

FIG. 5

FIG. 5	PAD LGTHS
MODEL	"B"
M10	26"
M20	40"
M30	54"
M40	68"
M50	82"

Figure 5-1 — Typical Foundation Layou

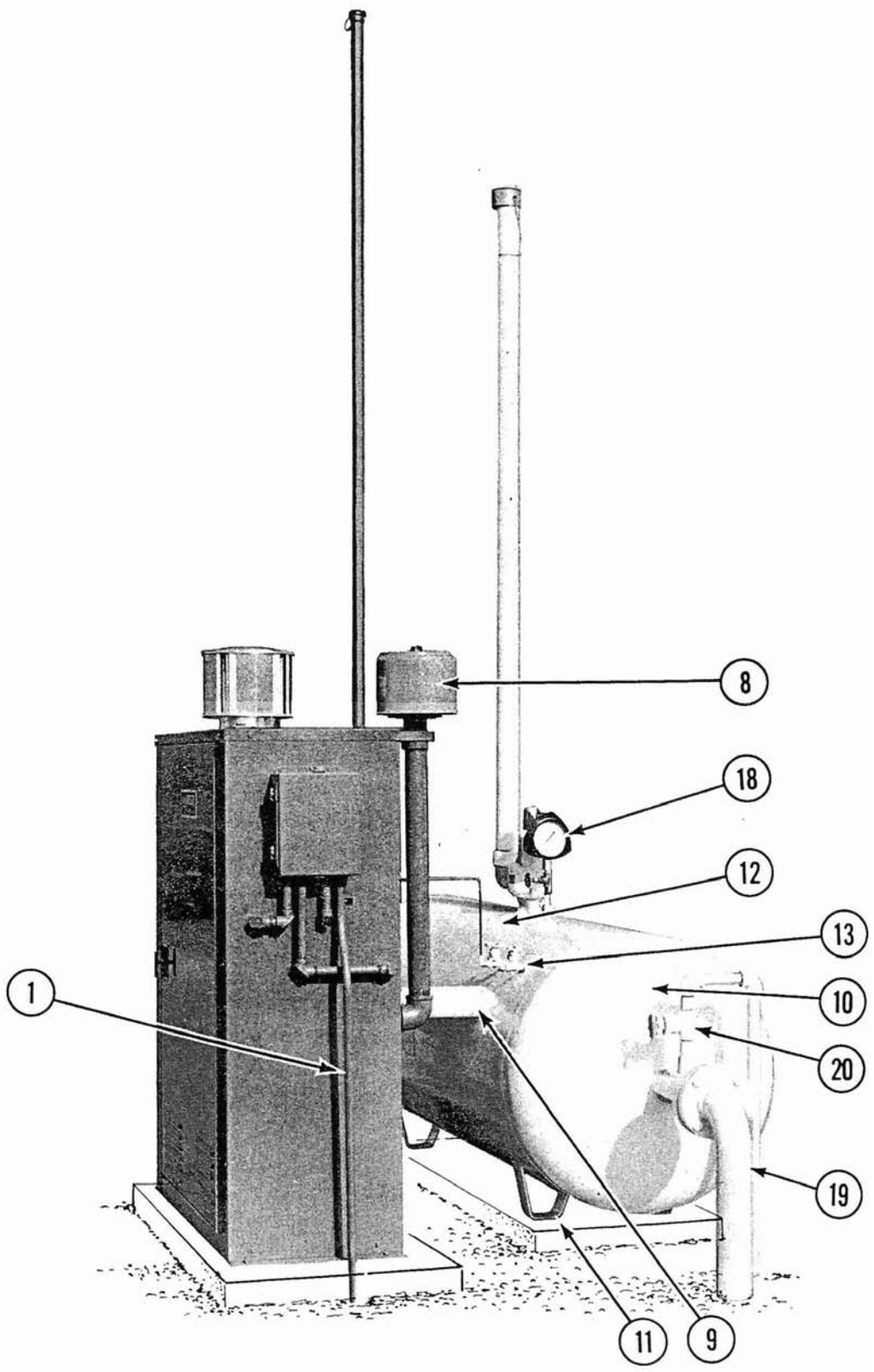


Figure 5-2 — PAMW 045-2.7 Installation

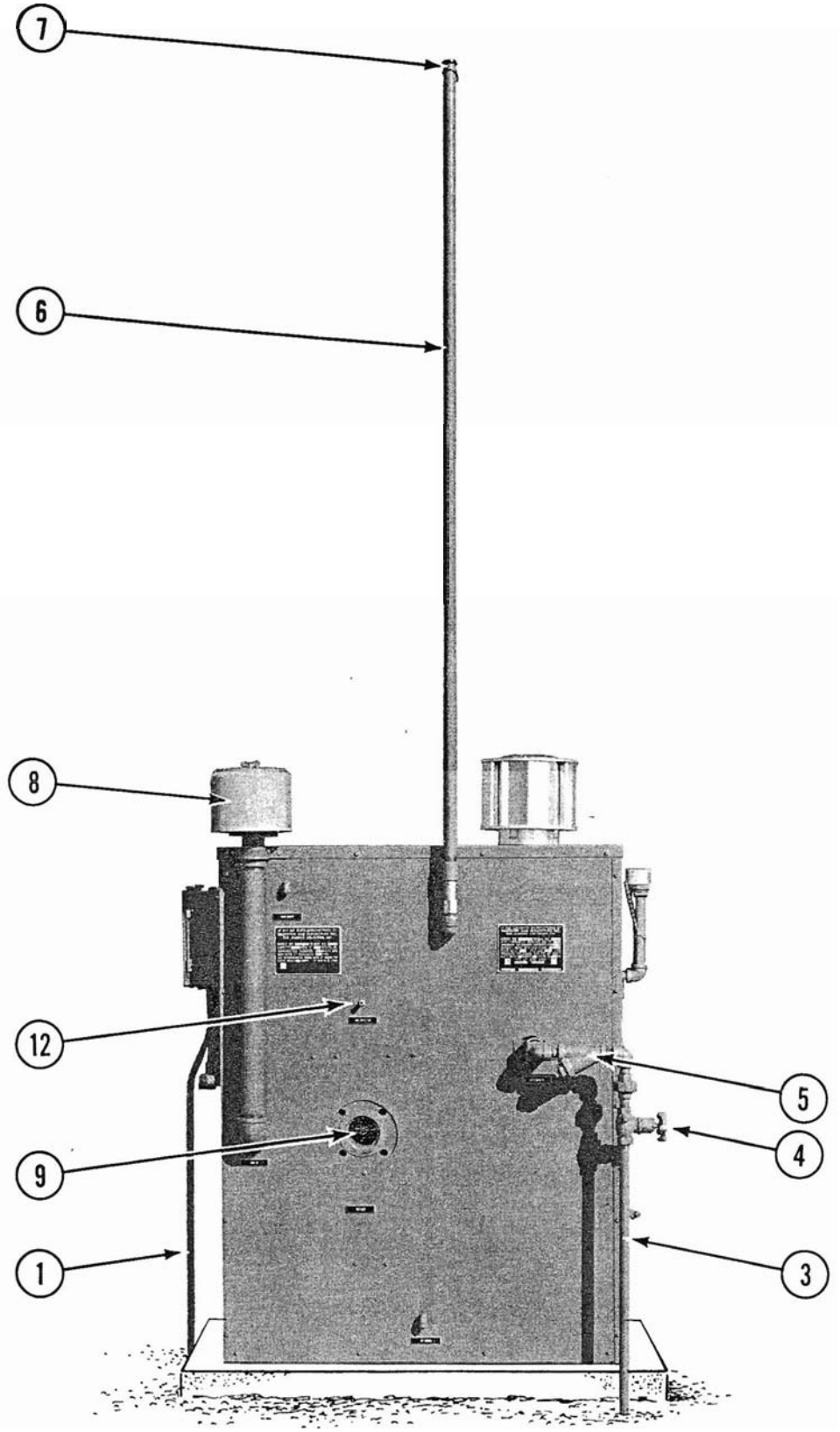


Figure 5-3 – PAMW 045-2.7 Installation

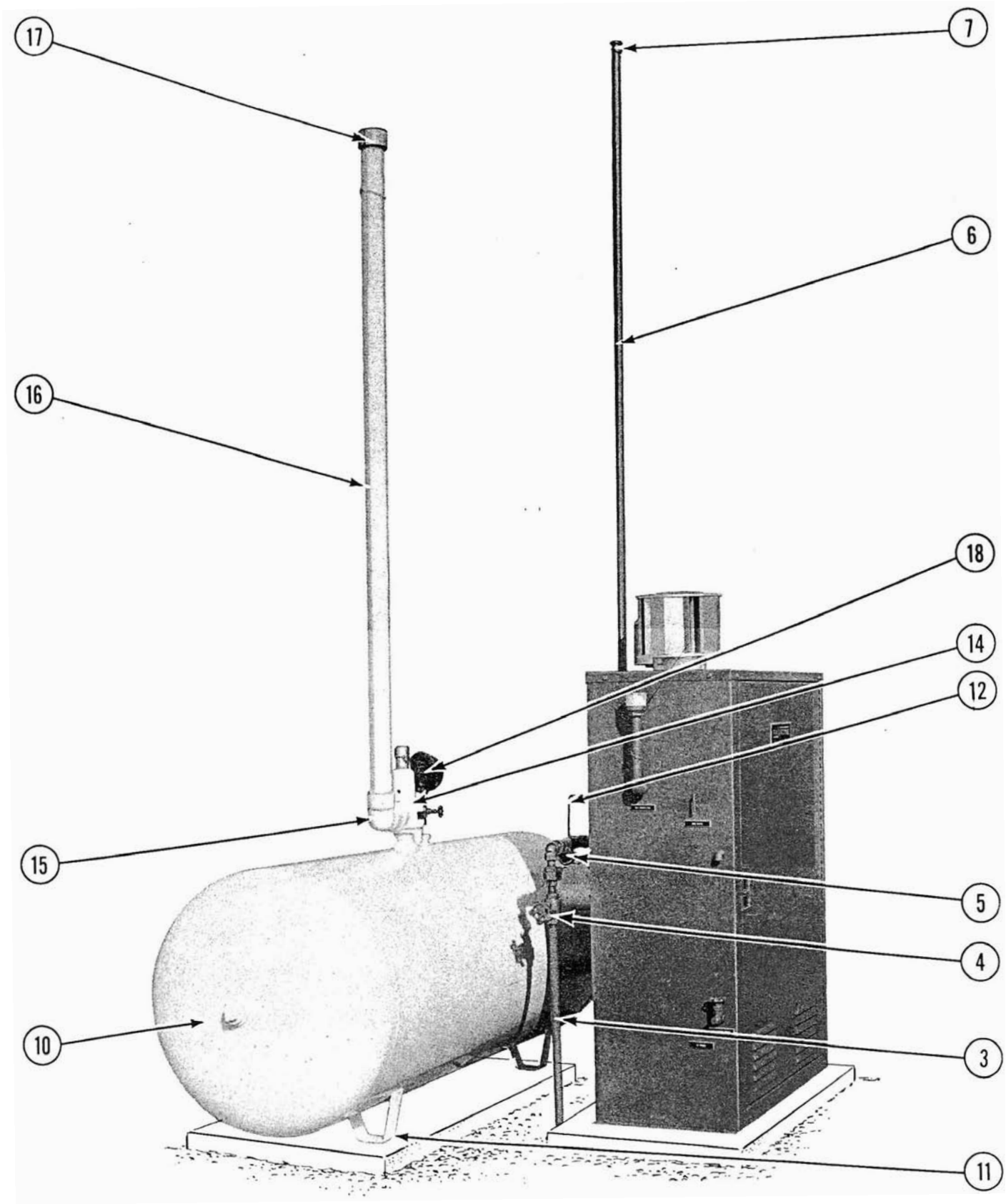


Figure 5-4 – PAMW 045-2.7 Installation

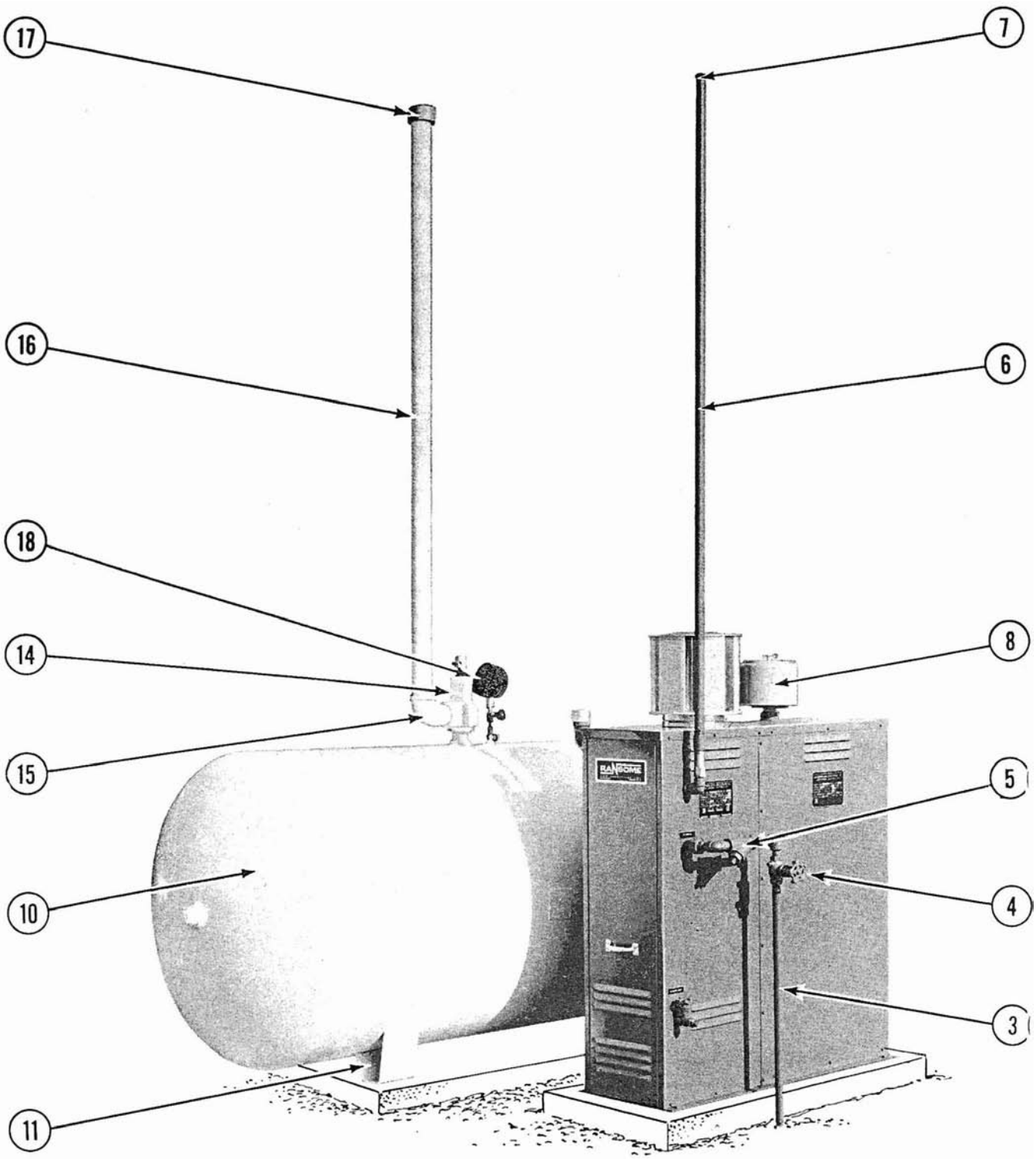


Figure 5-5 – PAMW 100-6 Installation – Typical for -6

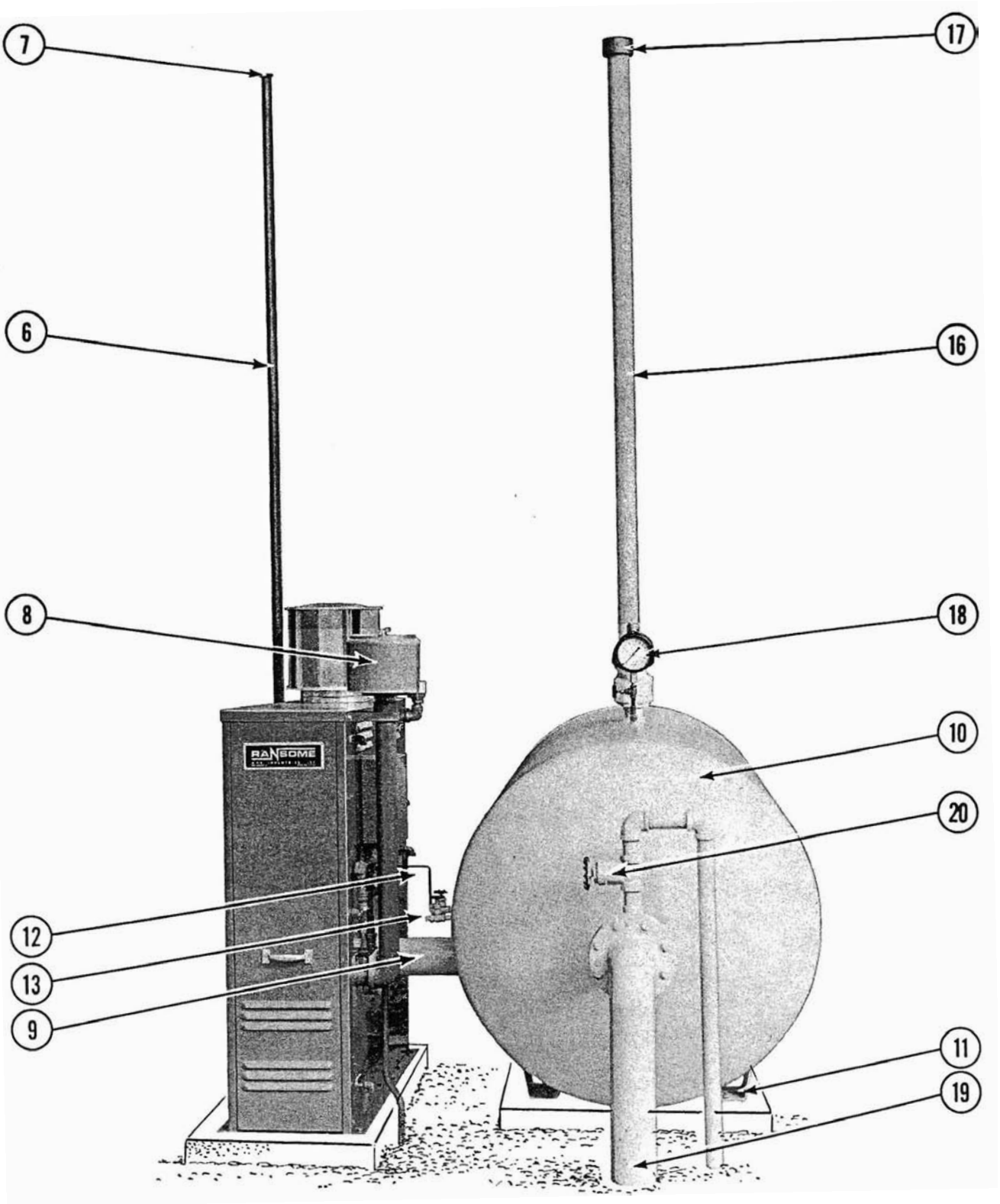


Figure 5-6 — PAMW 100-6 Installation — Typical for -6

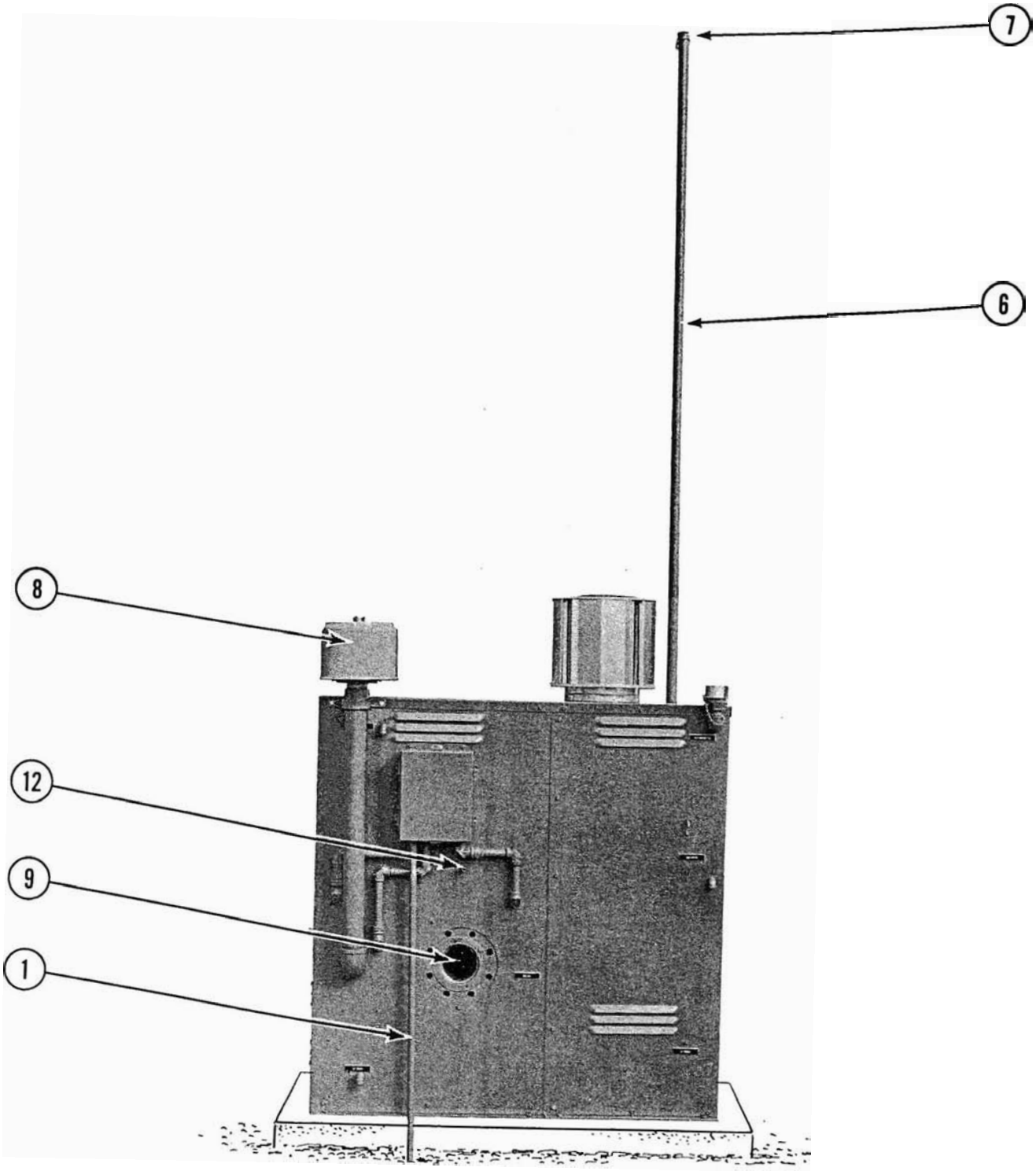


Figure 5-7 – PAMW 100-6 Installation – Typical for -6

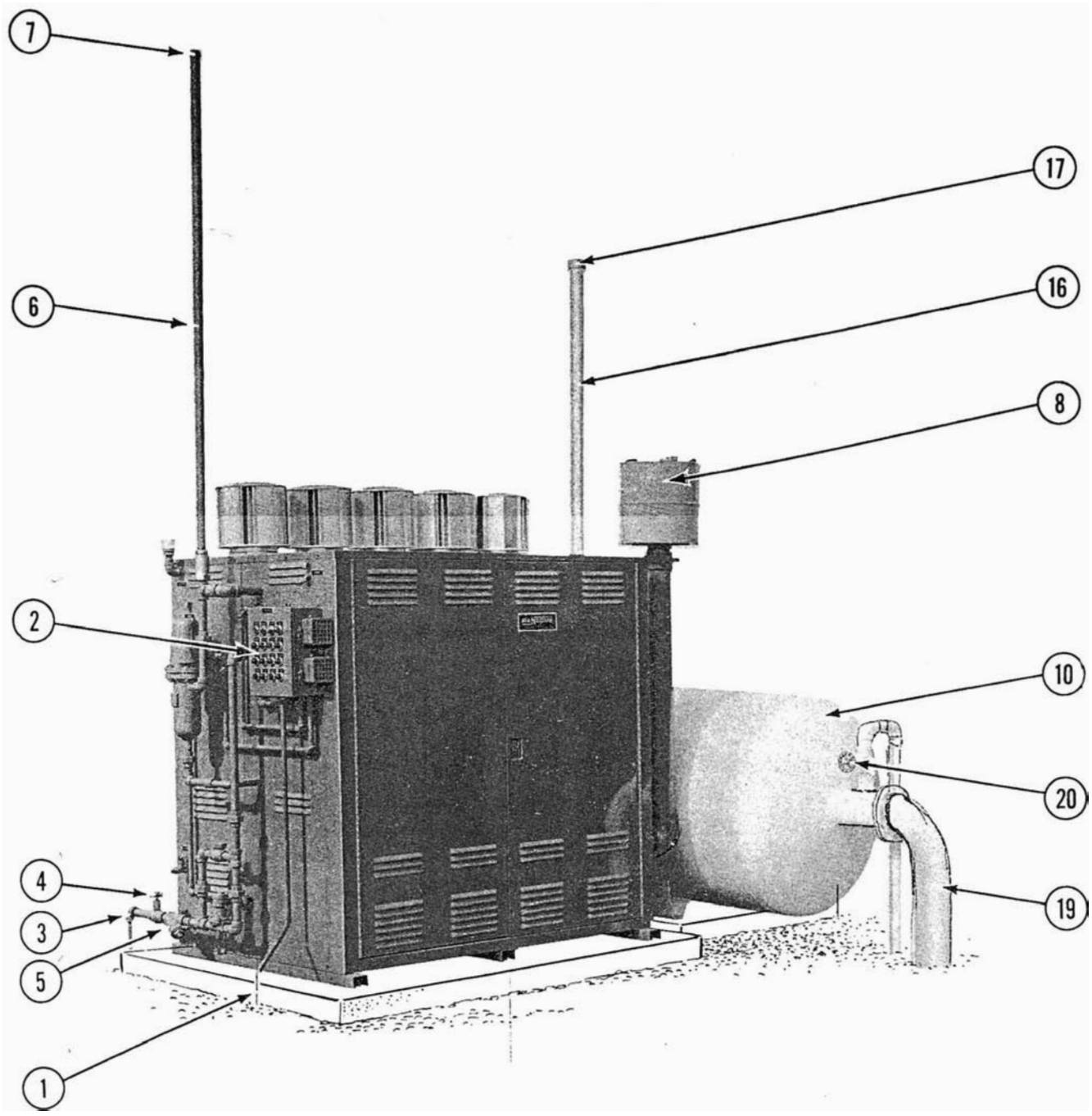


Figure 5-8 – PAMW 900-50 Installation Typical for -10 to -50

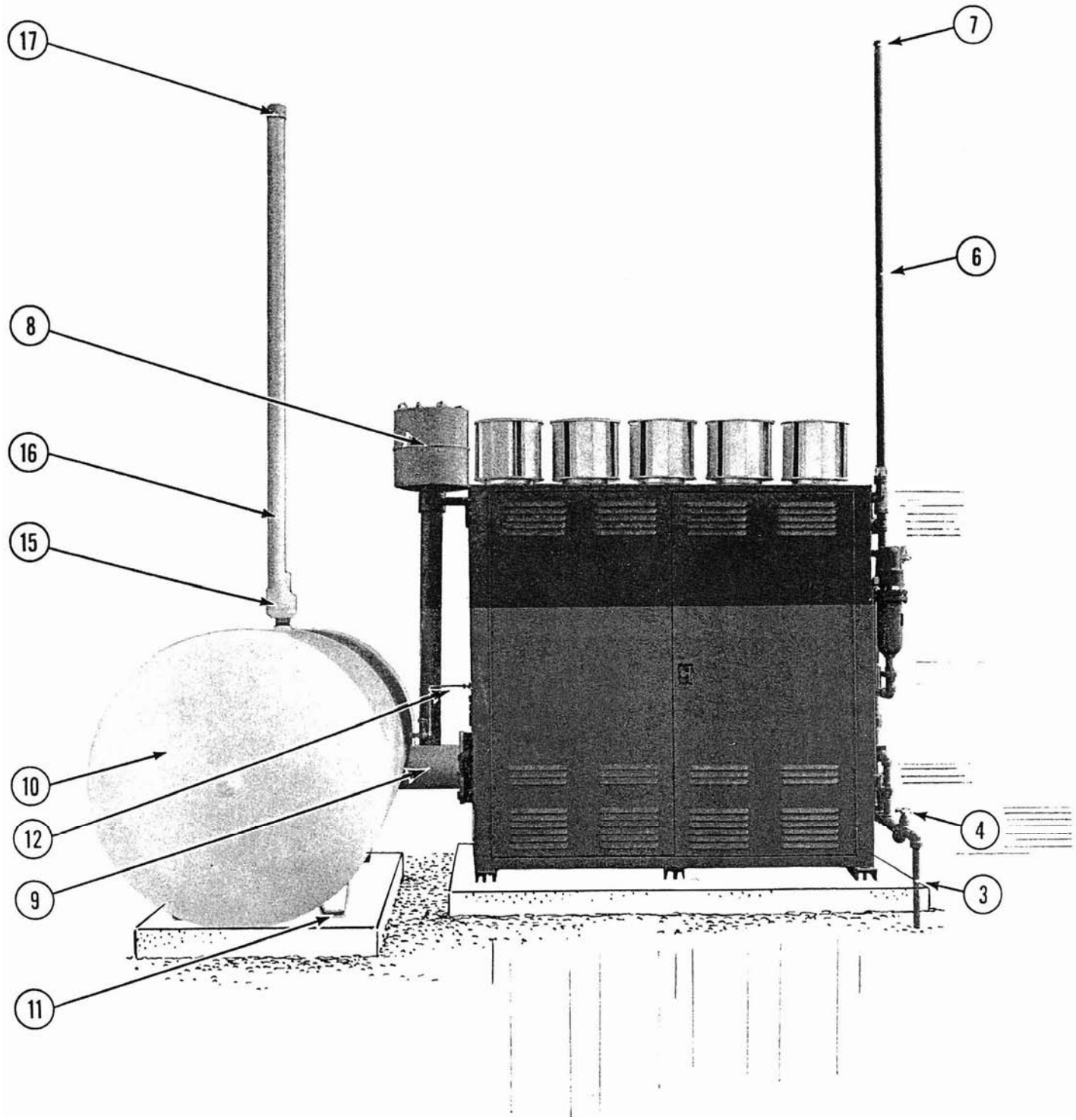


Figure 5-9 – PAMW 900-50 Installation Typical for -10 to -50

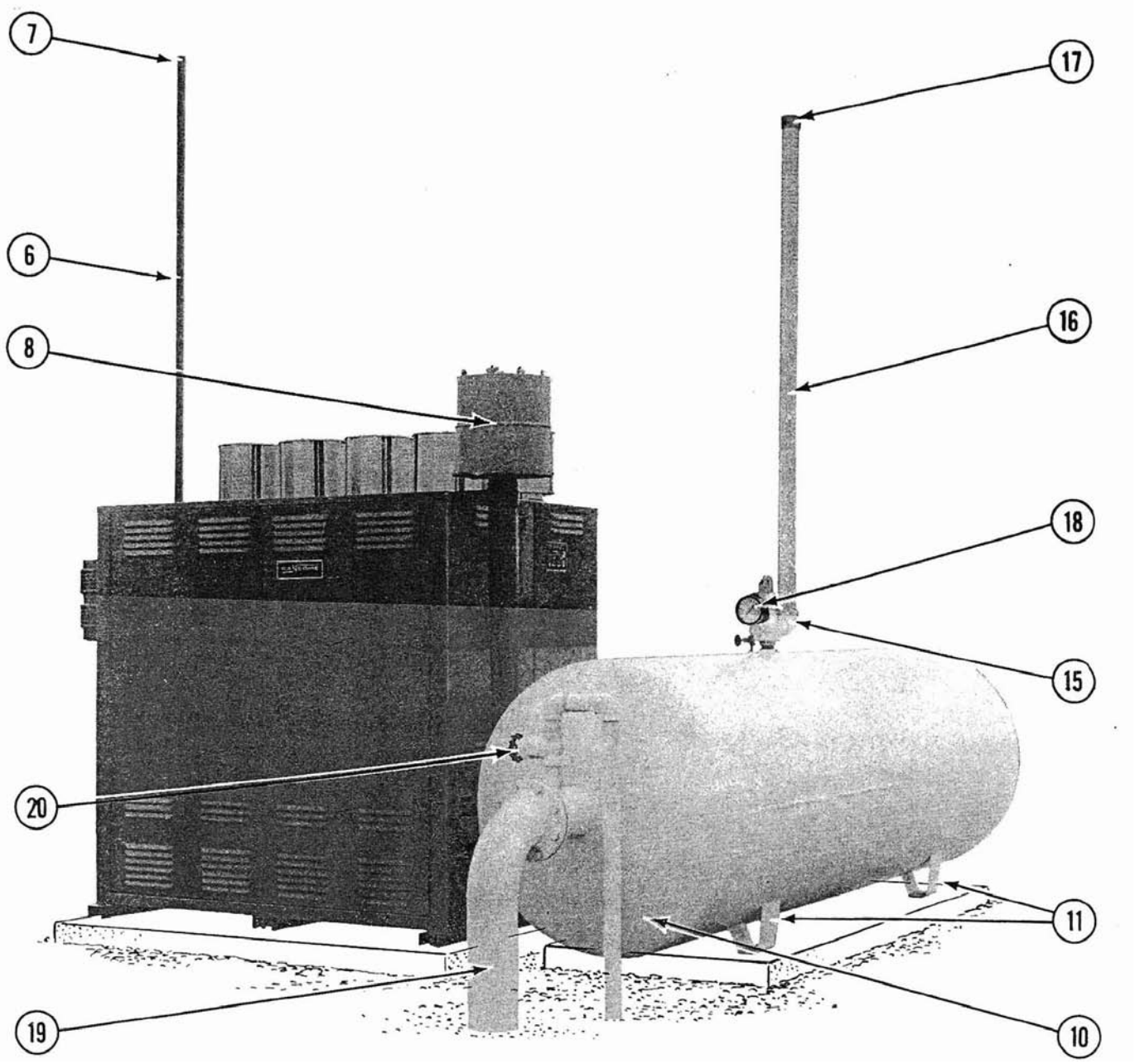


Figure 5-10 – PAMW 900-50 Installation Typical for -10 to -50

Table 5-2 — Installation Features For PAM, PAMW and M Series Vaporizer-Mixers

Key	Feature
1	Electrical power is wired for 117 Vac, 60 Hz, single phase, 20 A service, including a circuit breaker and a disconnect switch to be supplied by the customer. The disconnect switch should be able to be locked off during Mixer servicing.
2	The Control Panel (Option C) is factory installed or may be installed in the field. It can be mounted remotely from the Vaporizer-Mixer.
3	The LP-Gas Liquid Inlet piping is provided by the user. The piping must be sized to prevent excessive pressure loss between the LP-Gas Liquid Pump and the Vaporizer and to allow reverse flow of liquid and/or vapor into inlet piping under surging conditions. All piping should be designed to provide 5 PSI or less pressure drop between the pump outlet and the Vaporizer inlet.
4	Vaporizer LP-Gas Liquid Inlet Shut Off Valve. This is a Fisher Type N 300 Series or equivalent. The user must provide this valve to shut off flow of the LP-Gas liquid to the Vaporizer.
5	LP-Gas Liquid Inlet Strainer. This strainer is provided on standard Vaporizer-Mixers. The Inlet Strainer should be cleaned during periodic maintenance or whenever restriction in the Inlet Line is suspected.
6	Vaporizer Safety Relief Valve Vent Stack. The vent stack is required to meet some local codes. The Vent Stack should be supported to prevent undue stress to the Safety Relief Valve.
7	Vaporizer Safety Relief Valve Rain Cap. The rain cap is intended to prevent rain, snow or sleet from entering the Safety Relief Valve.
8	Air Inlet Filter, Piping and Bracket Assembly (Option F). An air inlet filter must be installed on the air inlet to prevent damage to the Air Back Check Valves from airborne materials or insects.
9	Mixed Gas Outlet to Surge Tank. Refer to Part 4, Specifications, for sizing.
10	Ransome ST Series Surge Tank and Trim Kit is mounted directly to the flanged mixed gas outlet. California Title 8 Code requires 5 feet minimum from Vaporizer to Surge Tank necessitating a spool piece.
11	Surge Tank mounting legs should be bolted to the cement slab. The height of the mixed gas inlet connections on the Ransome ST750 Surge Tank provide for nominal 1/2" shims under the legs thus providing for convenient alignment of the Surge Tank inlet connection with the Mixer outlet.
12	Mixed gas pressure sensing line installed between the Surge Tank and the mixed gas pressure tap on the Mixer module is provided by the user. A 1/4" Shut Off Valve and nipple are provided with the Surge Tank Trim Kit (Suffix T). The user also supplies 1/4" tubing and fittings.
13	Mixed gas test connection for connection to Specific Gravitometer or other test instrument provided by user. A 1/4" Shut Off Valve and nipple are provided with Surge Tank Trim Kit (Suffix T).

Table 5-2 – Installation Features For PAM, PAMW and M Series Vaporizer Mixers (Continued)

Key	Feature
14	Surge Tank Safety Relief Valve is provided with the Surge Tank trim kit (Suffix T). An ASME code relief valve is provided adjusted to 35 PSI start-to-discharge pressure. This valve must be installed on all Surge Tanks to prevent excessive pressures in the event of an emergency. It must be capable of relieving the entire capacity of the Mixer without exceeding safe limits. If this valve is intended to protect any downstream components with a lower working pressure, the 35 PSI setting must be reduced. If other than the 35 PSI setting is needed, it should be specified with the Surge Tank trim kit order.
15	A 2" Street Elbow for the Surge Tank Safety Relief Valve Stack is included with the Surge Tank trim kit (Suffix T).
16	Surge Tank Safety Relief Valve Vent Stack. Refer to Step 6.
17	The Surge Tank Safety Relief Valve Rain Cap is included with the trim kit (Suffix T). A Rain Cap is intended to prevent rain, snow or sleet from entering into the Safety Relief Valve.
18	A Mixed Gas Pressure Gauge is provided by the user. A Shut Off Valve and Nipple is provided with the Surge Tank trim kit (Suffix T). The recommended ranges are: (a) 0 - 15 PSI for naturally aspirated Mixers. (b) 0 - 60 PSI for pressurized Mixers.
19	Mixed Gas Outlet To Load. Piping is fitted to 6", 150 lb. flanged outlet connection on the Surge Tank and should be equipped with a full flow Shut Off Valve and/or Back Check Valve at the Surge Tank depending on the application and local codes.
20	Shut Off Valve for Flare Burner is provided with the Surge Tank trim kit (Suffix T). This valve and piping is installed on the Surge Tank Flare Outlet to provide control to test flare used for checking and calibrating the mixture.

Start Up and Operating Procedure

5.09 All Ransome Mixer Systems are factory tested using commercial Propane. Ransome Mixers are thoroughly tested at the factory and are assured to be free from leaks. However, vibration and jarring during subsequent handling, shipment and installation can cause leaks. The factory recommends:

(a) Use a good quality liquid leak detecting solution such as Leaktec for leak checking. This is available for subfreezing temperatures as needed. A thorough leak test using this solution or equivalent leak detector must be conducted after installation and any leaks must be repaired prior to operation of the system.

CAUTION

Do not use matches or other flames to conduct leak tests.

5.10 The RH and RW Series Operation Manuals furnish the user with a detailed start-up procedure for the Vaporizer. This start-up procedure assumes a complete, proper installation of the entire gas system including storage tank(s), Vaporizer, valves, piping, bypass valves, etc., and including electrical power. All installations must be in accordance with NFPA No. 58 Standards, state, provincial or local regulations, codes and laws. The procedure assumes use of clean, contamination-free LP-Gas. Close all valves in

RANSOME
MANUFACTURING
3495 South Maple Ave. / Fresno, CA. 93725
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VAPORIZER/MIXER TEST REPORT

WORK ORDER NUMBER: _____ DATE: _____

MODEL NUMBER: _____ SERIAL NUMBER: _____

VAPORIZER TUBE(S) SER. NO.(S): _____ _____ _____ _____ _____

MIXER INFORMATION: NOZZLE _____ VENTURI _____

SOLD TO: _____ SHIP TO: _____

_____ _____

_____ _____

Capacity, _____ SCFH Mixed Gas @ _____ PSIG Nominal Outlet Pressure

Minimum Required LP-Gas Liquid Inlet Pressure _____ PSIG.

Air Required _____ SCFM @ _____ PSIG.

Accessories: _____

Test Fuel _____ @ _____ S.G.U. Average Ambient Temp. _____ F.

VAPORIZER CALIBRATION

Burner Pressure, (All Burners On) Inches W.C.	
Burner Operating Control Switches, Degrees F.	
LP-Gas Inlet Pressure During Test, PSIG	
LP-Gas Vapor Header Pressure During Test, PSIG	

MIXER CALIBRATION, Nominal Specific Gravity _____

Mixer Module Number:	1	2	3	4	5
Gas Regulator Setting, PSIG					
Air Regulator Setting, PSIG					
Mixer Operating Switch On, PSIG					
Mixer Operating Switch Off, PSIG					

SAFETY INTERLOCK CALIBRATION

High Mix Pressure, PSIG		High Vaporizer Temp. Degrees F.	
Low Mix Pressure, PSIG		Low Mix Temp. Degrees F.	
High Vaporizer Pressure, PSIG		Low Water Cut-Off, W.C.	
Low Vaporizer Pressure, PSIG		High Air Pressure, PSIG	
Low Air Pressure, PSIG			

Complete Operational Test Conducted, and Unit Found Leak-Free By _____

Certified By _____ Test Date _____

Quality Assurance Officer

the system prior to start up. Then proceed as follows:

Step	Procedure
1	Slowly open Mixer Inlet Valve until Mixer pressure rises above minimum LP-Gas pressure. Refer to Table 5-1 or Mixer Data Plate. Then, open valve completely. (This step for M Series only). For Vaporizer Mixers, activating Vaporizer pressurizes Vapor Header. Open 3/4 inch ball valve on Mixer before lighting pilots. **NOTE** *If compressed air has been optioned, start the Blower or Compressor which is to supply air to the Mixer. Open Air Inlet Valve that will supply air to the Mixer Air Regulators.*
2	Slowly open Vapor Shut Off Valve(s) (3/4 inch Ball Valves) on the Vapor Header supplying vapor to the Venturi(s) and open mixed gas shutoff valves.
3	Operate the Mixer module START pushbutton for two seconds and then release. The Gas Solenoid Valve(s) should operate and the Mixer should start supplying mixed gas to the Surge Tank and stop when the pushbutton is released.
4	Operate the Mixer module START pushbutton holding in for eight seconds. Then, release it for 10 seconds. Repeat this sequence until pressure in the Surge Tank reaches 1.5 PSI below the specified mixed-gas pressure.
5	Again, operate the Mixer Module START pushbutton and then release it. If the Interlock Circuit is complete, the Mixer should continue to run until the specified mixed gas pressure is reached. The Gas Solenoid Valve(s) should release automatically.
6	Light the Flare Pilot. **(Pilot gas should be supplied from other than mixed gas to facilitate purging.)** Slowly open the valve between the Surge Tank and the Flare. The mixed gas pressure will drop and the Gas Solenoid Valve(s) will operate again to replenish the mixed gas consumed by the Flare. Flare will ignite when air is purged from the system. Adjust the valve to flare so that the Mixer cycles on and off with on-cycle time equal to approximately 1/5 of the off-cycle time.
7	Allow the Mixer system to operate for ten minutes under this condition and observe its performance.
8	Close the valve to extinguish the flare.
9	Carefully open the valves between the Surge Tank and the point of injection into the natural gas line starting at the Surge Tank. The Mixer will supply mixed gas automatically up to its capacity on demand.
10	To shut down, close the valve at the natural gas injection point. The Vaporizer should be left on while idle to maintain temperature in the Vaporizer Mixer and eliminate possible corrosion from condensation. (a) Close the Vapor Shut Off Valve(s) on the Vapor Header during long idle periods.

Step	Procedure
	(b) Close the Air Inlet Valve during long idle periods.
	Open both valves before restarting.
11	To restart from IDLE:
	(a) Restart pump if Vaporizer Mixer is equipped with auto idle option. Otherwise, pump must operate whenever vapor pressure is below setting of low pressure interlock to prevent unit from shutdown.
	(b) Open the valve to the natural gas line.
12	To restart from OFF:
	(a) Steps 1 to 9 above.
	(b) Step 6 — Air Purging — can be excluded.

Refer to paragraph 6.16 for gas-air ratio adjustment procedure, if required.

6. MAINTENANCE

6.01 Maintenance procedures in Part 6 should be performed in accordance with local regulations and the user's maintenance plan.

Safety Precautions

6.02 The PAM, PAMW and M Series Vaporizer-Mixers contain flammable gas under various pressures while in normal operation. Any gas leaks within the Vaporizer System or in any part of the installation are potentially dangerous and must be eliminated immediately or a fire may occur. Any odor, gas or dark oily stains on joints or fittings indicate a possible gas leak. If such a leak does exist, pilots or other sources of ignition must be immediately extinguished. Electrical power should be disconnected at a location remote from the suspected leak.

6.03 Thorough inspections for leaks should be conducted frequently. Any leaks should be repaired immediately. Since this equipment, as well as many other components in the installation use threaded joints, vibration and thermal stresses, the possibility of leaks developing over a period of time is always present.

EMERGENCY INSTRUCTIONS

If a large leak is discovered, do not attempt to effect repair,

(a) Evacuate all personnel from the area.

(b) Call the Fire Department.

(c) If it can be done with safety, shut off the Main Gas Supply Valve(s) at the LP-Gas Storage Tank(s).

The leak will stop when all gas downstream from the Gas Supply Valve(s) has been exhausted.

(d) Make certain all gas has safely dispersed before attempting repairs.

Routine Inspection

6.04 *Operating Switches, Controls, Interlock Switches and Air Back Check Valves* should be checked daily for correct performance. Repair or replacement should be accomplished at the

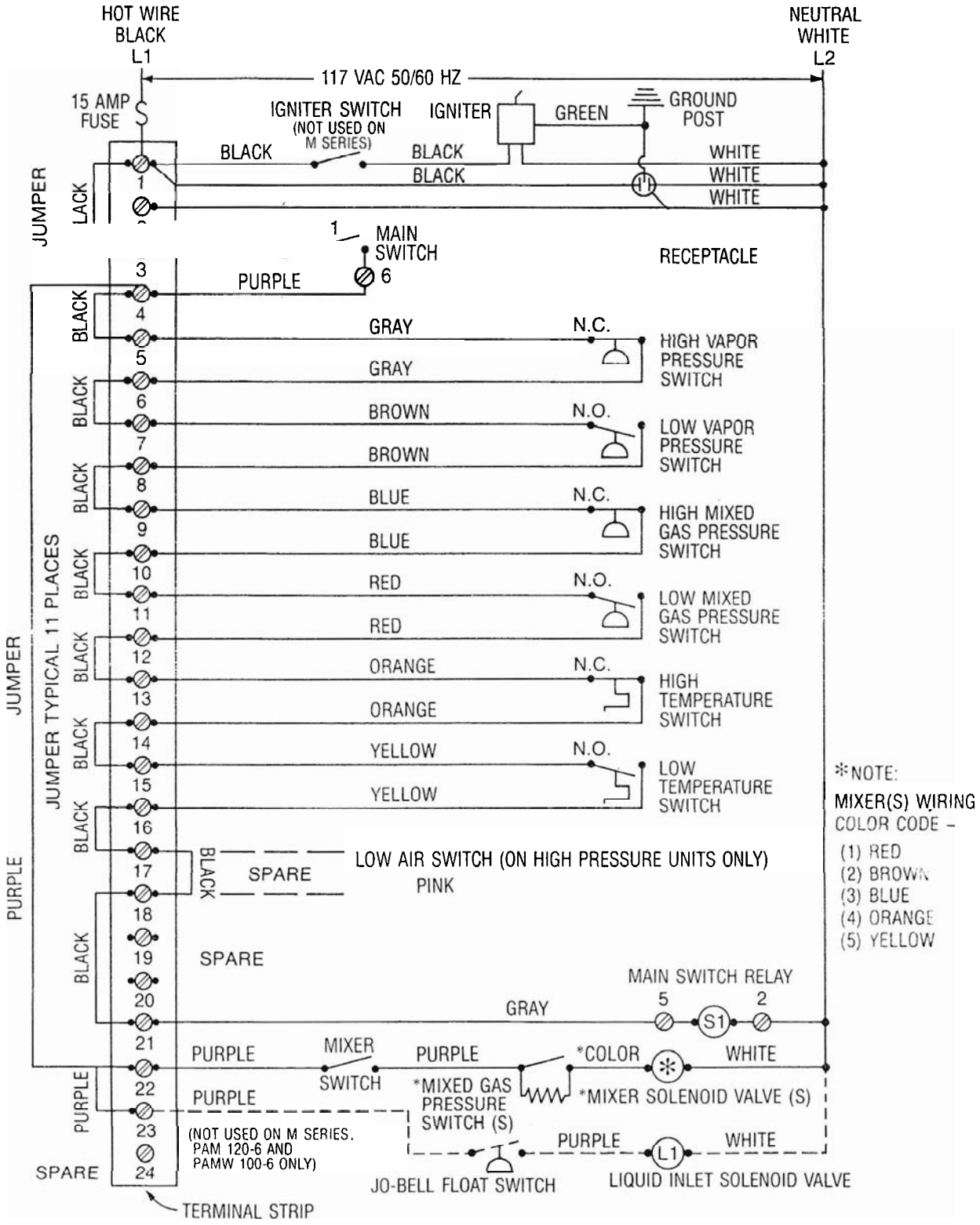


Figure 6-1 – PAM, PAMW, M Series Wiring Diagram

first indication of sticking, erratic performance or any abnormal condition. Paragraph 6.13 details the maintenance procedure for the Mixer Gas Regulator Valve.

6.05 *Safety Relief Valves* should be replaced at no more than five-year intervals or any time possible damage is suspected. Vent piping connected to Safety Relief Valves must be kept open, free from condensation, ice or other foreign material that might restrict release of excessive pressure in an emergency.

6.06 *Pressure Regulator Vents* must be kept clear or erratic operation, instability or loss of control may result.

6.07 *Burner Train* — Burners, pilots, controls and all related components must be kept free of insects, cobwebs, debris and/or other foreign materials that might impair operation. Particular attention should be paid to the possibility of tar or other sticky or oily deposits accumulating in the gas controls. These deposits must be removed to prevent faulty operation. If these heavy ends are continually found in the fuel, the burner gas for the Vaporizer Module may be withdrawn directly from the Storage Tank(s). If this is to be done, a suitable regulator should be installed at the Storage Tank to avoid recondensation.

6.08 *Vaporizer Tubes* should be inspected for corrosion and soot accumulation at regular intervals. Soot should be removed to obtain original efficiency. If signs of corrosion or other damage are found, the Vaporizer Tube should be reinspected, tested and approved by a Certified ASME Code Inspector. Any rejected Vaporizer Tube must be replaced.

6.09 *Glycol-Water Mixture* in Vaporizer Water Bath must be kept at the proper operating level. This can be routinely checked through the Sight Glass mounted on the front of each Vaporizer Tube. Continuous loss of liquid indicates a leak or could be due to excessive water bath temperature. The Fenwal Temperature Switch may require replacement or readjustment. To lower temperature, turn adjusting screw clockwise no more than 1/16 turn at a time and allow unit to stabilize for 5 minutes. To raise the temperature turn the screw counter clockwise. Adjust with unit under load. No boiling or steaming should take place while in operation. Check each Vaporizer Tube with a thermometer or thermocouple instrument. All tubes should be adjusted within 5 degrees of each other.

CAUTION

NEVER operate a water vath Vaporizer-Mixer on anything but a 50-50 mixture of a good quality glycol base antifreeze and water. Use of straight antifreeze will severely reduce vaporizing capacity. and straight water will boil away as well as cause severe corrosion. Dow Ambitrol CN or equivalent is recommended. A premixed antifreeze, such as Dow Ambitrol FL may also be used.

6.10 *Water Bath Mixture* tests should be made periodically for antifreeze protection as well as condition of the rust inhibitors. Replace mixture or supplement glycol or rust inhibitors as indicated.

6.11 *Venturi Assembly* — should be disassembled and cleaned any time the user suspects it is clogged by foreign material causing an improper mix ratio.

MAINTENANCE HINT

It is a good practice to select a Mixer system large enough to allow one Venturi Assembly to be closed off without overloading the Mixer to allow servicing at a convenient time.

6.12 *Exterior Paint* — Keep all external surfaces well painted to prevent deterioration and rust.

Mixer Gas Regulator Valve

6.13 Ransome Mixers use a Fisher type 620 Gas Regulator Valve to supply LP-Gas vapor to the Venturi Assembly. Pressure and flow must be properly controlled by this valve or improper gas-air mixture will result. The Regulator Disc and metal Orifice must be in good condition for proper performance. Any small nick on the metal Orifice, imperfection in the Disc surface or foreign material trapped in the Orifice and Disc can cause operating problems.

6.14 The first symptom to look for is a slow build-up in the Nozzle pressure while the Venturi is in its off cycle. This is caused by leakage at the Gas Regulator Valve's Orifice and results in an increasingly high load being applied to the Disc and Diaphragm. The greater the difference between the inlet pressure and Regulator outlet pressure setting, the more overloading can occur. Ultimately, the Disc will be cut by the Orifice, and the outlet pressure will build up until it equals the pressure at the inlet. The Fisher Company states that structural damage may occur if outlet pressure builds up more than 50 PSI over the Regulator setting.

6.15 Therefore, proper Disc and Orifice replacement should be performed whenever Nozzle pressure builds up during the OFF cycle. Replacement of these parts should be handled with great care; only new, correct parts are to be used. Follow this procedure:

Step	Procedure
1	Refer to Table 6-2, Replaceable Parts List, for the Ransome and Fisher part numbers.
2	Make sure all LP-Gas pressure is evacuated from the internal piping of the Vaporizer-Mixer. Refer to paragraph 6.16 for the proper procedure.
3	Each Orifice is specially packaged by Fisher to prevent damage to the seating surface in shipping. **This seating surface must be protected at all times during handling.** IMPORTANT *If an unprotected Orifice is dropped, do not use it in a valve without assuring it is undamaged. The smallest scratch or dent on the seating surface will damage the seat, and early failure will result. **Examine the seat under a strong magnifying glass** to assure it is undamaged.*
4	Use a good quality 12 point 7/8 inch hex socket wrench with a short extension to remove and install the new Regulator Orifice. Make sure the sealing surface is not bumped during the installation.
5	Examine the seating surface of the new Disc carefully, wipe off any dust or foreign matter with a soft cloth before installing it on the Valve Stem Assembly. Be sure the Disc Holder fits freely in the stem. Install the Cotter Pin so it holds the Disc Holder securely, but does not cause it to bind. Then immediately assembly the Diaphragm Assembly being sure nothing damages the Orifice.
6	Always use a new Body Gasket when reassembling the Diaphragm Assembly into the body.
7	Conduct a thorough leak test using a good soap solution or leak detector to assure no gas leaks exist before putting the Vaporizer-Mixer back into operation.
8	Adjust the Gas Pressure Regulator Valve to the proper setting; refer to the Ransome Vaporizer-Mixer Test Report furnished with the system or set to obtain the desired gas-air mixture. This setting must be made while the Venturi is in the ON position and the Mixer is in operation.
9	Check the system for any slow build-up in Nozzle pressure during the OFF cycle. Also, make sure there is no leakage at the Regulator Vent. If any problems are apparent, this repair procedure should be repeated.

Lp-Gas Vapor Air Ratio Adjustment

6.16 LP-Gas Vapor Air ratio is adjustable. To maintain the factory calibration, be sure Gas Pressure Regulator setting equals value shown on the Ransome Vaporizer-Mixer Test Report. To adjust:

Step	Procedure
1	Loosen lock nut and turn regulating adjusting screw very slightly. (a) Turn the screw in to raise the Venturi nozzle pressure. (b) Turn the screw out to lower the Venturi nozzle pressure.
2	If a richer mixture than factory set is desired, set the Venturi nozzle pressure slightly lower. If a leaner mixture is desired, set the regulator slightly higher. **NOTE** *The LP-Gas Vapor Air ratio adjustment should be made only by properly trained personnel using a calibrated Specific Gravitometer or other suitable test instrument.*

6.17 Mixers supplied by blower air must have air pressure adjusted to 2 PSI less than the mixed gas pressure. In the case of Mixers using plant air or air compressors, Air Regulator(s) on the Mixer should be individually adjusted to 2 PSI less than the mixed gas pressure. All mixture adjustments should be made using the same procedure as described above.

Purging Gas From The System

6.18 If service requires removal of gas from the system, do not merely vent gas to the atmosphere. This could result in fire with the possibility of injury or damage.

(a) A Flare Burner should be installed at a safe distance from any gas leakage.

(b) Dispose of gas by burning.

(c) Make sure all gas is actually removed from the equipment before any connections are loosened.

6.19 If LP-Gas liquid is present in the Ransome equipment, it will chill as the pressure is relieved, slowing the rate at which it will boil and discharge as vapor through the Flare Burner. *BE CERTAIN* all liquid is actually vaporized before loosening any connections. *The presence of frost on the outside of a component part is an indication of the presence of LP-Gas liquid and no connections should be loosened until it melts. The use of a heat source, such as a forced air heater, may expedite this process in cold weather.*

6.20 All servicing must be done in a safe, thorough, step-by-step manner. If in doubt about what to do, the serviceman should:

(a) Consult the Operation Manual,

(b) Contact the gas system installer,

(c) Contact Ransome Gas Industries, following the instructions under Warranty Service in this manual.

Gas System Trouble Shooting

6.21 The trouble shooting procedures described in Table 6-1 are intended to help a serviceman isolate the cause of trouble encountered during routine operation. Only the kinds of trouble more likely to be encountered in service are listed. The list is by no means comprehensive. The Probable Cause column of Table 6-1 lists

in order of most likely occurrence. To make the best use of these trouble shooting procedures, the serviceman should be thoroughly familiar with the Physical and Functional Descriptions of the Ransome system described in Parts 2 and 3 of this manual.

6.22 Before beginning any trouble shooting, make certain the Ransome Vaporizer has been properly installed. All system components including storage tanks, valves, piping, pumps and bypass valves must conform to NFPA No. 58 Standards and all state, provincial or local regulations, codes and laws.

Warranty Service

6.23 Faulty system components should be returned to Ransome Gas Industries, Inc., following the conditions set out in the Warranty. Defective material or technical questions should be referred to:

RANSOME
MANUFACTURING
3495 South Maple Avenue, Fresno, California 93725-2494, (209) 485-0979
TLX II 9103691171

When the material is returned to Ransome, the following information will expedite repair or replacement and return if it is included:

(a) The name and area code — telephone number of the individual most familiar with the failure,

(b) A brief statement of the problem with the unit,

(c) Make(s) of other gas equipment in the user's system,

(d) The approximate date and Purchase Order Number for the Ransome equipment (if known),

(e) The Model and Serial Number of the Ransome equipment.

Table 6-1 — Trouble Shooting

Symptom	Probable Cause	Remedy
Mixture too rich	1. Gas Pressure Regulator setting.	Raise pressure setting. Check with Specific Gravitometer.
	2. Air Inlet Filter clogged.	Clean or replace.
	3. Air Inlet Line clogged with foreign matter.	Remove.
	4. Air Back Check Valve(s) not operating correctly.	Repair or replace.
	5. Gas Pressure Regulator restriction.	Repair or replace.
	6. Vapor Shut Off Valve not fully open.	Open fully.
	7. Inlet Pressure to Vaporizer insufficient.	1. Check pump system. 2. Refer to "Insufficient Capacity" in Vaporizer Operation Manual.

Table 6-1 — Trouble Shooting (Continued)

Symptom	Probable Cause	Remedy
Mixture too lean	1. Gas Pressure Regulator setting.	Lower pressure setting. Check with Specific Gravitometer.
Mixture pressure incorrect	1. Operating Pressure Switch	Adjust or replace.
Mixer shuts down	1. Safety Interlock.	Correct basic problem. Push START button to reset. Refer to below "Safety Shut Down".
	2. Power Outage	Restore power. Push START button. If power outages continue, install a Ransome CPC Series Continuous Power Cell.
	3. Fuse blown.	Replace. If it continues to blow, look for cause.
Safety Shutdown		
High LP-Gas pressure	1. Valve is closed in Pump Bypass Line.	Open valve.
	2. Blockage in Pump Bypass Line or Bypass Valve is inoperative.	Clean or replace.
	3. Vaporizer Back Check Valve blocked or inoperative.	Clear or replace.
	4. Safety Interlock Switch	Adjust or replace.
Low LP-Gas pressure	1. Pumping problem.	Repair.
	2. Vaporizer capacity insufficient.	Refer to Vaporizer Operation Manual.
	3. Safety Interlock Switch	Adjust or replace.

Table 6-1 – Trouble Shooting (Continued)

Symptoms	Probable Cause	Remedy
High LP-Gas temperature	1. Vaporizer overheated.	Refer to Vaporizer Operation Manual.
	2. Safety Interlock Switch	Adjust or replace.
High or low mixed gas pressure	1. Operating Switch	Adjust or replace.
	2. Safety Interlock Switch	Adjust or replace.
	3. Load exceeds Mixer capacity.	Reduce load or use higher capacity Mixer.
Pilot Outage (optional)	1. Refer to Vaporizer Operation Manual.	
High or low Specific Gravity (optional)	1. Refer to "Mixture too rich" and "Mixture too lean".	
	2. High or low limits on Specific Gravitometer defective.	Refer to Specific Gravitometer manual.
Low air pressure	1. Air blower or compressor failure or inadequate capacity.	Correct as required.
	2. Safety Interlock Switch	Adjust or replace.

Table 6-2 – M-6 Through M-50 Replaceable Parts List

Item	Description	Manufacturer and Part No.	Quantity Needed Option Std	Quantity Needed Option HB	Quantity Needed Option HP	Order Ransome No.
	Section A Mixer System					
1A	Valve, Vapor, Shutoff	Apollo 80-104-00, 3/4 in. NPT	1*	1*	1*	145800200
2A	Regulator, Gas, Pressure	Fisher 620/466, 3/4 in. NPT	Op	Op	Op	206003101
3A	Seat, Regulator	Fisher 1C4248-000B2	1*	1*	1*	206011101
4A	Orifice, Regulator	Fisher 1A9288-14012	1*	1*	1*	206011102
5A	Pin, Cotter, Regulator	Fisher 1A3393-28992	1*	1*	1*	206011202
6A	Gasket, Body, Regulator	Fisher 1A8325-04032	1*	1*	1*	206011203
7A	Diaphragm, Regulator	Fisher 1E 6066-02052	1*	1*	1*	206011201
8A	Valve, Gas, Solenoid	Asco 8210D3	Op	Op	Op	145801000
9A	Kit, Repair, Solenoid, Valve	Asco 99-019	1*	1*	1*	145801001
10A	Venturi Assembly, Complete	Ransome (Specify Mixer Gas Pressure)	1*	1*	1*	
11A	Switch, Operating, Pressure 5-10 11-30	UEJ302-9765-453-R,0-20PSI UEJ302-9804-454-R,0-30PSI	Op	Op	Op	065705500 065705600
12A	Microswitch, for Pressure Operating Switch	United Electric 12B S204	1*	1*	1*	065704801
13A	Capacitor	General Electric GR-S20SP-484 (C5)	1*	1*	1*	015500600
14A	Switch, Stop-Start Relay	Honeywell S446A1018	1	1	1	015532100
15A	Fuse, 15 Ampere	Buss No. 3AB-15A	1	1	1	015563402
16A	Valve, Back Check, Flanged	Ransome	Op	Op		755320001
17A	Valve, Back Check, Screwed	Ransome	Op			755320002

Table 6-2 — M-6 Through M-50 Replaceable Parts List (Continued)

Item	Description	Manufacturer and Part No.	Quantity Needed Option Std	HB	HP	Order Ransome No.
18A	Flapper Assembly, Complete for Back Check Valve	Ransome	2*	2*		755320020
19A	Gauge, Pressure 0-160 PSI	Ametek 46912	1*	1*	1*	416400401
20A	Valve, Mixture Shut Off	2 in. †	1*	1*	1*	145831000
	Section B Safety Interlock System					
1B	Switch, Pressure, High Vapor		1	1	1	065700000
2B	Switch, Pressure, Low Vapor		1	1	1	065700101
3B	Switch, Temperature, High Vapor	Honeywell L4006A-1009	1	1	1	065701600
4B	Switch, Pressure, High-Low Mix	United Electric 9804	1	1	1	065705600
5B	Switch, Temperature, Low Mix	Honeywell L6021A-1054	1	1	1	065701800
	Section D Air System					
1D	Regulator, Air Pressure	Fisher 620/466, 3/4 in. NPT			Op	206003101
2D	Seat, Regulator	Fisher 1C4248-000B3			1*	206011101
3D	Orifice, Regulator	Fisher 1A9288-14012			1*	206011102
4D	Pin, Cotter, Regulator	Fisher 1A3393-28982			1*	206011202
5D	Gasket, Body, Regulator	Fisher 1A8325-04032			1*	206011203
6D	Diaphragm, Regulator	Fisher 1E 6066-02052			1*	206011201

Table 6-2 — M-6 Through M-50 Replaceable Parts List (Continued)

Item	Description	Manufacturer and Part No.	Quantity Needed Option			Order Ransome No.
			Std	HB	HP	
7D	Valve, Air, Solenoid	Asco 8210D3			Op	145801000
8D	Valve, Air, Solenoid	Asco 8215A80		Op		145801600
9D	Kit, Repair, Solenoid Valve	Asco 99-019			1*	145801001
10D	Kit, Repair, Solenoid Valve	Asco 103-234		1*		145801601
11D	Valve, Air, Shutoff	Apollo 80-104-00, 3/4 in NPT			1 ea	145800200
12D	Valve, Air, Shutoff	Nibco 2 in.		1*		145815600
13D	Switch, Air, Low	United Electric		Op	Op	065703900
14D	Microswitch, For Low Air Switch	United Electric 6259-233		1 ea	1 ea	065703002
15D	Gauge, Pressure 0-60 PSI			1 ea	1 ea	416400201

* For Major Overhaul

M -6 requires 1 unit
M-10 requires 1 unit
M-20 requires 2 units
M-30 requires 3 units
M-40 requires 4 units
M-50 requires 5 units

† M-20 — M-50 only

Table 7-1 – General LP-Gas Information

	Propane	Butane
Formula	C_3H_3	C_4H_{10}
Boiling Point, °F	– 44°	32°
Specific Gravity of Gas (Air = 1.00)	1.53	2.00
Specific Gravity of Liquid (Water = 1.00)	0.51	0.58
Pounds per Gallon of Liquid at 60°F	4.24	4.81
BTU per Gallon of Gas at 60°F	91690	102032
BTU per Pound of Gas	21591	21221
BTU per Cu. Ft. of Gas at 60°F	2516	3280
Cu. Ft. of Vapor at 60°F/Gallon of Liquid at 60°F	36.39	31.26
Cu. Ft. of Vapor at 60° F/Pound of Liquid at 60° F	8.547	6.506
Latent Heat of Vaporization at Boiling Point BTU/Gal.	785.0	808.0
Combustion Data:		
Cu. Ft. Air Required To Burn One Cu. Ft. Gas	23.86	31.02
Flash Point, °F	– 156°	N.A.
Ignition Temperature in Air, °F	920°-1020°	900°-1000°
Maximum Flame Temperature in Air, °F	3,595°	3,615°
Limits of Inflammability, Percentage of Gas in Air Mixture:		
At Lower Limit	2.4%	1.9%
At Upper Limit	9.6%	8.6%
Octane Number (ISO-Octane = 100)	Over 100	92

NOTE:

1. Commercial quality. Figures shown in this chart represent average values.

7. REFERENCES

7.01 Additional information on the PAM, PAMW and M Series Mixer components can be obtained from the following sources:

(a) ASCO Valves Automatic Switch Company
50-56 Hanover Road
Florham Park, New Jersey 07932

(b) Fisher Controls Company
McKinney Division
P. O. Box 900
McKinney, Texas 75069

(c) Honeywell
Minneapolis, Minnesota 55408

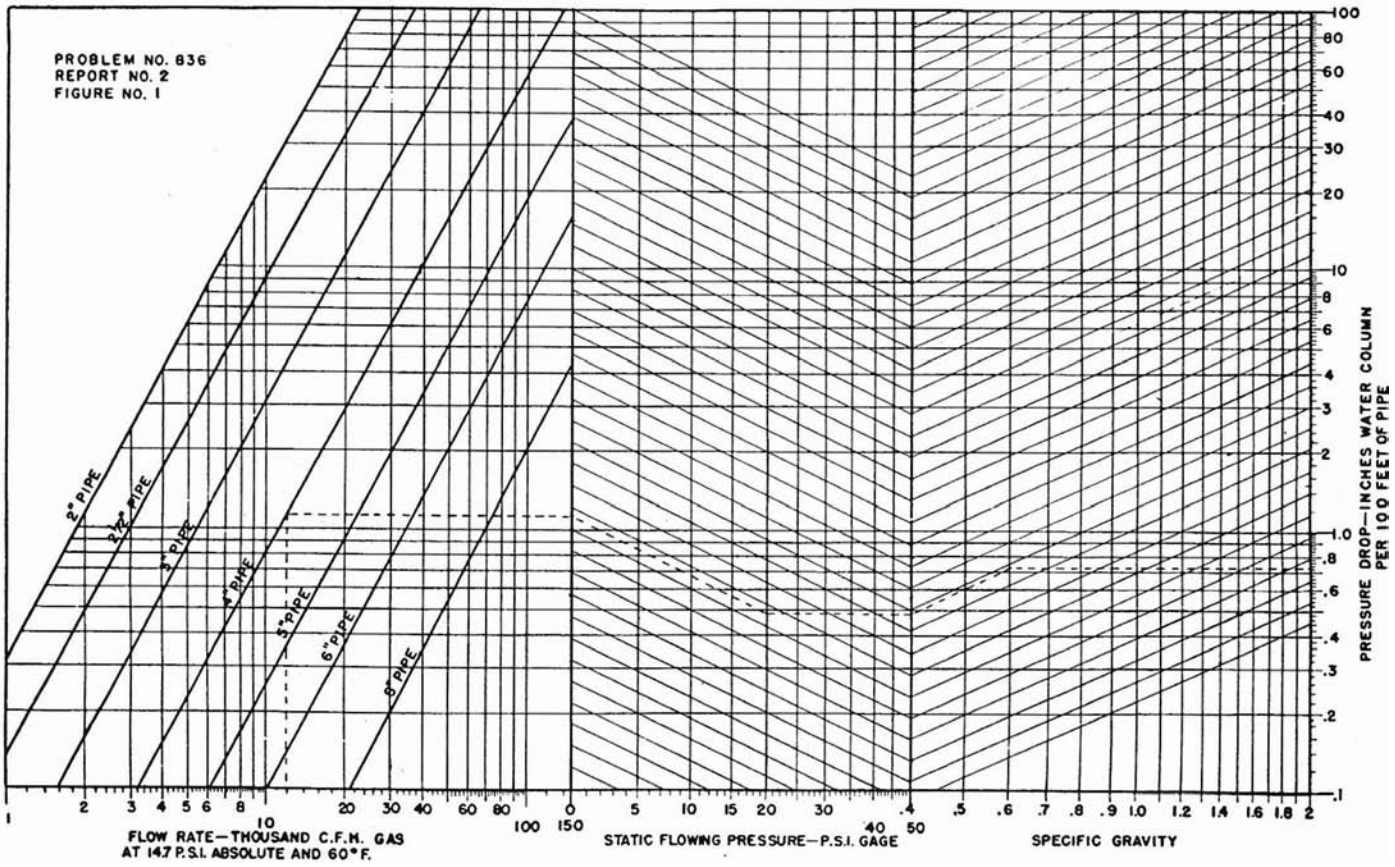
(d) Mercoid Series "D" Pressure Controls
The Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois 60641

(e) United Electric Controls Company
85 School Street
Watertown, Massachusetts 02172

7.02 Figure 7-1 and Tables 7-1 through 7-3 will furnish the LP-Gas user with helpful information for specifying and installing LP-Gas systems.

Table 7-2 – LP-Gas Vapor Pressure

Temperature (°F)	Approximate Saturated Vapor Pressure (PSIG)	
	Propane	Butane
110	220.0	46.0
100	190.0	37.0
90	165.0	29.0
80	140.0	22.0
70	120.0	16.5
60	102.0	11.5
50	86.0	6.9
40	72.0	3.0
30	58.0	
20	47.0	
10	37.0	
0	28.0	
-10	20.0	
-20	13.5	
-30	8.0	
-40	3.6	



The chart above provides a simple method of determining the pressure drop in a gas transmission line under a given set of conditions. The chart was constructed on a calculated theoretical basis, and the results were checked against actual laboratory test data.

To find the pressure loss in a given length of pipe, the pipe size, static flowing pressure, specific gravity of the flowing gas, and the flow rate must be known. Solution of a typical problem is indicated by dotted lines on the chart.

In this example, it is proposed that a 4" outlet pipe be used to carry natural gas (0.6 specific gravity) at a pressure setting of 20 PSIG. The pipe is to be 500 ft. long, and the maximum flow rate is to be 12,000 cfh of gas at 14.7 PSI absolute and 60°F. From the point "12,000" on the flow rate scale, move vertically to the point of intersection with the diagonal line marked 4" pipe. From this point, move horizontally to the right to the point of intersection with the vertical zero line of the "static flowing pressure" scale.

Then, move parallel to the diagonal lines downward and to the right to vertical line "20" on the "static flowing pressure" scale. Move horizontally to "0.4" on the specific gravity scale, then upward and to the right, parallel to the diagonal lines, to the vertical line "0.6" on the "specific gravity" scale. Then move horizontally and read .725 inches water column pressure drop per 100 feet of pipe. For 500 feet there would be 5 x .725 or 3.625 inches water column pressure drop under the conditions given in the problem.

If, however, it is required to find the minimum pipe size, having been given the maximum allowable pressure drop, the same procedure is followed, except that the movement is from right to left along the same paths as described above.

Data courtesy Fisher Controls, Inc.

Figure 7-1 — Pipe Sizing Nomogram