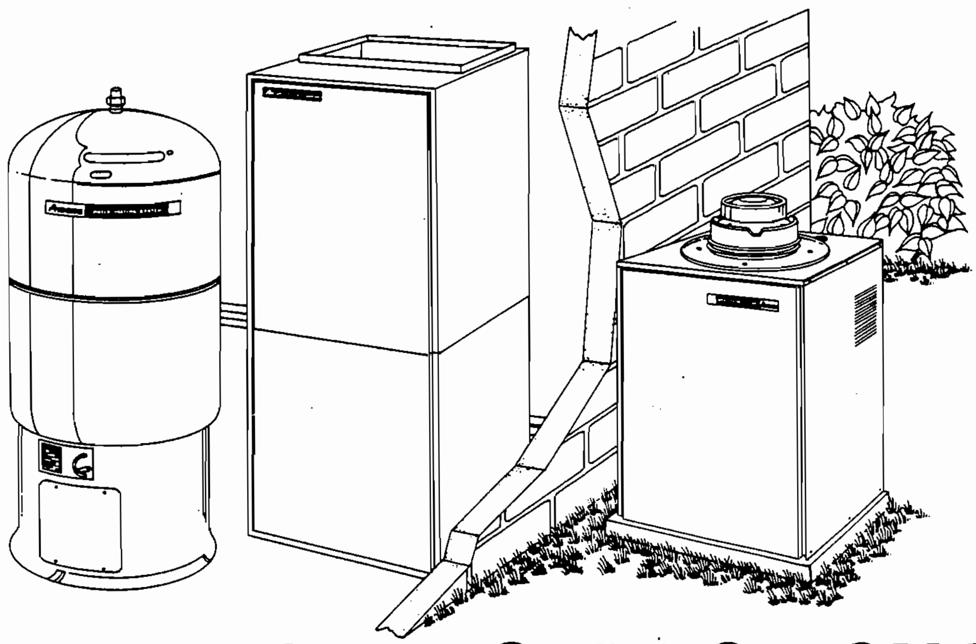
Amana V.I.P. CUSTOMER SERVICE

REMOTE HTM®

HEAT AND HOT WATER



SERVICE INSTRUCTIONS

AMANA REFRIGERATION, INC., AMANA, IOWA, 52204

MANUFACTURING NUMBERS

COVERED IN THIS MANUAL

ERGW00151A	P6819104F
ERGW00151A	P6819107F
EBWC6015MA	P6938901F
EBWC6015MA	P6977502F
EGWH0040CA	P6864002F
EGWH0040CB	P6864005F

A Raytheon Company

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REV.3

INDEX

REV. 1 - ADDED ERGW00151A, P6819107F
EGWH0040CB, P6864005F

REV. 2 - ADDED EBWC6015MA, P6977502F

REV. 3 - ADDED PRESSURE DROP CALCULATIONS

IMPORTANT INFORMATION

Great pride and workmanship go into every Amana product to provide our Customers with the highest possible quality. We realize, however, that during its lifetime the product may require service. The information contained in this manual is intended for use by a qualified Amana service technician who is familiar with the safety procedures required in the repair and who is equipped with the proper tools and testing instruments.

Repairs covered in this manual that are made by unqualified persons can result in hazards due to improper assembly or adjustments subjecting inexperienced persons making such repairs to the risk of injury or electrical shock which can be serious or even fatal.

IMPORTANT NOTE TO CONSUMER

If you perform service on your own Amana product, you must assume responsibility for any personal injury or property damage which may result. Amana will not be responsible for any injury or property damage arising from improper service and/or service procedures.

In order to locate an authorized Amana service agency, please consult your telephone book or the dealer from whom you purchased this product. If you require further assistance, please contact:

CUSTOMER RELATIONS DEPARTMENT		1-319-622-5511
AMANA REFRIGERATION, INC.	OR	and ask for the
AMANA, IOWA 52204	CALL	Customer Relations Department

Users of Amana products outside of the United States and Canada should contact:

EXPORT CUSTOMER RELATIONS DEPARTMENT
AMANA REFRIGERATION, INC.
AMANA, IOWA 52204, USA
TELEX: 464-450 AMANA
CABLE: "AMANA", AMANA, IOWA, USA

FOREWARD

This manual covers the Remote HTM Outdoor Unit, Indoor Unit and Optional Hot Water Tank to provide a complete Heating System. The use of this manual will assist the Service Technician in diagnosing customer complaints when they arise and enable him to provide better service for the consumer.

PRODUCT IDENTIFICATION

REMOTE HTM

ERGW0015-1A	P68191-4F
ERGW0015-1A	P68191-7F

INDOOR UNIT

EBWC6015M-A	P69389-1F
EBWC6015M-A	P69775-2F

HOT WATER TANK

EGWH0040C-A	P68640-2F
EGWH0040C-B	P68640-5F

The Model Number, Manufacturing and Serial nameplates for the Remote HTM and indoor unit are found inside the equipment whereas they are mounted to the exterior of the Hot Water Tank. These plates provide the following information

MODEL NUMBER NAMEPLATE

EXAMPLE: EBWC6015M-A

E - High Efficiency

B - Blower Section

W - Hot Water Coil

C - Cooling Adaptable

60 - Up to 5 Tons

15 - 150,000 Heating

M - Multiple position

1 - 115 V. Single Phase

A - Engineering Identification

MANUFACTURING AND SERIAL NUMBER NAMEPLATES

The manufacturing number is used for positive identification of component parts used in manufacturing. Whenever Engineering and Manufacturing changes occur where interchangeability of components are affected, this number will change.

It is very important to use the number at all times when requesting service or parts information.

The remainder of the plates contain the unit voltage characteristics, motor amps, ampacity and etc., for service and installation purposes.

PRODUCT IDENTIFICATIONS

FOR PARTS & SERVICE LIST MODEL, MFG. NO. & SERIAL

MFG. NO.	P69389-1F
SERIAL	

AMANA REFRIGERATION, INC.
AMANA, IOWA, U.S.A.

MODEL EBWC6015M-A AIR HANDLING

UNIT FOR USE ONLY WITH OUTDOOR UNIT

MODEL ERGW 0015-1A

TEMPERATURE RISE 60°F. TO 90 °F. FORCED AIR FURNACE FOR OPERATION AT EXTERNAL STATIC PRESSURE UP TO .50 IN. W.C. DESIGNED MAX. OUTLET AIR TEMP. 200 °F.

ELECTRICAL RATING 10.0 AMPS. 115 V - 60 HZ. - 1 PH

FOR INSTALLATION IN A BLDG. CONSTRUCTED ON SITE OR A MANUFACTURED BLDG. WITH THE UNIT INSTALLED AT FINAL SITE.

FOR CLOSET INSTALLATION WITH MINIMUM CLEARANCES TO COMBUSTIBLE MATERIAL SIDES, REAR, FRONT, TOP - O. FOR INSTALLATION ON COMBUSTIBLE FLOORING.

MUST BE USED WITH FILTER KIT

ALLOW SERVICE ACCESSIBILITY, FOR HTG. CAP. AND CERTIFICATION SEE RATING PLATE ON OUTDOOR UNIT. IF INPUT HAS BEEN ALTERED THE HEATING BLOWER SPEED MUST BE CHANGED AS SHOWN ON THE WIRING DIAGRAM. UNIT MUST BE INSTALLED IN ACCORDANCE WITH MFG. INSTRUCTIONS AND LOCAL CODES.

IN THE ABSENCE OF LOCAL CODES, FOLLOW THE NATIONAL FUEL GAS CODE Z223.1

SPECIFICATIONS

OUTDOOR SECTION

ERGW0015-1A

Heating Max. Capacity BTUH Input Heating Capacity BTUH/AFUE*	150,000 ----
Heating Min. Capacity BTUH Input Heating Capacity BTUH/AFUE*	130,000 ----
Pump and Combustion Blower Motor: H.P. R.P.M. Pumping Rate GPM @ 31' Water Head	 1/5 3,300 10
Temperature Rise Range °F.	
Gas Connection Male, IPS	1/2"
Heating Solution Connections (Inlet and Outlet)	Copper 1" Nominal (1-1/8 O.D.)
Electrical Data** Voltage Maximum Over Current Protection, Amps Maximum Input Amps Wire - Number and Minimum Size (AWG) Ground Wire, AWG (Chassis Ground)	 115/1/60 15 8.1 2 - 14 1 - 14

*AMANA TESTS BASED ON DOE TEST PROCEDURES
**NATIONAL ELECTRICAL CODE, CANADIAN ELECTRICAL CODE AND ALL EXISTING LOCAL CODES TAKE PRECEDENCE OVER RECOMMENDED FUSE AND WIRE SIZES SHOWN.

SPECIFICATIONS

INDOOR SECTION

EBWC6015-1A

Heating Coil Face Area Square Feet Rows Deep Fins/In. Tube O.D. In.	3.66 3 16 3/8
Air Circulating Blower Wheel Quantity Diameter Width Bore	 1 10 In. 10 In. 1/2 In.
Blower Motor, Direct Drive (With Oil Ports) H.P. Type Number Speed Taps	 3/4 PSC 3
External Static Pressure " W.C. Minimum Maximum	 .2 .5
Air Temperature Rise Range °F.	60 - 90
Electrical Data* Voltage Maximum Input Amps Wire - Number And Minimum Size (AWG) Ground Wire (AWG)	 115/1/60 10.0 2 - 14 1 - 14
Filter, Permanent	(2) 16 X 25 X 1

*NATIONAL ELECTRICAL CODE, CANADIAN ELECTRICAL CODE AND ALL EXISTING LOCAL CODES TAKE PRECEDENCE OVER RECOMMENDED FUSE AND WIRE SIZES SHOWN.

HOT WATER TANK

EGHW0040C-A, C-B

Tank Capacity	Approx. 40 Gal.
Insulation	Rigid Preformed Foam
Tank Liner	Polyethylene
Thermostat - Adjustable	140°F. - 20°F. Diff.
Heating Solution Connections (Inlet and Outlet)	Female 1" IPS
Cold Water Connection	Female 3/4" IPS
Hot Water Outlet and Relief Valve Connections	Female 3/4" IPS (Half Unions)

SPECIFICATIONS

BLOWER PERFORMANCE - EBWC6015M-A

EXTERNAL STATIC PRESSURE VRS CFM AND TEMPERATURE RISE (DATA @ 10°F.)*

EXTERNAL STATIC PRESSURE INCHES. W.C.	INPUT 150,000						INPUT 130,000					
	HIGH SPEED		MEDIUM SPEED		LOW SPEED		HIGH SPEED		MEDIUM SPEED		LOW SPEED	
	CFM	TR	CFM	TR	CFM	TR	CFM	TR	CFM	TR	CFM	TR
.5	2000	58	1680	68	1420	81	2000	50	1680	59	1420	70
.4	2100	55	1740	66	1480	78	2100	48	1740	57	1480	68
.3	2200	52	1780	65	1490	77	2200	45	1780	56	1490	67
.2	2300	50	1800	64	1500	76	2300	43	1800	55	1500	66

*FULL FIRING RATE IS WITH INCOMING GAS TEMPERATURES AT APPROXIMATELY 10°F. AT 70°F. GAS TEMPERATURE, HEATING CAPACITIES ARE DECREASED BY APPROXIMATELY 12%.

PRODUCT DESIGN

GAS CONNECTIONS

Local codes and the National Fuel Code ANSI Z223.1 (NFPA54) or Canadian Gas Association Manual B-149-1 Installation Code for Gas Appliances, would have been followed for installing the gas piping. All L.P. gas installations must conform to the safety standards of the National Board of Fire Underwriters (See NFPA Manual 58) or in Canada with Canadian Gas Association B-149-1.

The gas piping to the unit will have a manual service shut-off valve and a drip leg. A union of the ground joint or flange type will be installed between the manual shut-off valve and the unit redundant servo regulator gas valve.

This unit is manufactured for use with natural gas, but may be field converted for use with Propane. It also may have the firing rate reduced or increased.

Propane conversions or firing rate changes shall be made as follows:

With Electrical Power and Gas turned OFF:

1. Loosen screws (item 1) with 1/4" box or open end wrench.

2. Remove screw (item 2).

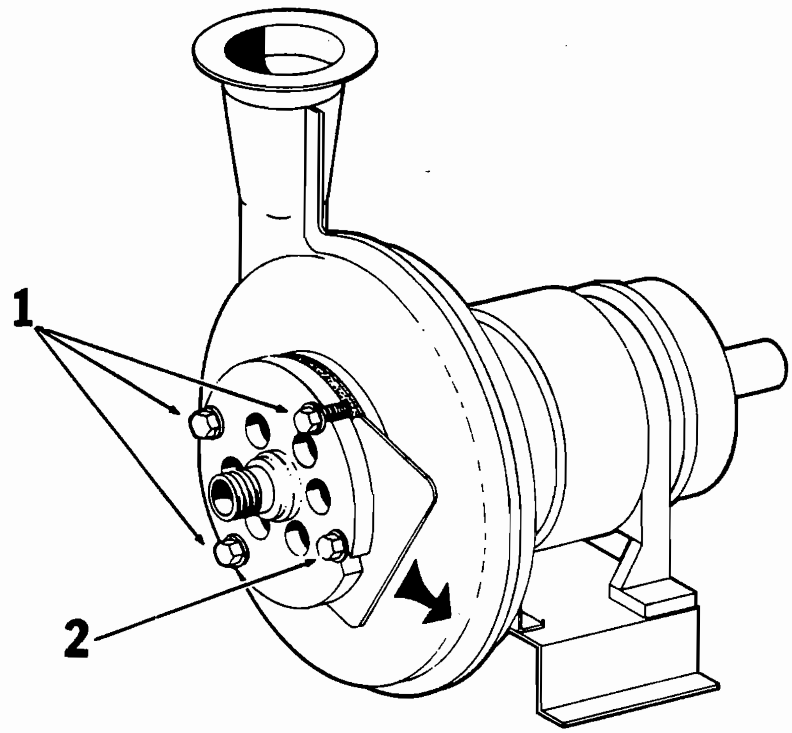
3. Pull gas/air orifice plate out.

(Continued)

GAS CONNECTIONS (Continued)

4. Install the new plate (propane or natural gas), with the stamping towards the gas valve. (All plates supplied with the unit are marked with the type gas and BTUH Input).

5. Replace screw (item 2) and tighten screws (item 1). All screws must be drawn up evenly.



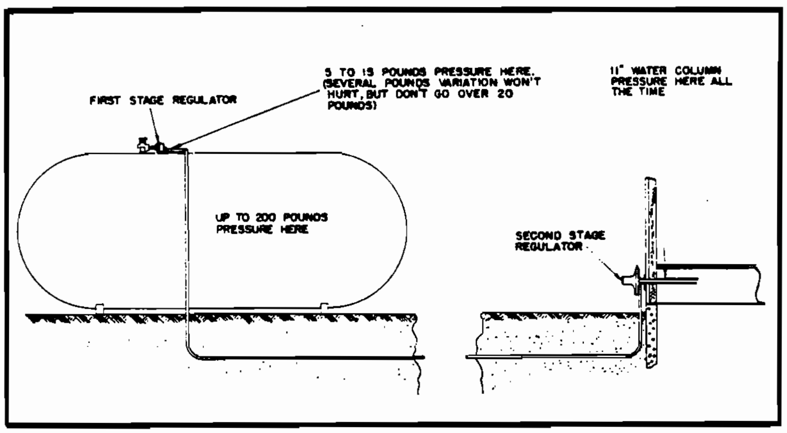
GAS/AIR INLET PLATE (GAS VALVE REMOVED)

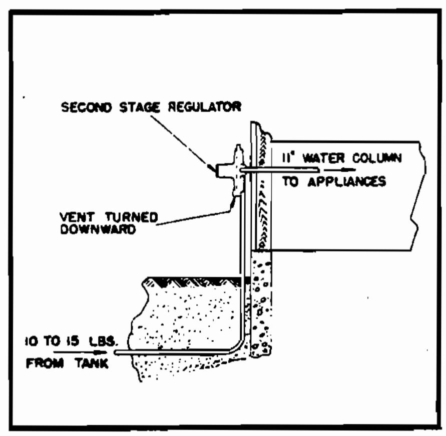
PROPANE TANK SIZING (MINIMUM)

MAXIMUM GAS NEEDED TO VAPORIZE*	TANK SIZE REQUIRED IF LOWEST OUTDOOR TEMPERATURE (AVERAGE FOR 24 HOURS) REACHES —						
	32°F.	20°F.	10°F.	0°F.	-10°F.	-20°F.	-30°F.
125,000 BTU/HR (50 CFH)	115 Gal.	115 Gal.	115 Gal.	250 Gal.	250 Gal.	400 Gal.	600 Gal.
250,000 BTU/HR (100 CFH)	250 Gal.	250 Gal.	250 Gal.	400 Gal.	500 Gal.	1000 Gal.	1500 Gal.
375,000 BTU/HR (150 CFH)	300 Gal.	400 Gal.	500 Gal.	500 Gal.	1000 Gal.	1500 Gal.	2500 Gal.
500,000 BTU/HR (200 CFH)	400 Gal.	500 Gal.	750 Gal.	1000 Gal.	1200 Gal.	2000 Gal.	3500 Gal.
750,000 BTU/HR (300 CFH)	750 Gal.	1000 Gal.	1500 Gal.	2000 Gal.	2500 Gal.	4000 Gal.	5000 Gal.

*AVERAGE RATE OF WITHDRAWAL IN 8 HOUR PERIOD

TYPICAL PROPANE PIPING





VAPOR PRESSURE, PSIG

OUTDOOR AMBIENT °F.	-30	-20	-10	0	10	20	30	40	50	60	70	80	90	100	110
100% Propane	6.8	11.5	17.5	20.5	34	42	53	65	78	93	110	128	150	177	204
70% Propane 30% Butane	—	4.7	9	15	20.5	28	36.5	46	56	68	82	96	114	134	158
50% Propane 50% Butane	—	—	3.5	7.6	12.3	17.8	24.5	32.4	41	50	61	74	88	104	122
70% Butane 30% Propane	—	—	—	2.3	5.9	10.2	15.4	21.5	28.5	36.5	45	54	66	79	93
100% Butane	—	—	—	—	—	—	—	3.1	6.9	11.5	17	23	30	38	47

Sizing Between First and Second Stage Regulator
Maximum Propane Capacities listed are based on 2 PSIG Pressure Drop at 10 PSIG Setting. Capacities in Cubic Feet of Gas per Hour.

PIPE OR TUBING LENGTH, FEET	TUBING SIZE, O.D., TYPE L					NOMINAL PIPE SIZE, SCHEDULE 40	
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"
10	292	680	1,280	2,120	3,320	1,280	3,000
20	200	440	880	1,480	2,320	880	1,680
30	160	368	800	1,160	1,880	720	1,600
40	148	340	680	1,080	1,640	640	1,480
50	132	308	600	960	1,480	600	1,360
60	120	280	520	880	1,320	520	1,240
80	104	244	480	760	1,160	480	1,040
100	88	216	400	680	1,040	400	920
125	80	196	360	560	920	360	840
150	76	172	332	520	840	332	760
175	68	160	312	480	760	308	680
200	64	152	292	440	720	288	600

To Convert To Capacities at 15 PSIG Settings - Multiply by 1.130
To Convert To Capacities at 5 PSIG Settings - Multiply by 0.879

Sizing Between Single or Second Stage Regulator and Appliance*
Maximum Propane Capacities Listed are Based on 1/2" W.C. Pressure Drop at 11" W.C. Setting. Capacities in Cubic Feet of Gas Per Hour.

TUBING LENGTH, FEET	TUBING SIZE, O.D. TYPE L						NOMINAL PIPE SIZE, SCHEDULE 40				
	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
10	15.6	36.8	79.6	131.6	200.4	374	110	226.8	428.4	882	1,322.8
20	10.4	24.8	52.4	86.4	138.4	252	75.6	157.2	292.8	598.4	919.6
30	8.4	20	42.8	72.4	110.8	200	60.8	126	236	484.8	743.2
40	7.6	16.4	36	58	93.2	170.8	51.6	106.8	201.6	415.6	623.6
50	7.2	14.8	31.6	52.4	79.2	150.4	45.6	94.8	179.2	365.2	566.8
60	6.4	14	28.8	48.4	74.8	136	41.2	86.8	163.6	333.6	510
80	5.2	11.6	24.8	41.6	62	115.6	35.6	74	138.4	289.6	434.4
100	4.4	10.4	22	36	55.2	102	31.2	64.8	122.8	252	390.4
125	4	9.6	19.2	32.4	48.8	89.6	27.6	58.4	110	226.8	346.4
150	3.6	8.4	17.2	28.8	43.6	80.8	25.2	52.8	100.8	204.4	314.8
200	3.2	7.6	15.6	26.4	40	74.8	21.6	44.8	83.6	175.6	266
250	3.2	6.8	14.4	24	37.2	68.8	19.2	40	74	156	236

*DATA IN ACCORDANCE WITH NFPA PAMPHLET NO. 54

PRESSURE EQUIVALENTS

1" Water Column ...... equals ...... .58 oz./sq. in.
11" Water Column ...... equals ...... 6.35 oz./sq. in.
11" Water Column ...... equals ...... .4 lb./sq. in.
1 Lb/sq. in. ...... equals ...... 27.71" Water Column
1 Lb/sq. in. ...... equals ...... 2.04" Mercury
1" Mercury ...... equals ...... .49 Lb./sq. in.
1 Std. Atmosphere ...... equals ...... 14.73 Lb./sq. in.

TABLE I

MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR FOR GAS PRESSURE OF 0.5 PSIG (APPROX. 13" W.C.) OR LESS AND A PRESSURE DROP OF 0.3 INCH WATER COLUMN (BASED ON 0.60 SPECIFIC GRAVITY GAS)

NATURAL GAS*

NOMINAL IRON PIPE SIZE, INCHES	LENGTH OF PIPE, FEET													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/4	32	22	18	15	14	12	11	11	10	9	8	8	7	6
3/8	72	49	40	34	30	27	25	23	22	21	18	17	15	14
1/2	132	92	73	63	56	50	46	43	40	38	34	31	28	26
3/4	278	190	152	130	115	105	96	90	84	79	72	64	59	55
1	520	350	285	245	215	195	180	170	160	150	130	120	110	100
1-1/4	1,050	730	590	500	440	400	370	350	320	305	275	250	225	210
1-1/2	1,600	1,100	890	760	670	610	560	530	490	460	410	380	350	320
2	3,050	2,100	1,650	1,450	1,270	1,150	1,050	990	930	870	780	710	650	610
2-1/2	4,800	3,300	2,700	2,300	2,000	1,850	1,700	1,600	1,500	1,400	1,250	1,130	1,050	980
3	8,500	5,900	4,700	4,100	3,600	3,250	3,000	2,800	2,600	2,500	2,200	2,000	1,850	1,700
4	17,500	12,000	9,700	8,300	7,400	6,800	6,200	5,800	5,400	5,100	4,500	4,100	3,800	3,550

TABLE II

MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR FOR GAS PRESSURE OF 0.5 PSIG (APPROX. 13" W.C.) OR LESS AND A PRESSURE DROP OF 0.5 INCH WATER COLUMN (BASED ON 0.60 SPECIFIC GRAVITY GAS)

NATURAL GAS*

NOMINAL IRON PIPE SIZE, INCHES	LENGTH OF PIPE, FEET													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/4	43	29	24	20	18	16	15	14	13	12	11	10	9	8
3/8	95	65	52	45	40	35	33	31	29	27	24	22	20	19
1/2	175	120	97	82	73	66	61	57	53	50	44	40	37	35
3/4	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1-1/4	1,400	950	770	660	580	530	490	460	430	400	360	325	300	280
1-1/2	2,100	1,460	1,180	990	900	810	750	690	650	620	550	500	460	430
2	3,950	2,750	2,200	1,900	1,680	1,520	1,400	1,300	1,220	1,150	1,020	950	850	800
2-1/2	6,300	4,350	3,520	3,000	2,650	2,400	2,250	2,050	1,950	1,850	1,650	1,500	1,370	1,280
3	11,000	7,700	6,250	5,300	4,750	4,300	3,900	3,700	3,450	3,250	2,950	2,650	2,450	2,280
4	23,000	15,800	12,800	10,900	9,700	8,800	8,100	7,500	7,200	6,700	6,000	5,500	5,000	4,600

*FOR PROPANE, MULTIPLY THE VALUES SHOWN IN TABLES I AND II BY 0.63. EXAMPLE: A 1/2" PIPE, 30 FEET LONG WILL CARRY 73 CFH OF NATURAL GAS OR 46 CFH OF PROPANE IN TABLE I OR 97 AND 61 IN TABLE II.

SPECIFIC GRAVITY FACTOR FOR TABLE I AND II

SPECIFIC GRAVITY	MULTIPLIER	SPECIFIC GRAVITY	MULTIPLIER
.50	1.10	1.00	.78
.55	1.04	1.10	.74
.60	1.00	1.20	.71
.65	.96	1.30	.68
.70	.93	1.40	.66
.75	.90	1.50	.63
.80	.87	1.60	.61
.85	.84	1.70	.59
.90	.82	1.80	.58
		1.90	.56
		2.00	.55
		2.10	.54

REMOTE HTM

The Remote HTM is for outdoor application only. The unit should be mounted on a concrete slab with a minimum clearance of 36" to the front, 6" on the sides and 12" to the rear for servicing.

Gutters or deflectors must have been installed on the roof to prevent water from shedding on the unit.

The location of the outdoor unit should have been picked to provide the most direct piping to the indoor air handler and the optional water heater if used.

The indoor air handler and water heater must not be located more than 15 feet vertically above the outer unit.

The solution pump (circulator) will deliver 10 GPM of solution against a 31 foot of water head.

PRESSURE DROP (FOOT OF HEAD) @ 10 GPM

Indoor Unit -------------	8.0
Hot Water Tank ----------	13.5
Diverter Valve (Flair) ---	6.5
Restrictor Pipe ----------	16.5

SOLUTION VOLUME

Hot Water Tank ----------	.56 Gals.
Indoor Unit -------------	.86 Gals.
Remote HTM --------------	1.80 Gals.
Expansion Tank ----------	.75 Gals.

SOLUTION VOLUME (GAL./LIN. FT. TYPE L COPPER)

3/4" Nominal -----------	.0251
1" Nominal -----------	.0429
1-1/4" Nominal -----------	.0653

Therefore the maximum effective foot of run (counting the supply and return) using type L copper tubing must be calculated. Effective footage is figured by adding the actual lineal length of piping to the equivalent lengths of all elbows, couplings, tee's, valves and etc. used in the run.

This effective footage is then converted to pressure drop at a flow rate of 10 GPM.

The tubing pressure drop is then added to the equipment pressure drop for a total resistance to flow.

In any instance, however, the maximum vertical lift must not exceed 15 lineal feet.

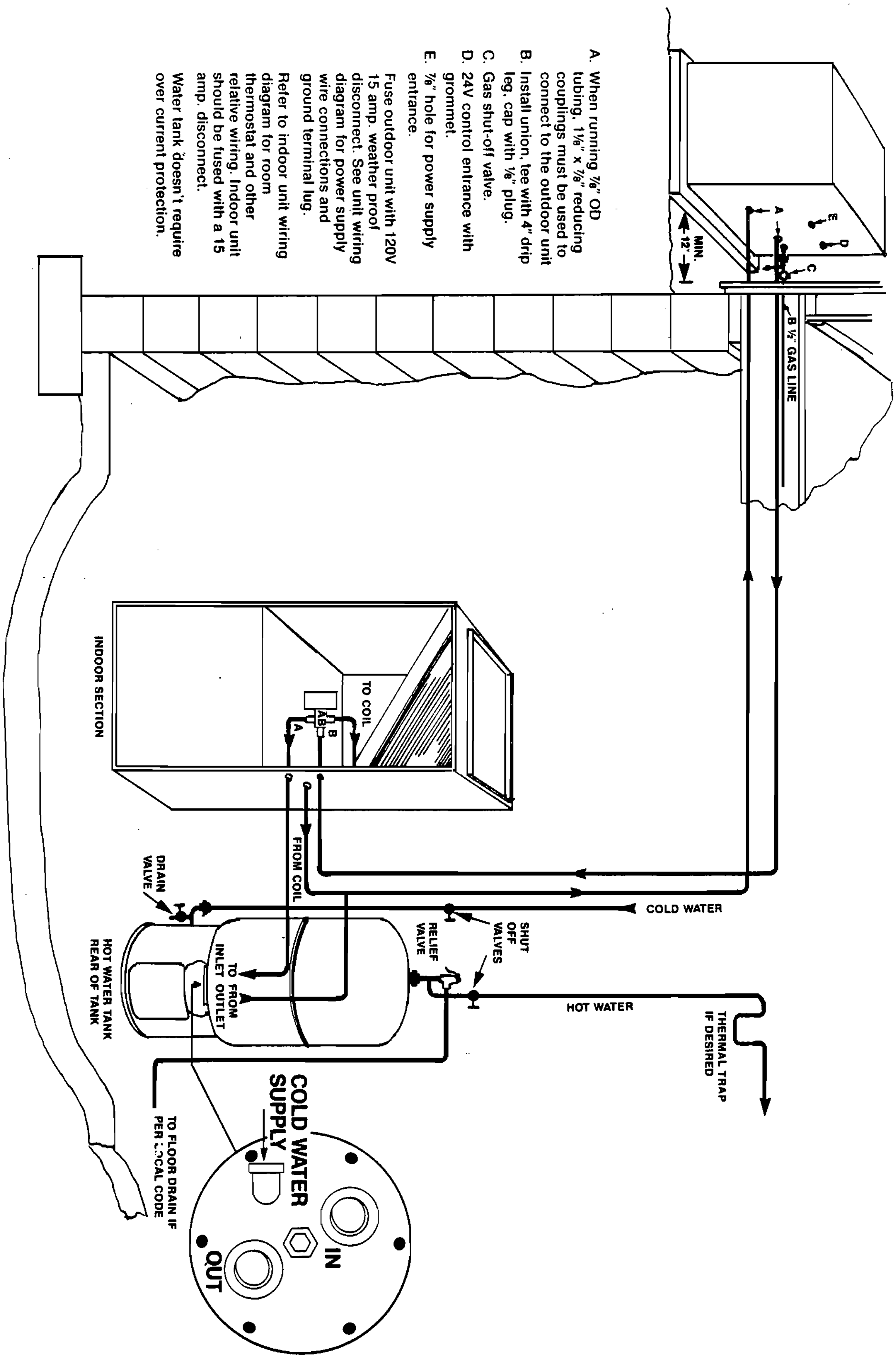
A minimum of 9 GPM of solution must be circulated in order to provide proper heat transfer with a maximum not to exceed 13.7 GPM.

INDOOR UNIT AND OPTIONAL HOT WATER TANK

The indoor unit may have been installed as an upflow, counterflow or horizontal air handler.

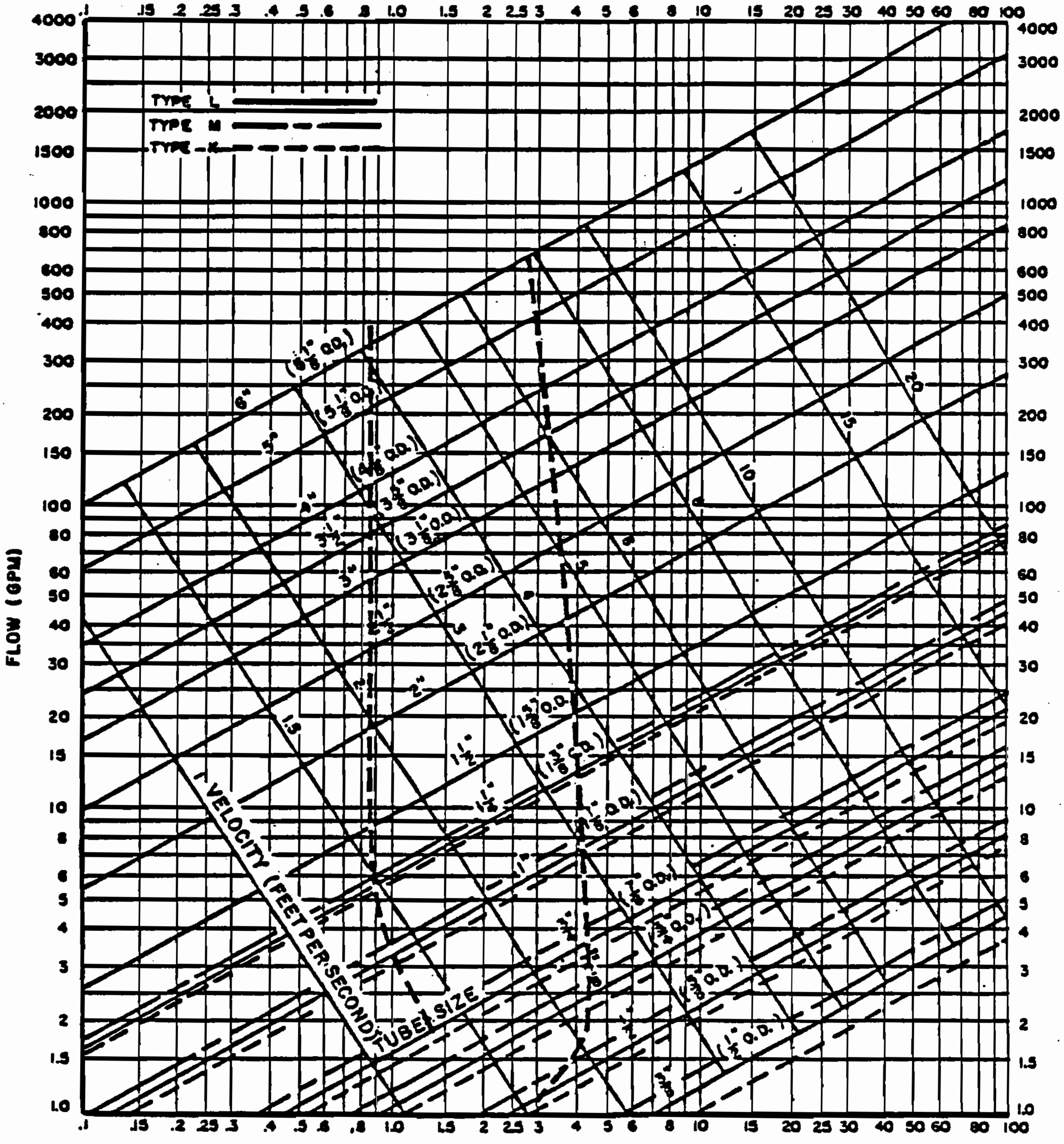
If the optional hot water tank was not used then the restrictor pipe supplied with the air handler must have been installed between the inlet of the coil and field solution piping. This restrictor tube compensates for the two way valve which is used with the hot water tank.

If the hot water tank is used, then the restrictor tube was discarded and the two way valve installed with the solution flow from the remote HTM entering valve line marked AB. Valve line B is connected to the inlet of the hot water coil in the air handler and valve line A is connected to the inlet of the hot water tank.


A. When running 7/8" OD tubing, 1 1/8" x 7/8" reducing couplings must be used to connect to the outdoor unit
B. Install union, tee with 4" drip leg, cap with 1/8" plug.
C. Gas shut-off valve.
D. 24V control entrance with grommet.
E. 7/8" hole for power supply entrance.
Fuse outdoor unit with 120V 15 amp. weather proof disconnect. See unit wiring diagram for power supply wire connections and ground terminal lug.
Refer to indoor unit wiring diagram for room thermostat and other relative wiring. Indoor unit should be fused with a 15 amp. disconnect.
Water tank doesn't require over current protection.
MIN. 12"
B 1/2" GAS LINE
INDOOR SECTION
TO COIL
FROM COIL
COLD WATER
SHUT OFF VALVES
RELIEF VALVE
DRAIN VALVE
HOT WATER
THERMAL TRAP IF DESIRED
TO INLET
FROM OUTLET
HOT WATER TANK REAR OF TANK
COLD WATER SUPPLY
IN
OUT
TO FLOOR DRAIN IF PER LOCAL CODE

FRICTION LOSS IN COPPER TUBING

CLOSED AND OPEN SYSTEMS



FRICTION LOSS (FEET OF WATER PER 100 FT.)

DASHED VERTICAL LINES SUGGEST APPROXIMATE AREA OF SELECTION FOR AIR PURGE VELOCITIES AND QUIET FLOW.

BASED ON 60°F. WATER - REQUIRES NO CORRECTION FOR TEMPERATURE BETWEEN 40°F. AND 240°F.

COPPER SWEAT FITTINGS - EQUIVALENT LENGTH, FEET

FOR COPPER TUBING TYPES K, L AND M

TYPE FITTING	3/4" NOMINAL (7.8" O.D.)	1" NOMINAL (1-1/8" O.D.)	1-1/4" NOMINAL (1-3/8" O.D.)
90° Elbow, Wrought Or Cast Long Radius	1.1	1.4	1.9
90° Elbow, Wrought Or Cast Short Radius	2.1	2.7	3.7
45° Elbow, Wrought Or Cast	1.5	1.9	2.6
Coupling	1.0	1.1	1.5
Tee - Straight Run	1.9	2.5	3.3
Tee - Side Branch	4.2	5.2	7.4
Gate Valve - Open	1.5	1.9	2.6
Globe Valve - Open	35.7	46.0	62.8

HEATING CYCLE

The heating cycle is accomplished by using an extremely efficient compact boiler utilizing a unique method of heat exchange. The heat exchanger (Heat Transfer Module) consists of multiple tubes (24 passages tubes arranged so that six passes are made through the module) imbedded in nickel plated steel fins, which is oven brazed. The products of combustion flow through this fin construction.

The gas burner (which will burn either natural or propane gas) consists of a stainless steel cylindrical screen with multiple holes in it. The gas-air mixture burns on the outside of the screen with very minute flames.

A motor operated combustion blower (combination blower-circulator motor) is used to create a negative pressure (below atmospheric) at the electrically operated gas valve to provide gas supply from the valve through a pre-determined gas orifice into the mixing chamber. Primary combustion air is is then also passed through matching pre-determined air orifices, to be mixed with the gas supply by the combustion blower paddle wheel. This gas-air mixture is then discharged into the stainless steel gas burner. The maximum capacity the module can hold is approximately 0.11 cubic feet of a combustible mixture before it is discharged to the atmosphere.

The gas-air mixture is then ignited for combustion by the use of a specially designed ceramic glow ignitor, (this durable silicon carbide tip ignitor heats to approximately 2900 degrees Fahrenheit), which is powered electrically by the ignition control.

The ignitor also serves as a safety sensor (flame rectification) checking for proof of flame every half of an electrical cycle (3600 times a minute).

(Continued)

HEATING CYCLE (Continued)

The flue products of combustion are then power vented to the atmosphere through the flue outlet and vent cap at the top of the outdoor unit.

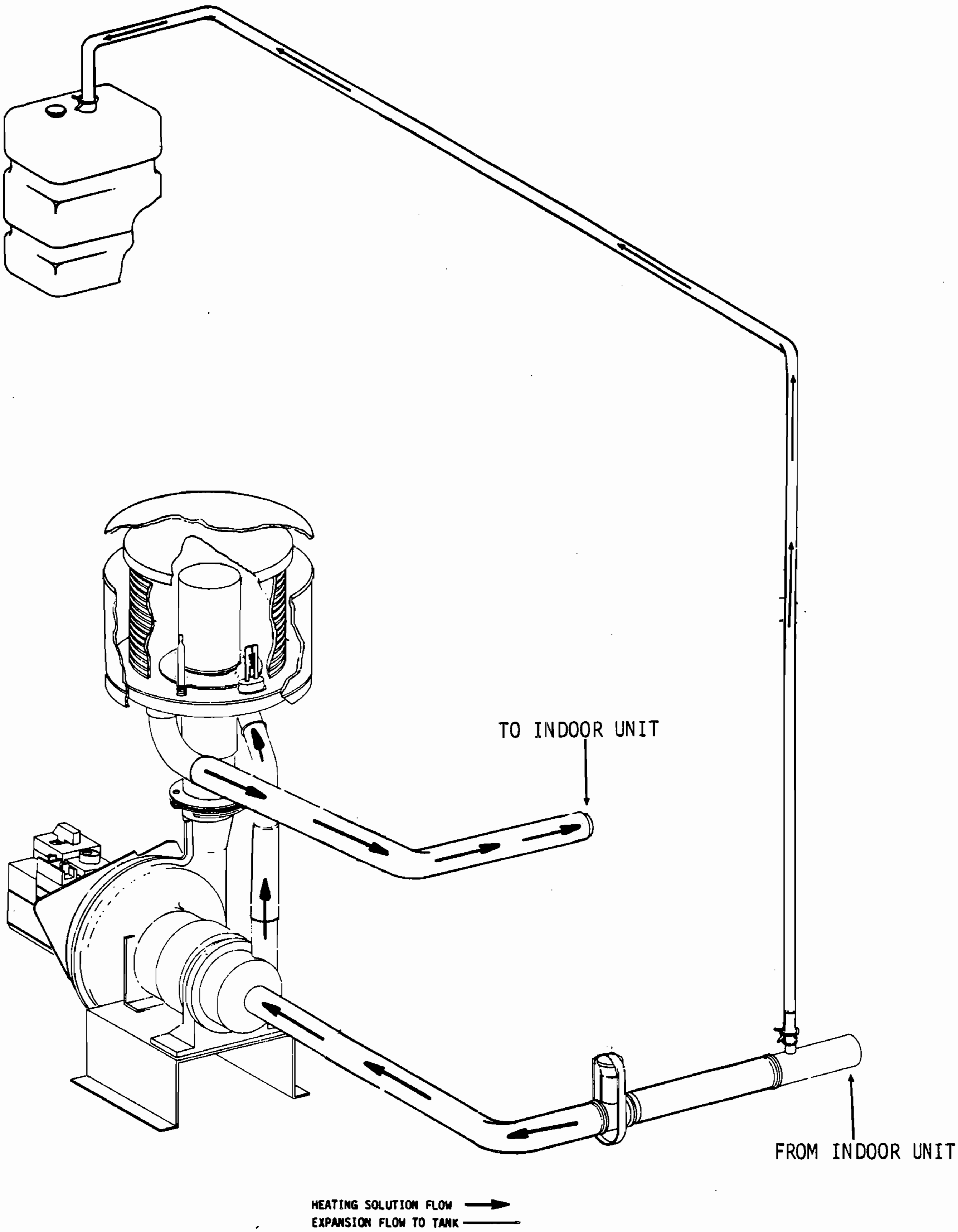
The heating solution, consisting of a 50% mixture of ethylene glycol and distilled water, is circulated by the use of a small motor driven centrifugal pump at a high velocity that will give turbulent flow in the boiler tubes for a high rate of heat transfer.

The solution circulates through the boiler where it is heated and then delivered to the indoor coil (for heating of the structure) or to the hot water tank (for heating of domestic hot water). It will only flow through one or the other at any given time.

Indoor circulated air is passed over the indoor heating coil by the indoor blower motor, to remove the heat and discharge it into the conditioned space.

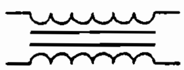
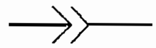
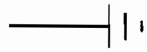
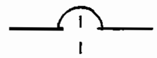
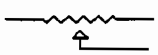
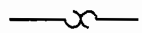
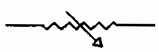
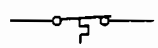
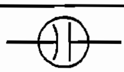
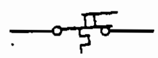
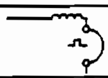
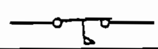
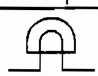
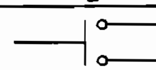
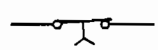
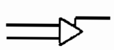
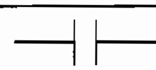
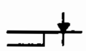
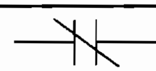
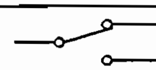
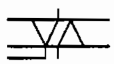
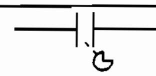
The cooled heating solution is then returned back to the inlet of the solution pump, ready to repeat the cycle. The heating solution is circulated at approximately 10 gallons per minute.

The system operates at essentially atmospheric pressure. Since the solution expands when heated and contracts when cooled, an expansion tank is provided that is open to the atmosphere using a split rubber grommet to control the evaporation rate. This also provides a point where any air that is in the system escapes during the heating up period. Between cycles, as the solution cools, it is siphoned out of the expansion tank back into the system.

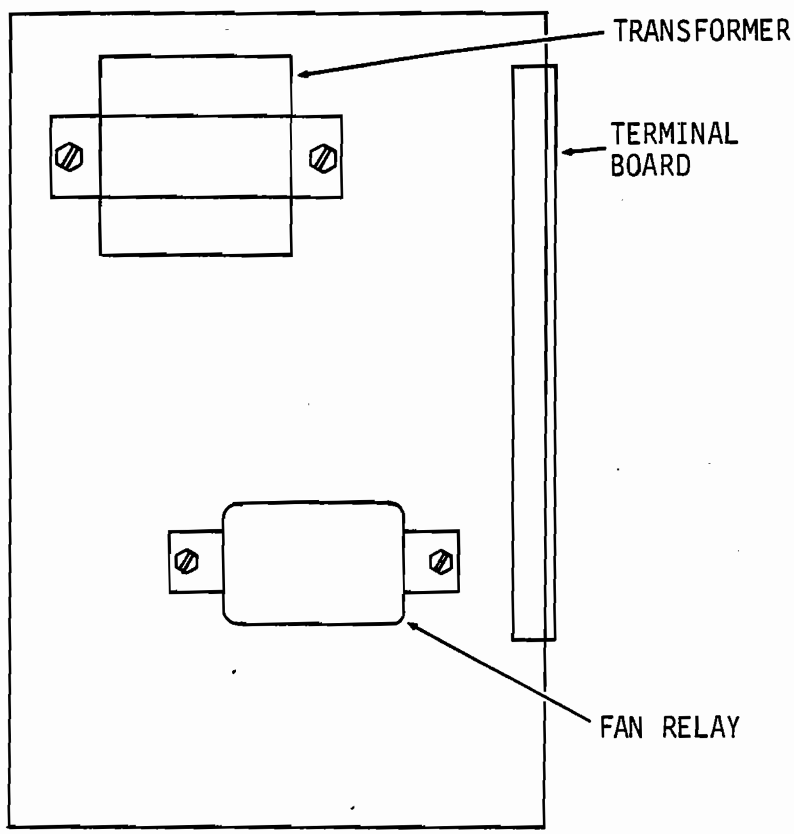


SCHEMATIC HEATING SYSTEM

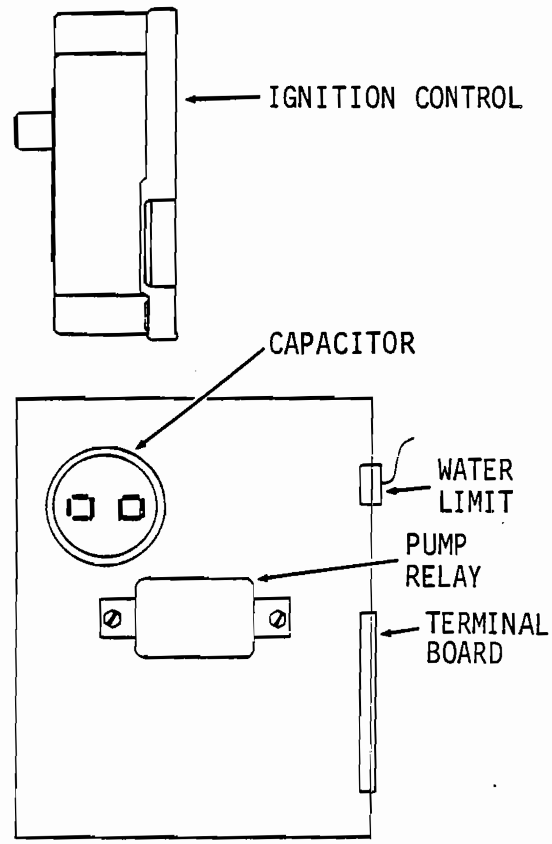
ELECTRICAL SYMBOL IDENTIFICATION

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	TRANSFORMER		CONNECTOR
			TIE CONNECTION
	RELAY HOLING COIL (FAST ACTION)		GROUND CONNECTION
	RELAY HOLDING COIL (TIME DELAY)		FUSE, FUSESTAT
	FIXED RESISTANCE (HEATERS, ANTICIPATORS, ETC.)		CIRCUIT BREAKER
	ADJUSTABLE RESISTANCE (ANTICIPATORS, POTENTIOMETER, ETC.)		OVERLOAD
	PTC RESISTANCE (POSITIVE TEMP COEFFICENT-RESISTANCE CHANGE AS TEMP. CHANGES]		FUSE LINK
	MOTOR WINDINGS		NC PRESSURE SWITCH (AUTO RESET)
	SOLENOID COIL, GAS VALVE COIL, ETC.		NC TEMPERATURE SWITCH (AUTO RESET)
	CAPACITOR		NC TEMPERATURE SWITCH (MANUAL RESET)
	OVERLOAD, CURRENT-TEMP, OPERATED-AUTO RESET		NC SAIL SWITCH (AUTO RESET)
	INDICATING LAMP		NO PUSH BUTTON SWITCH
	DIODE		NC TIME DELAY SWITCH- (BREAK ON POWER INTERUPTION)
	AMPLIFIER		NO CONTACTS SPST
	SILICON CONTROLLED RECTIFIER		NC CONTACTS SPST
	TRANSISTOR		SPDT CONTACTS 1-NC, 1-NO
	TRIAC		NO CONTACTS (MECHANICAL OPERATED)

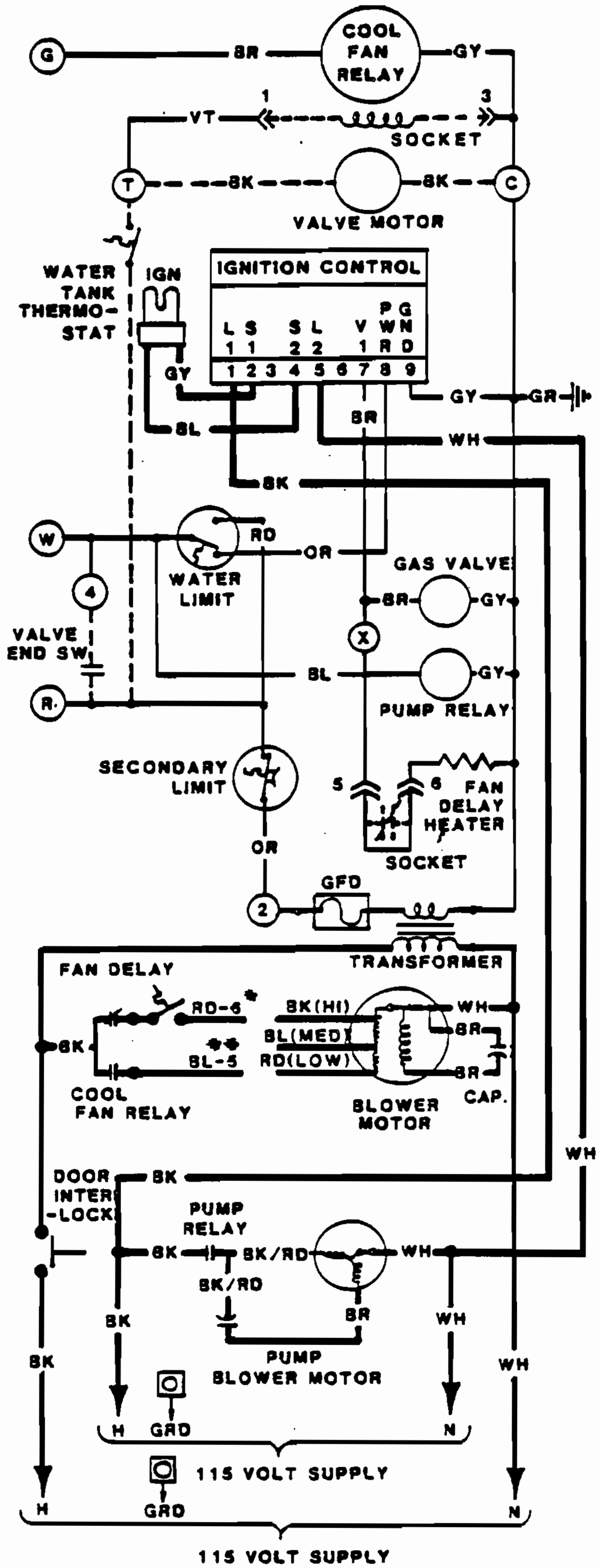
SYSTEM OPERATION



EBWC6015M-A CONTROL PANEL (INDOOR)



ERGW0015-1A CONTROL PANEL (OUTDOOR)



SCHEMATIC FOR ERGW0015-1A, EBWC6015M-A AND EGWH0040C-A, C- B

SYSTEM OPERATION

HEATING CYCLE

With a standard heating only thermostat connected on low voltage terminals R and W of the indoor unit section, on a call for heat from the thermostat, low voltage contact (24 V.) is made from R to W and the transformer circuit is completed to the pump relay (PR) and ignition control.

A current now flows through the holding coil of the pump relay (PR) which energizes the control causing the normal open set of contacts to close. This completes the line voltage (115 V.) circuit to the combination pump-blower motor. The operation of the pump-blower motor begins to circulate the heating solution throughout the closed circuit piping and also creates a negative pressure at the outlet of the gas valve.

At the same time when the ignition control was energized it completes the line voltage circuit (115 V.) to the ceramic glow ignitor through terminals S_1 and S_2 of the ignition control.

The ignition control being both electronic and electromechanical will start a nominal 45 second pre-heat time to raise the temperature of the ignitor to approximately 2900°F. At the end of the pre-heat time, the ignition control will complete the electrical low voltage (24 V.) circuit to the gas valve through PWR and V_1 terminals.

The ceramic ignitor is still energized as well as the gas valve being energized. Since the pump-blower motor has been running, the negative pressure created at the gas valve outlet, will control the gas valve pressure regulator which will now begin to let gas flow into the mixing chamber. Air for combustion is also flowing into the mixing chamber and this gas-air mixture is fed up into the gas burner.

We now have a nominal 15 second period for ignition. Approximately two seconds before this period runs out, the ignition control breaks the voltage circuit to the ignitor and switches to accept the flame rectifica signal. If the micro-amp si there (approximately 35 microamp combustion will continue, if not, the ignition control goes into lock-out breaking the gas valve electrical circuit.

Now that combustion has been established, the heating solution is being heated and circulated by the solution pump.

At the same time the gas valve was energized, we energize the holding coil of the Fan Delay (Time Delay) Relay. In a pre-determined time the normally open contacts of the Fan Delay Relay will close completing the electrical circuit (115 V.) to the indoor blower motor. The motor will turn on, circulating indoor air across the hot water coil, removing the heat from the heated solution.

When the thermostat is satisfied, it opens its contacts, breaking the electrical circuit to the ignition control and pump relay (PR).

The ignition control de-energizes the gas valve circuit, stopping gas flow, and the opening of the pump relay (PR) contacts stop the solution flow and negative pressure at the gas valve outlet.

The indoor blower motor will continue to run until the fan delay relay pre-determined time causes it to open its contacts and stopping the motor.

When both heating and the domestic hot water tank is used, the temperature of the water within the hot water tank will override the control of the indoor thermostat.

The water tank thermostat is wired in series with the diverter valve motor between terminals R and C (24 V. circuit).

(Continued)

HEATING CYCLE (Continued)

If the unit should be running in the structure heating mode, and a demand for additional domestic hot water was required, the hot water tank thermostat would close. This would complete the 24 V. circuit to the diverter valve motor, causing it to change position diverting the flow of heating solution from the indoor coil to the hot water tank.

This will take approximately 15 seconds at which time the motor end switch (normally open) will close overriding the indoor thermostat.

Once the domestic water temperature has been increased and the water tank thermostat is satisfied, the motor will return to its original position, and if structure heating is still required the units will continue to operate.

SAFETY COMPONENTS

Even though the entire circuit is protected by main line fuses, each component must have its own protection.

PUMP, BLOWER MOTOR OVERLOADS (INTERNAL)

Each motor is equipped with an internal overload. The line break internal overload senses both motor amperage and winding temperature. High motor temperature or amperage heats the disc causing it to open, breaking the circuit within the motor. As the temperature within the motor is dissipated the self-resetting overload will remake.

WATER LIMIT CONTROL

The water limit control feeler bulb is immersed in one of the Heat Transfer Module (HTM) solution tubes. If the heating solution should become overheated due to dirty air filters, indoor blower motor failure, partial loss of solution, reduction of pumping rate or any other such reason, the control will open its contacts at approximately 226°F.

This will open the power leg to the ignition control which in turn will de-energize the gas valve and its normally open contacts will close keeping the pump relay (PR) energized which will keep the pump-blower motor running.

The limit will remain open until the solution temperature is lowered approximately 40 degrees.

SECONDARY LIMIT (WRAPPER)

The secondary limit control is designed to sense the module manifold temperature and is set to open its contacts at approximately 220°F. This is a manual reset control and is wired in series with the power (R) side of the transformer. Opening of its contacts will shut down the unit in all modes of operation. Determine the cause of failure before resetting the limit control. A loss of heating solution in the system is the most usual reason for this control to function.

GLOW IGNITOR

The glow ignitor is not only used to provide heat for combustion, but is also used to prove combustion. The ignition control powers the glow ignitor, when the burner flame is established, an electrical circuit is completed through the glow ignitor through the flame to ground.

This operates on the flame rectification principle with the burner and module serving as the ground area. The glow ignitor being immersed in the burner flame and when flame is present, passes a direct current (rectified AC) signal to the ignition control. This current flow (micro-amps) maintains the safety lockout timer in the reset or normal operating condition.

If combustion is not established or the electrical circuit is not completed, for some reason, the system will go into a safety lockout.

OPERATING COMPONENTS

CAPACITOR

A run capacitor is wired across the start and main windings of a single phase permanent split capacitor motor. The capacitors primary function is to reduce the line current while greatly improving the torque characteristics of a motor. This is accomplished by using the 90° phase relationship between the capacitor current and voltage in conjunction with the motor windings so that the motor will give two phase operation when connected to a single phase circuit. The capacitor also reduces the line current to the motor by improving the power factor of the load.

RELAYS

The relay magnetic holding coils are wired into the low voltage circuit. When the control circuit is energized, the coil pulls in the contacts. When the magnetic coil is de-energized, springs open the contacts.

VALVE MOTOR

The diverter valve motor when energized drives a lever operated ball to change the flow of circulating heating solution from the indoor heating coil to the coil of the domestic hot water tank. It takes approximately 15 seconds for this switching mode and at the end of the stroke it engages a normally open end switch, closing its contacts.

When the valve motor is de-energized, the switching lever is returned to its original position by a spring also opening the end switch contacts.

IGNITION CONTROL

The ignition control provides the electrical circuit to power the glow ignitor for heat to provide combustion, operate the gas valve, monitor combustion and safety circuit lockout.

The control is a combination electronic and electromechanical device.

If a safety lockout should occur, it is necessary to de-energize the control for approximately 1 minute.

This may be done at the thermostat by turning the selector switch from the "HEAT" to "OFF" position or lowering the temperature set point below the room temperature.

If a domestic hot water tank is used in conjunction with the indoor heating unit, then it is advisable to de-energize the main electrical circuit to the indoor unit since the water tank thermostat can override the room thermostat. If air conditioning should also be installed, and at the time of a lock out if the air conditioner was in operation, you should wait at least 3 minutes before reclosing the main electrical circuit.

Since the ignition control is an electronic module, which is not repairable, it must be replaced if any function does not perform properly.

A 115 V. power source is applied directly to terminals L_1 and L_2 of the control.

A 24 V. power source is applied to GND (direct) and PWR through the normally closed contacts of the water limit control in series with the normally open thermostat contacts and paralleled normally open valve end switch.

On either a call for heat for the structure or hot water tank, the 24 V. circuit is completed.

This electromechanically permits the completion of the 115 V. power source to the glow ignitor through terminals S_1 and S_2. We have an approximate 45 second pre-heat time to bring the glow ignitor up to approximately 2900°F.

At this point the gas valve is energized with 24 V. through terminal V_1 and our ignition safety time commences for 15 seconds while the glow ignitor is still energized.

(Continued)

IGNITION CONTROL (Continued)

Within the last 2 seconds of the safety time, the 115 V. power source to the glow ignitor is switched off and the flame rectification circuit to the glow ignitor is completed. If combustion has occurred this electrical circuit is completed (approx. 30-35 micro-amps) and the unit is allowed to continue combustion.

If the micro-amp circuit is not completed for any reason, the control goes into lockout de-energizing the gas valve circuit as well as the glow ignitor circuit.

If there has been an unsafe failure in electronic components, either the unit will not start or will lock out on initial trial.

GAS VALVE

The gas valve is a redundant servo valve-regulator type and listed for operation from -40°F. to +150°F.

Redundant means that there are two operators within the valve and they both must function to permit gas flow.

The valve regulates at a negative outlet pressure of minus (-) .2" of water column +.15" -.20".

This means that the combustion blower must be operating and imposing a negative (suction) pressure on the gas valve outlet for it to open and permit the flow of gas.

Thus the system is fail safe should any malfunction or component failure occur.

The valve will regulate at the above pressures with an inlet pressure range of 2 to 25 inches of water column over the range of flow and ambient conditions.

From the time the valve is energized with the combustion blower operating, it takes approximately 4 seconds before gas can flow from the valve.

Following are typical schematic cut away views of the negative regulated pressure gas valve. The views shown may vary somewhat from the actual valve but functions are the same.

The valve operation is as follows:

1. Note the additional spring beneath the regulator diaphragm to accomplish negative regulation.

2. If the off cycle (operator coils de-energized), the first main valve is closed and the port from the second operator section is open to the gas outlet, relieving any working pressure under the main diaphragm. This keeps the valve in a closed position.

3. With the operators energized, the first valve opens and the second operator closes the port to the gas outlet and the supply port is open. This supplies pressure against the regulator diaphragm, which will allow a slight bleed to the gas outlet, which is sufficient to keep working gas pressure from building up under the main diaphragm.

4. When a negative pressure is applied (combustion blower running) to the outlet of the gas valve, this pressure reduction will draw down on the regulator diaphragm through the bleed passage, which will restrict the regulator bleed and allow working pressure to build up under the main diaphragm.

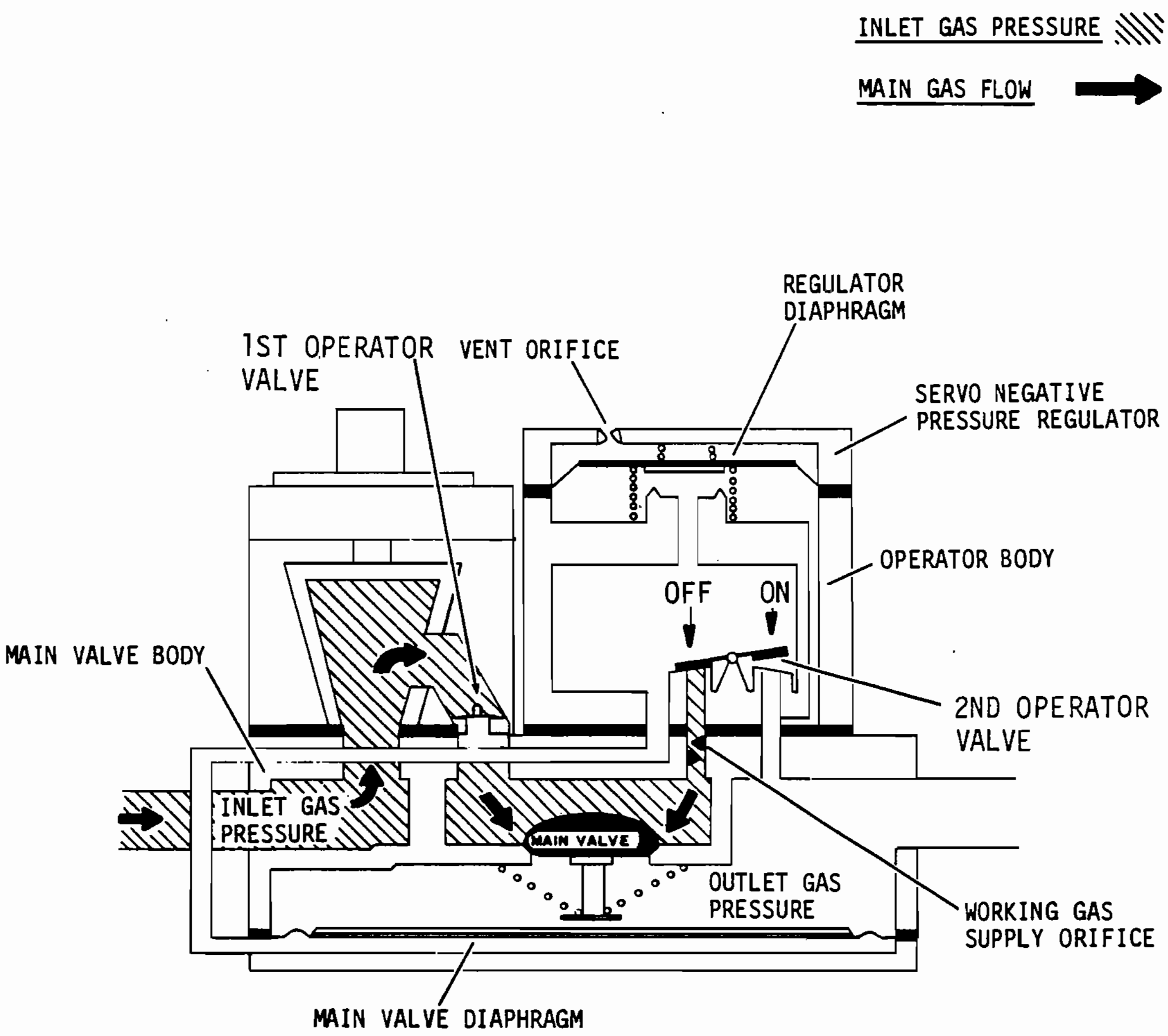
5. The main valve seat will now lift and allow gas to flow through the gas valve.

6. Should the negative pressure on the valve outlet decrease, the regulator diaphragm will relax, allowing working gas pressure to bleed through the bleed passages in the regulator and reduce the working pressure under the main diaphragm. This will result in less gas flow.

GAS VALVE (Continued)

7. In the case of combustion blower failure where there is now no negative pressure but the operators are still energized, there would be no gas flow as in paragraph number 3.

8. In the case where the operators are not energized or inoperative, but the combustion blower is running to create the negative pressure, there still would be no gas flow, since both operators must be open as well as negative pressure before gas can flow.

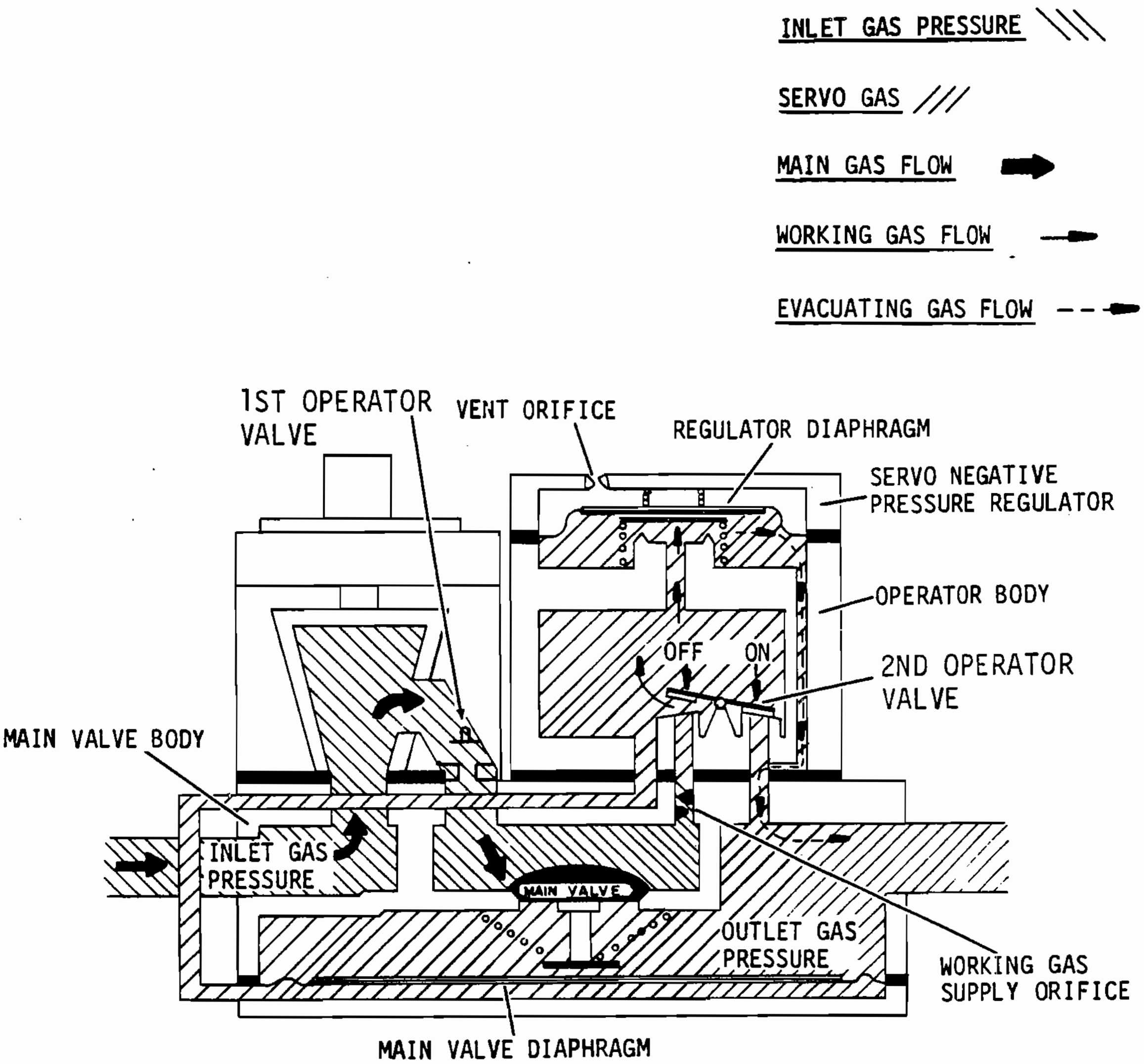


SCHEMATIC OF V800 NEGATIVE PRESSURE REGULATOR C.G.C.

OPERATORS DE-ENERGIZED (REFERENCE PARAGRAPH 2)

NEGATIVE REGULATED GAS VALVE

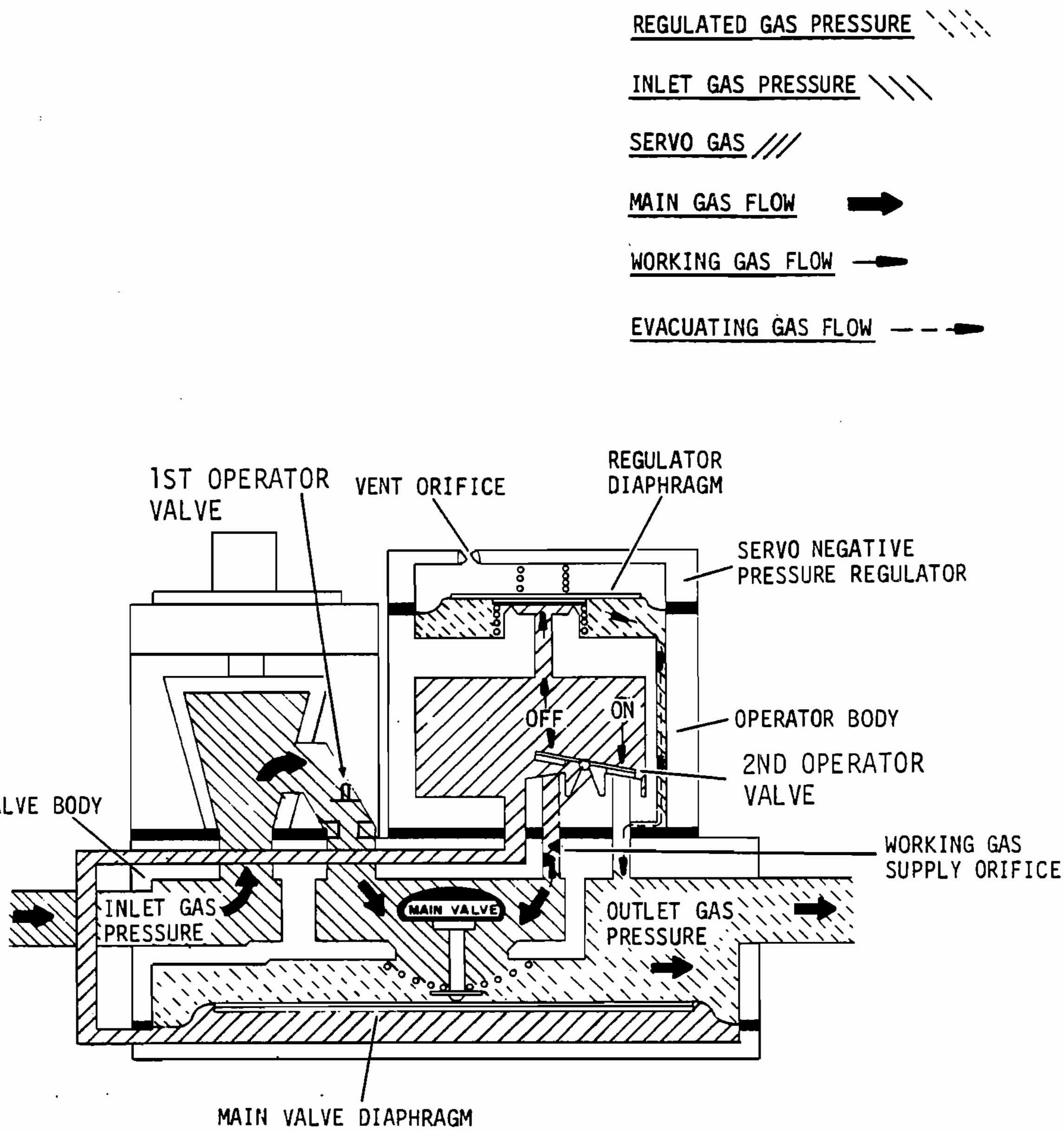
GAS VALVE (Continued)



SCHEMATIC OF V800 NEGATIVE PRESSURE REGULATOR C.G.C.

OPERATORS ENERGIZED - (REFERENCE PARAGRAPH 3 AND 7)

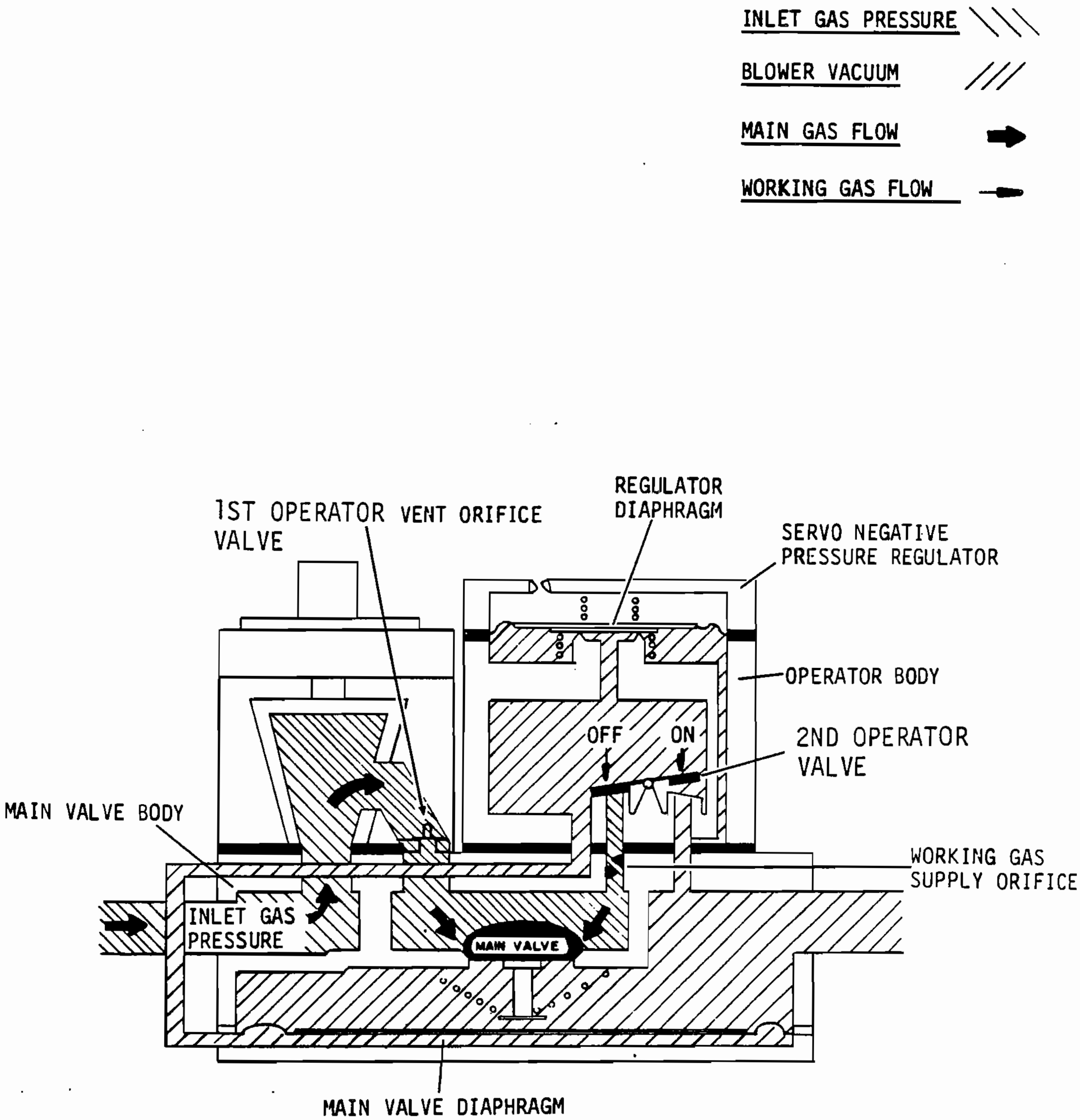
GAS VALVE (Continued)



SCHEMATIC OF V800 NEGATIVE PRESSURE REGULATOR C.G.C.

OPERATORS ENERGIZED - BLOWER RUNNING (REFERENCE PARAGRAPH 4, 5 AND 6)

GAS VALVE (Continued)



SCHEMATIC OF V800 NEGATIVE PRESSURE REGULATOR C.G.C.

OPERATORS CLOSED - BLOWER RUNNING (REFERENCE PARAGRAPH 8)

The Owner should be made aware of the fact that, as with any mechanical equipment, the Remote HTM Units require regularly scheduled maintenance to preserve high performance standards, prolong the service life of the equipment and lessen the chance of costly failure.

In many instances the Owner may be able to perform some of the maintenance, however the advantage of a service contract, which places all maintenance in the hands of a trained serviceman should be pointed out to the Owner.

ONCE A MONTH

1. Inspect the air filter(s) and clean or change if necessary.

   NOTE: Depending on operating conditions, it may be necessary to clean the filters more often. If permanent type filters are used, they should be washed with warm water, dried and sprayed with an adhesive according to the manufacturer's recommendations.

ONCE A YEAR

1. Lightly lubricate both bearings of the indoor blower motor. Use an SAE non-detergent 20 weight motor oil.

2. Inspect the control panel wiring and all other component wiring to be sure all connections are tight. Inspect wire insulation to be certain that it is good.

3. Observe the heating solution level in the expansion tank, when the unit is cold. It should be between one half and three quarters full.

   If necessary to add solution use a 50% mixture of ethylene glycol (automotive anti-freeze) and distilled water (DO NOT use an anti-freeze that contains anti-leak ingredients).

4. Check (or tighten) all hoses, clamps on heating system and inspect sweat joints.

5. Start the system and run a "HEATING" Performance Test. If the results of the test are not satisfactory, see the "Service Problem Analysis" chart for the possible cause.

TEST EQUIPMENT

Proper test equipment for accurate diagnosis is as essential as regular hand tools.

The following is a must for every service technician and service shop:

1. Thermocouple type temperature meter - measure dry bulb temperatures.
2. Amprobe - measure amperage and voltage.
3. Volt-Ohm Meter - Testing continuity, capacitor, voltage.
4. Inclined manometer - measure static pressure. (Duct work - gas valve) preferrably 3" W.C. size.
5. Water manometer or gauge - measure gas line inlet pressure.
6. Hydrometer - testing heating solution.

Other recording type instruments can be essential in solving abnormal problems, however; in many instances they may be rented from local sources.

Proper equipment promotes faster, more efficient service and accurate repairs with less call backs.

HEATING PERFORMANCE TEST

Before attempting to diagnose an operating fault, run the heating performance test and apply the results to the Service Problem Analysis Guide.

To conduct a heating performance test, the BTU input to the burner must be calculated.

After the heating cycle has been in operation for at least 15 minutes, and with all other gas appliances turned off, the gas meter should be clocked.

NOTE: The gas input will vary with the temperature of the gas. Rated input will be at approximately 10°F. With warmer ambient and gas temperatures, the input will be decreased. For example, at 70°F. the input will decrease approximately 12%. To find the BTU input, multiply the number of cubic feet of gas consumed per hour by the heating value of the gas being used.

EXAMPLE: It is found by the gas meter that it takes 25 seconds for the hand on the one cubic foot dial to make one complete revolution with all appliances off, except the Remote HTM. Take this information and locate it on the gas rate chart. Observe the 25 seconds, locate and read across to the one cubic foot dial column. There we find the number 144, which means that 144 cubic feet of gas will be consumed in an hour.

To find the actual input to the unit, we multiply the heating value of the gas, which is obtained from the local gas company, by the cubic feet of gas being used.

EXAMPLE: 1025 BTU gas (supplied by local gas company)

INPUT = 144 X 1025 = 147,600 BTUH.

The dissipation of the heat transferred to the heating solution is now controlled by the amount of air circulated over the indoor heating coil or the domestic water within the hot water tank.

The amount (CFM) of air circulated by the indoor blower is governed by the external static pressure in inches of Water Column, or duct work and filter, applied externally to the indoor unit . As the external static pressure goes up, also the temperature rise will increase.

A properly operating unit, must have the BTU input and CFM of air, within the limits shown to prevent short cycling of the equipment. The same follows true for the GPM of solution being circulated.

Since normally, propane (LP) gas is not installed with a gas meter, clocking will be virtually impossible. The gas and air orifices used with propane, are calculated for 2500 BTU gas and with proper inlet pressure and correct piping size, full capacity will be obtained.

RATE CHART

Gas Input to Burner - Cubic Feet Per Hour

SECONDS FOR ONE REVOLUTION	ONE CUBIC FOOT DIAL	SECONDS FOR ONE REVOLUTION	TWO CUBIC FEET DIAL
18	200	36	200
19	189	37	195
20	180	38	189
21	171	39	185
22	164	40	180
23	157	41	176
24	150	42	172
25	144	43	167
26	138	44	164
27	133	45	160
28	129	46	157
29	124	47	153
30	120	48	150
31	116	49	147
32	113	50	144
33	109	51	141
34	106	52	138
35	103	53	136
36	100	54	133
37	97	55	131
38	95	56	129
39	92	57	126
40	90	58	124
41	88	59	122
42	86	60	120
43	84	62	116
44	82	64	112
45	80	66	109
46	78	68	106
47	77	70	103
48	75	72	100
49	73	74	97
50	72	76	95
51	71	78	92
52	69	80	90
53	68	82	88
54	67	84	86
		86	84
		88	82
		90	80
		94	76
		98	74
		100	72
		104	69
		108	67

NOTE: TO CONVERT TO BTU PER HOUR MULTIPLY BY THE BTU HEATING VALUE OF THE GAS USED.

COMPLAINT / POSSIBLE CAUSE. DOTS IN ANALYSIS GUIDE INDICATES "POSSIBLE CAUSE"	NO HEAT: SYSTEM WILL NOT START	NO HEAT: BURNER WON'T IGNITE	UNSATISFACTORY HEAT: BURNER IGNITES - LOCKS OUT	BURNER CYCLES ON LIMIT	RUNS CONTINUOUSLY - LITTLE HEAT	TOO WARM - THEN TOO COOL	CERTAIN AREAS TOO WARM OTHERS TOO COOL	NO HOT WATER (DOMESTIC)	TEST METHOD-REMEDY	SEE SERVICE PROCEDURE REFERENCE
POWER FAILURE	●								TEST VOLTAGE	S-1
BLOWN FUSE	●								INSPECT FUSE SIZE & TYPE	
LOOSE CONNECTIONS	●	●	●	●				●	INSPECT CONNECTIONS TIGHTEN	
SHORTED OR BROKEN WIRES	●	●						●	TEST CIRCUIT WITH OHMMETER	
OPEN SECONDARY LIMIT (MANUAL RESET)	●								TEST CONTINUITY	S-10
FAULTY THERMOSTAT	●	●			●	●			TEST CONTINUITY OF STAT & WIRING	S-3
FAULTY TRANSFORMER	●								CHECK CONTROL CIRCUIT WITH VOLTMETER	S-4
FAULTY WATER LIMIT		●		●					TEST CONTINUITY & TEMPERATURE	S-11
FAULTY DIVERTER VALVE								●	TEST CONTINUITY	S-15
FAULTY IGNITION CONTROL		●	●						TEST CIRCUIT	S-14
FAULTY GAS VALVE		●	●	●	●				TEST CIRCUIT AND PRESSURE	S-13
GAS TURNED OFF		●							TURN ON	
FAULTY PUMP RELAY		●							TEST CONTINUITY	S-6,S7
FAULTY GLOW IGNITOR		●	●						CHECK RESISTANCE	S-12
FAULTY WATER TANK THERMOSTAT								●	TEST CONTINUITY	S-16
FAULTY COMBUSTION MOTOR		●	●		●				TEST CONTINUITY	S-2,S-5,S-6
IMPROPER GAS PRESSURE		●	●	●	●				ADJUST	S-13
AIR LEAKS (GAS-AIR MIXING CHAMBER)		●	●						SEAL	S-13
FAULTY SOLUTION PUMP				●					TEST CONTINUITY & PRESSURE	S-2,S-5,S-8,S-17
COLLAPSED HOSE (RESTRICTED SOLUTION FLOW)				●					REPLACE OR ADJUST	
LOW SOLUTION LEVEL				●					ADD	S-24
DIRTY HEATING COIL				●					CLEAN	
DIRTY FILTER				●					CLEAN OR REPLACE	
FAULTY BLOWER MOTOR				●					TEST CONTINUITY	S-2,S-5,S-8
FAULTY CAPACITOR				●					TEST WITH OHMMETER	S-5
IMPROPER DUCT STATIC				●					CORRECT	S-18
FAULTY FAN CONTROL				●					TEST CONTINUITY	S-9
UNIT UNDERSIZED					●				RUN LOAD CALCULATION	
IMPROPERLY LOCATED THERMOSTAT						●			RE-LOCATE	
WRONG ANTICIPATOR SETTING						●			RESET	S-3
INFILTRATION OF OUTDOOR AIR					●		●		CORRECT-SEAL	
AIR FLOW UNBALANCED							●		REBALANCE	

S-1 CHECKING VOLTAGE

Using a voltmeter, check the voltage across the two power line connections at the indoor unit and Remote HTM.

The readings must be within 103-127 volts for proper operating voltage.

Start the system and recheck the voltage. If the reading falls below the minimum voltage, check the line wire size. Long runs of undersized wire can cause low voltage problems.

If the wire size is adequate, notify the local power company of the condition.

S-2 CHECKING INTERNAL OVERLOADS

With no power to the unit, remove the leads from the motor being tested.

Using an Ohmmeter:

Test continuity between Common and Start, Common and Run. If not continuous, the overload is open.

Allow ample time for the overload to reset, then retest.

If the overload still open, it is internal and cannot be repaired, replace the motor.

S-3 CHECKING THERMOSTAT, WIRING AND ANTICIPATOR

S-3A Thermostat and Wiring

1. With no power to the unit, remove the thermostat leads from the low voltage panel connection.

2. Jumper leads R to W.

3. Turn On the power.

4. If the heating system operates and combustion takes place, the trouble is in the thermostat or wiring.

5. Check the continuity of the thermostat and wiring. Repair or replace as necessary.

S-3B Heating Anticipator

The heating anticipator is a wire wound adjustable heater, which is energized during the "ON" cycle to help prevent overheating of the conditioned space.

The anticipator is a part of the thermostat and if it should fail for any reason, the thermostat must be replaced.

The nominal setting for the anticipator would be .8 amps.

S-4 CHECKING TRANSFORMER AND CONTROL CIRCUIT

With Power OFF:

1. Remove thermostat leads at the thermostat connections to the unit.

With Power ON:

2. Using a voltmeter, check voltage across 2 and C. (Should read 24 V. A.C.).

3. No voltage indicates faulty transformer, bad wiring.

4. Check transformer primary voltage at incoming line voltage connections and/or splice.

5. If line voltage is available at primary voltage side of transformer and the wiring and splices are good, transformer is inoperative. Replace.

S-5 CHECKING CAPACITORS

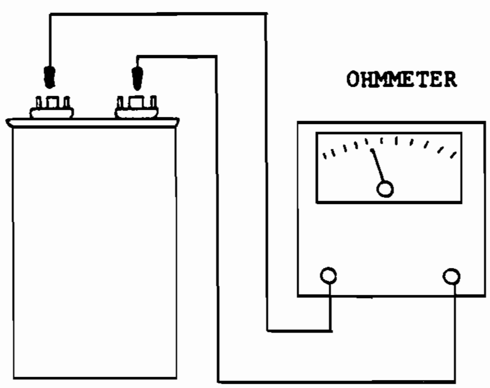
CAUTION: Discharge capacitor through a 20 to 30 ohm resistor before handling.

Two quick ways to test a capacitor, are a resistance and a capacitance check.

S-5A Resistance Check

With Power OFF:

1. Remove wire leads and discharge capacitor.
2. Set an ohmmeter on its highest ohm scale and connect the leads to the capacitor.
   a. Good condition - indicator swings to zero and slowly returns to infinity.
   b. Shorted - indicator swings to zero and stops there - replace.
   c. Open - no reading - replace.

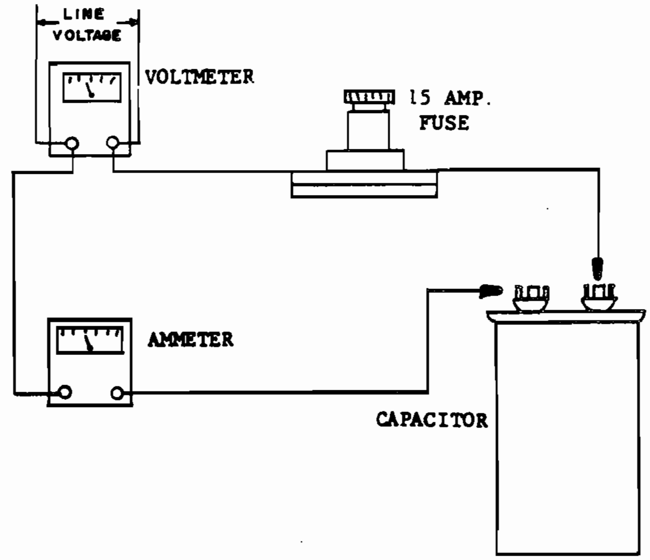


TESTING CAPACITANCE RESISTANCE

S-5B Capacitance Test

Using a hook-up as shown below, take the amperage and voltage readings and use them in the formula:

$$\text{Capacitance (MFD)} = \frac{2650 \times \text{Amperage}}{\text{Voltage}}$$



TESTING CAPACITANCE

S-6 CHECKING RELAY HOLDING COILS

With Power OFF:

1. Remove the leads from the coil.
2. Using an ohmmeter, test across the coil terminals (See Wiring Diagram).

If the coil does not test continuous, replace the relay.

S-7 CHECKING RELAY CONTACTS

With Power OFF:

1. Disconnect wires from contact terminals (See Wiring Diagram).
2. Using an ohmmeter - Test across normally closed contacts, should read continuous. Test across normally open contacts - no reading.
3. With power ON, energize the relay.
4. Using an ohmmeter, test again - across normally closed contacts - no reading. Test across normally open contacts - should read continuous. If not as above, replace relay.

S-8 CHECKING MOTOR WINDINGS

With Power OFF:

1. Remove the motor wire leads from the respective control and capacitor (if applicable).

Using an Ohmmeter -

2. Check the continuity between each of the motor leads.

3. Touch one probe of the ohmmeter to the motor frame (ground) and the other probe in turn to each lead. If the windings do not test continuous or a reading is obtained from lead to ground, replace the motor.

S-9 CHECKING FAN DELAY RELAY

With Power OFF:

1. Disconnect high voltage wires from terminals M and M.

Using an Ohmmeter -

2. Check continuity between terminals M and M - should test open.

3. Turn power ON and energize fan control stat with 24 volts, A.C.

4. The normally open contacts should close in approximately 30 seconds - ohmmeter reads continuous.

5. De-energize fan control stats 24 volts, A.C. - the contacts should open in approximately 120 seconds.

If not as above, replace.

NOTE: This Time Delay Relay is not temperature compensated - actual time as follows:

Close -	15 - 35 Sec.
Open -	25 - 65 Sec.

S-10 CHECKING SECONDARY LIMIT CONTROL

With Power OFF:

1. Remove the two wires from the control.

Using an Ohmmeter -

2. Check control continuity - should test continuous.

3. If checks open, push reset button and test again - should read continuous - if not, replace control.

CAUTION: If control resets, check all possible causes which could cause control to function, such as loss of solution, overfiring, inoperative motors and etc. (Control will open at approximately 220°F.)

S-11 CHECKING WATER LIMIT CONTROL

With Power OFF:

1. Disconnect the three leads from the control terminals.

Using an Ohmmeter -

2. Check continuity between terminal connections 1 and 3 - should test continuous (closed). Check continuity between terminals 1 and 2 - should test open.

3. Attach one temperature probe in direct contact with solution pipe elbow leaving the heat transfer module.

4. Reinstall wires on control and with power On, place the unit in the heating cycle.

5. Observe the temperature reading.

Under normal conditions, the unit should not cycle on the high limit control. The feeler bulb from the limit control is immersed in the heating solution (one tube) of the Heat Transfer Module.

(Continued)

S-11 CHECKING WATER LIMIT CONTROL (Cont.)

The control is set to open at approximately 226°F. with an automatic reset differential of 30°F. to 100°F.

If the heating cycle should be interrupted by the opening of the high limit control points, check for the following:

a. Abnormal duct restrictions, or dirty return air filters.

b. BTU input too high.

c. Low solution level, restricted solution circulation.

d. Air in the system.

e. More than 50% glycol solution mixture.

Any of these items may cause the unit to cycle - If control defective - replace.

S-12 CHECKING GLOW IGNITOR

With Power OFF:

1. Bridge the normal open contacts of the pump relay so the pump blower motor will run continuous.

2. Remove low voltage wires from indoor low voltage panel from thermostat, wire W and from hot water tank if used, wire T.

3. Disconnect the glow ignitor from the ignition control (terminals 2 and 4).

4. With power On, let the pump blower motor run for approximately 3 to 5 minutes to cool the ignitor to at least 70-75°F.

5. Using an ohmmeter, measure the resistance of the ignitor. Should read between 50 to 400 ohms.

6. With Power OFF, reconnect ignitor and low voltage wires, remove bridge from pump relay.

7. With power on, put into heating cycle.

8. Using an amprobe, measure current draw of ignitor during 45 second preheat cycle. Should read approximately 4 amps.

If not as above, replace.

S-13 CHECKING GAS VALVE

With Power OFF:

1. Disconnect valve operator leads from gas valve.

2. Using an ohmmeter, check for continuity at the valve terminals.

NOTE: This is a redundant gas valve having two operator coils. Would suggest that each coil resistance be checked individually.

3. If coil(s) is open, replace entire valve. DO NOT attempt to replace component parts or repair. Always replace with the same model valve as listed in the parts manual.

CAUTION: This is a negative regulated gas valve.

If the gas input should exceed or be less than the nominal figures given in the Heating Performance Test, proceed as follows:

1. Check attachment of the combustion blower assembly and placement of all gaskets. (Gasket at Heat Transfer Module, gasket at combustion blower assembly to extension tube, combustion blower assembly gasket to motor and to gas-air orifice plate). Look for air leaks.

2. If input still wrong, remove 1/8" pipe plug at front of gas valve marked pressure tap on valve, when in the off cycle.

(Continued)

S-13 CHECKING GAS VALVE (Continued)

3. Install a fitting, so a slope gauge (inclined manometer) may be installed. Recommend that 3" manometer be used. Attach the hose connection, from the fitting to the negative side of the gauge. (Right Hand Side). Also install a water manometer or gauge to drip leg fitting in order to read inlet gas pressure.

CAUTION: If a manometer is used with less than 3" reading (scale) you cannot do the next step.

4. Turn the gas off and start the unit in a heating cycle. Should be able to read a minimum of negative (-) 2.0" of water column. If not, check again for air leaks, blower up to speed, restricted module fins, etc.

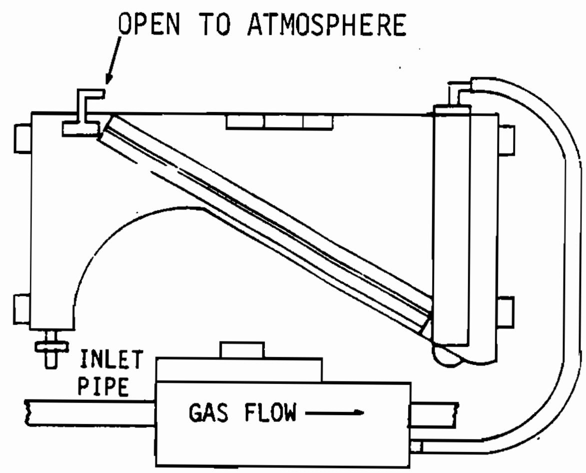
5. With gas on, restart in the heating cycle. If the test in Step 4 took more than one minute, you could be in a safety lock-out. De-energize the line voltage to the air handler for at least one minute to allow the ignition control to reset.

6. With unit firing, the negative pressure reading at the inclined manometer should be (-) .20" water column, with a nominal inlet gas pressure of 7" W.C. for natural gas or 11" W.C. for propane.

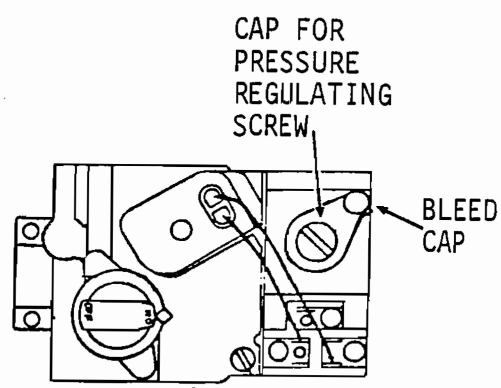
7. If the reading is higher than (-) .05 inches (closer to zero) the input will be high, or if lower than (-) .35 (further from zero) the input will be reduced. Readings within these tolerances (±.15) will show approximately ±5% BTU input change from the normal (-) .20 inches water column capacity. (Rated capacity will be at approximately 10°F. With warmer ambients and gas temperatures, the input will be decreased. 70°F. gas temperature, the input will be decreased about 12%).

8. If the negative pressure readings are out of the above tolerances adjust the gas valve regulator. (However, do not adjust gas valve regulator, if inlet gas pressures are low).

CAUTION: The gas valve must always be in a horizontal position with the gas cock knob up. This is mandatory on controls designed for negative outlet pressures.



SLOPE GAUGE CONNECTIONS



PRESSURE REGULATING SCREW LOCATION

S-14 CHECKING IGNITION CONTROL

CAUTION: If any condition should exist which will cause the system to go into safety lock-out, always de-energize the system for at least one minute, before recycling for further test.

With Power OFF:

1. Disconnect molex type connector from ignition control.

With Power ON:

2. Using voltmeter check for 115 V. between wire terminals (at connector) Black-8 and White-29. If no reading, check wire connections, continuity and etc.

3. Energize system for call for heating. Using voltmeter check for 24 V. between wire terminals gray and Orange-27. If no reading, check wire connections, continuity and etc.

With Power OFF:

4. Reconnect molex type connector to ignition control, being sure good contact is made.

5. Place amprobe around one lead-in wire of glow ignitor. Install voltmeter across gas valve terminals TH-TR set on low voltage scale (24 V. AC).

With Power ON and Gas Valve On:

6. Start unit in heating cycle.

7. Check amp draw at glow ignitor. Should read from 0 amps at start up to approximately 4 amps during 45 second preheat cycle. (If not - test glow ignitor S-12).

8. At the end of the 45 second preheat cycle, should still read amp draw at glow ignitor and should read 24 V. AC at gas valve.

9. Listen or feel for combustion during 15 second ignition safety time. (Confirm combustion during this period. If no combustion, ignition control will lock-out. This is a normal condition).

10. If combustion confirmed, ignitor reading will still be approximately 4 amps until last two seconds of ignition safety time.

11. Amperage draw will drop to zero, still read 24 V. AC at gas valve, combustion will continue. (If system goes into lock-out and only if combustion was confirmed, safety micro-amp signal was not available or inadequate. Recycle and reconfirm proper combustion if still locks-out, replace ignition control).

S-15 CHECKING DIVERTER VALVE (HOT WATER VALVE

With Power OFF:

1. Remove case cover from diverter valve motor.

2. Disconnect diverter valve end switch wires (blue) from low voltage terminal board R and 4. Connect ohmmeter across blue leads. Should read open.

3. Jumper low voltage terminals R and T (Hot Water Tank Thermostat).

With Power ON:

4. Observe diverter valve motor gear - should be turning and arm moving to reposition stop valve.

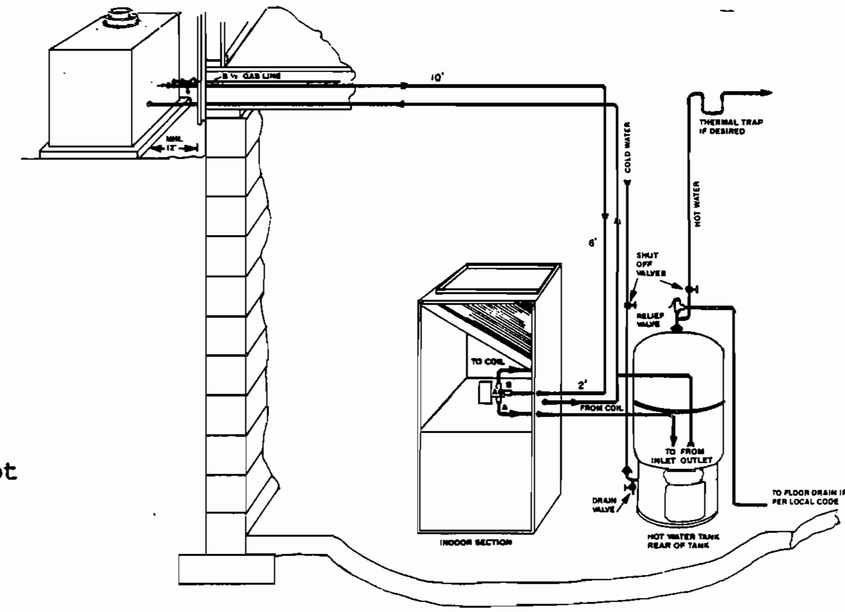
5. In approximately 15 seconds, motor will have completed travel length and close end switch. Should read continuous at ohmmeter.

With Power OFF:

6. Motor will return to original position (spring loaded) and break end switch contacts in approximately 2 seconds.

If not as above, replace - see caution condition sweating new valve into place S-23.

EXAMPLE: Remote To Indoor Section Using 3/4" Type L Nominal Pipe)



DESIGN GPM = 10 GPM (Page 5)
PRESSURE DROP 3/4" NOMINAL PIPE @ 10 GPM = 25'/100 (Page 15)
PRESSURE DROP = 7.5 (Page 19)
I.D. SECTION = 8' (Page 13)
PRESSURE DROP DIVERTER VALVE = 6.5' (Page 13)
PIPING LENGTH = 10' + 6' + 2' + 2' + 6' + 10'
PIPING ELBOWS = 5 (One From Coil to Return Line Not Shown (Page 16)
PIPING TEE = 1 (Page 16)
PIPING COUPLINGS = 2 (Page 16)

SYSTEM WORK SHEET									
LOCATION		UNIT A.H.							
GPM		10							
PIPE SIZE		3/4							
MEASURED LENGTH		36							
EQUIV. LGTHS	90° ELLS, SHORT 5 @	2.1/10.5							
	90° ELLS, LONG								
	45° ELLS								
	COUPLINGS 2@	1.0/2.0							
	TEE'S GROUP I %								
	TEE'S GROUP II % 1@	1.9/1.9							
	TEE'S GROUP III %								
	VALVES								
	OTHER								
	OTHER								
TOTAL EFFECTIVE LENGTH		50.4							
PRESSURE DROP 100'		25							
PIPE & FITTING LOSS		12.6							
TERMINAL	UNIT NO.	AH							
UNIT	HEAD LOSS	8.0							
CONTROL	CV								
VALVE	HEAD LOSS	6.5							
TOTAL LOSS		27.1							

SEE CHART ON PAGE 40

A = Calculated Pressure Drop at 10 GPM from System Work Sheet - 27.1' Head

B = Actual Pressure Drop At Actual Flow Rate (10.6 GPM at 30.9' Head)

The minimum flow rate is approximately 9 GPM with a maximum flow of 13.7 GPM. If limit tripping should exist check the total quantity of air being circulated by the indoor blower as well as the GPM of solution.

S-16 CHECKING WATER TANK THERMOSTAT

The water tank thermostat has a capillary tube (sensor) inserted into a well up into the water storage area. The thermostat is of an adjustable type with a maximum setting of approximately 140°F. with a 20°F. differential.

With Power OFF:

1. Disconnect the low voltage field wiring at the indoor unit low voltage terminal board. (Terminals R and T).

2. Using an ohmmeter, connect to these two removed leads. If thermostat is satisfied (water at temperature of setting) will read open.

3. Open hot water faucet, as hot water is removed from tank (replenished with cold water) at approximately 20°F. reduction in water temperature, thermostat should close giving continous reading on ohmmeter.

S-17 CHECKING FOOT OF HEAD OR PUMP PRESSURE

The Remote Heat and Hot water is a closed loop piping circuit, with open to atmosphere expansion tank, two pipe (diverter) system. It can only provide one function at a time, either circulate heated solution for structure heating or provide heated solution for domestic hot water heating. Both functions can not be performed simultaneously.

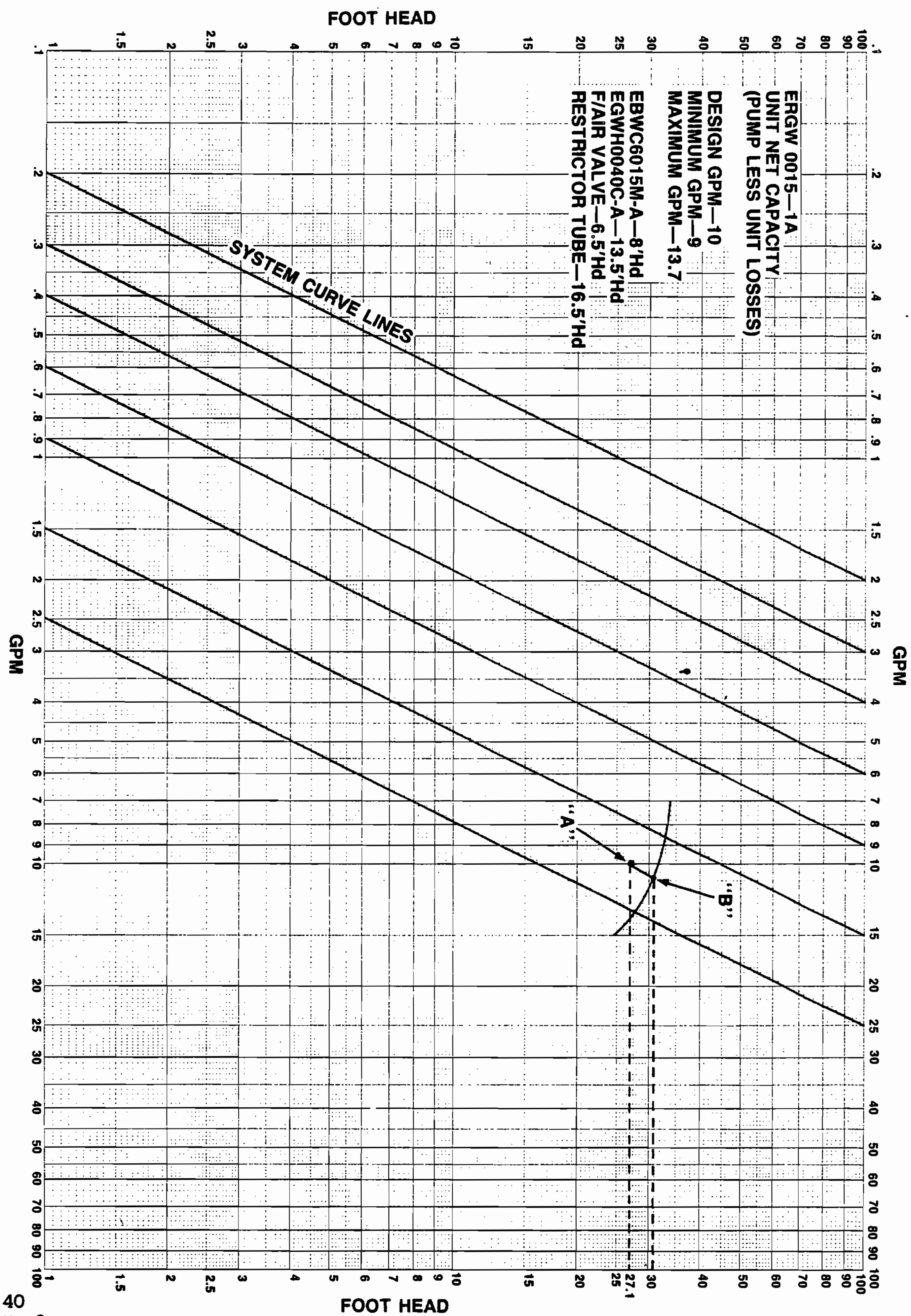
The circulator (combination pump-blower motor) is provided with the remote unit. See page 13 for foot of heat available @ 10 GPM and pressure drops.

Depending on the size of tubing used and the actual effective feet involved, will govern the GPM circulated and at what foot of head or pressure.

By removing the flue cap, sound ring and 3/8" pipe plug from the top of the module, a pressure gauge may be installed.

By pinching OFF the outlet hose from the module with a pair of pinch-off pliers, you can check the capability of the circulator (pump-blower motor) you should read approximately ---- for a good circulator. (See Pump curve page 40, zero gallons flow equals foot of head).

By the use of the following logarithmic chart and calculating the effective footage (lineal plus equiv.) of run you should be able to plot the GPM of flow and at what foot of head or pressure. (1 PSI = 2.31 Ft. head).


FOOT HEAD
ERGW 0015—1A
UNIT NET CAPACITY
(PUMP LESS UNIT LOSSES)
DESIGN GPM—10
MINIMUM GPM—9
MAXIMUM GPM—13.7
EBWC6015M-A—8'Hd
EGWH0040C-A—13.5'Hd
F/AIR VALVE—6.5'Hd
RESTRICTOR TUBE—16.5'Hd
SYSTEM CURVE LINES
"A"
"B"
27.1
GPM
GPM
FOOT HEAD

S-18 CHECKING DUCT STATIC PRESSURE

The maximum and minimum allowable duct static pressures are found in the specification section.

The indoor blower is not designed to deliver proper air quantities (CFM) against statics other than those listed.

Too great of an external static pressure will result in insufficient air that can cause too high of a temperature rise in heating (possible icing of the coil if air conditioning added). Whereas too much air can cause too low of a temperature rise in heating (poor humidity control if air conditioning is added). Too much air can also cause motor overloading and in either case this constitutes a poorly designed system.

To determine proper air movement, proceed as follows:

1. Using a draft gauge (inclined manometer) measure the static pressure of the return duct at the inlet of the unit. (Negative pressure). Since a return filter is not supplied with the unit, the reading must be taken downstream of the filter.

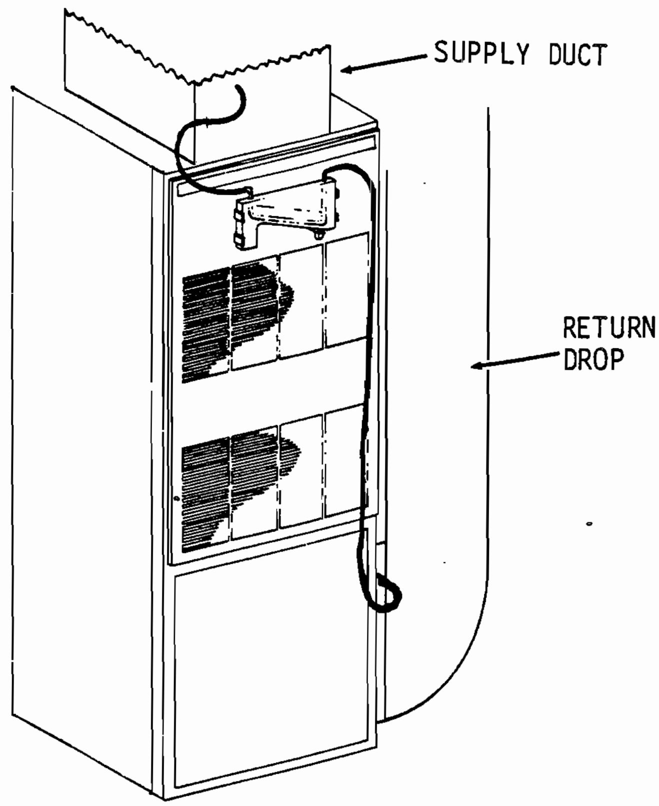
2. Measure the static pressure of the supply duct (positive pressure). If air conditioning has been added, the reading must be taken before the coil.

3. Add the two readings together.

NOTE: Both readings may be taken simultaneously and read directly on the manometer if so desired.

4. Consult proper tables for quantity of air.

If the total external static pressure exceeds the minimum or maximum allowable statics, check for closed dampers, dirty filters, under-sized or poorly laid out duct work.



EXTERNAL STATIC PRESSURE

S-19 SOLUTION PUMP - COMBUSTION BLOWER MOTOR REPLACEMENT

With Power OFF - Solution Cool:

1. Using two hose pinch-off pliers, pinch the inlet and discharge hoses as close to the pump body as possible leaving room so you can loosen the hose clamps later.

2. Disconnect the combustion blower housing from the extension tube.

3. Disconnect the gas valve plate (holding gas-air orifice) from combustion blower housing.

4. Disconnect pump motor from mounting bracket.

5. Disconnect pump motor wiring leads.

6. Place flat tray (ice cube tray) under pump and remove hose clamps, disconnect hoses.

(Continued)

S-19 SOLUTION PUMP - COMBUSTION BLOWER MOTOR REPLACEMENT (Continued)

7. Remove complete assembly.

8. Remove tinnerman nut holding blower wheel (left hand thread).

9. Remove the four nuts from the inside of the combustion blower assembly, behind the paddle wheel.

These are a 11/32" pal nut, which will require a shallow socket or spin tite with a ground down shank for clearance.

10. Replace motor and pump as a complete assembly, do not attempt to repair.

11. Reassemble combustion blower housing to new motor using new gasket if torn. (Back off outer nuts, pull inner nuts just snug. Then tighten outer nuts against blower housing).

12. Reinstall assembly into unit making necessary connections.

13. Install inlet hose to pump and tighten hose clamp. Release hose pinch-off plier slightly allowing fluid to displace the air in the pump and let the fluid rise to the top of the pump. Install outlet hose and tighten hose clamp. Remove inlet hose pliers and outlet hose clamp pliers.

With Power ON:

14. Put system through 4 or 5 short heating cycles.

S-20 WATER LIMIT CONTROL REPLACEMENT

With Power OFF - Solution Cool:

1. Remove wires from control bellows head and two screws which hold it to the control panel.

2. Loosen bottom nut only, where capillary goes into the heat transfer module.

3. Pull down on capillary (pigtail) until movement noticed.

4. Have replacement control handy and unscrew bottom nut holding capillary into module.

5. Remove capillary and place finger over this hole to prevent additional loss of solution, until new capillary is inserted.

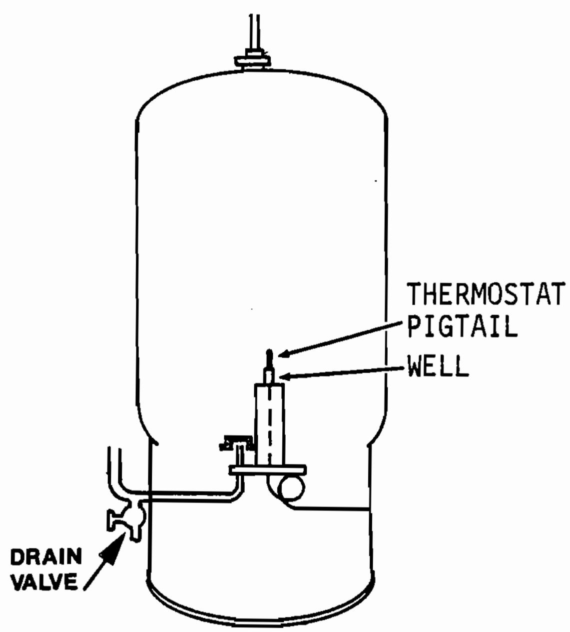
6. Tighten bottom nut.

7. Unwind capillary and secure bellows to control panel, rewire and dress up capillary so it won't rub against other components.

S-21 HOT WATER TANK THERMOSTAT REPLACEMENT

With Power OFF:

1. Shut off water inlet and drain at least half of water tank.
2. Disconnect wires, remove control knob disconnect power lead from tank.
3. Unscrew brass union nut and remove capillary.
4. Insert new capillary into well, tighten brass union nut, remount head to cabinet, replace knob.
5. Rewire control, open water inlet valve.



HOT WATER TANK

S-22 HEAT TRANSFER MODULE REPLACEMENT

With Power OFF - Solution Cool:

1. Using two hose pinch off pliers, pinch off hoses up close to module.
2. Remove or disconnect wiring to all components at module.
3. Remove secondary limit control.
4. Loosen hose clamps and drain solution from module into receptacle, (pan, bucket or etc.).
5. Remove water limit control capillary from module.

NOTE: Before draining solution from module, would suggest covering gas valve and motor to keep them dry.

6. Remove hoses from module.
7. Remove flue cap, complete module can now be lifted up through top of the cabinet.
8. Remove extension tube from bottom of module, burner and glow ignitor.
9. Reassemble above to new module and reinstall module.
10. Install controls and reconnect wiring and hoses.
11. Remove 3/8" pipe plug from top of module, install fitting with hose attached and insert other end of hose into the expansion tank. Fill expansion tank to at least 3/4 full.

With Power On - Gas Off:

12. Remove hose pinch-off pliers and start unit in heating cycle.
13. Make-up solution will be siphoned from expansion tank and air in module will be purged over into expansion tank. Watch level in expansion tank so it does not drop below pick up tube and run system until solid stream of solution is coming from hose at top of module.
14. Shut unit down, remove hose and fitting, repalce 3/8" pipe plug in top of module, replace flue cap, turn power off for one minute, turn gas on and cycle several times in heating mode.

S-23 DIVERTER VALVE REPLACEMENT

With Power OFF - Solution cool:

1. Using two hose pinch off pliers, pinch off return hose in front of and in back of charging fitting at pump inlet hose.

2. Remove strap and plug from charging tee. Install 7/8" I.D. plastic hose with clamp over tee and tighten clamp.

3. Place other end of hose into a receptacle and save the solution if possible.

4. Remove hose pinch off pliers and drain solution.

5. Disconnect electrical wires to diverter valve and move manual lever at base of valve from auto position to manual open position. This will move the valve plug to the mid-position.

6. Unsweat the valve and install a new one (be sure the center tube of the valve marked AB connects to the discharge line from the Remote Unit. Tube marked B goes to the indoor coil. Tube marked A goes to the hot water tank.

7. Move the manual lever of the new valve to the manual open position.

8. Solder in place - do not use silfos, silver solder or equal high temperature melting solders on these connections.

9. Reconnect electrical connections, move manual lever to auto position and fill unit with solution as per S-24.

S-24 REPLACEMENT OF HEATING SOLUTION

These instructions only apply in the event of a complete solution loss, or changing of a component which would have allowed air to enter the system.

If the solution level should be low in the expansion tank due to evaporization or a leak repaired before air was drawn into the system, then additional solution may be added directly into the expansion tank through the fill hole.

See the illustration of material needed and Points A, B, C D and E, where pinch-off pliers are used or valves closed and opened.

A straight-through hand valve should be used at Point B because of the thickness of the 7/8" I.D. plastic hose makes it almost impossible to use pinch-off pliers.

If an angle type hand valve is not used at the top of the module then pinch-off pliers can be used at Point A.

Calculate the approximate amount of solution required because the fill pail solution level must stay well above the outlet tube at all times so as not to draw air into the system.

1. Remove flue cap, sound ring and 3/8" pipe plug from the top of the module and slide the wire tie from the fill plug (return line to the circulator) and remove the plug.

2. Connect the hoses as shown in the illustration, securing with hose clamps.

3. Close off valve B and fill the fill pail with proper solution mixture.

4. Turn the gas off and disconnect the electrical connector to the glow ignitor.

5. Elevate the fill pail by setting it on top of the Remote HTM® or on a suitable fixture.

6. If the domestic hot water tank is used, place the diverter valve manual lever to the manual open position.

(Continued)