Fiscal Services
1800 Ignacio Blvd
Novato CA 94949
415-884-3162

PROJECT: KENTFIELD – FUSSELMAN HALL BOILER DESIGN-BUILD BOILER PLANT, CONTROLS SYSTEM & HAZARDOUS MATERIALS ABATEMENT PROJECT #16-0408

ADDENDUM #1

Marin Community College District

April 21, 2016

ADDITIONAL INFORMATION

1. April 19, 2016 mandatory Pre-Bid Conference Sign-In Sheet attached for information only.

2. Per request at the Pre-Bid Conference conducted April 19, 2016, Existing Mechanical Drawing Excerpts & Specifications are attached herewith at end of Addendum #1.

- M-2 (A) Boiler Room #18 Plan
- M-2 (B) First Floor Plan
- M-2 (C) Sections A & B/M-2, Partial Plan 2/M-2 and Detail A/M-2
- M-5 (A) Mechanical Room #25 Plan
- M-5 (B) Sections A&B/M-5
- M-5 (C) Sections C&D/M-5
- Schedules (A)
- Schedules (B)
- Existing Peerless Boiler Specifications & Operating Manual

REVISIONS/CLARIFICATIONS

3. 1.1 Notice Inviting Bids

12. Add sentence: Contractor must possess appropriate California Contractor License Classification to properly remove associated hazardous materials and lead paint as or hire subcontractor possessing such License.

4. 1.3 Bid Proposal Form

ALTERNATES:

ADD ALTERNATE #1: Correct Typos in description to read as:

Replace all three existing AHU units located on the first floor mechanical room (match airflow and static pressure drop). Provide new AHU's to be compliant with current energy code Title 24-2013 including full air economizer.

Provide factory installed controls compatible with new DDC building controls system, and single point power connection. New AHU's shall be selected such that airflow velocity through all components (filters, coils) shall be 400 FPM or less. AHU's shall have MERV pre-filters and MERV 13 final filters.

ADD
ALTERNATE #2: Correct Typos in description to read as:

> Replace all existing first floor mechanical room outside air supply and exhaust air fans (match airflow and static pressure drop). Provide new fan to be compliant with current energy code Title 24-2013 including full air economizer.

Note, for clarity, it was explained at the Pre-Bid Conference conducted April 19, 2016 that Deductive Alternate #1 deletes a defined scope and Deductive Alternate #2 deletes the same scope described in Deductive Alternate #1, but adds wireless thermostats. Therefore amount of cost deleted for Deductive Alternate #1 should be greater than the amount for Deductive Alternate #2. If the District chooses to delete scope, only one of the Deductive Alternates can be selected.

BID QUESTIONS

BQ#1 Can Bidders revisit the site?

Answer: Yes, please contact the M&O office to make arrangements at 415-485-9451.

BQ#1 The RFP document makes multiple references to Contract Documents, including Drawings. Please advise specifically what Drawings are a part of this bid and where/how they may be obtained.

Answer: The Contract Documents as originally issued consisted of the Project Manual, the Limited Asbestos and Lead Survey dated February 12, 2016 prepared by American Compliance Services, LLC and the 100% SD MEP Basis of Design dated April 1, 2016 prepared by PAE Engineers. This Addendum #1 also issues excerpts from the existing Mechanical Drawings and Specifications for Fusselman Hall.

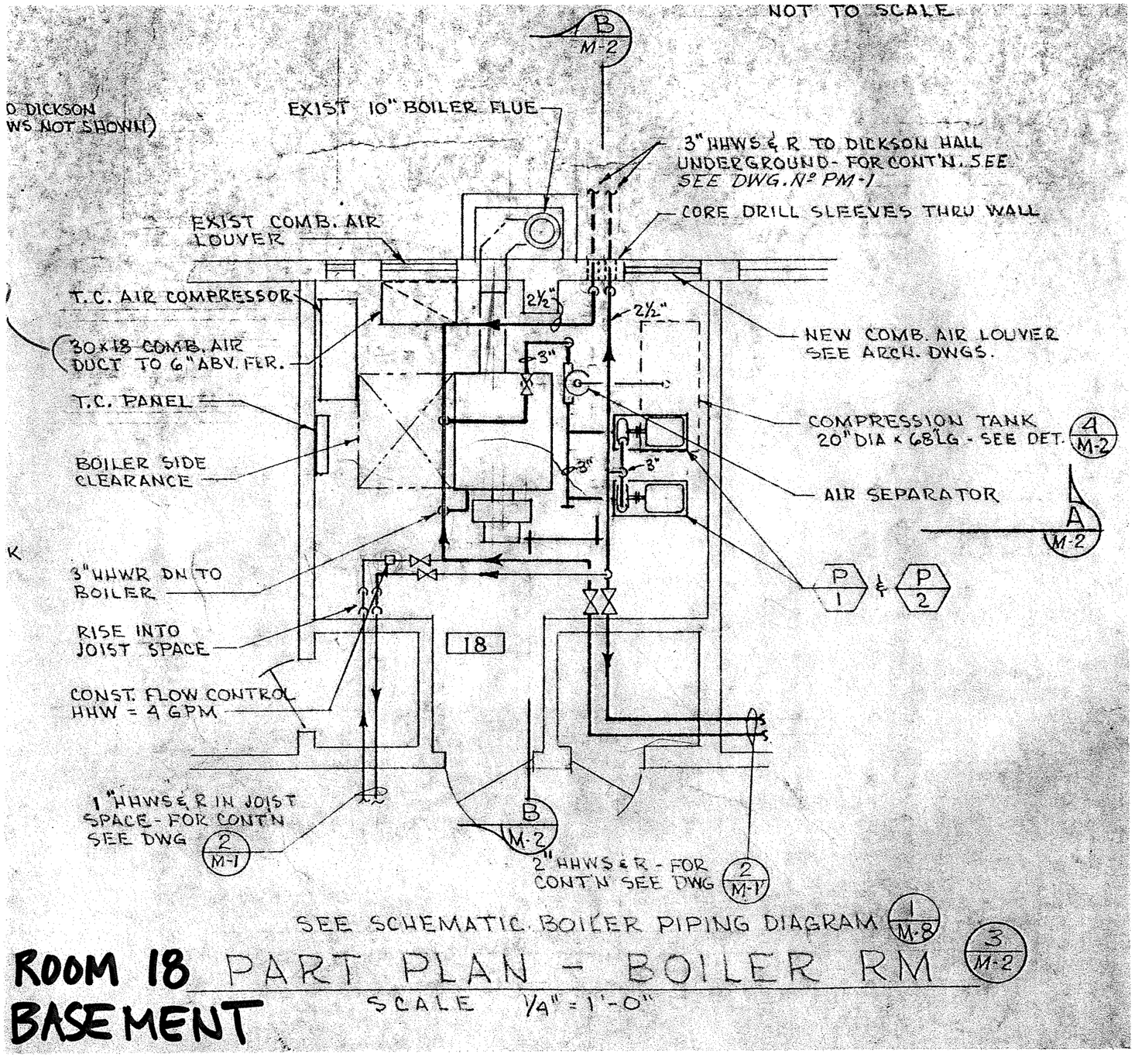
Bidders can contact the M&O office at 415-485-9451 to make arrangements to view complete sets of existing drawings and specs.

Kentfield Campus_Fusselman Hall Design-Build Boiler, Controls & Haz Mat Abatement Project #16-0408
Maintenance Office, M1 101-Kentfield Campus
1:00 pm Tuesday, April 19, 2016

Company Name and Address	Print Name	E-mail	Contractor's License #	Fax # Phone #
MCCD DIR. MAINT.	HEIDI RANK	hrank@marin.edu	—	415-747-0693
MCCD DIR. MOD.	LAURA McCARTY	lmccarty@marin.edu		
Peterson Mechanical	Scott Fentey	scottfc Petersonmechanical.com	171486	O - 707-940-3145 M - 707-721-4371
EMCOR Service	Adam Stramel	adam_stramel @ emcorgroup.com		O - 510-670-1690 m - 925 · 766 · 6570
TrinityEMCS	Julie Eiler	jeiler@trinityemcs.com		O: 707.335.4665 M: 707.326.1804
SYSERCO	ERIK ESKES	[redacted] e.eskes@syserco.com		707 338-7923
Haile Johannes	Haile J	HJOHANNES@[illegible]		[redacted]-415-485-977

Company Name and Address	Print Name	E-mail	Contractor's License #	Fax # Phone #
Envise	Mike Smoyer	msmoyer@enviseco.com		570-598-8433

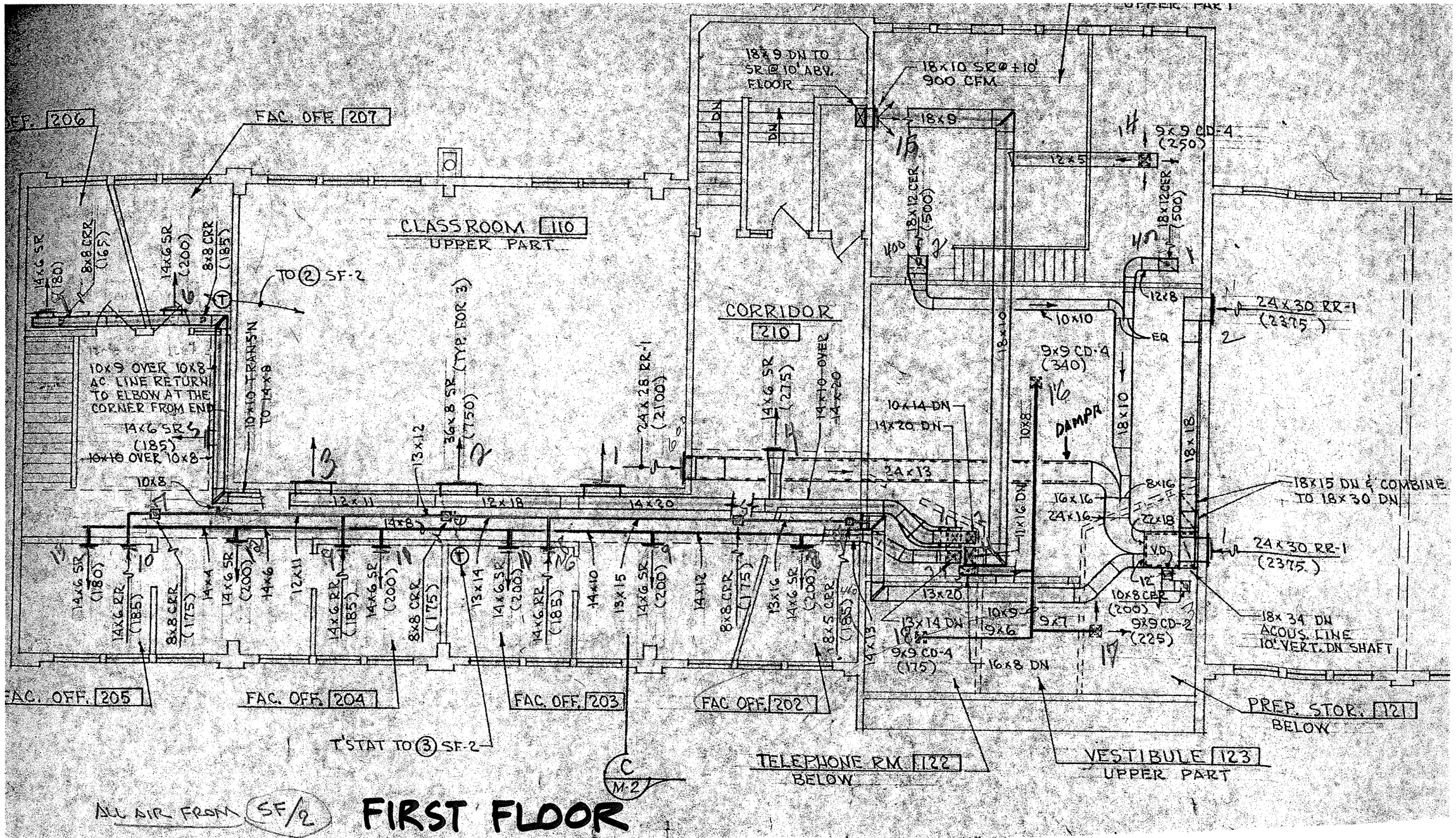
NOT TO SCALE



ROOM 18 BASEMENT PART PLAN - BOILER RM

SCALE 1/4" = 1'-0"

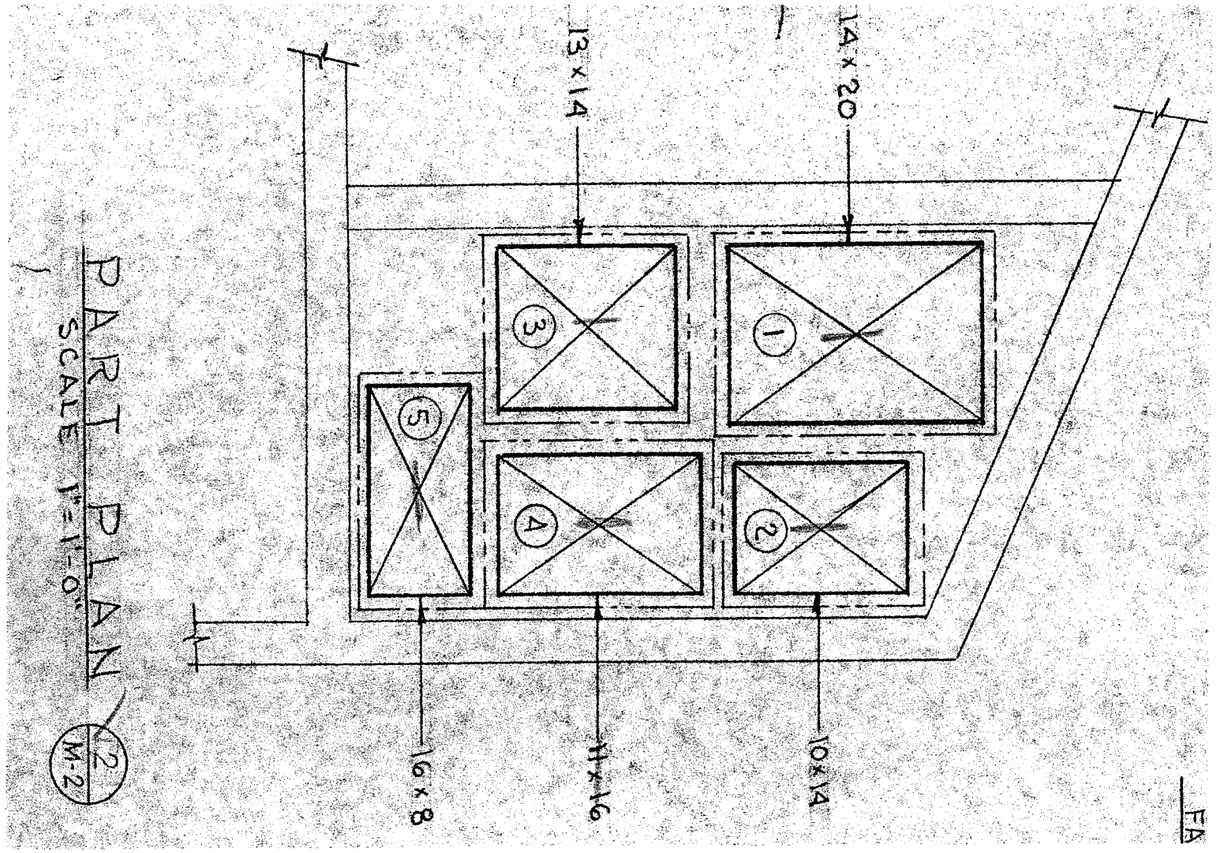
M-2(A)

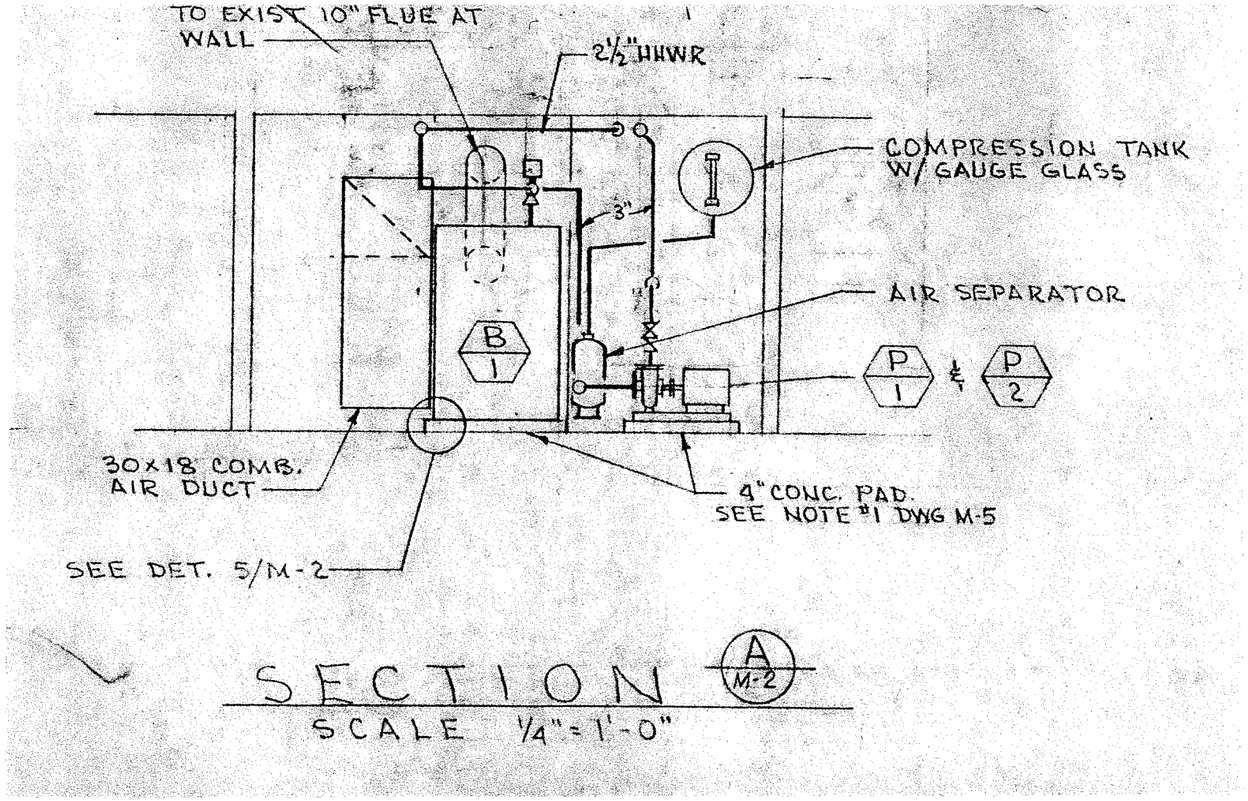


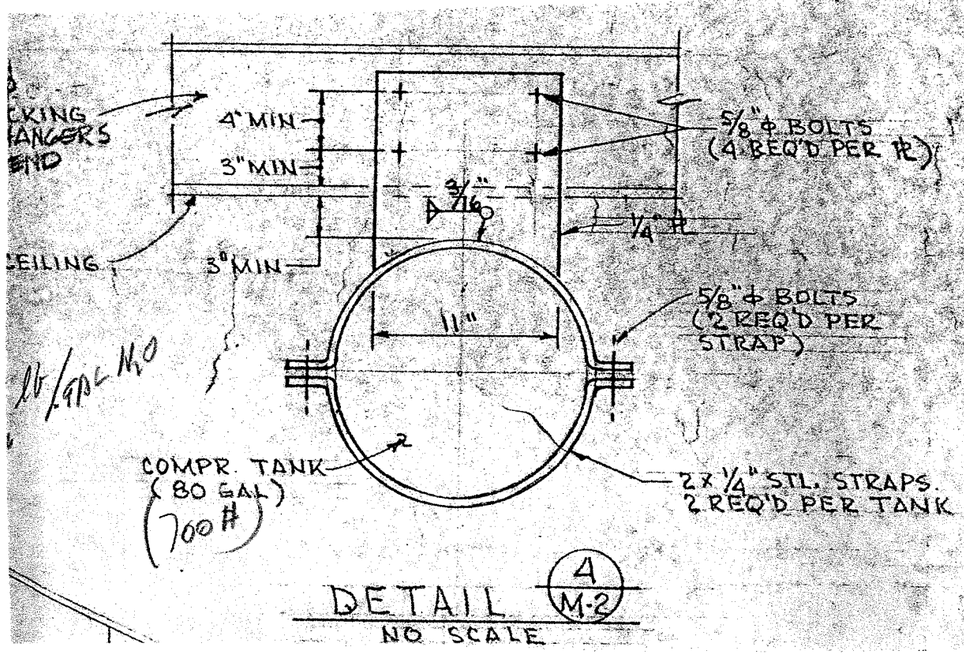
ALL AIR FROM (SF/2)

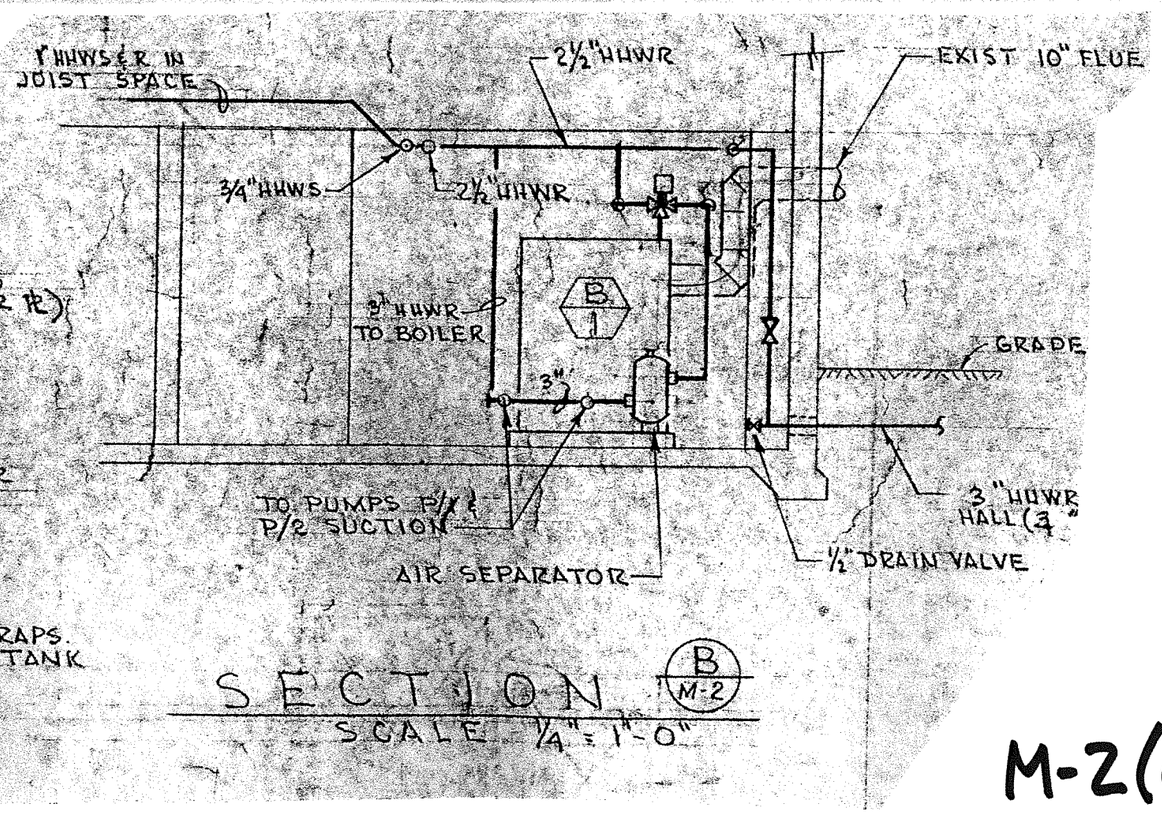
FIRST FLOOR

M-2(B)


13 x 14
14 x 20
16 x 8
11 x 16
10 x 14
1
2
3
4
5
PART PLAN
SCALE 1"=1'-0"
2
M-2

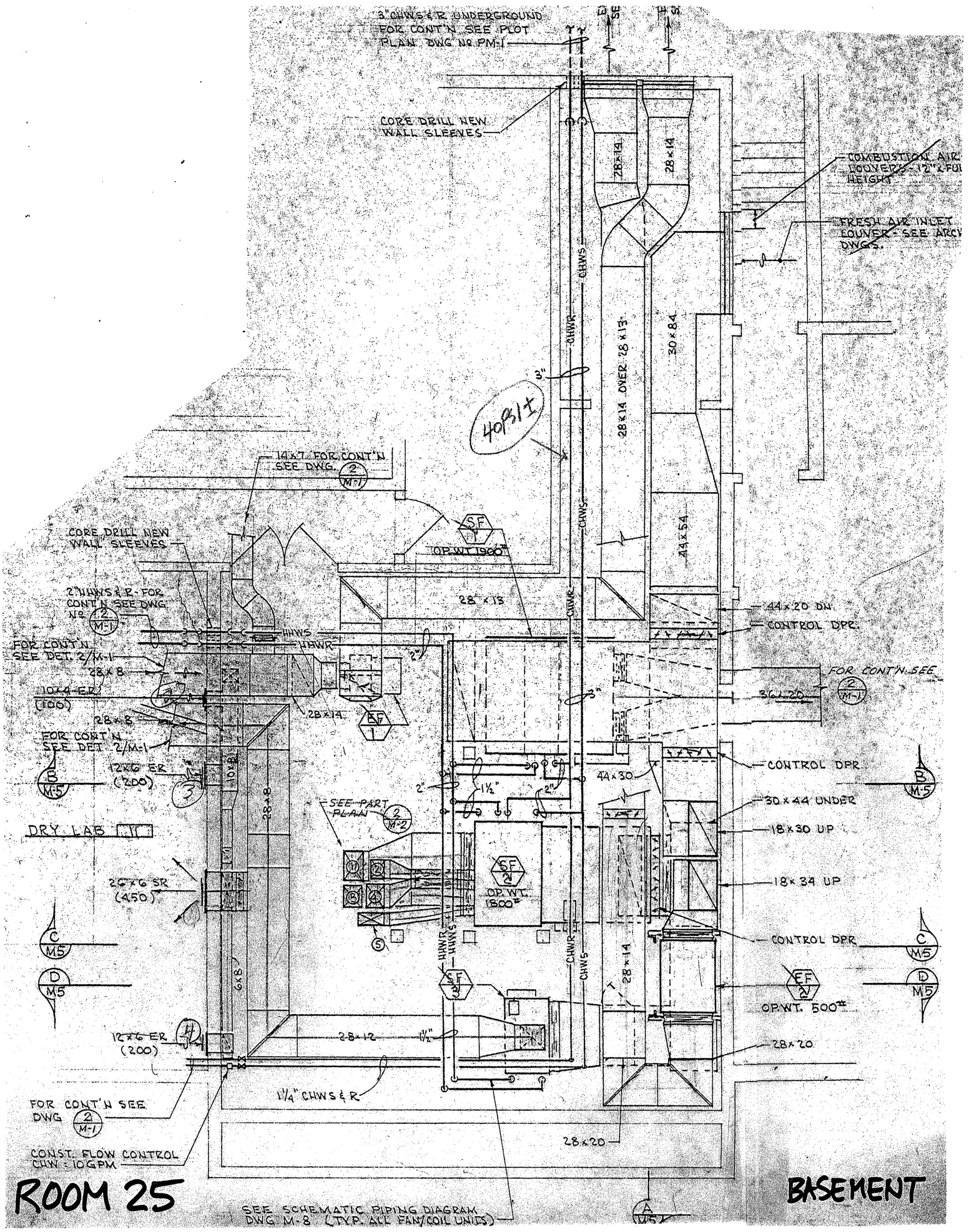

TO EXIST 10" FLUE AT WALL
2½" HHWR
COMPRESSION TANK W/ GAUGE GLASS
3"
AIR SEPARATOR
B 1
P 1
&
P 2
30x18 COMB. AIR DUCT
4" CONC. PAD. SEE NOTE #1 DWG M-5
SEE DET. 5/M-2
SECTION
A
M-2
SCALE ¼"=1'-0"

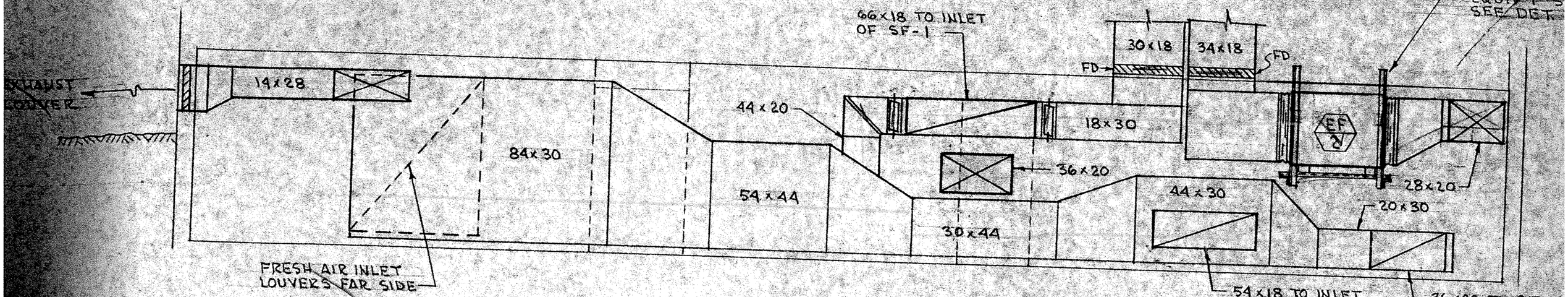

CKING
ANGERS
END
CEILING
4" MIN
3" MIN
3" MIN
3/16
5/8" ϕ BOLTS (4 REQ'D PER ℄)
¼" ℄
11"
5/8" ϕ BOLTS (2 REQ'D PER STRAP)
COMPR. TANK (80 GAL) (700 #)
2 x ¼" STL. STRAPS. 2 REQ'D PER TANK
DETAIL
4
M-2
NO SCALE


¾" HHWS & R IN JOIST SPACE
2½" HHWR
EXIST 10" FLUE
¾" HHWS
2½" HHWR
B 1
3" HHWR TO BOILER
GRADE
3"
TO PUMPS P/1 & P/2 SUCTION
AIR SEPARATOR
3" HHWR HALL (3")
½" DRAIN VALVE
SECTION
B
M-2
SCALE ¼"=1'-0"

M-2(C)

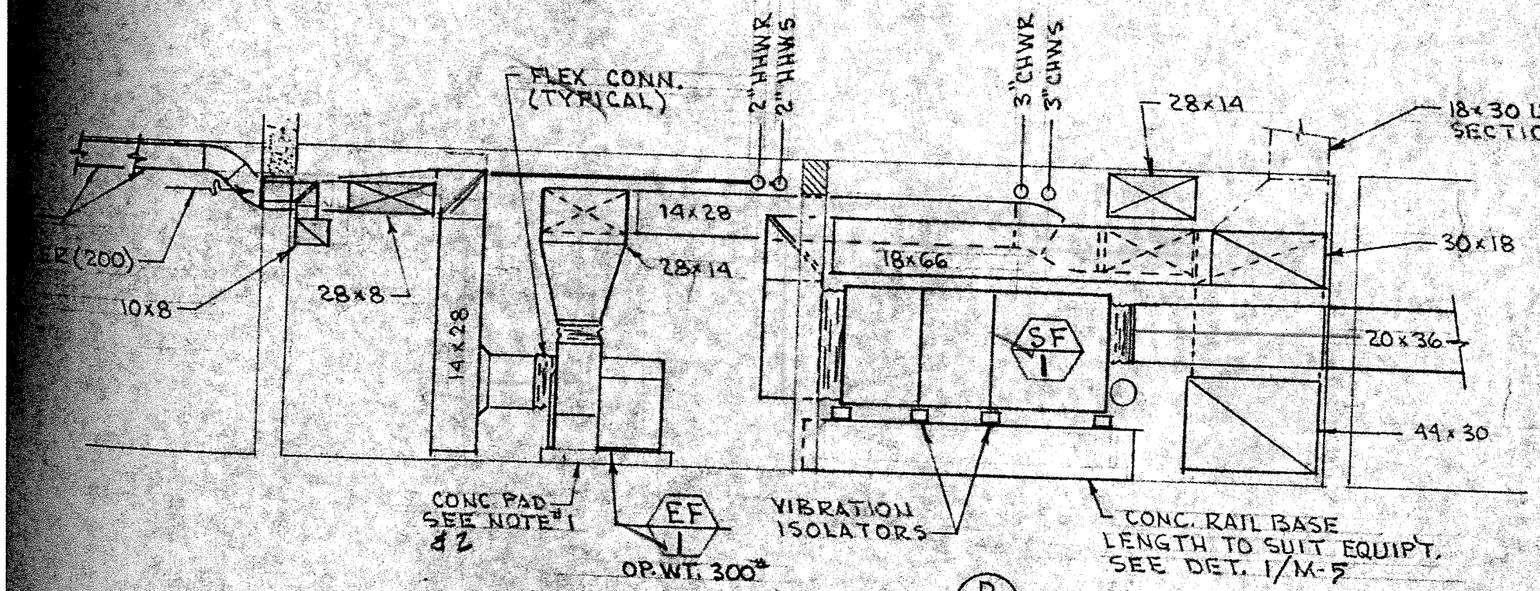
M-5 (A)


3" CHWS & R UNDERGROUND FOR CONT'N SEE PLOT PLAN DWG Nº PM-1
CORE DRILL NEW WALL SLEEVES
COMBUSTION AIR LOUVERS 12" x FU HEIGHT
FRESH AIR INLET LOUVER - SEE ARCH DWGS.
28x14
28x14
28x14 OVER 28x13
30x84
49x54
CHWS
CHWR
40 GPM
14x7 FOR CONT'N SEE DWG. 2/M-1
CORE DRILL NEW WALL SLEEVES
SF 1
OP. WT. 1900#
28x13
2" HHWS & R - FOR CONT'N SEE DWG Nº 2/M-1
HHWS
HHWR
FOR CONT'N SEE DET. 2/M-1
28x8
10x4 ER (100)
28x14
EF 1
44x20 DN
CONTROL DPR.
FOR CONT'N SEE 2/M-1
36x20
44x30
CONTROL DPR
30x44 UNDER
18x30 UP
18x34 UP
CONTROL DPR
EF 2
OP. WT. 500#
28x20
12x6 ER (200)
20x6 SR (450)
SEE PART PLAN 2/M-2
SF 2
OP. WT. 1800#
SF 3
28x12
1¼"
1¼" CHWS & R
FOR CONT'N SEE DWG 2/M-1
CONST. FLOW CONTROL CHW = 10 GPM
DRY LAB
ROOM 25
SEE SCHEMATIC PIPING DIAGRAM DWG M-8 (TYP. ALL FAN/COIL UNITS)
BASEMENT



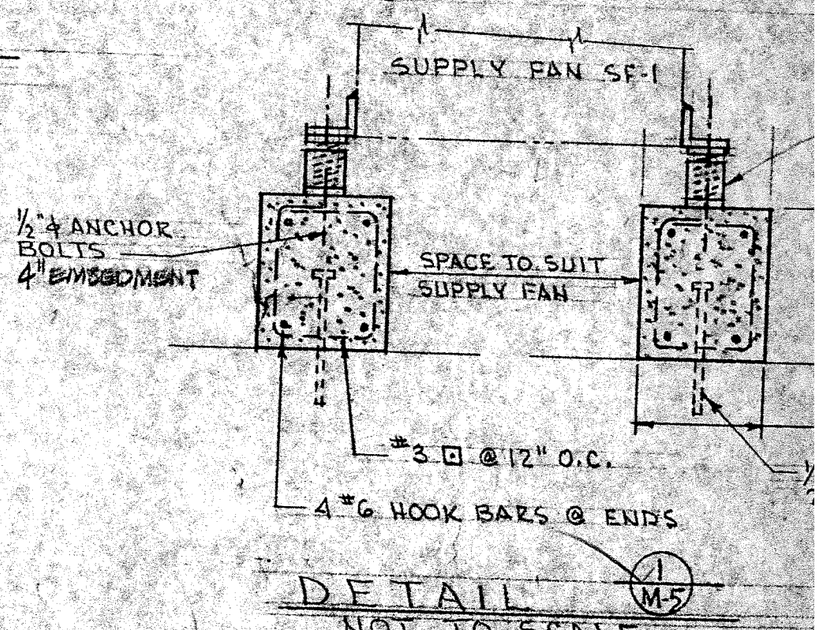
SECTION (A/M-5)

SCALE 1/4" = 1'-0"



SECTION (B/M5)

SCALE 1/4" = 1'-0"



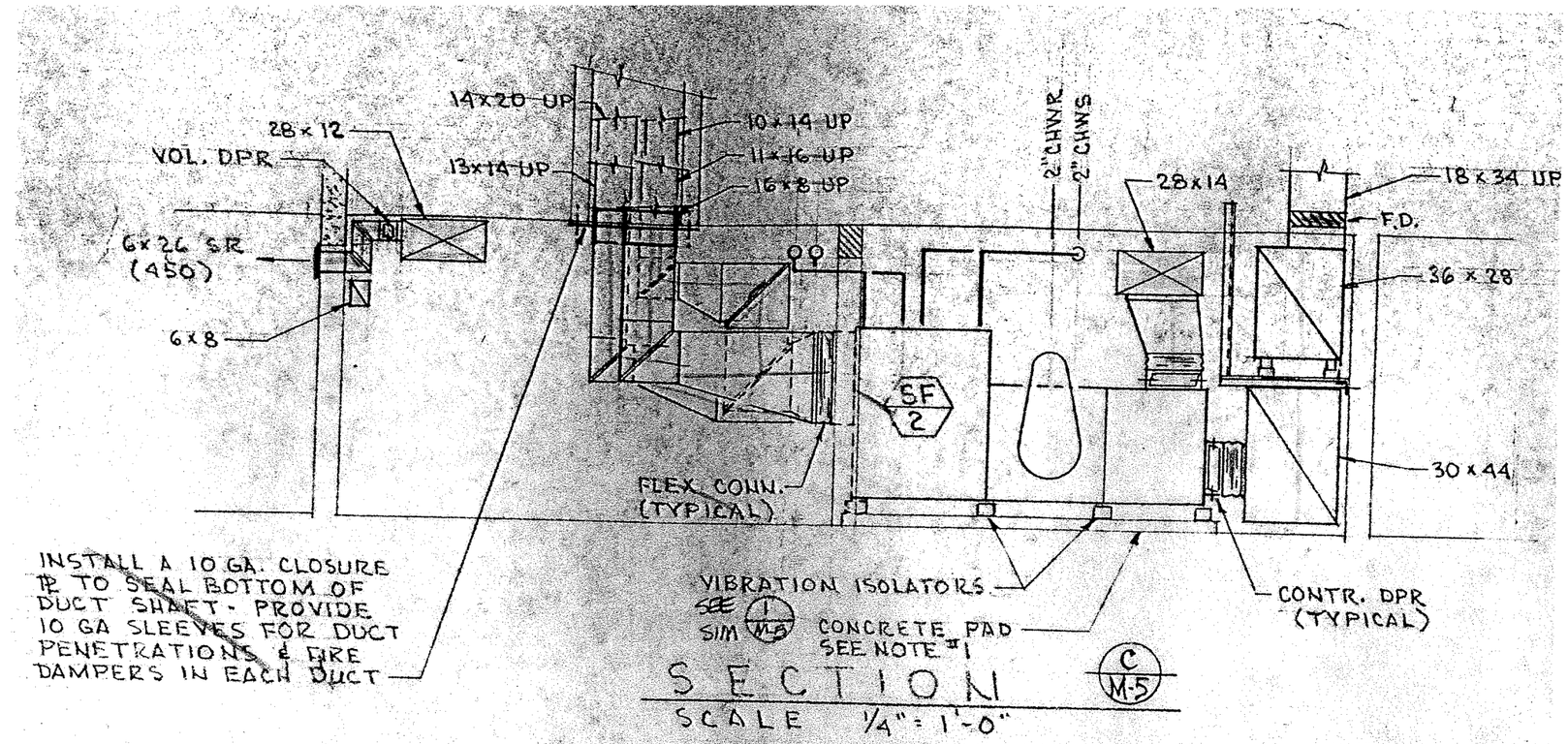
DETAIL

NOT TO SCALE

NOTES

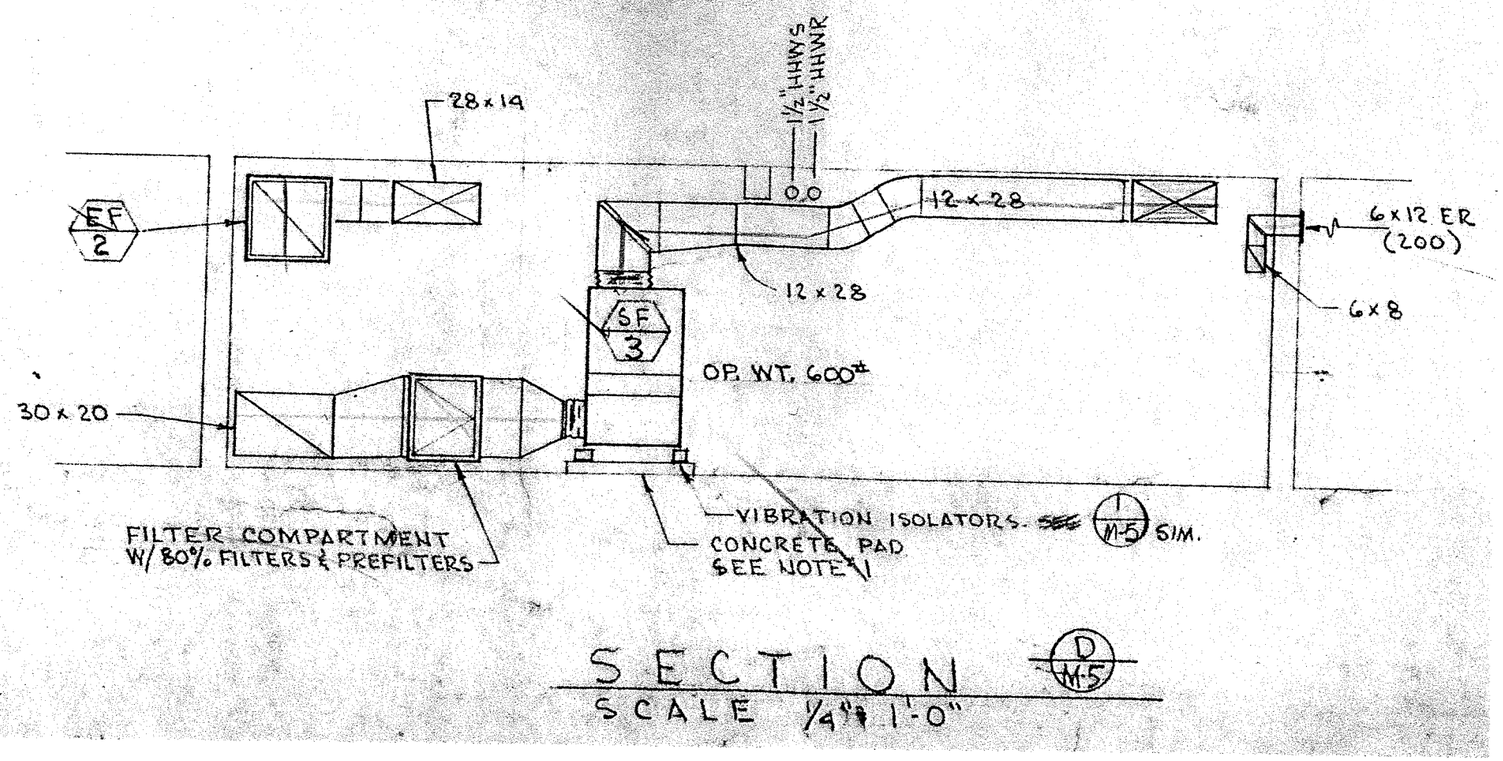
1 - 4" HIGH CONCRETE HOUSEKEEPING PADS WITH 6x6 W1.4 x W1.4 MESH, PLAN SIZE TO ACCOMMODATE EQUIPMENT. SECURE WITH BENT #6 REBARS DOWELED INTO EXISTING CONCRETE FLOOR.

M-5(B)



SECTION C/M-5

SCALE 1/4" = 1'-0"



SECTION D/M-5

SCALE 1/4" = 1'-0"

M-5(c)

FAN SCHEDULE

SYM.	DWG NO.	AREA SERVED	FAN					ELECTRICAL			REMARKS
			CFM ①	T.S.P. IN.W.C.	RPM	O.V. FPM	TYPE	HP	RPM	V, ϕ & HZ	
SF 1	M-5	FUSSELMAN HALL LECTURE RM	7800	2⅝			CENTRIFUGAL DRAW THRU - CABINET	7½	1750	208, 3, 60	W/ COILS HC-1 & CC-1 AND ANGLE TYPE FILTER SECTION.
SF 2	M-5	FUSSELMAN HALL UPPER LEVELS	6450	2½			CENTRIFUGAL BLOW THRU - MULTIZONE	7½			W/ COILS HC-2 & CC-2 AND COMB. MIXING BOX & FILTER SECTION
SF 3	M-5	FUSSELMAN HALL BASEMENT	2500	1½			CENTRIFUGAL DRAW THRU - CABINET	2			W/ COIL HC-3
EF 1	M-5	FUSSELMAN HALL BASEMENT	2600	1			VENT SET CENTRIF. VERT. DISCH.	1	1750	208, 3, 60	INTERLOCK WITH SF-3
EF 2	M-5	FUSSELMAN HALL UPPER LEVELS	5100	1¼			CENTRIFUGAL INLINE	2			INTERLOCK WITH SF-2
EF 11	M-1	FUSSELMAN HALL UPPER LEVEL	800	⅛			CLG. TYPE EXHAUST CENTRIFUGAL	⅛	1050	115, 1, 60	W/ WALL LOUVER, INLET GRILLE & SOLID STATE SPEED CONTROL

① FAN CAPACITIES HAVE BEEN SELECTED APPROX. 5% HIGHER THAN TOTAL OF ROOM CFM'S

COOLING COIL SCHEDULE

SYM	DWG NO.	SERVICE	CAPACITY		AIR					WATER				NO ROWS	MAX. FACE VEL. FPM
			TOTAL MBH	SENSIBLE MBH	EAT - °F DB	EAT - °F WB	LAT - °F DB	LAT - °F WB	P.D. IN.W.C.	GPM	EWT °F	LWT °F	P.D. FT. H_2O		
CC-1	M-5	SF 1	211.6	167.1	79.8	64.5	56.7	55.2	0.60	42.3	45	55	10.5	3	530
CC-2	M-5	SF 2	193.8	162.5	80.7	64.8	55.7	54.3	0.76	38.8			9.8	4	556

HEATING COIL SCHEDULE

SYM	DWG NO.	SERVICE	CAPACITY MBH	AIR			WATER				NO ROWS	FACE VEL. FPM	
				EAT °F	LAT °F	P.D. IN.W.C.	GPM	EWT °F	LWT °F	P.D. FT H_2O			
HC-1	M-5	SF 1	230.0	61.8	89.0	0.19	15.3	190	160	1.8	1	530	
HC-2	M-5	SF 2	190.0	59.3	87.7	0.23	12.7			1.2	1	556	
HC-3	M-5	SF 3	160.0	31.0	92.5	0.38	10.7			0.8	2	641	

BOILER SCHEDULE

SYM	DWG NO	TYPE	CAPACITY		BURNER		WATER		PRESS. RATING PSIG	MIN. GAS PRESS
			INPUT MBH	OUTPUT MBH	HP	V, ϕ & HZ	EWT °F	LWT °F		
B 1	M-2	FORCED DRAFT	1701	1380	¾	120, 1, 60	160	190	30	6 IN.W.C.

SCHEDULES (A)

SYM	CFM	COOLING					HEATING				ELECTRICAL			REMARKS
		SENSIBLE MBH	GPM	P.D. FT. H_2O	PIPE SIZE CHWS&R	PIPE SIZE DRAIN	CAPACITY	GPM	P.D.	HHWS&R SIZE	WATTS	RPM	V, Φ & HZ	
FC 1	200	3807	0.8	1.65	½"	1"	2510	0.2	0.15	½"	50	1040	115, 1, 60	W/INTEGRAL T'STAT & SPEED CONTROL
FC 2	300	5345	1.1	1.95	¾"		4612	0.3	0.17	½"	60	1040		
FC 3	400	7887	1.6	4.70	¾"		4652	0.3	0.17	½"	90	1040		
FC 4	570	12,277	2.5	7.10	¾"		7241	0.5	0.30	½"	100	1050		
FC 5	200	5000	1.0	2.00	¾"		7520	0.5	0.16	½"	45	900		W/REMOTE T'STAT & SPEED CONTROL
FC 6	200	4287	0.9	1.50	½"		6716	0.4	0.15	½"	45	900		
FC 7	300	5764	1.2	3.50	¾"		3820	0.3	0.15	½"	66	1035		
FC 8	400	7926	1.6	7.00	¾"		1663	0.1	0.10	½"	120	1080		

COOLING BASED ON 45°F EWT & 55°F LWT, 76°F/63°F EAT AND HEATING BASED ON 190°F ENT & 75°F EAT.

SYM	DWG NO	TY
B 1	M-2	FORCE

SYM	DWG NO.	AREA S OR SE
GH 1	PM-2 M-3	IND. ART & AUTO
GH 2	PM-2 M-3	IND. ART & AUTO
GH 3	M-3	IND. ART M.MT
GH 4	M-3	IND. AR ENG/TR

AIR COOLED WATER CHILLER SCHEDULE

YM	DWG NO	EVAPORATOR CAPACITY TONS	EWT °F	LWT °F	GPM	P.D. FT H_2O	NO. PASSES	COND. TEMP. °F	ELECTRICAL INPUT KW	V, Φ & HZ	REMARKS
CH 1	PM-2	78.8	45	55	195	8.9		100	128.4	460, 3, 60	KW SHOWN IS MAX FOR UNIT & INCL. COMPRESSORS AND FANS.

PUMP SCHEDULE

YM	DWG NO	SERVICE	GPM	HEAD FT. H_2O	ELECTRICAL HP	ELECTRICAL RPM	ELECTRICAL V, Φ & Hz	REMARKS
P 1	M-2	HOT WATER	75	45	2	1750	208, 3, 60	BASED ON B&G SIZE 2"AB
P 2	M-2	HOT WATER	75	45	2		208, 3, 60	" " " " " - STAND BY
P 3	PM-2	CHILLED WATER	160	68	7½		460, 3, 60	BASED ON B&G SIZE 2½"BB
P 4	PM-2	CHILLED WATER	160	68	7½		460, 3, 60	" " " " " - STAND BY

LEVEL PUMPS WITH SHIMS & BOLT TO CONCRETE PAD WITH (4) 5/8" ϕ BOLTS & EXPANSION
SHIELDS.

NOTE #1 - HEATE

SCHEDULES (B)

HANG THESE INSTRUCTIONS IN VICINITY OF BOILER

PEERLESS

OF BOYERTOWN, PENNSYLVANIA

SINCE 1908

THE CARE AND OPERATION OF PEERLESS BOILERS

THE PEERLESS HEATER CO.

DIV. OF PEERLESS INDUSTRIES, INC.

BOYERTOWN, PENNSYLVANIA

PEERLESS HEAT SINCE 1908

10T975G

8501-2

CARE AND OPERATION OF PEERLESS BOILERS

GENERAL . . .

Peerless Cast Iron Boilers require very little service after being put in operation. However if something seems to be operating improperly, the services of a qualified heating contractor or service man should be enlisted.

STEAM BOILERS . . .

1. Observe the pressure gauge to be sure it is working properly. Pressures shall not exceed 15 lbs.
2. Check the water glass to observe if water is being maintained at proper level. The level will fluctuate a little when boiler is operating. If it should disappear from glass or rise up to top of glass, shut down the boiler and have heating contractor or service man determine the cause and remedy the trouble. Shut down the boiler by turning off the electricity to the boiler.
3. At least once each week, open the drain valve on the bottom of the low water cut-off long enough to remove sediment.

WATER BOILERS . . .

1. The installer should provide instructions as to the temperature and pressure showing on the altitude and thermometer gauge. This will depend on the system installed. If the gauge shows higher temperature or pressure than recommended, the boiler should be shut down by turning off electricity to boiler. Consult with installer or service man immediately.

STARTING THE BOILER AT BEGINNING OF THE HEATING SEASON

Before the start of each heating season, it is suggested that a qualified service man inspect and make all necessary adjustments to insure proper boiler operation. The following is a check list to follow.

1. Check chimney to make certain it is clean, free of obstructions and cracks.
2. The flue pipe from the boiler should be inspected to make sure it is clean, in good condition and properly supported with the end flush with the inside of chimney. Be certain all joints are tight and the point where it enters into chimney sealed.

3. If boiler is oil fired, it is recommended that the heating surfaces be cleaned each year.

4. If boiler is gas fired, it is recommended that the heating surfaces be inspected annually and cleaned if necessary. The burners and pilots should be protected when cleaning.

5. Be certain adequate ventilation is provided for proper combustion.

6. The water must be at normal level for steam boilers or full of water for hot water boiler before allowing burner to light.

   CAUTION: Never add water to a boiler that is hot. If in doubt, allow it to cool naturally. If loss of water occurs, a leak in the system may be the cause.

7. After starting the boiler be certain all controls are working properly before leaving it unattended. Check to be sure that the temperature limit control or pressure limit control will shut off the burner in the event of excessive temperature or pressure.

8. Test the relief valve or safety valve. Attach a wire to lever and standing a safe distance away, pull to determine if the valve discharges and seats properly.

CARE OF BOILERS NOT IN SERVICE

If the system is not a summer-winter hook-up, with the boiler furnishing domestic hot water, the following recommendations are made:

1. If the boiler is gas fired, it is recommended to allow the pilots to burn at all times. This will control condensation and help to increase boiler life.

2. An oil fired boiler needs no special attention.

3. The electrical power to the boiler may or may not be shut off. This is something that can be done at the discretion of the homeowner. If electrical power is shut off, be certain it is turned on at beginning of heating season.

4. If the boiler is to remain idle during freezing weather, it is recommended that the boiler and system be completely drained. Be certain boiler is refilled before firing when it is restored to service. Refer to "Starting Boiler At Beginning Of Heating Season".

ERECTION INSTRUCTIONS, INSTRUCTIONS FOR OPERATION AND COMPLETE INFORMATION ON CONTROLS AND WIRING DIAGRAMS WERE FURNISHED WITH THE BOILER.

CLEANING A STEAM BOILER

TO ELIMINATE OIL AND GREASE

IMPORTANT? NOT UNLESS YOU READ IT.

WHY?

The steam boiler should be **cleaned within one week after it is installed and put into continuous operation.** This should be done to remove any accumulation of oil, grease, etc., which has a tendency to cause the water in the boiler to foam, produce a very unsteady water line, and the apparent failure of the heating system. The inside of pipe is covered to some extent with oil or grease. The boiler and radiator tappings and parts may contain a protective oil film. Joints of pipe threads and fittings are made with compounds containing oil and grease. After the system is in operation, all of this is carried with the condensation back to the boiler, where it remains to cause trouble until removed.

It is, therefore, necessary to blow off the boiler under pressure. If one blowing does not result in a continuous steady water line and clean gauge glass, the operation must be repeated a second and, if necessary, a third or fourth time.

NOW. SKIM — DON'T DRAIN

Close all radiator valves, or, if the mains are equipped with valves, close both flow and return valves tightly. If possible, connect a gate valve, 1" or larger in one of the outlets above the water line of the boiler. Should there be no place provided to do this, remove the safety valve, and with a short nipple, screw in an ell to which the gate valve can be attached. From the gate valve, run to a sewer connection or out of a window with a steam hose or pipe.

Pour some sal soda (common washing soda) into the boiler through the safety valve tapping. For a boiler having a capacity of 350 sq. ft. about one pound of soda should be ample and one pound for each additional 350 sq. ft. capacity.

Fill the boiler with **water to the top of the water gauge glass.** With fire burning to capacity, allow pressure to build up to one or two pounds. Allow fire to remain burning and open gate valve, allowing dirty, greasy water to flow off. When water in gauge glass drops to within one inch of bottom of glass, close gate valve, turn off fire and allow fresh water to run very slowly into boiler until it is again to the top of gauge glass. Great care should be taken not to allow water to get too low or to run in too fast, as if all the water is blown out of the boiler and fresh water put in too fast a cracked boiler will result. **Repeat this operation until water runs clear from boiler.**

NOW DRAIN

All of the oil and dirt floating on top of water has then been removed but **there still remains the sediment** and heavier matter which has settled to the bottom of the boiler, which also must be removed. To do this, again fill the boiler to the top of the water gauge glass, raise one or two pounds pressure as before, turn off all fire under boiler, open the drain cock and allow all water in the boiler to be blown off. Allow the boiler to remain until all parts of all of the sections are entirely cool. To run cold water in before, will result in a cracked boiler. After the boiler is cold, close the drain cock and fill to top of boiler and again drain. This is done to remove all of the soda. The boiler is now ready to be again put into operation. Fill to normal water line, open all supply, return valves and radiator valves, and set controls for normal operation.

REPEAT?

If the water in the boiler again becomes dirty and trouble is experienced as in the first place, more dirt and oil has been brought back to the boiler by the returning condensation and the entire operation must be repeated.

HOW TO CLEAN A WATER GAUGE GLASS

It is necessary to have one pound pressure of steam on the boiler before starting this operation.

Never remove a gauge glass to clean by wiping it out as this may result in a broken glass. It can be much more easily cleaned without danger of breakage without removing.

Mix at least a tablespoonful of Muriatic acid into a cupful of hot water drawn from the bottom try cock.

Close both water gauge valves. Open top water gauge valve, pet cock at bottom and blow water out of glass. Then close the top valve and immediately submerge the end of the pet cock in the cup of hot water solution. A vacuum is at once created in the gauge glass which causes the solution in the cup to be drawn in.

Keep the pet cock immersed and operate the top valve, slightly opening and closing, alternately expelling and drawing in the solution until all grease, oil, or other matter adhering to the inside of the glass is removed. Then close pet cock and open both water gauge valves.

STILL NOT IMPORTANT — UNLESS YOU USE IT!

MODEL R

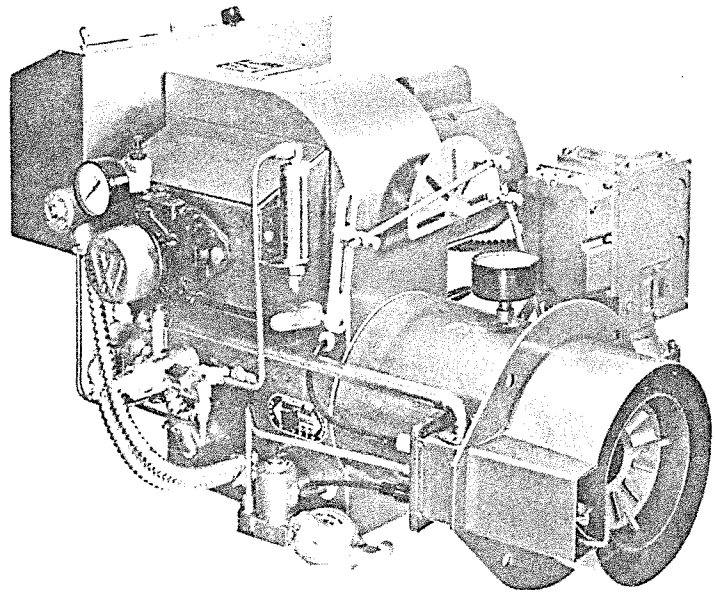
Burner Instruction Manual

FOR

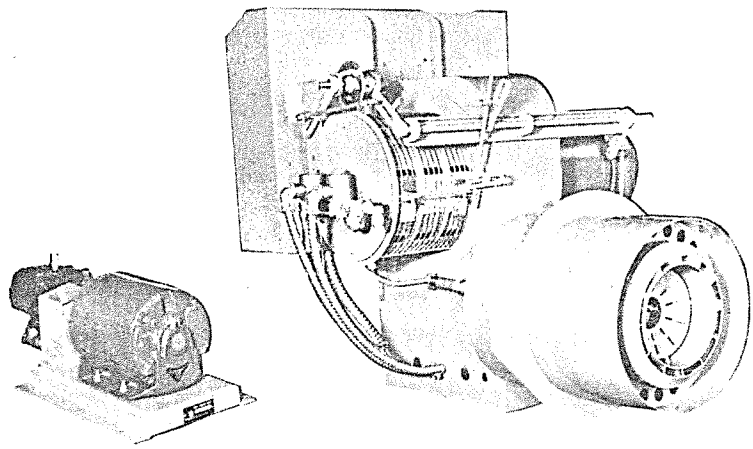
GAS AND PRESSURE ATOMIZING LIGHT OIL FUEL SYSTEMS

MANUFACTURED BY PEABODY GORDON-PIATT, INC.

NOTE: YOUR BURNER MAY HAVE A LETTER PREFIX OR SUFFIX ADDED TO THE MODEL DESIGNATION; HOWEVER, THIS IS FOR IDENTIFICATION PURPOSES ONLY AND DOES NOT AFFECT THE INSTRUCTIONS IN THIS MANUAL



The illustration at left shows a typical Model R6, R8 or R10 burner with combination gas-oil fuel system. General appearance may differ between units because of size and fuel system used. The oil pump is normally burner mounted on these size units.



The illustration at right shows a typical Model R12 oil burner. Note the oil pump is normally remote on the R12 size.

These burners are listed by UL, CSA, The New York Board of Standards and Appeals, the State Fire Marshal of the Commonwealth of Massachusetts and others. Burners and controls are also available which comply with FM, FIA, City of Minneapolis, Iowa and Illinois Gas Co., and most other special Agency Codes.

GARDNER-DENVER GORDON-PIATT, INC.
WINFIELD, KS 67156

ORDER ENTRY AND
EQUIPMENT PRICING FORM

ORDER/QUOTE # 20230
PAGE 1 DATE: _____

SHIP TO: SAME

BILL TO: (CODE: 31-0135)
The Eastern Fdy
Spring & Schaeffer Sts
Boyertown, PA 19512

SHIPMENT REQUESTED: A.O.
SCHEDULED: Jan. 23, 76 or 8
CUSTOMER'S ORDER NO.: 47526

SHIP VIA (✓) TRUCK (✓) COLLECT ( ) PREPAY & CHARGE (CHARGE TO WHOM?): _____
SPECIAL INSTRUCTIONS: PRICE/ROADWAY
SLSM'S NO.: 6

QUANTITY 1 EQUIPMENT MODEL NUMBER: RB.1-G-05-R4795A4-B.15 (ABMA: ICA)

UNIT FIRED: MFGR. PEERLESS MODEL G-713FD-WU TYPE C.I. SECTIONAL

HEATING SURFACE _____ SQ.FT. COMBUSTION CHAMBER WIDTH _____ BASE HEIGHT _____ LENGTH _____ NO. PASSES _____

COMBUSTION CHAMBER PRESSURE _____ STEAM PRESSURE _____ PSIG WATER/AIR TEMPERATURE _____ °F

VOLTAGE SUPPLY: POWER = 120 VOLTS, 60 HZ. 1 PH. FIRE: ( ) THRU DOOR ( ) THRU BASE

GAS: TYPE NAT. MBH INPUT = 1832 BTU/CF = 1000 CFH = 1832 SP.GR. = 0.60 PRESSURE @ INLET = 7.0" w.c.

TYPE _____ MBH INPUT = _____ BTU/CF = _____ CFH = _____ SP.GR. = _____ PRESSURE @ INLET = _____

ORIFICE DRILL SIZE: PRIMARY = 19 - #6 SECONDARY = ---- GROSS ORIFICE PRESSURE = 2.8" w.c.
(NOTE: GROSS ORIFICE PRESSURE INCLUDES COMBUSTION CHAMBER PRESSURE WHEN KNOWN.)

OIL: GRADE(S) _____ BTU/GAL = _____ GPH = _____ VISCOSITY = _____ @ _____ °F

OIL NOZZLE(S): QUANTITY PER BURNER = ____ TYPE _____ MODEL _____ RATED GPH = _____ @ _____ PSIG

NOZZLE SPRAY ANGLE = _____ °, NOZZLE FIRING PRESSURE = _____ PSIG, AIR PRESSURE = _____

AGENCY APPROVAL: (✓) UL ( ) FM (HI RISK) ( ) OTHER (SPECIFY): _____
( ) FIA ( ) FM (STANDARD RISK)

ALTITUDE _____ FT. MSL (IF OVER 2000 FT. MSL)

ENGINEERING DATA:
SCHEMATIC WIRING DIAGRAM = 31-000333-20 ✓ FIELD WIRING DIAGRAM = 32-000138-30 ✓

11/4/75 OPERATING SEQUENCE = 33-000020-40 ✓ GAS PIPING SCHEMATIC = 14EN10.J

OIL PIPING SCHEMATIC = NONE INSTALLATION DRAWINGS = NONE

OTHER = NONE REQ. # 9996 (12-1)

MARK OR TAG SHIPMENT:
PEERLESS ORDER X-3898 P.O.# 47526
BURNER MODEL RB.1-G-05-R4795A4-B.15
BOILER MODEL G-713FD-WU
ORIFICES INCLUDED

JOB NAME: _____

SUBMITTALS: QUANTITY ____ (LOOSE / ROUND) (SUBMITTALS / DRAWINGS) TO BE SENT TO:

REQUIRED BY (DATE):

ORDER ENTERED BY: _____ WRITTEN BY: WCM 12-11-75 CHECKED BY: WKT 12/11 PROD. ENGRG: _____

FORM 1196

(✓) NEW ORDER ( ) CHANGE TO EXISTING ORDER (OR SLBM) ( ) SLBM (SINGLE LEVEL BILL OF MATERIALS)

SO NUMBER 50330 QUANTITY 1 (✓) RELEASED ( ) SUBMITTALS REQUIRED ( ) PAGE 1 OF 3

MODEL NUMBER = R8.1 - G - 05 - R4795A11 - B15 - - - UL - 713 F.D.
TYPE & SIZE | FUEL(S) | MOTOR HP | SAFEGUARD SYSTEM | GAS SYSTEM | GAS TRAIN | OIL SYSTEM | AGENCY APPROVAL | OEM UNIT

SLBM NUMBER = 90-500713-0000- (03 04 05 06 07 08 09 10 11 12 13 14 15) DESCRIPTION = BURNER R8 -G- -05.2 (16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43)

PHYSICAL DESCRIPTION = B- UL- 120-1-C7027A 4 0 1 (44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78)

LINE	QUAN	ACD	PGP PART OR ASSEMBLY NUMBER	SHIP	ITEM NAME
000			- - -		BURNER COMPLETE ASSEMBLY 13-072000-2010-3
001	1		23-031204-5500-7		COMBUSTION HEAD ASSEMBLY 030300-5-8 (8⅛ x 4)
002	1		23-040030-5000-6		BLOWER HOUSING ASSEMBLY 040030
003	1	C	23-090135-5100-0		RATING & N/P I.D. GRO 090135/17-099027 /094210
004			- - -		SWIRLER
005	1		23-150217-2000-8		DRAWER ASSEMBLY 150217-4
006			- - -		AIR INLET CONE 150027 & 050079
007	1		23-190103-1010-2		SAFETY GAS PILOT ASSY. GP214D4A
008			- - -		* OIL NOZZLE ( ) PRES. ( ) AIR ATOM.
009			- - -		LINKAGE SET
010	1		23-250161-2000-7		AIR INLET ASSEMBLY 250161
011			- - -		OIL SYSTEM
012	1		16-322203-0201-1		AIR FLOW SWITCH R72-B1-GFJ-87
013	1		16-324201-0000-9		GAS PILOT IGN. TRANSFORMER, 6000V T4201
014			- - -		OIL IGN. TRANSFORMER, __000V
015			- - -		BLOWER WHEEL 700 x 40 x .63 FC (Bwoo M)
016	1	A	.50-36-56C-6-1-115-230		ELECTRIC MOTOR 1/2 HP 120/60/1-6.8A
017			- - -		AIR-FUEL CONTROL MOTOR 5-RC37JG411AY
018			- - -		GAS PRESSURE GAUGE
019	1		23-359110-5540-6		GAS SYSTEM, BURNER MOUNTED B
020	1		23-359270-1110-4		PILOT CONTROL GROUP 3/8" K3R - 3/8" RV30-3-6"wc
021	1		16-374007-0010-8		FLAME DETECTOR, MOUNTED ON C7027A 1049
022			- - -		* OIL PREHEATER, KW, PH, V.
023			- - -		OIL PUMP SET
024			- - -		OIL STRAINER FOR LINE 23
025			- - -		AIR COMPRESSOR SET
026			- - -		
027			- - -		
028			- - -		
029			- - -		
030			- - -		
031			- - -		
032			- - -		
033			- - -		
034			- - -		
035			- - -		
036			- - -		
050			- - -		CONTROL CABINET COMPLETE ASSEMBLY
100			- - -		PGP STANDARD GAS TRAIN, MODEL NO.

* = ITEMS THAT ARE NOT INCLUDED IN "STANDARD PGP BURNER" SLBM.

ACD: A = ITEM TO BE ADDED TO ORDER (SLBM), C = ITEM TO BE CHANGED ON ORDER (SLBM), D = ITEM TO BE DELETED FROM ORDER (SLBM).

SHIP: INDICATE "L" (SHIP LOOSE) IF ITEM IS NOT TO BE MOUNTED ON BURNER NOR MOUNTED IN CONTROL CABINET WHEN UNIT IS SHIPPED.

JM

12 PRIM. ORIF #15-230003-2000-2

(X) NEW ORDER ( ) CHANGE TO EXISTING ORDER (OR SLBM) ( ) SLBM (SINGLE LEVEL BILL OF MATERIALS)

SO NUMBER 50330 QUANTITY 1 (X) RELEASED ( ) SUBMITTALS REQUIRED ( ) PAGE 2 OF 3

MODEL NUMBER = - G - 1/3 - 40 1HP R4795A4 B - - - UL -

TYPE & SIZE | FUEL(S) | MOTOR HP | SAFEGUARD SYSTEM | GAS SYSTEM | GAS TRAIN | OIL SYSTEM | AGENCY APPROVAL | OEM UNIT

SLBM NUMBER 94 40 1200 1100 1 HOUR DESCRIPTION PANEL 2413 G R4795A4 B 2L
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

PHYSICAL DESCRIPTION = 1.0HP IMCO UL 401
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78

LINE	QUAN	ACD	PGP PART OR ASSEMBLY NUMBER	SHIP	ITEM NAME
050			- - -		CONTROL CABINET COMPLETE ASSEMBLY
051	1	C	23-180001-0000-2	L	CONTROL CABINET BODY GP.1812 "REMOTE MTG
052	1		23-180000-0100-2		CONTROL CABINET COVER ASSEMBLY
053	1		23-180001-1110-8		CONTROL CABINET INSERT ASSEMBLY
054			- - -		ALARM ( ) BELL, SIZE ___ ( ) HORN
055			- - -		SIGNAL LAMP 2-738K
056			- - -		SIGNAL LAMP
057			- - -		SIGNAL LAMP
058			- - -		SIGNAL LAMP
059			- - -		POTENTIOMETER, FIRING RATE CONTROL
060			- - -		CONTROL SWITCH CS2502
061			- - -		MANUAL-AUTO SWITCH
062			- - -		ALARM SILENCING SWITCH
063			- - -		FUEL TRANSFER SWITCH
064			- - -		BLOWER MOTOR STARTER
065			- - -		# BLOWER MOTOR STARTER HEATERS
066			- - -		OIL PUMP STARTER
067			- - -		# OIL PUMP STARTER HEATERS
068			- - -		AIR COMPRESSOR MOTOR STARTER
069			- - -		# AIR COMPRESSOR MOTOR STARTER HEATERS
070			- - -		CONTROL FUSE ASSEMBLY, WITH FUSE FNM-5
071			- - -		CONTROL TRANSFORMER
072			- - -		LO VOLT TRANSFORMER
073			- - -		CONTROL RELAY
074			- - -		CONTROL RELAY
075			- - -		CONTROL RELAY
076			- - -		CONTROL RELAY
077			- - -		BLOWER MOTOR CONTACTOR CR5004
078			- - -		OIL HEATER CONTACTOR
079			- - -		TIME DELAY ASSEMBLY
080			- - -		TIME DELAY ASSEMBLY
081	1		16-370000-0000-8		FLAME SAFEGUARD BASE Q270A1024
082	1		16-371003-0000-1		FLAME SAFEGUARD CHASSIS R4795A1016
083	1		16-372007-0000-1		FLAME SAFEGUARD AMPLIFIER R7290A1001
084	1		16-373000-0001-3		FLAME SAFEGUARD TIMER ST71A1018
085			- - -		
086			- - -		
087			- - -		
088			- - -		

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SHIP: INDICATE "L" (SHIP LOOSE) IF ITEM IS NOT TO BE MOUNTED ON BURNER NOR MOUNTED IN CONTROL CABINET WHEN UNIT IS SHIPPED.

(✓) NEW ORDER ( ) CHANGE TO EXISTING ORDER (OR SLBM) ( ) SLBM (SINGLE LEVEL BILL OF MATERIALS)

SO NUMBER 50330 QUANTITY 1 (✓) RELEASED ( ) SUBMITTALS REQUIRED ( ) PAGE 3 OF 3

MODEL NUMBER = - J - - - B - 15 - - UL - 400-2500 3-6

TYPE & SIZE | FUEL(S) | MOTOR HP | SAFEGUARD SYSTEM | GAS SYSTEM | GAS TRAIN | OIL SYSTEM | AGENCY APPROVAL | OEM UNIT

SLBM NUMBER = 95-004100-4100-8 DESCRIPTION = TRAIN GAS UL DIA B HON

PHYSICAL DESCRIPTION = 1.50 .4-2.5M RV81-1.50 3-6WC 401

LINE	QUAN	ACD	PGP PART OR ASSEMBLY NUMBER	SHIP	ITEM NAME
100			- - -		* PGP STANDARD GAS TRAIN, MODEL NO.
101			- - -		* HI GAS PRESSURE SW., MODEL & RGE =
102			- - -		* LO GAS PRESSURE SW., MODEL & RGE =
103			- - -		MODULATING CONTROLLER, MODEL & RGE =
104			- - -		BURNER MOUNTING FRONTPLATE ASSEMBLY
105	1		16-350090-1200-8	L	* 1ST (~~OR BOTH~~) SAFETY SHUTOFF GAS VALVE(S) 1.50VH8A2185
106			- - -		* ACTUATOR FOR VALVE ON LINE 105
107	1		16-350070-1200-0	L	* 2ND SAFETY SHUTOFF GAS VALVE 1.50 KBA782
108			- - -		* ACTUATOR FOR VALVE ON LINE 107
109			- - -		* NORMALLY OPEN VENT VALVE
110	1		16-350106-1200-2	L	* MAIN GAS PRES. REG., MODEL & RGE = 3-6" 1.50 RV81
111	1		17-350400-1200-7	L	* MANUAL MAIN (~~& LEAK TEST~~) SHUTOFF VALVE 1.50 LS150
112	1		17-350400-1200-7		* MANUAL LEAK TEST SHUTOFF VALVE 1.50 LS150
113	1		23-350450-0100-4	L	* MANUAL PILOT GAS SHUTOFF VALVE 8-2M3C
114	1		18-620006-0768-1	L	* 3/8" PILOT GAS TUBING 8'
115			- - -		
116			- - -		
117			- - -		
118			- - -		
119			- - -		
120			- - -		
121			- - -		
122			- - -		
123			- - -		
124			- - -		
125			- - -		
126			- - -		
127			- - -		
128			- - -		
129			- - -		
130			- - -		
131			- - -		
132			- - -		
133			- - -		
134			- - -		
135			- - -		
136			- - -		
137			- - -		
138			- - -		

* = ITEMS WHICH ARE INCLUDED IN "STANDARD PGP GAS TRAIN" SLBM.

10-28-75

ACD: A = ITEM TO BE ADDED TO ORDER (SLBM), C = ITEM TO BE CHANGED ON ORDER (SLBM), D = ITEM TO BE DELETED FROM ORDER (SLBM).

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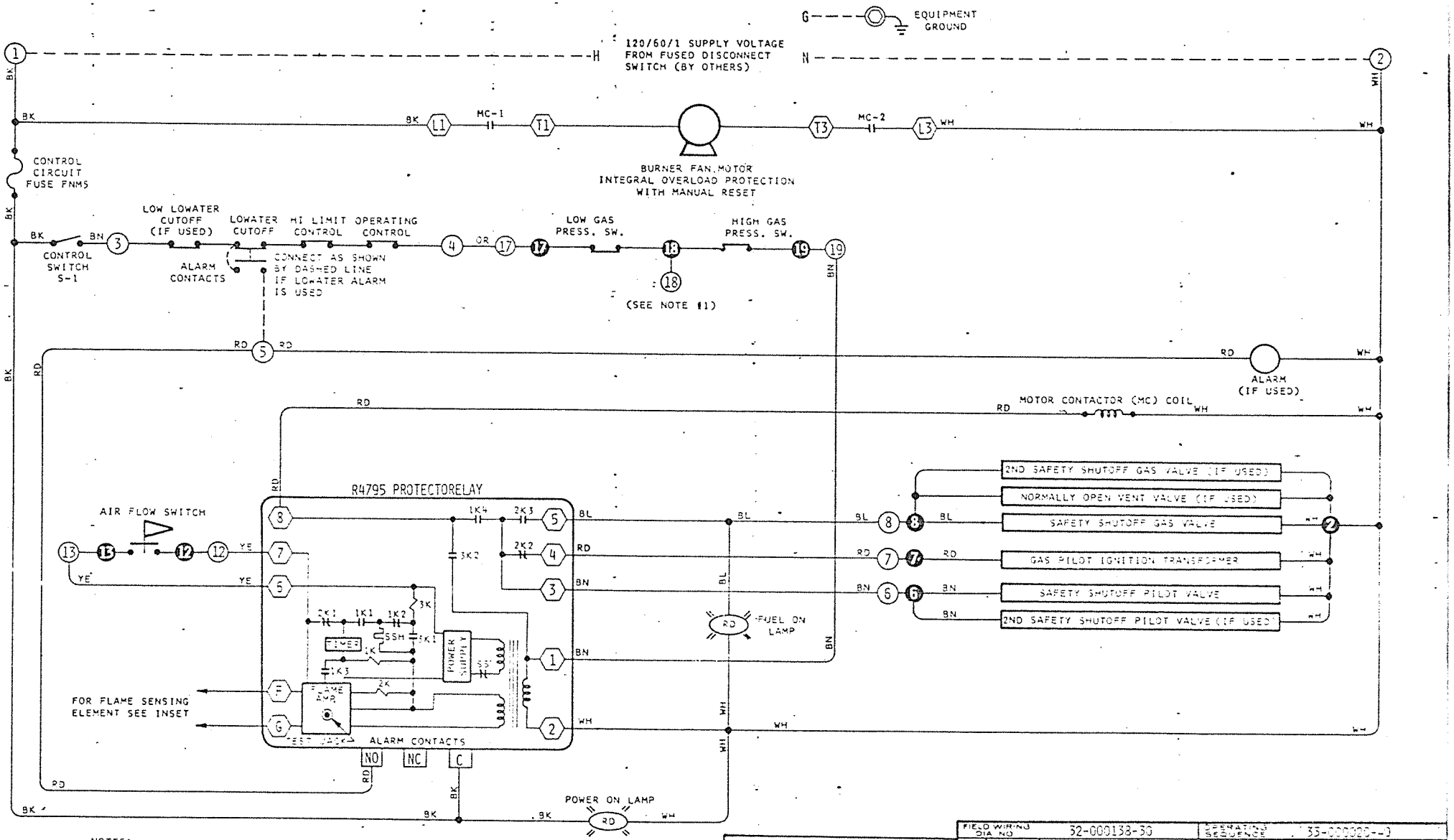
1199 - 3 - 375



NOTES:
1. GAS PRESSURE SWITCHES ARE OPTIONAL. WHEN A SWITCH IS NOT USED, JUMPER THE RESPECTIVE CABINET TERMINALS.

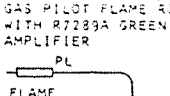
COLOR CODE

WH-WHITE OR-ORANGE BK-BLACK DB-DARK BLUE RD-RED
TN-YELLOW PK-PINK BL-BLUE GR-GREEN TN-TAN
AM-AMBER PU-PURPLE BN-BROWN GY-GRAY

CONTROL CABINET TERMINAL (2) BURNER TERMINALS (2)
COMPONENT TERMINALS (2)

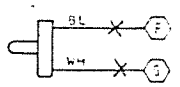
ALL WIRING MUST BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL CODES AND THE NATIONAL ELECTRIC CODE FOR CLASS 1 REMOTE CONTROL SIGNAL CIRCUITS.

GAS PILOT FLAME ROD USED WITH R7289A GREEN AMPLIFIER



TERMINALS ON FLAME SAFEGUARD CONTROL

C7027A ULTRAVIOLET FLAME SCANNER USED WITH R7290A VIOLET AMPLIFIER



TERMINALS ON FLAME SAFEGUARD CONTROL

FOR HI-LO OPERATION, SAFETY SHUTOFF GAS VALVE CHANGES TO HI-LO VALVE. WIRE AS SHOWN.

TO HI-LO PORTION OF VALVE CONTROL CIRCUIT (PER VALVE WIRING INSTRUCTIONS)

FIELD WIRING DIA NO	32-000138-30	SEQUENCE	33-000020-03	
DRAWN	CK PJR	TEST		REVISED ECN CK
DATE 12-19-78	DATE 12-8-78	DATE / /		

FG-R4795-B-G-WC
CONTROL SYSTEM SCHEMATIC WIRING

NONE
COMPONENT DRAWINGS
DIAGRAM NO 31-000333-03

P.O. Box 650 Winfield Kansas 67156
Manufacturers Of Combustion Equipment
Peabody Gordon-Piatt

BURNER OPERATING SEQUENCE

FG-R4795-$\frac{B}{H}$- G CONTROL SYSTEM

1. Begin starting sequence with Power On lamp lighted, control switch off and all Fuel valves closed.

2. Open the main manual gas valve.

3. Manually reset the high and low gas pressure switches, if being used.

4. Close control switch S-1. With all limit and operating controls calling for heat, the burner will follow the flame safeguard sequence below.

5. When burner motor starts, open the pilot gas cock.

6. When the Fuel On lamp lights, indicating pilot flame proven, open the manual leak test gas valve to ignite the main burner.

R4795 FLAME SAFEGUARD SEQUENCE

A. The flame safeguard control is energized and 3K relay pulls in. Burner motor starts.

B. Air flow switch closes, proving air flow, and the purge timing starts.

C. With purge timing complete, 1K relay pulls in; the pilot ignition transformer is energized, and the safety shutoff pilot valve(s) open to ignite the safety pilot.

D. Flame detector proves pilot flame, and 2K relay pulls in. Gas pilot ignition transformer is de-energized; purge timer resets; fuel on lamp lights; safety shutoff and second, if used, safety shutoff gas valve open. The normally open vent valve, if used, is energized to close. The main burner ignites.

If the "H" gas system is being used, the safety shutoff gas valve damper arm opens the burner air louver as the valve moves toward the full open position.

If the hi-lo operating control, "H" gas system only, if used, the safety shutoff gas valve and the burner air louver open to the low fire position. When the hi-lo operating control calls for heat, the gas valve and the burner air louver open to the high fire position gradually. The gas valve is now operated between low and high fire position by the hi-lo control as required to meet load demands.

AUTOMATIC SHUTDOWN

Operating control opens:

A. The flame safeguard control is de-energized, and relays 1K and 3K drop out. Relay 2K drops out in 2-4 seconds. All fuel valves close and the

normally open vent valve is de-energized to open. The burner motor stops. Burner is ready for automatic startup on the next call for heat.

MANUAL SHUTDOWN

1. Turn control switch off. Burner shuts down as in Automatic Shutdown.

2. Close all manual fuel valves.

SAFETY SHUTDOWN

1. If the R4795A flame safeguard control is used and a flame failure occurs, all fuel valves close and the ignition transformer is de-energized. If air flow is still proven, the purge timing restarts. When the purge timing is complete, the burner will attempt a relight. If a flame is not proven within 15 seconds, the R4795A will lock out on flame failure; the alarm, if used, sounds, and the burner motor stops.

   If the R4795D flame safeguard control is used and a flame failure occurs, all fuel valves close within 2-4 seconds. In approximately 15 seconds, the R4795D will lock out on flame failure without an attempt to relight. The burner motor stops, and the alarm, if used, sounds.

   A. The flame safeguard safety lockout switch must be manually reset before the burner will fire again.

2. If air flow fails at any time during the operating cycle, the flame safeguard 1K relay drops out. All fuel valves close and the ignition transformer is de-energized. The burner motor will continue to run. If air flow is re-established, the purge timing restarts, and startup sequence is repeated.

   A. Condition must be corrected before the burner will fire again.

3. If a lowater condition occurs, the burner shuts down as in Automatic Shutdown. If lowater alarm contacts are used, the alarm sounds.

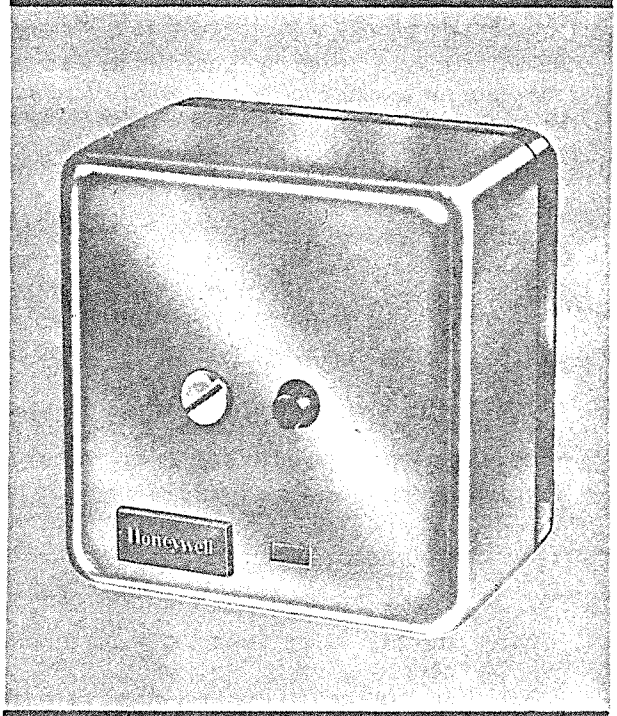
   A. Condition must be corrected before the burner will fire again.

4. If a high or low gas pressure condition occurs and the gas pressure switches are used, the burner shuts down as in Automatic Shutdown.

   A. Condition must be corrected and the respective gas pressure switch manually reset before the burner will fire again.

Honeywell

FLAME SAFEGUARD PRIMARY CONTROL



R4795A,D

THE R4795A,D PROTECTORELAY PRIMARY CONTROL PROVIDES SOLID STATE ELECTRONIC FLAME SAFEGUARD PROTECTION FOR COMMERCIAL AND INDUSTRIAL GAS OR OIL BURNERS. IT PROVIDES A PREPURGE PERIOD BEFORE EACH START, AND INTERMITTENT PILOT.

- ☐ The 120 volt models of the R4795 meet the requirements of Underwriters Laboratories Inc. Standard 795 for mechanical draft and atmospheric burner inputs from 400,000 to 2,500,000 Btu.
- ☐ R4795A meets Underwriters Laboratories Inc. requirements for oil burners, groups 7 and 8, if 30, 60, or 90 second prepurge timer is used.
- ☐ R4795D is designed for use on direct or indirect fired makeup air and space heaters; meets Factory Mutual and F.I.A. requirements for makeup air heaters.
- ☐ Selection of solid state, plug-in prepurge timers provides 7, 10, 30, 60, or 90 second prepurge time.
- ☐ R4795 includes terminals for connection of an airflow switch to prove airflow before the prepurge period starts, during purge, and during the entire "run" period.
- ☐ Choice of interchangeable, color-coded, solid state, plug-in flame signal amplifiers permits the R4795A,D to be used with rectification or ultraviolet type flame detectors.
- ☐ Safe-start feature prevents start if a flame or flame simulating condition is present.
- ☐ The R4795A will recycle once through prepurge if the flame goes out while the burner is running. If the pilot flame is not re-established, the safety switch will trip and lock out the system.
- ☐ On the R4795D, safety switch lockout will occur on (1) detection of flame (or flame simulating condition) during prepurge, (2) failure to ignite pilot or main flame, or (3) loss of flame while burner is running.
- ☐ If the safety switch trips, it must be manually reset to restore operation.
- ☐ Push-to-reset safety switch is in dust-resistant enclosure.
- ☐ Optional spdt alarm contacts are available to operate an external alarm on safety switch lockout.
- ☐ Ignition interference circuit (rectification amplifier only) protects electronic network from high voltage ignition crossover, and provides a visual indication when interference is occurring.
- ☐ Solid state circuitry eliminates vacuum tube replacement and increases resistance to vibration. Application of power not required during off cycle; no tube warmup before starting.
- ☐ Plug-in components are easy to replace, resulting in faster service and reduced inventory.
- ☐ Flame current jack, located on amplifier, provides means of plugging in microammeter to measure flame signal with system in operation.
- ☐ Easy mounting and removal through use of captive mounting screws, which also serve as electrical connections. Mounting base is made of durable thermoplastic.
- ☐ Models available with minus 40 F [minus 40 C] temperature rating.

H.A.
REV. 8-75 (.086)

Residential Div. Form Number 60-2285—4

MOUNTING R4795 ON SUBBASE

Make sure that the power supply is disconnected.

Loosen the thumbscrew and remove the cover (see Fig. 7).

Position the R4795 over the Q270 Subbase. Start all 10 mounting screws and tighten uniformly. These screws complete electrical circuits (terminal 1 excepted) as well as hold the R4795 to the subbase.

CAUTION

Do not overtighten the mounting screws as damage to the circuit board may result. Maximum recommended torque is 10 pound-inches.

Replace cover and tighten thumbscrew securely.

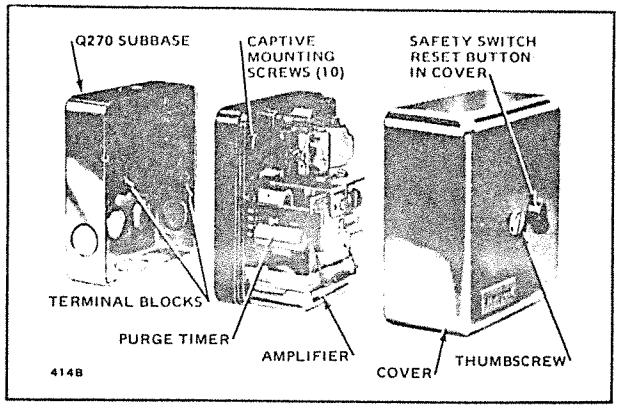


FIG. 7–R4795 AND Q270 SUBBASE.

CHECKOUT

CAUTION

Use utmost care while testing the R4795; line voltage can be present on most terminals when power is on.

CHECKOUT SUMMARY

The following list summarizes the checkout tests that are required for each type of installation. Instructions for each test are included in this section.

Preliminary Inspection–all installations.

Flame Current Check–all installations.

Pilot Turndown Test–if a pilot must be proved before the main fuel valve(s) can open.

Hot Refractory Hold-in Test–photocell oil installations only.

Ignition Spark Response Test–all ultraviolet detector applications.

Safe Shutdown Checks–all installations.

Refer to Fig. 2, 3, and 4 for terminal locations, and to Fig. 8, 9, and 10 for location of component parts. Loosen thumbscrew to remove cover.

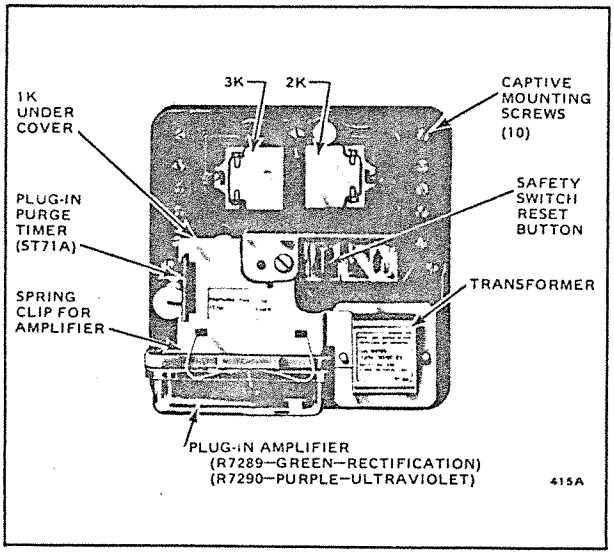


FIG. 8–INTERNAL COMPONENTS OF THE R4795A.

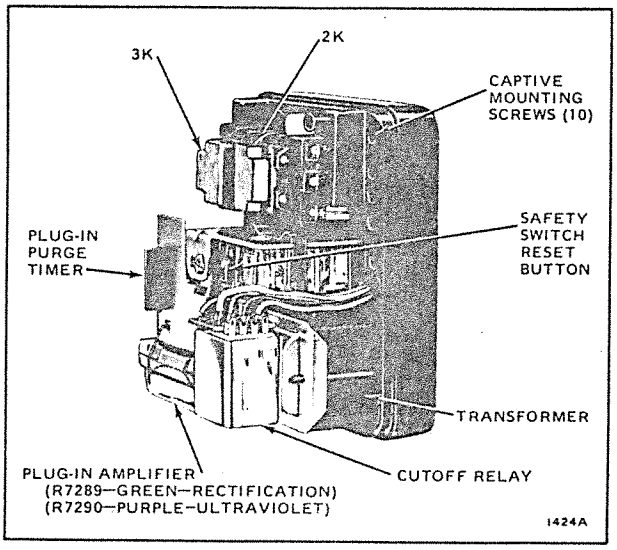


FIG. 9–INTERNAL COMPONENTS OF THE R4795D.

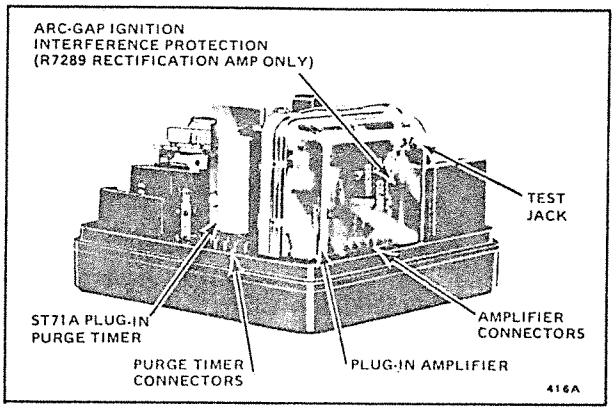


FIG. 10–INTERNAL VIEW SHOWING AMPLIFIER AND TEST JACK FOR FLAME CURRENT TEST.

PRELIMINARY INSPECTION

Make certain that:

1. Wiring connections are correct and all terminal screws are tight. Use a meter to check the continuity of all circuits.

2. Flame detector is installed and positioned properly. Consult the appropriate instruction sheet.

3. Ambient temperature at flame detector does not exceed maximum rated temperature.

4. Correct combination of amplifier and flame detector is used. Refer to Plug-in Flame Signal Amplifiers under SPECIFICATIONS.

5. Burner is completely installed and ready to fire; fuel lines are purged of air.

6. Combustion chamber and flues are clear of fuel and fuel vapor.

7. Power is connected to system disconnect switch (master switch).

8. Safety switch is reset; push in and then release the green safety switch button.

9. All limits and interlocks are reset.

IMPORTANT

Anytime you reset the safety switch, wait at least 1 minute after it trips to allow the heater to cool before pushing in the reset button.

CAUTION

Make initial pilot lightoff with manual main fuel shutoff cock closed.

FLAME CURRENT CHECK

The flame current check is the best indicator of proper flame detector application. The check should be done at the time of installation, at any time service is done on the system, and at least once a month (or more often) while the system is in operation. This will prevent shutdowns due to poor flame signal.

The test is done by connecting a W136 (or equivalent) to the amplifier and reading the flame current while the main burner is operating (Fig. 11).

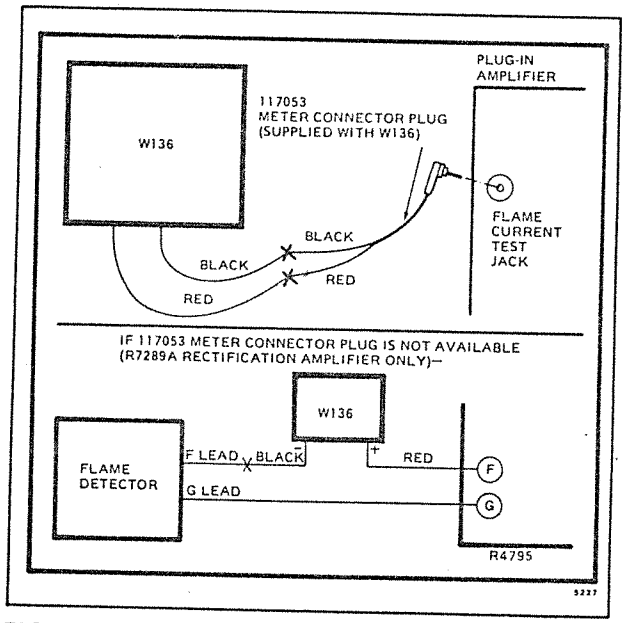


FIG. 11—CONNECTING METER TO READ FLAME CURRENT.

Insert a 117053 Meter Connector Plug, wired color-to-color to the W136 leadwires, into the test jack on the amplifier (see Fig. 10). This automatically puts the microammeter in series with the flame detector.

If an R7289A rectification type amplifier is used and a meter connector plug is not available, disconnect the flame detector lead from the F terminal; then connect this lead to the BLACK lead of the microammeter, and connect the RED lead of the microammeter to the F terminal.

NOTE: If an R7290A ultraviolet type amplifier is used, the flame current cannot be read by connecting a microammeter in series with the F lead.

When reading the flame current, insure that 2 criteria are met:

1. The flame current must be steady; meter should not vary more than a needle width.

2. The flame current must be at least 2 microamperes for an R7289A Rectification Amplifier (color-coded green), or at least 1.5 microamperes for an R7290A Ultraviolet Amplifier (color-coded violet).

IF A STEADY READING OF AT LEAST MINIMUM STRENGTH CANNOT BE OBTAINED, 1 OR MORE OF THE FOLLOWING CONDITIONS MAY EXIST:

- Improper supply voltage.
- Defective flame detector wiring, including—
  - —open circuits.
  - —short circuits.
  - —high resistance shorts caused by moisture, accumulated dirt, or an improper choice of detector leadwire for the particular installation.
- Improper sighting, improper viewing window, or dirty viewing window for optical detectors.
- Improper application of a flame rod, including—
  - —insufficient ground area.
  - —poor location of flame rod in flame.
  - —excessive heat on flame rod insulator (greater than 600 F [316 C]).
  - —ignition interference.
- Improper application of a vacuum photocell, including—
  - —temperature over 165 F [74 C] at photocell.
  - —dirty photocell envelope.
- Defective sensor.

PILOT TURNDOWN TEST

IMPORTANT

If the R4795 is used to prove a pilot flame, perform the following turndown test to insure that the main burner can be lit by the smallest pilot flame that will hold in the 2K (flame) relay.

1. Shut off the fuel supply to the main burner only by closing the manual main burner shutoff cock. Do not shut off fuel supply to the pilot valve.

2. Start the system by raising the set point of the controller (or pressing the start button). After the prepurge is completed, the pilot will light and pull in the flame relay.

(continued on page 8)

3. Reduce the size of the pilot flame to the turndown condition by slowly closing the manual valve on the pilot gas line. At the turndown condition, the pilot will be small enough so it just barely holds in the flame relay (2K).

a. Slowly turn down the pilot until the flame relay drops out.
b. Allow the control to complete prepurge. (On the R4795D, the control will lock out when relay 2K drops out. Permit the safety switch to cool, reset, and restart the system.)
c. As the control attempts to restart the pilot, turn the pilot back up slowly just until relay 2K pulls back in. You will have 15 seconds to complete this step before lockout occurs.
d. Again turn the pilot down slightly but not enough so the flame relay drops out. If the relay drops out, simply allow the control to complete the purge period and then turn the pilot back up to pull in the flame relay as in step c, above. The R4795D will lock out if the 2K relay drops out. If this occurs, allow the safety switch to cool, reset the switch, then restart the system and adjust the pilot as in step c, above. The closer the pilot is to the dropout condition the more conclusive the test will be.

CAUTION
DO NOT PUSH THE RELAYS IN MANUALLY.

4. Check that pilot is lit and relay 2K is pulled in.
5. Open the manual main burner shutoff cock. Main flame should light within 1 second. If the burner does not light within 1 second, close the shutoff cock and shut off power to the relay. Proceed to step 7.
6. If the burner lights, repeat step 5 two or three times to verify the lightoff.
7. If the lightoff is unsatisfactory, readjust the flame detector to require a larger pilot flame to hold in the flame relay. This usually requires–
   a. resighting a photocell or UV type detector farther out on the axis of a pilot flame, or
   b. adjusting a flame rod detector so that a larger minimum pilot is required.
8. Repeat the entire turndown test until the flame is established promptly in step 5.
9. Turn the pilot up to full flame at the completion of the test.

HOT REFRACTORY HOLD-IN TEST (Photocell Oil Installations Only)

If hot refractory holds in the flame relay at the end of the burner-on cycle, the system cannot restart until the relay drops out. Check for hot refractory hold-in by observing the flame relay for immediate dropout at the end of a long burner-on period. If the relay does not drop out, resight the photocell so it does not sight the refractory, or decrease photocell sensitivity by use of aperture discs or filters.

IGNITION SPARK RESPONSE TEST (UV Detectors)

The flame relay should not respond (pull in) to ignition spark. To determine flame detector sensitivity to ignition spark, perform the following test.

1. Shut the pilot and main fuel manual valves.
2. Start the system by raising the controller set point or pressing the start button. This should energize the ignition transformer so spark is produced between electrode and ground.
3. Check the flame relay 2K. The relay should not pull in. The flame signal current should not be more than 1/4 microamp.
4. If relay 2K does pull in, resight the detector farther out from the spark, or away from possible reflection. It may be necessary to construct a barrier to block the ignition spark from the detector's view. Continue adjustments until flame detector does not respond to the ignition spark.

IMPORTANT

Repeat ALL required checkout tests after all adjustments have been completed. ALL tests must be satisfactory when the flame detector is in its FINAL position.

SAFE SHUTDOWN CHECKS

LIMIT ACTION

With the burner operating, lower the high limit setting to simulate an overheated boiler or furnace. Normal shutdown should occur. Restore the normal limit setting and the burner should go through a normal prepurge and start.

The use of manual reset limits is desirable to prevent the system from cycling off the high limit, and to insure that the condition which caused the limit action is detected as soon as possible.

FLAME FAILURE

Let burner operate 5 minutes; then manually shut off fuel supply to simulate flame failure. Relay should drop out and fuel valve(s) close. The system will purge and then lock out on safety. (The R4795D will lock out without purge.) Let the safety switch cool for 1 minute, reopen manual fuel valve, and reset safety switch. Burner should start.

POWER FAILURE

Let burner run 5 minutes; then simulate power failure by opening and immediately closing line switch. All relays should drop out and fuel valves should close. The R4795 should go through a normal cycle.

IMPORTANT

At the completion of all Checkout tests, make sure that the R4795 is not on safety lockout, that the pilot is turned up to its normal level, and that all limit settings are correct. Operate the system through 1 normal cycle. Replace cover and tighten thumbscrew securely.

OPERATION

NORMAL OPERATION (Refer to Figs. 2 and 3 on page 4.)

Call for Heat (limit switch closed)	Terminal 1 energized. Relay 3K pulls in to close contact 3K2 and energize terminal 8—fan or burner motor.
Airflow Proved	Low voltage airflow switch between terminal 6 and 7 closes to energize the purge timer.
Prepurge Complete (7, 10, 30, 60, or 90 seconds)	Relay 1K pulls in to close contact 1K4 and energize terminal 3 (pilot valve, 1st stage oil valve(s), or expanding pilot valve) directly and terminal 4 (ignition) through the closed flame relay contact 2K2. Contact 1K1 closes to energize the safety switch heater.
Flame Proven (pilot or first stage oil)	R4795A Relay 2K pulls in. Contact 2K2 opens to cut off ignition, contact 2K3 closes to energize the main fuel valve(s) or 2nd stage oil valve(s). Contact 2K1 opens to de-energize the safety switch heater and reset the purge timer. R4795D Relays 2K and 4K pull in. (Pull-in of 4K de-energizes the prepurge circuit.) Contact 2K2 opens to cut off ignition; 2K3 closes to power the main valve(s). Contact 2K1 opens to de-energize the safety switch heater.
Controller Satisfied	All relays drop out, system shuts down.

SAFETY OPERATION

Flame Failure	R4795A Relays 1K and 2K drop out. Contact 1K4 opens to de-energize terminals 3, 4, and 5. If air is still proven, the prepurge period begins. After prepurge, one attempt is made to start the burner. R4795D Relays 1K and 2K drop out. Contact 1K4 opens to de-energize terminals 3, 4, and 5. Safety switch heats and the control locks out without going through prepurge.
Airflow Failure	If airflow fails at any time during the operating cycle, relay 1K drops out. Contact 1K4 opens to de-energize terminals 3, 4, and 5. Only terminal 8, fan or burner motor, remains powered. If air is re-established, the prepurge period starts and the startup sequence is repeated.
Prepurge Timer Failure	If the plug-in purge timer is not properly seated, or is not functioning properly, the fan motor will start on a call for heat, but the 1K relay will not pull in. The result will be a continuous purge (safe failure).
Hot Refractory Hold-in (photocell installations)	If hot refractory holds in the flame relay at the end of the running cycle— R4795A Startup is prevented until the hot refractory no longer holds in the flame relay. R4795D The safety switch heater is energized on startup and the control locks out. (Photocell must be orificed or resighted so that hot refractory is no longer sensed.)

TROUBLESHOOTING

The first step in troubleshooting the R4795A,D is to determine the location of the trouble in the system.

Reset the safety switch and operate the system on a normal start. Refer to the Normal Operation summary on page 8. Observe the operation carefully to determine at what point the trouble occurs. Then refer to the trouble list below and follow the troubleshooting procedure outlined.

IMPORTANT

At the completion of any troubleshooting procedure, be sure to perform the CHECKOUT beginning on page 6.

PRELIMINARY INSPECTION

1. Disconnect power to the R4795 by opening the system disconnect switch.

(continued on page 10)

2. Remove the R4795 cover. Make sure all mounting screws are tight, and insure that the plug-in amplifier and purge timer are properly seated (refer to Fig. 10, page 6).

3. Reset the safety switch (push in and release the small round button which extends through the plastic safety switch cover; see Figs. 8 and 9).

TROUBLE LIST

Compare the following list of troubles with the actual deviations from the normal operating sequence. Select the applicable letter(s) and proceed to the corresponding troubleshooting procedure(s).

A. Relay 3K doesn't pull in on a call for heat.
B. Relay 3K pulls in but the burner motor doesn't start.
C. Control locks out during prepurge (R4795D).
D. Burner motor starts but prepurge does not stop at end of purge timing (relay 1K does not pull in).
E. Relay 1K pulls in but the pilot doesn't light, ignition doesn't occur, or expanding pilot valve doesn't open.
F. Pilot lights but relay 2K does not pull in (control locks out without lighting the main burner).
G. Pilot lights and relay 2K pulls in but the main burner doesn't light.
H. Relay 2K remains in after flame is extinguished.
I. Miscellaneous problems–
   1. Repeated lockouts or control failures.
   2. Ignition interference (flame rod installations only).

TROUBLESHOOTING PROCEDURES

CAUTION

1. Use utmost care while troubleshooting the R4795; line voltage is present on most contacts when power is on.
2. Open the master switch before removing cover, cleaning contacts, removing R4795 from subbase, or reinstalling R4795 on subbase.

Refer to Figs. 8 and 9 (page 6) for location of relays.

IMPORTANT

1. Clean contacts only when instructed to do so in a troubleshooting procedure. Follow instructions under Contact Cleaning on page 12.
2. If, after completing an applicable troubleshooting procedure, proper operation still cannot be obtained, replace the R4795 (except amplifier and purge timer, unless noted).

A. RELAY 3K DOESN'T PULL IN ON A CALL FOR HEAT–

1. Check for power at terminals 1 and 2 with the controller calling for heat.
   a. Voltage must be within plus 10 to minus 15 percent of the rated voltage for dependable operation.
   b. If voltage is zero, check the continuity of the limit and controller contacts and check the power supply. Look for blown fuses, open switches, and bad wiring connections.
2. If voltage at terminals 1 and 2 is satisfactory and relay 3K will not pull in, clean the 1K and 3K relay contacts. Press safety switch button several times to clean its contacts. If trouble persists, replace the R4795.

B. RELAY 3K PULLS IN BUT THE BURNER MOTOR DOESN'T START–

1. Check for power at terminal 8 when the 3K relay pulls in.
   a. If terminal 8 is not powered, clean the 3K relay contacts and recheck for power. If terminal 8 cannot be powered, replace the R4795.
   b. If terminal 8 is powered, check the fan or burner motor.

C. CONTROL LOCKS OUT DURING PREPURGE (R4795D)–

If the flame relay pulls in during the prepurge period of the R4795D, the control will lock out. Check for flame simulating failure.

R7289A RECTIFICATION AMPLIFIER

1. Disconnect the flame circuit by inserting the plug end of a meter jack or flame simulator into the flame current jack on the front of the amplifier. Do not ground the other end of the plug or simulator.
2. Restart the system. If the flame relay now pulls in, replace the amplifier. If the flame relay does not pull in, check the flame detector and external flame circuit. Check for light reaching photocell, hot refractory hold-in, defective wiring, or defective detector.

R7290A ULTRAVIOLET (UV) AMPLIFIER

1. Measure flame current with a W136 Microammeter by inserting the meter connector plug into the flame current jack. The flame current should not exceed 1/4 microamp during the prepurge period.
2. If an excessive flame current is present, replace the UV amplifier and measure flame current during prepurge. If an excessive current persists, replace the UV detector and check detector wiring.

If the lockout problem cannot be traced to a flame simulating failure, replace the R4795.

D. BURNER MOTOR STARTS BUT PREPURGE DOES NOT STOP AT END OF PURGE TIMING (RELAY 1K DOES NOT PULL IN)–

1. Check the seating of the plug-in purge timer.
2. Check that the airflow switch contacts are making. Approximately 20V dc should appear between terminals 7 (plus) and G (minus) if airflow switch contacts are made.

3. Check the position of the flame relay. If relay 2K is pulled in, check for flame simulating condition as described in procedure C, above.
4. If the flame relay is not pulled in, clean the 2K relay contacts.
5. Replace the purge timer with one of the same timing. If problem still continues, replace the R4795.

E. RELAY 1K PULLS IN BUT THE PILOT DOESN'T LIGHT, IGNITION DOESN'T OCCUR, OR EXPANDING PILOT VALVE DOESN'T OPEN–

1. Make sure that all manual fuel valves are open.
2. Check voltage between terminals 3 and 2, or 4 and 2, as applicable. (Terminal 3 is used for pilot or 1st stage oil valve; terminal 4 for ignition.) Check must be made before control locks out on safety.
3. If zero voltage, clean the 1K and 2K relay contacts; then recycle the system and recheck the voltage at terminal 3 or 4. If terminals cannot be powered, replace the R4795.
4. If correct voltage at terminals 3 and 4, check the pilot valve and ignition, and their circuits.

F. PILOT LIGHTS BUT RELAY 2K DOES NOT PULL IN (CONTROL LOCKS OUT WITHOUT LIGHTING THE MAIN BURNER)–

1. Use a 121708 (rectification) or 123514B (UV) Flame Simulator to check the flame relay. Follow the instructions with the simulator.
2. If no flame simulator is available, make a flame current check as instructed on page 7. If the flame current is satisfactory, replace the R4795. If the flame current is not satisfactory, check all items on page 7.

G. PILOT LIGHTS AND RELAY 2K PULLS IN BUT THE MAIN BURNER DOESN'T LIGHT–

1. Check that the manual main fuel valves are all open.
2. Check the voltage at terminal 5 when the 2K relay pulls in.
   a. If normal voltage at terminal 5, check the main valve and the external valve circuit.
   b. If zero voltage at terminal 5, clean the 2K relay contacts. If terminal 5 cannot be powered, replace the R4795.

H. RELAY 2K REMAINS IN AFTER FLAME IS EXTINGUISHED–

1. If the flame detector is a rectifying flame rod, install a new plug-in amplifier.
2. If the flame detector is a rectifying photocell or C7012 Ultraviolet Detector, plug the jack end of the flame simulator into the jack of the plug-in amplifier.
   a. If that does not cause relay 2K to drop out, install a new plug-in amplifier.
   b. If plugging into the meter jack causes relay 2K to drop out, the trouble is caused by hot refractory hold-in, detector failure, or other flame simulating conditions.
      (1) Resight the photocell at a cooler or more remote area of the refractory.
      (2) Recheck the flame detector current for the condition recommended in the CHECKOUT section. Replace the detector if necessary.
      (3) Remove any flame simulating condition such as false light.
      (4) Any change made in the detector or its sighting will require a pilot turndown test.
3. If using an R7290 Ultraviolet Amplifier, replace the amplifier and recheck the flame relay dropout time. If the flame relay dropout timing is still excessive, replace the detector and check its wiring.
4. If trouble persists, replace the R4795.

I. MISCELLANEOUS PROBLEMS–

1. REPEATED LOCKOUTS OR CONTROL FAILURES

The most common causes of repeated failures of the control or flame detector, or repeated lockouts are:

a. High ambient temperatures–over 125 F [52 C]. Subtract 10 F [6 C] for alarm contacts and 10 F [6 C] for 50 Hz operation. Minus 40 F [minus 40 C] models have a maximum ambient of plus 115 F [46 C] at 60 Hz, plus 105 F [40 C] at 50 Hz.
b. Supply voltage variation greater than plus 10 to minus 15 percent.
c. Marginal flame signal.
d. Intermittent limits or airflow switch (R4795D).
e. Faulty flame detector.

2. IGNITION INTERFERENCE (FLAME ROD INSTALLATIONS ONLY)

What it is. Ignition interference is a false signal from a spark ignition source superimposed upon the basic flame signal. It is normally associated with a marginal flame reading, and usually caused by a marginal flame ground.

How detected. The arc gap circuit in the rectification amplifier (Fig. 10) protects the R4795 from ignition interference. However, it also prevents operation when ignition interference is present above the arcing level of the device. If a shutdown is caused by ignition interference, the arc gap protector will glow.

Continuous interference below the arcing level can be detected by reading flame current with pilot and ignition on; then with pilot only. Any substantial difference indicates the presence of ignition interference.

Intermittent ignition interference may be due to very turbulent air in the ignition electrode area.

(continued on page 12)

For arc-over elsewhere, examine the electrodes for spacing and for unusual dirt conditions or dust accumulations between the ignition leads and flame leads.

How eliminated (tabulated in order of importance).

1. Provide adequate flame grounding area.
2. Be sure the ignition electrode and the flame rod are on opposite sides of the grounding area.
3. Check for correct spacings on the ignition electrode. Spacing should be 1/16 in. [1.5 mm] to 3/32 in. [2.5 mm] for 6,000 volt systems; 1/8 in. [3 mm] to 3/16 in. [5 mm] for 10,000 volt systems.
4. Eliminate any marginal spacings at other areas along the lead routes. Replace any deteriorated leads.

SERVICE

GENERAL

1. Only qualified personnel should attempt to service heating equipment or controls.

2. Do all checks required under the CHECKOUT section (beginning on page 6) when replacing the R4795, or when relighting or restoring power to the system after shutdown.

3. The captive mounting screws carry current; always disconnect power before loosening or tightening the mounting screws.

4. On each service call, check the controller for approximate correct calibration and differential; insure that it is mounted securely. (See controller instructions.)

5. Never use oil on any part of the R4795.

6. When cleaning the burner, clean flame detector.

7. DO NOT PUSH IN THE R4795 RELAYS MANUALLY. This may damage the relays and it is an unsafe practice because it overrides the protective features of the relay. Clean relay contacts only as instructed below.

PERIODIC MAINTENANCE

The specific maintenance schedule set up will depend on a number of factors, including type of equipment being controlled, operating conditions (dirt and heat especially), and the cost of a nuisance shutdown. The following should be included in any program:

Replace the vacuum tubes in the C7012 Flame Detector (if used) annually.

Perform a flame failure check and pilot turndown test whenever the burner is serviced, and at least annually.

Inspect and clean the detector and any viewing windows as often as required by soot accumulation and heat conditions at the detector.

Do a flame current check at least monthly, and more often where a shutdown may be costly.

Clean contacts only when required by failure to operate properly.

CONTACT CLEANING

CAUTION

Open the master switch before removing cover or cleaning contacts. Line voltage is present on most contacts when power is on.

IMPORTANT

1. Do not clean contacts unless absolutely necessary.
2. Use only Honeywell contact cleaner, Part No. 132569. Do not use any other type of contact cleaner.
3. Use utmost care to avoid bending the contacts or changing their specifications or configuration in any way.
4. Do not use abrasive material to clean contacts.
5. Do not use hard paper, such as a business card, to clean contacts.

If relay contacts must be cleaned, use only Honeywell pressurized contact cleaner, Part No. 132569. Honeywell's chemical analysis laboratory has found this cleaner to be acceptable for this task. Directions for using this cleaner are printed on the can.

Do not risk use of other types of contact cleaners. Honeywell's chemical analysis laboratory tested other pressurized type contact cleaners but did not approve them for these reasons:

1. Some had solvents that could deteriorate plastic parts and wire insulation.
2. Some leave an oily residue which will collect dust and dirt. The residue will also break down to form various carbonaceous products. Either result will cause early contact failure.

Do not use an abrasive (burnishing tool, sand paper stick, file, etc.) to clean contacts. Use of an abrasive can cause early contact failure for these reasons:

1. Some relay contacts are plated with gold for increased reliability. Burnishing can quickly remove the plating.
2. The radii or points of the contacts are designed with specific shapes to best serve the intended functions of the contacts. Burnishing can rapidly alter these contact configurations.
3. Use of an abrasive loosens fine particles of the contact material which adhere to the surface of the contact, thus increasing its resistance.
4. Contact specifications (contact pressures, press-back, and gaps) are carefully controlled during manufacturing to ensure maximum contact life. Burnishing can easily change these specifications.

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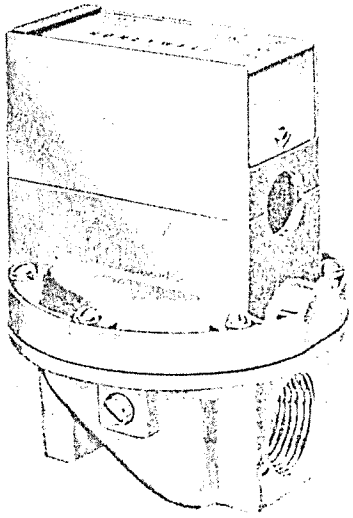
Honeywell

DIAPHRAGM GAS VALVES

THE V48 AND V88 ARE SOLENOID OPERATED DIAPHRAGM VALVES USED TO CONTROL ALL TYPES OF HEATING GASES.

- A line voltage, two wire thermostat or controller is used with the V48; the V88 is used with a 24 volt thermostat.
- These valves provide slow opening and fast closing.
- 2 seconds maximum closing time on 2 to 3 inch valves.
- 1 second maximum closing time on 3/4 to 1-1/2 inch valves.
- V88H is rated for use in minus 40 F ambients.
- V48F is rated for 5 pound service. V48A and V88A are rated for either 8 ounce or 1 pound service depending on model.
- One model for all types of gas.
- Wide range of sizes and capacities.
- Firm closing—diaphragm is both weight and spring loaded.
- Valve closes on power failure.
- Adjustable or fixed bleed orifices available for installation by OEM.



V48A,F,H
V88A,H

Residential Div. Form Number 60-2080—2

S.K.
REV. 8-75 (.059)

SPECIFICATIONS

MODELS:

V48A, V88A Solenoid Operated Diaphragm Gas Valves for 8 ounce or 1 pound operating pressures.

V48F–For 5 pound operating pressure and 32 to 125 F [0 to 52 C] ambient temperature.

V88H–For 1 pound operating pressure and minus 40 to plus 125 F [minus 40 to plus 52 C] ambient temperature.

MODEL	VOLTAGE/ FREQUENCY	PIPE SIZE (IN.)	THREADS	MAXIMUM OPERATING PRESSURE
V48A	120/60	3/4, 1, 1-1/4, 1-1/2	NPT	8 oz.
	240/60	3/4, 1, 1-1/4	NPT	
	120/60	1, 1-1/4, 1-1/2, 2, 2-1/2, 3	NPT	
	220/50	1, 1-1/4, 1-1/2, 2, 2-1/2, 3	BSP PL.	1 lb.
	240/50	2	NPT	
V88A	24/60	3/4, 1, 1-1/4, 1-1/2	NPT	8 oz.
	24/60	3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3	NPT	1 lb.
	24/50	1	BSP PL.	
V48F	120/60	2, 2-1/2, 3	NPT	5 lbs.
V88H	24/60	1	NPT	1 lb.

NOTE: Additional combinations available on special order. See your Honeywell salesman.

TYPE OF GAS: Suitable for all heating gases.

VALVE CAPACITIES: See table, graph, and conversion formula on page 4.

VALVE PATTERN: Straight-through, nonoffset.

VALVE BODY MATERIAL: Aluminum.

PILOT TAPPING:

3/4 to 1-1/2 inch valves–1/8-27 NPT std., available with adapter for 1/8-28 BSP PL.

2 to 3 inch valves–1/4-18 NPT std., available with adapter for 1/4-19 BSP PL.

BLEED TAPPING: 1/8 inch–27 NPT. (Part No. 100418 1/4 inch compression fitting included.)

VALVE CLOSING TIME: 2 seconds maximum (1 sec. on 3/4, 1, 1-1/4, and 1-1/2 sizes).

VALVE OPENING TIME: 5 seconds maximum at 2 ounce pressure. Adjustable or fixed bleed orifices available for longer opening time.

PRESSURE RATINGS: See table above.

POWER CONSUMPTION:

V48–8 watts, running.

V88–5.2 watts, running.

AMBIENT TEMPERATURE RATING:

V48A,F, V88A–32 to 125 F [0 to 52 C].

V88H–minus 40 to plus 125 F [minus 40 to plus 52 C].

mended. Order separately.

THERMOSTAT HEAT ANTICIPATOR SETTING: On V88, set at 0.6 amp for 60 Hz or 0.65 amp for 50 Hz.

UNDERWRITERS LABORATORIES INC. LISTED: File No. MH1639, Guide No. YIOZ (all 60 Hz models).

(continued on page 3)

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALER OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER.

SPECIFY–

1. MODEL NUMBER.
2. PIPE SIZE.
3. PRESSURE RATING.
4. TRANSFORMER FOR V88A.
5. OPTIONAL FEATURES, IF REQUIRED.

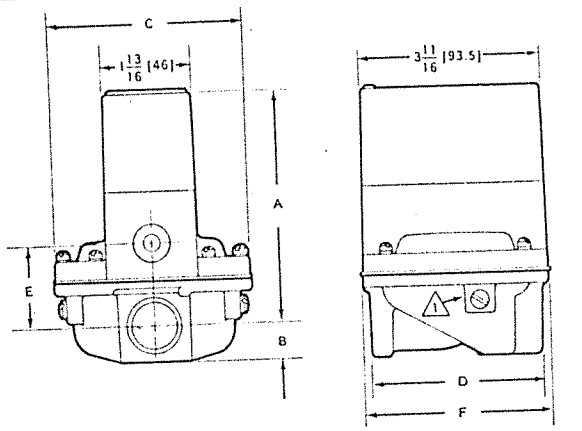
IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL RESIDENTIAL SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY).
2. RESIDENTIAL DIVISION CUSTOMER SERVICE
   HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
   MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500

   (IN CANADA–HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO) INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

DIMENSIONS:

VALVE SIZE	A		B		C		D		E		F	
	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
3/4	4-11/16	119	3/4	19.0	4-1/16	103.0	3-1/2	89.0	1-5/8	41.5	3-13/16	97.0
1	5- 1/8	130	1	25.5	4-1/2	114.5	3-1/2	89.0	2	51.0	4- 1/4	108.0
1-1/4	5- 5/16	135	1- 3/16	30.0	5-1/2	139.5	4-5/8	117.0	2-1/4	57.0	5- 5/16	135.0
1-1/2	5- 5/16	135	1- 1/4	32.0	5-1/2	139.5	5-5/16	135.0	2-1/2	63.5	5- 5/16	135.0
2	6- 5/8	168	1-15/16	49.0	9	228.5	8-3/8	212.5	3-5/16	84.0	9	228.5
2-1/2	6- 5/8	168	1-15/16	49.0	9	228.5	8-3/8	212.5	3-5/16	84.0	9	228.5
3	6-15/16	176	2- 1/4	57.0	9	228.5	8-3/8	212.5	3-5/8	92.0	9	228.5



⚠ PILOT TAPPING (2). 1/8—27 NPT FOR 3/4 IN. THROUGH 1-1/2 IN. SIZES, 1/4—18 NPT FOR 2, 2-1/2, AND 3 IN. SIZES. 22238

CANADIAN STANDARDS ASSOCIATION CERTIFIED (all 60 Hz models of V48A and V88A).

AMERICAN GAS ASSOCIATION CERTIFIED (all 60 Hz models).

CANADIAN GAS ASSOCIATION CERTIFIED (V48H, V88H, and 60 Hz models of V48F).

OPTIONAL FEATURES:

126590 Adjustable Bleed Valve Assembly. Consists of adjustable bleed valve, and ferrule and compression nut for 1/4-inch tubing. See Fig. 6.

Fixed Bleed Orifice. Required for field mounting—126070 Orifice Tool and orifice from Table 1.

REPLACEMENT COIL ASSEMBLIES:

V48A,H—
120V, 60 Hz, Part No. 116931.
220V, 50 Hz, Part No. 116932.
240V, 50 Hz, Part No. 116950.
240V, 60 Hz, Part No. 116932.

V88A,H—
24V, 60 Hz, Part No. 116930.
24V, 50 Hz, Part No. 116949.

V48F—
120V, 60 Hz, Part No. 137700.

TABLE 1—EXTENDING VALVE OPENING TIME (IN SECONDS[a]) BY ADDING BLEED ORIFICES

VALVE SIZE INCHES	VALVE OPENING TIME (SEC)				
	NO ORIFICE	ORIFICE NO. 388448E, .018 IN. SIZE	ORIFICE NO. 388448C, .011 IN. SIZE	ORIFICE NO. 388448N, .008 IN. SIZE	ORIFICE NO. 388448U, .006 IN. SIZE
1	1	—	3	6	16
1-1/4	1	—	6	12	15
1-1/2	1	—	6	13	18
2	4	—	32	75	170
2-1/2	4	23	37	68	—
3	5	24	37	68	—

[a]Time to reach 80 percent gas flow at full open position. Inlet pressure 4.2 in. wc, 1-2 in. valves; 5 in. wc for 2-1/2, 3 in. valves. Pressure drop across valves at full open position, .2 in. wc for 1-2 in. valves; 1 in. wc for 2-1/2, 3 in. valves.

GAS VALVE SIZING

1. Check the burner nameplate for (a) the type of gas used, and (b) the gas flow capacity. The capacity will be listed in Btuh or in cfh.

2. Call the gas utility for information on (a) the specific gravity (sp gr) and (b) Btu per cubic feet (Btu/cu ft) for type of gas used.

3. Find the capacity in cfh. If the capacity is listed in Btuh, convert to cfh by the following formula.

$$\text{Capacity in cfh} = \frac{\text{Btuh (from burner nameplate)}}{\text{Btu/cu ft (from gas utility)}}$$

4. For gases with specific gravities other than 0.64, multiply the burner cfh by the proper conversion factor shown.

TYPE OF GAS	SP GR (AVERAGE)	MULTIPLY CFH BY
Manufactured	0.60	.97
Mixed	0.70	1.05
LP—Propane	1.53	1.55
LP—Butane	1.98	1.76

5. Use the corrected capacity in cfh when plotting the gas valve size in Fig. 1.

6. Determine the maximum pressure drop to be taken across the valve.

7. Plot the capacity (cfh) vs. pressure drop (psi) in Fig. 1 to find the proper valve size. NOTE: Use the corrected cfh for gas other than 0.64 sp gr.

TO SIZE 2 IDENTICAL VALVES PIPED IN SERIES

1. Find the cfh for the type of gas used.
2. Consider both valves as 1 unit. Determine the total maximum pressure drop across the unit.
3. Find the pressure drop across the first valve by assuming it to be 45 percent of the total pressure drop.
4. Plot the valve size using the Capacity vs. Pressure Drop Chart.
5. The second valve size will be the same as the first valve.

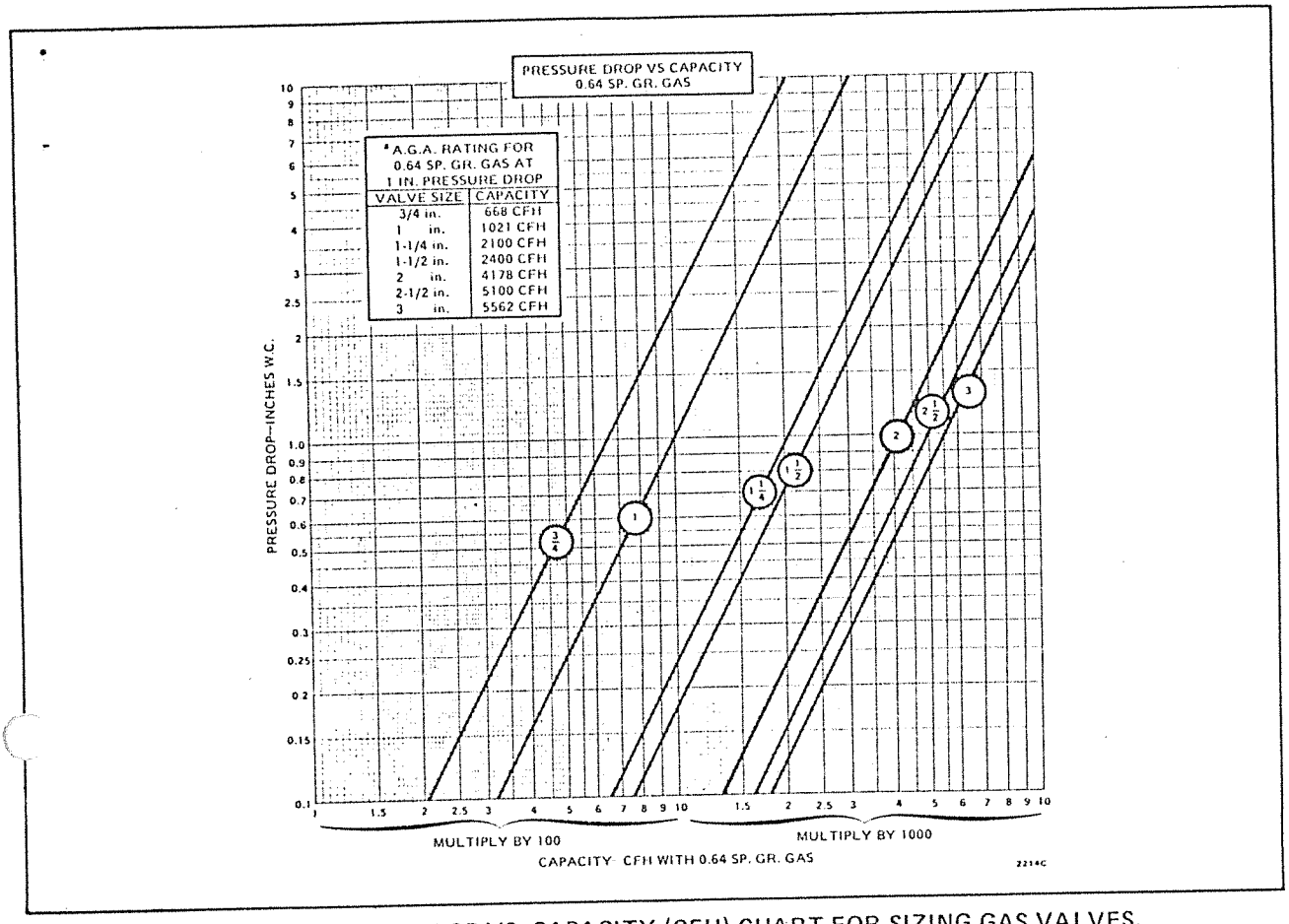


FIG. 1—PRESSURE DROP VS. CAPACITY (CFH) CHART FOR SIZING GAS VALVES.

INSTALLATION

CAUTION

1. Installer must be a trained, experienced serviceman.
2. Turn off gas supply before starting installation.
3. Do not remove seal over valve inlet or outlet until ready to connect piping.

PREPARE AND INSTALL VALVE

1. Use new, properly reamed pipe free from chips.
2. Do not thread pipe too far. Valve distortion or malfunction may result from excess pipe in control.
3. Apply good quality pipe dope, putting a moderate amount on the male threads only. If pipe dope lodges on the valve seat, it will prevent proper closure. If using LP gas, use pipe dope resistant to action of LP gas.
4. Install valve in a horizontal pipe line in an upright position with the gas flow in the direction indicated by the arrow on the casting.
5. Apply a parallel jaw wrench only to the flat next to the pipe being inserted. A wrench applied to the valve body itself or to the end farthest from the pipe being inserted may distort the casting, causing a malfunction.
6. The gas flow MUST be in the same direction as the arrow on the bottom of the valve body.

WARNING

If flow is not in direction of arrow, valve may not shut off.

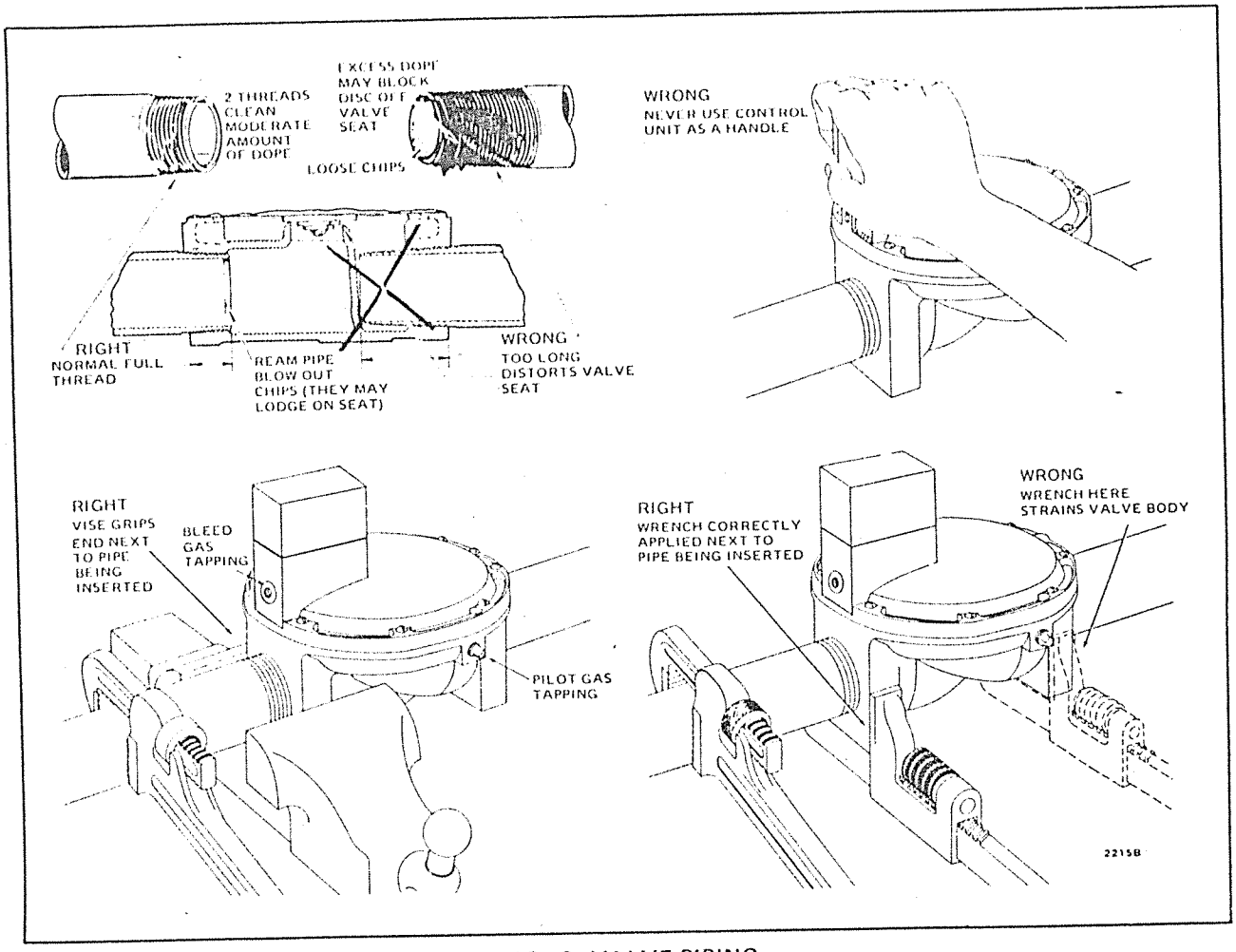


FIG. 2–VALVE PIPING.

CONNECT PILOT AND BLEED GAS TUBING

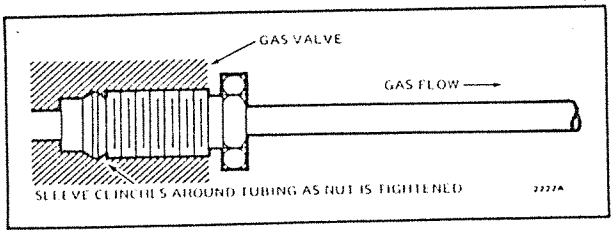
1. Square off and remove burrs from end of tubing. Bend tubing to desired form for routing to pilot burner.

CAUTION

Do *not* bend tubing at control after compression nut has been tightened, as this may result in gas leakage at the connection.

2. Unscrew brass compression fitting from pilot gas tapping (Fig. 2). Slip the fitting over the tubing and slide out of the way.

NOTE: When replacing a valve, cut off old compression fitting and replace with the compression fitting provided on the V48 or V88. Never use the old compression fitting as it may not provide a tight gas seal.



3. Push tubing into the pilot gas tapping on the outlet end of the control until it bottoms. While holding tubing all the way in, slide fitting into place and engage threads–turn until finger tight. Then use wrench and tighten 1 turn beyond finger tight.

4. Connect other end of tubing to pilot burner according to pilot burner manufacturer's instructions.

WIRING

CAUTION

1. Disconnect power supply before making wiring connections to prevent electrical shock or equipment damage.
2. All wiring must comply with local codes and ordinances.

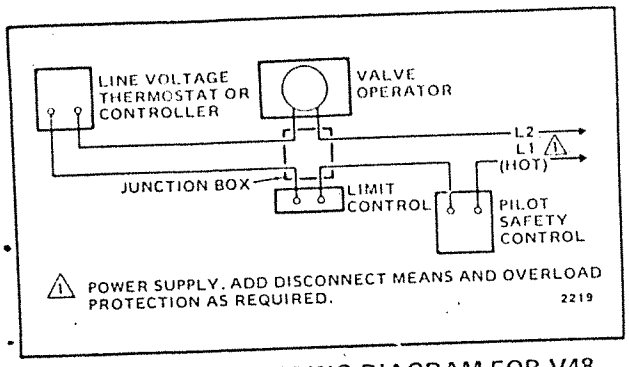


FIG. 3–TYPICAL WIRING DIAGRAM FOR V48.

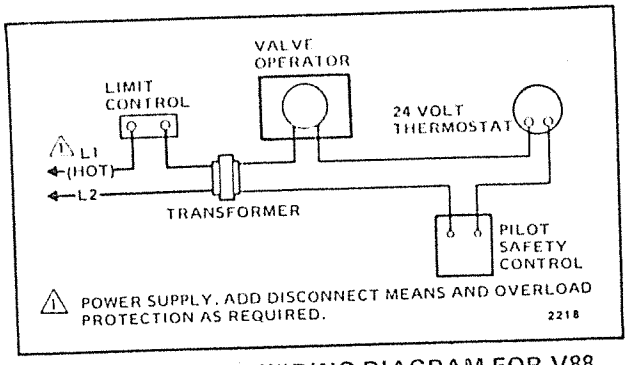
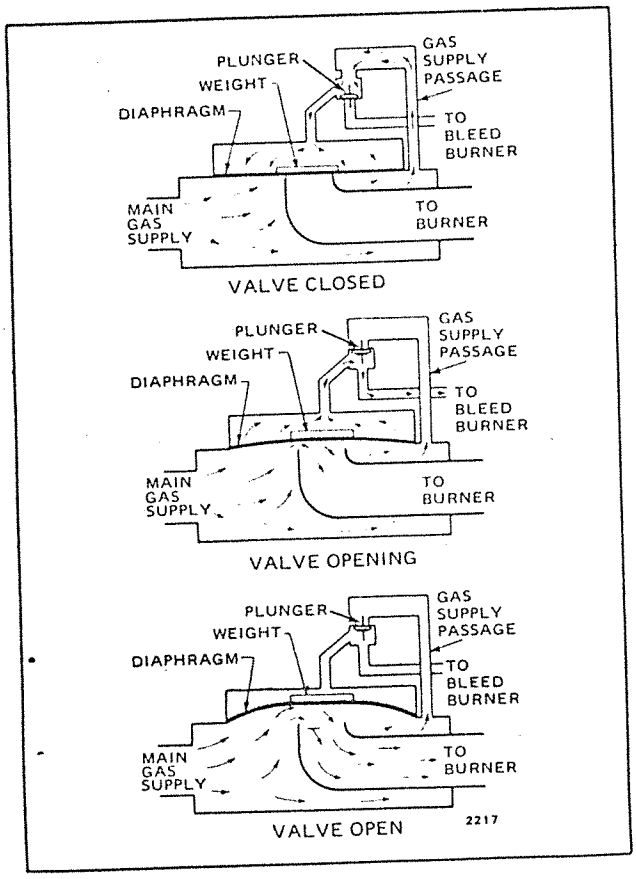


FIG. 4–TYPICAL WIRING DIAGRAM FOR V88.

OPERATION



When the controller is not calling for heat, the coil is de-energized. The plunger in the 3-way actuator is in the DOWN position, so that the bleed port is closed and the supply port is open. Gas flows to the top of the diaphragm. The gas pressure and spring hold the valve closed.

On a call for heat, the controller contacts close and the coil is energized. This pulls the plunger to the UP position, opening the bleed port and closing the supply port. The gas then bleeds off the top of the diaphragm, allowing the gas pressure below to lift the diaphragm and open the valve.

When all the gas has bled off the top of the diaphragm the valve is fully open, permitting gas flow to the main burner.

After the controller is satisfied, the procedure is reversed. The controller contacts open so that the coil is de-energized. The plunger is released, moving to the DOWN position. This closes the bleed port and opens the supply port so that gas again flows to the top of the diaphragm. As the pressure above the diaphragm increases, the diaphragm drops, closing the valve with a positive snap action.

In the event of a power failure during automatic operation, all V88 and V48 valves will close. Normal operation will be resumed upon the restoration of power.

INSTALLATION OF ADJUSTABLE BLEED VALVE

Screw the 126590 Bleed Valve into the tapping marked BLEED. Be sure to screw the *1/8-NPT threads* into the BLEED tapping. Complete the bleed line connection. Then alternately energize and de-energize the diaphragm controller, and adjust the screw for the desired valve opening time.

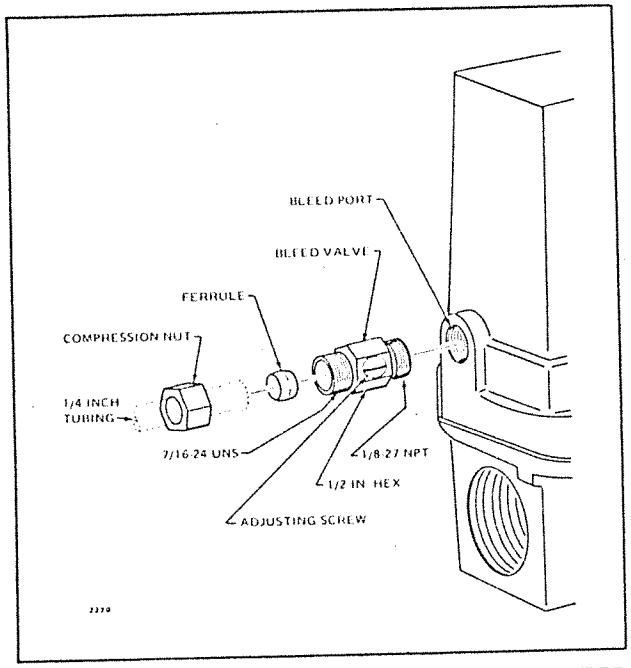


FIG. 5—INSTALLATION OF ADJUSTABLE BLEED VALVE.

INSTALLATION OF BLEED ORIFICE

Press the selected bleed orifice over the slotted end of the orifice tool, see Fig. 6. With the tool, insert the orifice into the bleed port until the tool threads mate with the threads in the bleed port. Finger-thread the tool into the bleed port (turn clockwise) as far as possible, then use pliers to seat the orifice. Seating will have occurred when the threading comes to an abrupt halt. Now withdraw the tool and complete the connection of the bleed tubing.

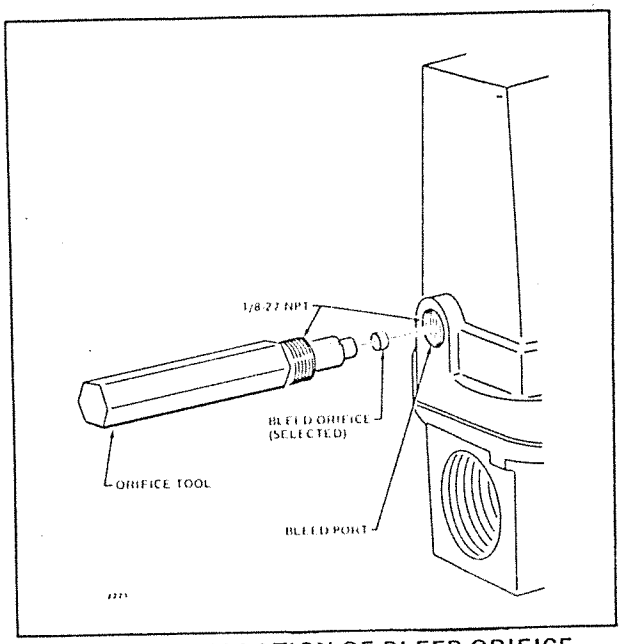


FIG. 6—INSTALLATION OF BLEED ORIFICE.

SERVICE AND CHECKOUT

SERVICE

DO NOT ASSUME THAT THE VALVE MUST BE REPLACED UNTIL ALL OTHER SOURCES OF TROUBLE HAVE BEEN ELIMINATED.

IF THE VALVE WILL NOT OPEN WHEN THE THERMOSTAT AND LIMIT CONTROL ARE CALLING FOR HEAT:

1. Check power supply at the valve. If no voltage is indicated check power source (transformer or line source), then thermostat and Pilotstat and limit controls. If proper voltage at valve, but valve does not pull in, replace valve coil. (See table in SPECIFICATIONS.)
2. Make sure that normal gas pressure is available at the valve.
3. Make sure that the bleed line is unobstructed.

IF THE VALVE WILL NOT CLOSE WITH ONE OR MORE OF THE CONTROL CONTACTS OPEN:

1. Make sure that the gas flow is in the direction of the arrow on the valve body.
2. Look for a short in the circuit.

CHECKOUT

Put the system into operation and observe through at least one complete cycle to be sure valve functions as described in OPERATION.

TO REPLACE COIL

CAUTION

Service of this valve should be performed by trained, experienced servicemen only.

1. Remove nameplate and disconnect wiring. Remove cast housing.
2. Remove holding nut from top of coil housing.
3. Lift coil housing off of valve plunger tube. Snap out the wraparound cover.
4. Remove the old coil and replace with new coil of correct part number (see SPECIFICATIONS).
5. Replace wraparound cover and slip coil housing over plunger tube. Replace the holding nut to secure the housing to the valve body. Reinstall cast housing.
6. Reconnect the wiring leads, then test valve for proper opening and closing action.

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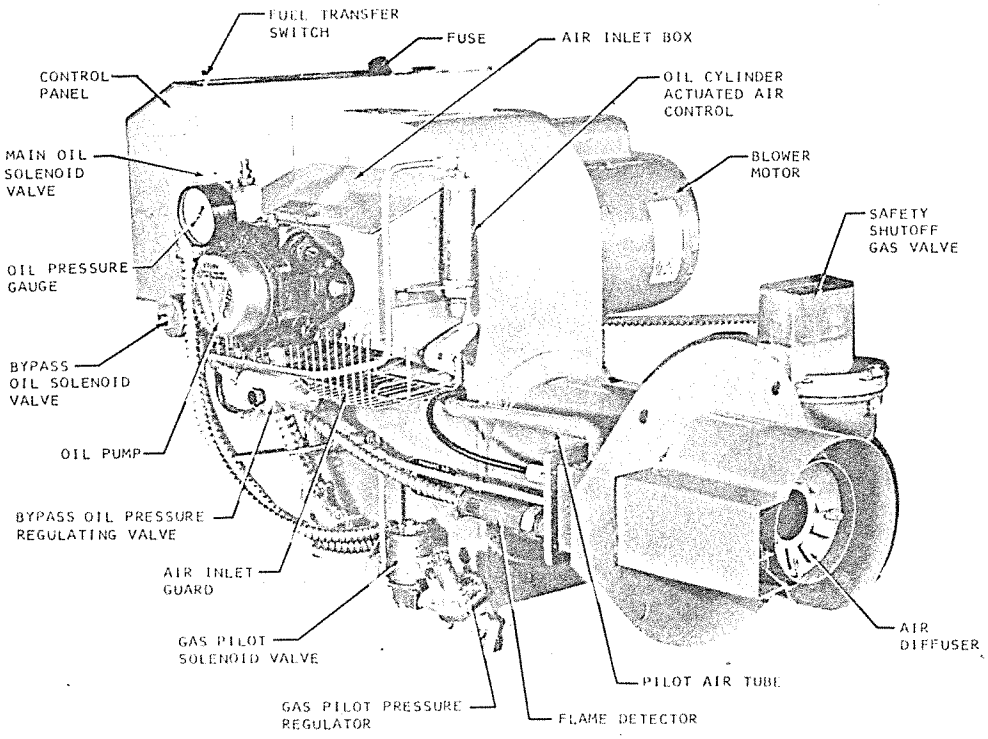
TABLE OF CONTENTS

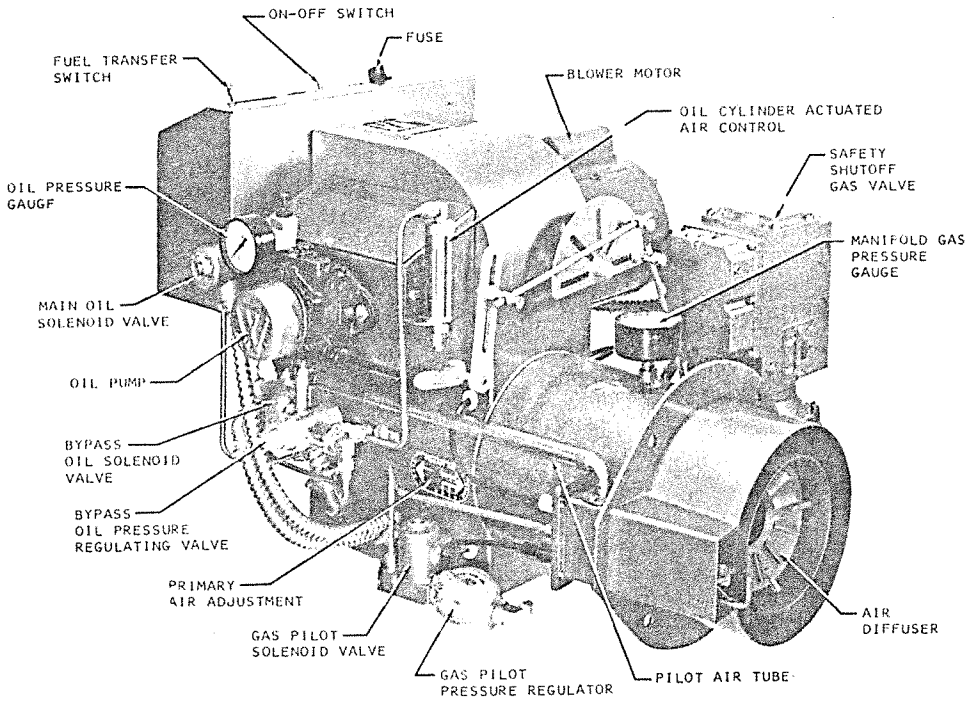
PART I

BURNER FAMILIARIZATION AND PRELIMINARY INSPECTION

BURNER FAMILIARIZATION - Study the following burner illustrations and determine the one which matches your unit. Take special note of the PART NAMES as shown in the call-outs. Fuel Systems are described in detail in Parts IV and V.



TYPICAL MODEL R WITH B-F4B GAS-OIL SYSTEM



TYPICAL MODEL R WITH H-F4H GAS-OIL SYSTEM

PART II

INTRODUCTION

This manual has been prepared to assist in the installation, operation and maintenance of your burner. It is good practice to know as much as possible about a piece of equipment before trying to install or operate it. Read the contents carefully before proceeding.

NOTE

Installation requirements and instructions should always be covered in appropriate engineering drawings and specifications which detail the applicable building codes, etc. Information contained herein is to be used as a guide ONLY and not as the final authority.

GENERAL

- Starting a burner is an event which normally culminates the efforts of several different contractors, manufacturers, utility and engineering concerns, sales and factory representatives, and others.
- In order for the burner to operate safely and meet its design capabilities, the interfacing fuel, air, electrical, exhaust and plant heating control systems must be properly sized, selected, installed and tested. Additionally, all conditions must be such that the heat generated by the burner can be safely used or wasted without endangering personnel or equipment.
- It shall be the policy of Peabody Gordon-Piatt, Inc. that no responsibility is assumed by the company nor any of its employees for any liability or damages caused by an inoperable, inadequate or unsafe burner condition which is the result, either directly or indirectly, of any of the improper or inadequate conditions described above.
- To insure that a safe and satisfactory installation has been made, a pre-start inspection is necessary. This inspection must be performed by an individual who is thoroughly familiar with all aspects of proper boiler/burner installation and how it interfaces with overall plant operation.
- Part I of this bulletin sets forth major inspection items that must be considered.

NOTE

This inspection should be performed before the burner start-up specialist is called in. An incomplete or inadequate installation may require additional time and effort by start-up personnel and cause an untimely and costly delay.

- The results of this inspection will often times identify corrections that must be made prior to start-up as well as point out potential or long range problems in plant operation if corrections are not made.
- Burner start-up is a serious matter and should not be viewed as a time for "crowd gathering" by unconcerned, uninformed or unauthorized personnel. The number of persons present should be held to an absolute minimum.
- Instruction of operating and other concerned personnel should be done after the burner has been successfully fired and adjusted by a qualified service agency or factory start-up specialist.

PART III

SUGGESTED INSTALLATION INSPECTION CHECKLIST

GENERAL

☑ CHECK WHEN COMPLETED

- ☐ Is burner installed in accordance with applicable installation drawings?
- ☐ If a refractory combustion chamber is part of the installation, is it completely dry, cured, and ready for firing at full boiler input?
- ☐ Has the proper electrical voltage been connected to the burner control cabinet as shown on the burner material list?
- ☐ Has the burner wiring been checked for completeness and accuracy? Have 3-phase motors been properly wired and checked for correct rotation?
- ☐ Are the boiler mounted limit controls such as low water cutoffs, high limit controls, operating controls, modulating controls, etc., properly installed and wired.
- ☐ Are the boiler controls the right type and range for the installation?
- ☐ Is the boiler water supply, including feed pumps, properly connected and is boiler filled with water?
- ☐ Is sufficient load connected to the boiler so that it can be fired continuously at full rating.
- ☐ If boiler load is not connected, can steam be wasted so that boiler can be fired continuously at full rating without endangering personnel or equipment?
- ☐ If the installation is a hot water boiler, have the circulating pumps been completely installed, wired, and tested to assure proper operation so that the burner can be fired continuously at full rating?
- ☐ For new boiler installations, has the boiler been boiled out in accordance with the boiler manufacturer's instructions?
- ☐ Have the boiler breeching connections to the stack been completed and are they open and unobstructed?
- ☐ Is draft control equipment required and, if so, installed?
- ☐ Have adequate provisions for combustion air been installed?
- ☐ Have the persons listed below been notified of the burner start-up date?
  - ☐ Owner's Representative
  - ☐ Mechanical Contractor's Representative
  - ☐ Electrical Contractor's Representative
  - ☐ Service Organization's Representative
  - ☐ Boiler Manufacturers' Representative
- ☐ Is all specified auxiliary equipment mounted and wired? This may include outdoor temperature controls, oil flow switches, space thermostats, water flow switches, motorized combustion air louvers, etc.

GAS FIRING

- ☐ Are all gas train components installed and have they been properly selected, sized and assembled?
- ☐ Have properly sized vent lines been installed on all gas train components which require venting? This includes such items as pressure regulators, normally open vent valves, diaphragm valves, low and high gas pressure switches, etc.
- ☐ Have gas train piping and components been tested and proven gas tight?
- ☐ Have the gas lines been purged?
- ☐ Is the proper gas pressure available at the inlet to the controls which meets the requirement shown on the burner material list?

OIL FIRING

- ☐ Is the oil tank installed and filled with the proper type and grade of fuel oil as required by the burner material list? There must positively be no water in the tank!
- ☐ Is the proper oil pressure, temperature and viscosity available at the inlet to the controls which meets the requirements shown on the burner material list and/or oil system sheet?
- ☐ Have oil supply and return lines been properly sized to meet the maximum pumping capacity of the pump and has the system been purged and proven leak proof?
- ☐ Is the oil system piped for two-pipe operation as required and is the oil pump set-up for two-pipe operation?

NOTE

Some pumps require the use of an internal bypass plug for two-pipe operation.

PART IV

GAS PIPING INFORMATION AND BURNER GAS SYSTEMS DESCRIPTION

GAS PIPING INFORMATION - The gas control size furnished and the minimum gas pressure required at the inlet to the controls is shown in the Burner Material List contained in the manual shipped with the burner.

Gas piping should be sized to provide the required minimum pressure at the main manual shutoff when operating at maximum input. Consult your local utility on any questions regarding gas pressure, piping pressure drops allowable and local piping requirements.

Gas piping should be installed in accordance with the National Board of Fire Underwriters' Pamphlet No. 54, or American Standards Association Bulletin No. Z21:30 and any other local codes which may apply. All gas piping should be tested after installation with air pressure or inert gas or at least three times the gas pressure that will be used. The piping ahead of the main manual shutoff should include a full size dirt pocket or trap.

CAPACITY OF PIPE - NATURAL GAS (CFH)

With Pressure Drop of 0.3" w.c. and Specific Gravity of 0.60

Pipe Length in Feet	Pipe Size - Inches (IPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	132	278	520	1050	1600	3050	4800	8500	17500
20	92	190	350	730	1100	2100	3300	5900	12000
30	73	152	285	590	890	1650	2700	4700	9700
40	63	130	245	500	760	1450	2300	4100	8300
50	56	115	215	440	670	1270	2000	3600	7400
60	50	105	195	400	610	1150	1850	3250	6800
70	46	96	180	370	560	1050	1700	3000	6200
80	43	90	170	350	530	990	1600	2800	5800
90	40	84	160	320	490	930	1500	2600	5400
100	38	79	150	305	460	870	1400	2500	5100
125	34	72	130	275	410	780	1250	2200	4500
150	31	64	120	250	380	710	1130	2000	4100
175	28	59	110	225	350	650	1050	1850	3800
200	26	55	100	210	320	610	980	1700	3500

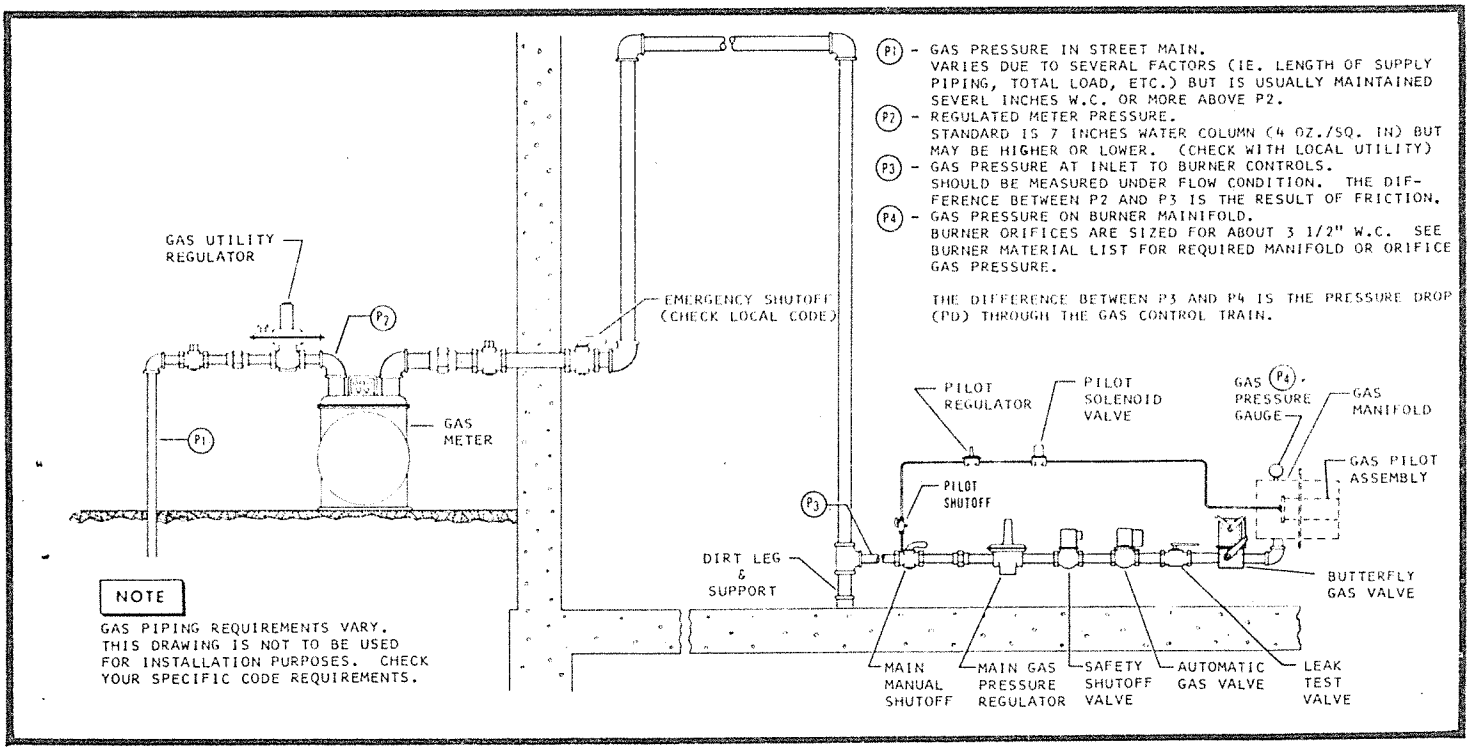
NOTE: Use multiplier at right for other specific gravities and pressure drops.

SPECIFIC GRAVITY OTHER THAN 0.60

Specific Gravity	Multiplier
0.50	1.10
0.60	1.00
0.70	0.926
0.80	0.867
0.90	0.817
1.00	0.775
Propane - Air	
1.10	0.740
Propane	
1.55	0.622
Butane	
2.00	0.547

PRESSURE DROP OTHER THAN 0.3"

Pressure Drop	Multiplier
0.1	0.577
0.2	0.815
0.3	1.00
0.4	1.16
0.6	1.42
0.8	1.64
1.0	1.83
2.0	2.58
3.0	3.16
4.0	3.65
6.0	4.47
8.0	5.15



TYPICAL GAS PIPING INSTALLATION

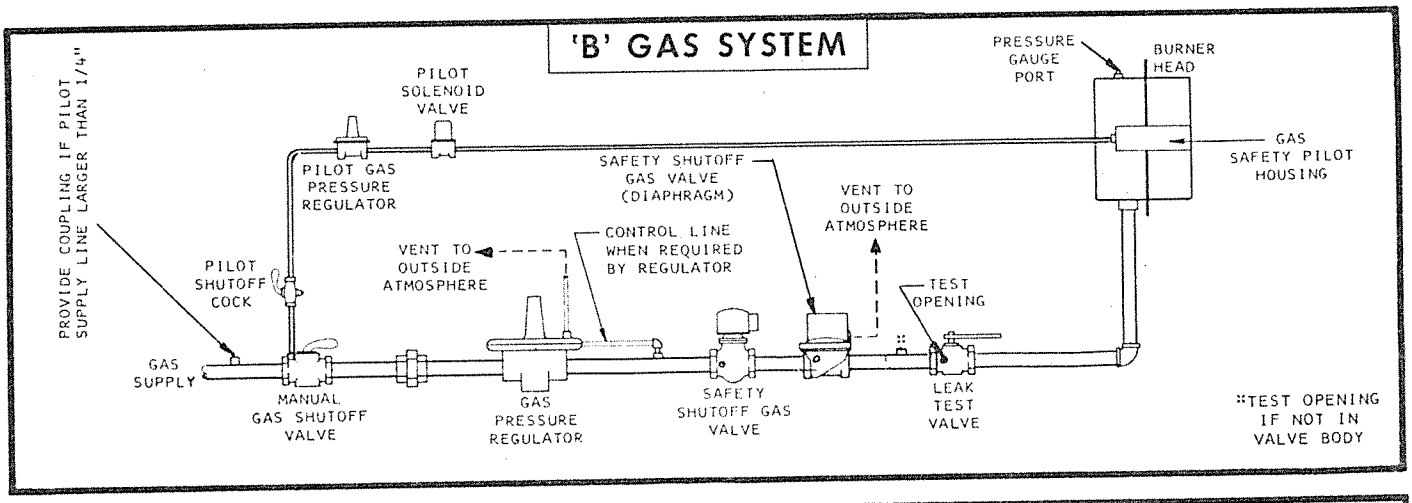
GAS SYSTEMS DESCRIPTION - Peabody Gordon-Piatt burners are supplied with UL approved gas trains as standard equipment. FM, FIA, CSA or other special Agency approved gas trains are supplied when specified.

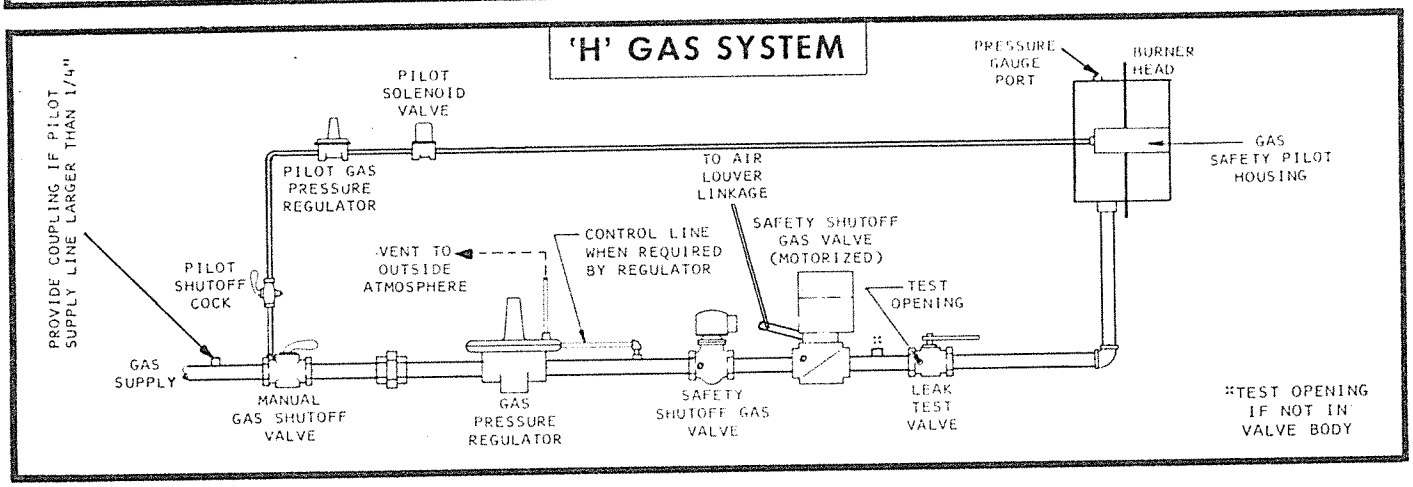
The following schematics depict the three UL approved systems used on burners with **Input Range 400 through 2500 MBH** commonly used on **R** and **S** models. The diaphragm gas valve shown in the **E** system schematic may be used for this range only.

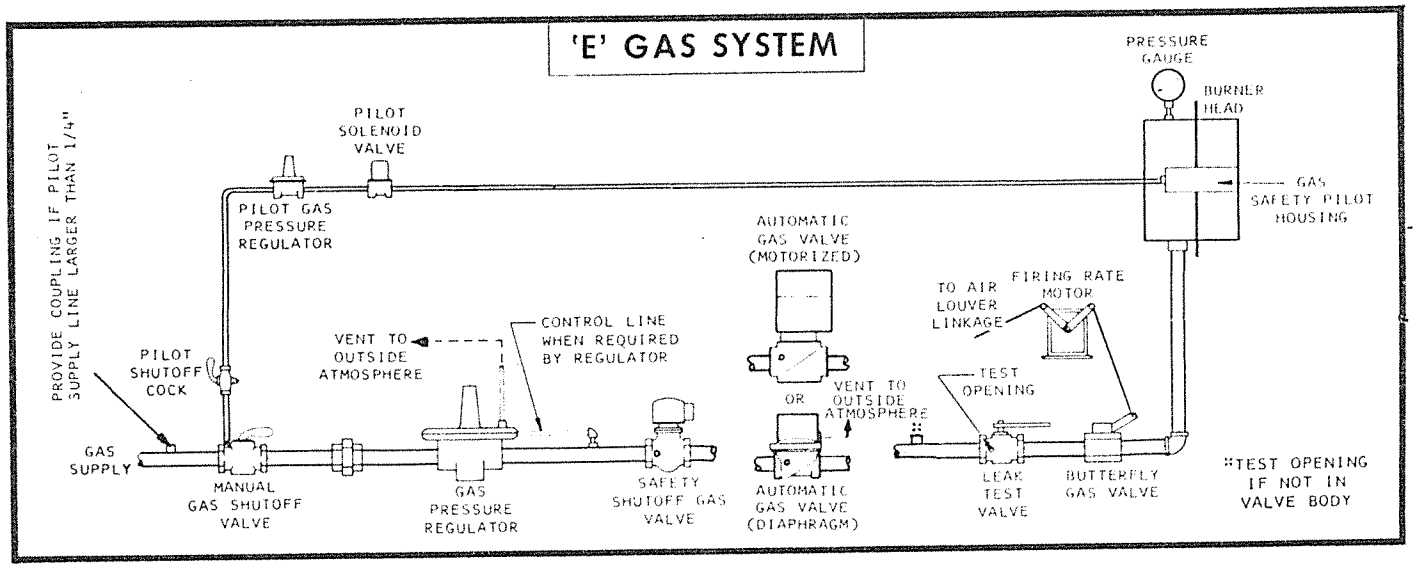
Input Range 2501 through 5000 MBH requires the use of low and high gas pressure switches which are added to the **H** and **E** systems.

Input Range 5001 through 12500 MBH requires the use of low and high gas pressure switches plus the safety shutoff valve nearest the burner must include proof-of-closure switch. These are added to the **E** system for this range.

See Peabody Gordon-Piatt catalog sheet **1-Gen-10.5** for further information.







PART VI
COMBUSTION CONTROLS

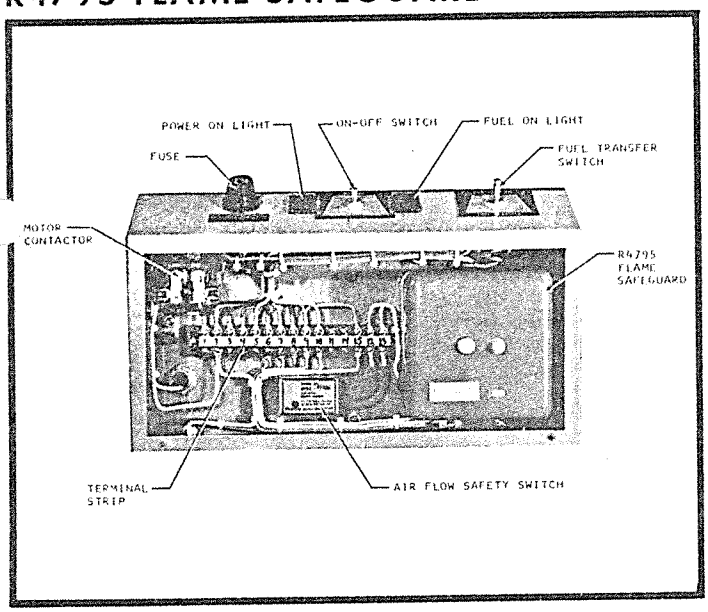
GENERAL - Different control systems are available to satisfy different needs. The most commonly used systems are briefly described in this part to outline the functional characteristics of the various flame safeguards. For further information, consult the specific bulletin covering the flame safeguard used in your burner.

NOTE

Wiring diagrams and operating sequences are prepared for each INDIVIDUAL burner unit. These are furnished as part of the engineering documentation included as supplementary data to the instructions manual SHIPPED WITH THE BURNER.

Each burner has a decal in its control panel which identifies the control system used.

R4795 FLAME SAFEGUARD



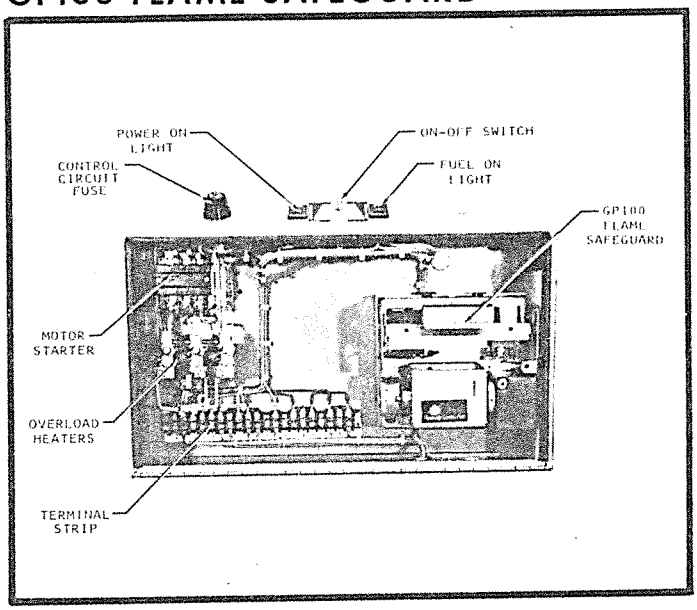
TYPICAL R4795 CONTROL PANEL

The R4795 Protectorelay Primary Control provides solid state electronic flame safeguard protection for commercial and industrial gas or oil burners. It provides a prepurge period before each start and intermittent pilot.

Choice of interchangeable, color-coded, solid state, plug-in flame signal amplifiers permits the R4795 to be used with rectification or ultraviolet type flame detectors.

The 120 volt models of the R4795 meet the requirements of Underwriters Laboratories, Inc. [UL] standard 795 for mechanical draft and atmospheric burner inputs from 400,000 to 2,500,000 BTU, effective October 1, 1974.

GP100 FLAME SAFEGUARD



TYPICAL GP100 CONTROL PANEL

The GP100 flame safeguard provides flame-out protection as well as automatic sequencing of burner motor, pilot valve, ignition spark and main fuel valve on gas, oil, or combination gas-oil burners.

A selection of color-coded, solid-state, interchangeable plug-in amplifiers allows the GP100 to be used with rectifying, infrared or ultraviolet flame detectors.

The GP100 flame safeguard control is Underwriters Laboratories, Inc. [UL] component recognized, Factory Mutual approved and Canadian Standards Association certified for automatic fired burners.

PART VII

BURNER ADJUSTMENTS

FACTORY ADJUSTMENTS - The burner is adjusted at the factory to meet normal firing conditions. These settings are acceptable for initial start-up, however, final adjustments should be based upon carefully conducted combustion testing of CO2, CO, smoke and stack temperature.

CAUTION

Do not set fire visually on forced draft burners. Instruments are the only safe and reliable means to determine the proper adjustments.

AIR AND FUEL ADJUSTMENT MECHANISMS - Various adjustment mechanisms control the air and fuel available for combustion. These will vary by the type fuel to be burned and the method used to control the air-fuel ratio.

Illustrations which follow show the items which are subject to adjustment. Determine the applicability of each illustration to your burner, then proceed to familiarize yourself with how the item functions. Where a setting is indicated, verify the setting or make preliminary adjustments as necessary to facilitate initial start-up.

BURNER AIR AND FUEL ADJUSTMENTS

Items 1 thru 13

CAUTION

Adjustable linkage mechanisms which are driven by an actuator [such as a modutrol motor or motorized gas valve] must be adjusted while the actuator's arm is in the 0° travel position.

Item 1 ADJUSTMENT OF PRIMARY-SECONDARY AIR CYLINDER

DESCRIPTION

A separate air adjustment at the firing head provides a unique air control system enabling quiet, stable combustion without objectional noise or pulsation. This feature allows flexibility in adapting to a variety of job conditions and insures greater combustion efficiency.

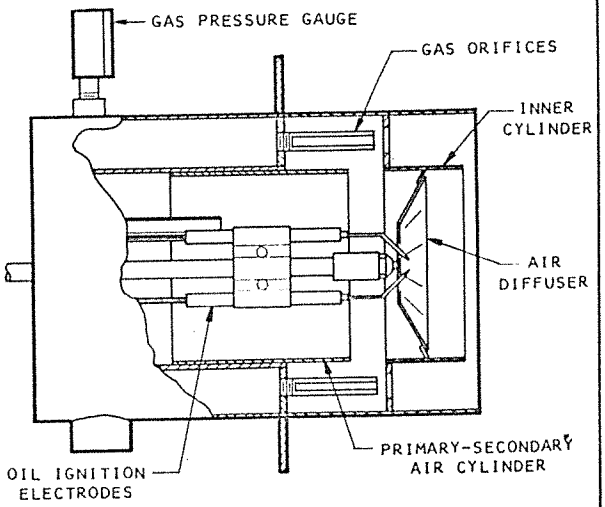
ADJUSTMENT PROCEDURE

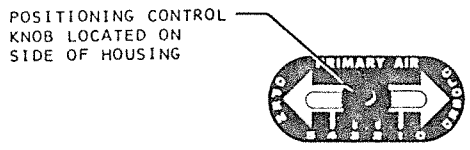
1. Loosen positioning control knob.
2. For initial start-up, position knob midway in the adjustment slot, then tighten against indicator scale.

NOTE

If positioned too far forward, the main flame may pulsate. If too far to the rear, the surplus air may cause noisy operation.

TYPICAL GAS-OIL BURNER HEAD

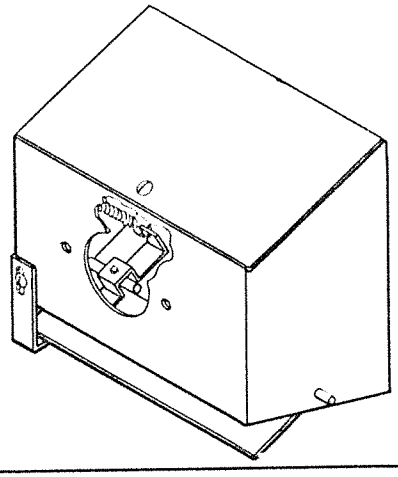




ADJUSTMENT OF AIR INLET LOUVER

Item 2

APPLICABLE TO THESE FUEL SYSTEMS — B GAS; F1 OIL; B-F1 GAS-OIL



DESCRIPTION

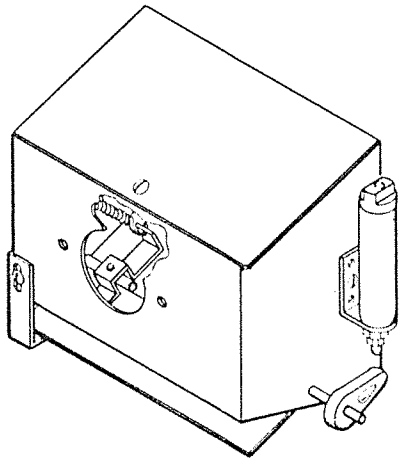
These systems use an air louver which is spring loaded OPEN against an adjustable stop bracket. The system function when firing gas or oil is ON-OFF, FIXED AIR and FUEL.

ADJUSTMENT PROCEDURE

1. Loosen screw holding louver adjustment bracket and move to desired position then retighten.
2. For initial start-up, set the louver so it is ½" open.

Item 2A

APPLICABLE TO THESE FUEL SYSTEMS — F4B OIL; B-F4B GAS-OIL



DESCRIPTION

These systems use an air louver which is spring loaded OPEN against an adjustable stop bracket. When firing on oil, an oil cylinder and actuator arm arrangement move the louver to the CLOSED position for low-fire start. The system function when firing on gas is ON-OFF, FIXED AIR and FUEL. When firing on oil, ON-OFF, LOW FIRE START.

ADJUSTMENT PROCEDURE

1. Loosen screw holding louver adjustment bracket and move to desired position then retighten.
2. For initial start-up:
   a. Set the louver so it is 1¼" open.
   b. Set the low-fire adjustment arm so there is 3/8" clearance between acorn nut on end of oil cylinder plunger and arm.

Item 2B

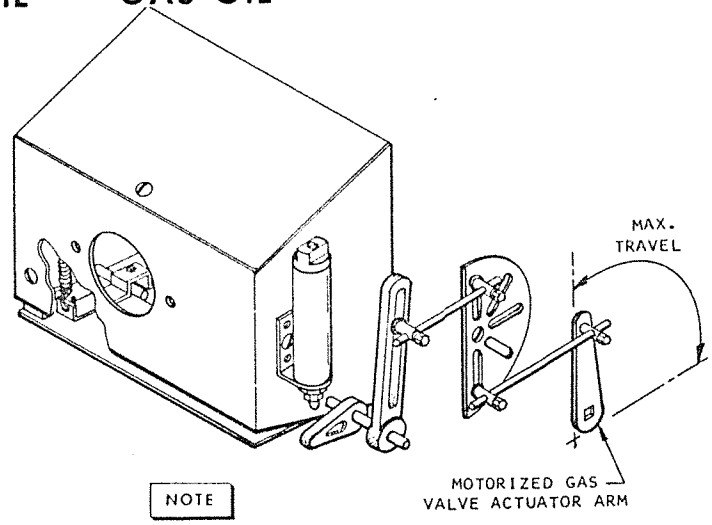
APPLICABLE TO THESE FUEL SYSTEMS — H GAS; F4H OIL; H-F4H GAS-OIL

DESCRIPTION

These systems use an air louver which is spring loaded CLOSED against an adjustable stop bracket. When firing on oil, an oil cylinder and actuator arm arrangement move the louver to the OPEN position for high fire. When firing on gas, a linkage arrangement to a motorized gas valve moves the louver OPEN. The system function is ON-OFF or HIGH-LOW, LOW FIRE START for both gas and oil.

ADJUSTMENT PROCEDURE

1. Loosen screw holding louver adjustment bracket and move to desired position then retighten.
2. For initial start-up:
   a. Set the louver so it is ¼" open.
   b. Set the louver actuator arm [under the oil cylinder] so there is 3/8" clearance between acorn nut on end of oil cylinder plunger and arm.
   c. Adjust linkage arrangement to motorized gas valve so louver will open approximately 1¼" when gas valve opens.



NOTE

Motorized gas valves and the linkage arrangement used will vary. Use good mechanical judgement to insure the linkage adjustments will open the louver as the gas valve opens.

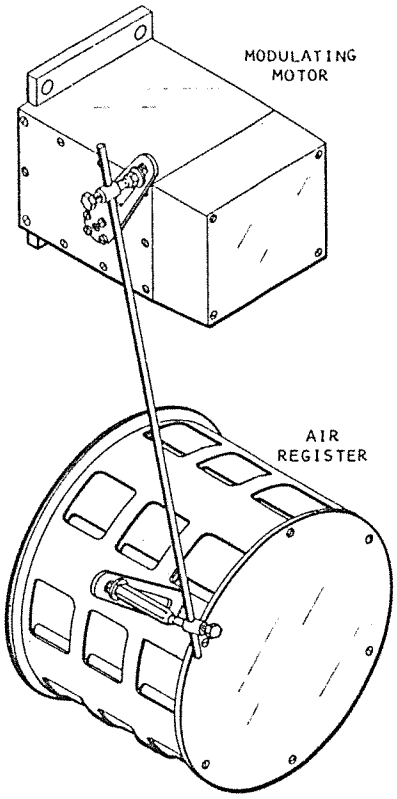
Item 3 — ADJUSTMENT OF AIR INLET REGISTER

APPLICABLE TO THESE FUEL SYSTEMS

E2	F6.2	F7.2	F7T.2	E2-F6.2	E2-F7.2	E2-F7T.2
GAS	OIL	OIL	OIL	GAS-OIL	GAS-OIL	GAS-OIL

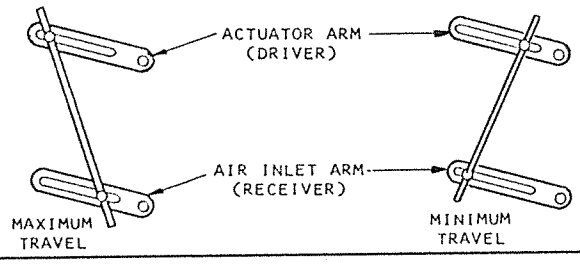
DESCRIPTION

These systems use an air inlet register which is opened and closed by an actuator, commonly termed a modulating motor. The system function is ON-OFF, HIGH-LOW or MODULATING, LOW FIRE START for both gas and oil.



ADJUSTMENT PROCEDURE

1. Position ball-joint connectors to obtain desired opening for low fire and high fire. [See diagram below]
2. For initial start-up, set register openings at ¼" for low fire.



Item 4 — ADJUSTMENT OF GAS PILOT AIR SUPPLY

DESCRIPTION

Some burners use a mechanism to control the amount of air flowing to the gas pilot. An air tab is installed in the pilot air fitting on the burner housing which can be adjusted to obtain the right amount of flow.

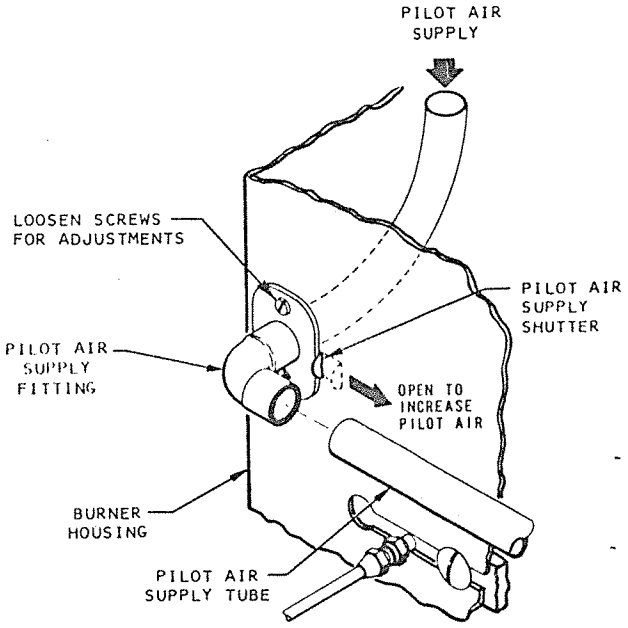
ADJUSTMENT PROCEDURE

1. Loosen two screws holding the pilot air fitting to the housing.
2. Pull the tab outward to increase the amount of air and push-in to decrease.

NOTE

Excess pilot air usually results in a short, hard pilot flame. Too little air causes a long, soft type flame.

3. For initial start-up, tab should be positioned approximately 3/8" out from the pilot air supply fitting.



Item 6

ADJUSTMENT OF GAS PILOT IGNITOR ASSEMBLY

DESCRIPTION

The gas pilot igniter is basically composed of [1] An ignition electrode with insulator which generates an arc between it and the adjacent ground, and [2] A fuel tube through which the gas is directed to the point of the electrical arc.

A charge from a high voltage transformer is routed to the ignition electrode causing an intense arc to ground. The electrode is then immersed in a concentration of gas as the pilot solenoid valve opens allowing flow to the pilot. The arc ignites the gas, the electrical discharge from the transformer terminates and the pilot stands ready to ignite the main burner flame.

There are three versions of the gas pilot that may be used, all of which are direct spark ignited.

1. Type 214B6B with integral flame rod for rectifying flame detection systems.
2. Type 214D with integral scanner tube for lead sulfide or ultraviolet flame detection systems.
3. Type 216C with integral air supply. Note the 216C igniter does not contain facilities for the flame detector since this system is separate and apart from the igniter.

ADJUSTMENT PROCEDURE

NOTE

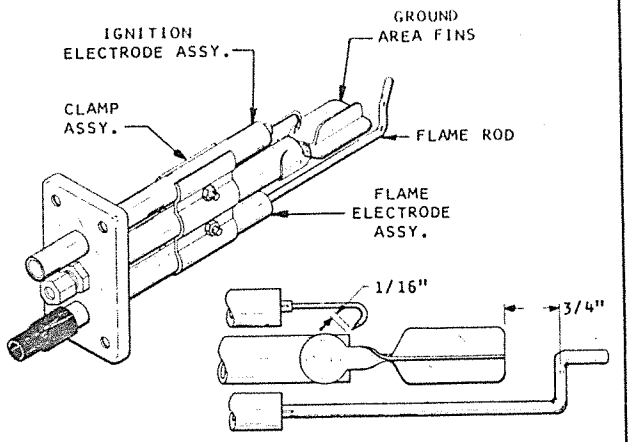
The gas pilot igniter assembly is a vital part of the burner and must be kept clean and properly adjusted at all times.

CAUTION

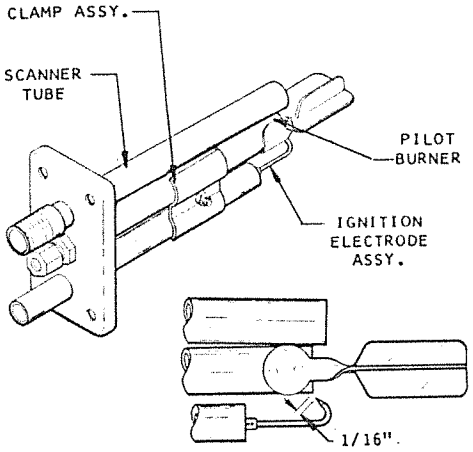
Turn off power at the master switch and remove flame safeguard from the subbase.

1. Disconnect cables, lines or tubes from the igniter assembly and remove from burner housing.
2. Inspect components for cleanliness and proper adjustment settings as shown in the following illustrations.
3. Reinstall igniter assembly and flame safeguard after cleaning, adjustment or inspection.

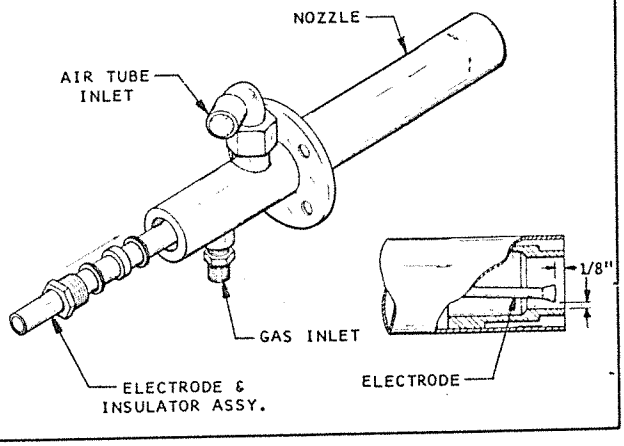
[TYPICAL] **Type 214B6B**



[TYPICAL] **Type 214D-A**



[TYPICAL] **Type 216C**



ADJUSTMENT OF GAS PRESSURE REGULATORS

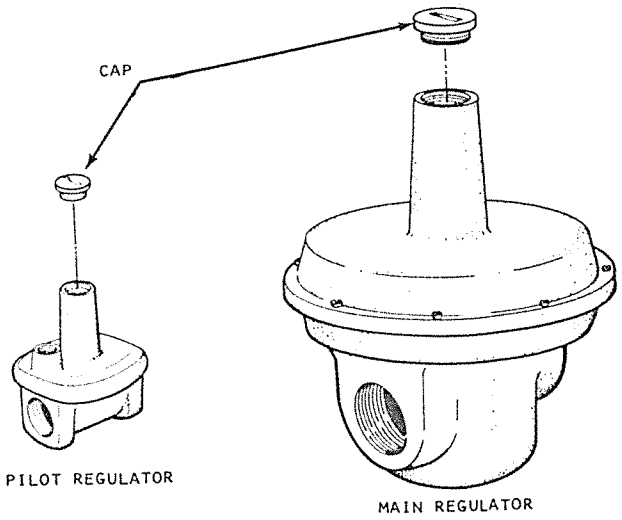
Item 7

DESCRIPTION

Gas burners have two gas pressure regulators, one to regulate the pressure to the main flame and the other to regulate the gas pilot igniter. Larger oil burners also use gas pilot ignition, therefore, the gas pressure regulator is common to many Model R and S burners.

Simply stated, gas flow is controlled by a spring of known load range which works against the supply [from the meter] gas pressure, therefore, each regulator must be fitted with the right spring for it to function properly. Additionally, the tension on the regulator spring must be adjusted to obtain the exact gas pressure required at the inlet to the controls.

GAS PRESSURE REGULATOR



ADJUSTMENT PROCEDURE

NOTE

See gas pressure regulator manufacturer's instructions for detailed procedures.

1. Remove cap or bonnet from regulator to gain access to adjustment screw or button.
2. Turn clockwise to increase and counter-clockwise to decrease outlet pressure.
3. For initial start-up:

NOTE

Pressure at which gas will be delivered to the burner cannot be determined without gas flowing thru the regulator. Be prepared to adjust the regulator as the burner is test fired.

4. Reinstall cap or bonnet after adjustment.

ADJUSTMENT OF BUTTERFLY GAS VALVE

Item 8

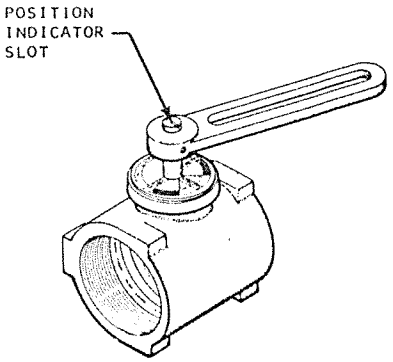
DESCRIPTION

The butterfly gas valve is a fuel throttling device which proportions the gas in proper ratio to the combustion air. The valve is opened or closed by an actuator as the combustion control programs the burner firing rate to meet the boiler load.

A centrally located disc turns within a cylindrical body which regulates the gas flow to the main burner flame. The butterfly valves used are the non-tight shutoff type.

Through a linkage system, an actuator drives the valve open or closed in response to electrical signals from the combustion control. Since the amount of air available for combustion is controlled by the same actuator, a proper fuel-air ratio is maintained at all times.

BUTTERFLY GAS VALVE



ADJUSTMENT PROCEDURE

1. Use box end or socket wrench to loosen or tighten ball joint connectors.
2. To adjust low fire [minimum] fuel setting, loosen ball joint connector holding drive rod and manually position butterfly disc to desired opening, then retighten connector.

NOTE

Slot in end of butterfly shaft indicates position of internal disc.

3. For initial start-up: Position actuator arm so internal disc is approximately 15° open.

PART VIII

BURNER START-UP

CAUTION

This manual has been prepared as a guide in burner start-up operations. It is written for the start-up specialist who is thoroughly qualified both by training and experience.

1. GENERAL - The following data is pertinent to the burner start-up and should be carefully studied before any attempt to operate the burner is made. This material is a part of the manual shipped with the burner.

   - ☐ Burner Material List
   - ☐ Burner Wiring Diagram and Operating Sequence
   - ☐ Flame Safeguard Bulletin
   - ☐ Gas System Bulletin [if applicable]
   - ☐ Oil System Bulletin [if applicable]
   - ☐ Miscellaneous Manufacturer's Data on Controls, Valves, Regulators, etc.

   NOTE

   The above cited manual is ONE OF A KIND in that it contains material covering your SPECIFIC burner. To replace it, considerable time, special handling and significant costs are involved. Accordingly, it should be handled with care and kept in a location free of dust and moisture.

2. FLAME SAFEGUARD INSTALLATION - Assure flame safeguard is properly installed in its subbase.

   NOTE

   The Burner Flame Safeguard is oftentimes packaged and shipped in a separate carton; however, the control cabinet will contain the mounting subbase which is installed and prewired at the factory. See separate instructions on Flame Safeguard for mounting the unit in the subbase.

3. IDENTIFICATION OF CONTROLS - Review the burner wiring diagram and operating sequence. Study these items and identify the various controls from the typical control panel assemblies shown in Part VI.

   NOTE

   Do not proceed with start-up unless all applicable checklist ☐ items in Parts I and II and preliminary adjustment requirements in Part VII have been satisfied.

   If the burner is a combination gas-oil unit, it is recommended that the burner be fired on GAS first so the correct input rate in BTU's per hour may be determined by reading the gas meter.

   WARNING

   Be certain combustion chamber, flues, and surrounding areas are free of GAS accumulations, OIL or OIL VAPOR and other combustibles such as paint thinners, cleaning solutions, etc. An explosimeter [Mine Safety Appliances Co. model No. 2A or equivalent] should be used to make this determination.

4. GAS BURNERS - [See Paragraph 5 for oil burners]

   4.1 REVIEW BURNER MATERIAL LIST IN THE INSTRUCTIONS MANUAL AND ANNOTATE THE FOLLOWING INFORMATION:

   a. Firing rate [MBTU]
   b. Cubic feet of gas per hour [CFH]
   c. BTU per cubic foot [BTU/CF]
   d. Required gas pressure at control inlet [inches W.C.]
   e. Required gas pressure at orifices [inches W.C., taken at burner manifold]

   The above information is pertinent to setting up the burner.

   4.2 START-UP SETTINGS OF BURNER FIRING CONTROLS - Using the burner operating sequence, proceed up to the step which calls for opening the manual gas valve[s].

   WARNING

   During initial start-up, the operator must be on constant alert for emergency conditions such as fuel leaks, electrical malfunctions, etc. The location of all manual shutoff valves and switches should be clearly in mind so the burner can be quickly shut down if necessary. Should the burner fail to ignite, never manually manipulate the flame safeguard sequence which provides for purging of the combustion chamber.

   4.3 Using the manufacturer's instructions bulletin on the FLAME SAFEGUARD, proceed with checkout to insure proper function of the safeguard under burner operational conditions. Table 8-1 shows those checks that should be performed.

NOTE

While performing these checks, certain adjustments and readings must be made at the appropriate time. These include:

a. Burner combustion air
b. Gas pressure [at control inlet and orifice]
c. Boiler limit controls
d. Draft controls
e. Other controls electrically interlocked with the burner control system
f. Gas flow thru utility meter [CFH]
g. CO2 and CO
h. Stack temperature

The Items Below Summarize the Flame Safeguard Checkout Tests Required for Each Type of Installation	
Checkout Item	When Performed
1. Preliminary Inspection	For All Installations
2. Flame Signal Measurement	For All Installations
3. Initial Lightoff Check with Proven Pilot	If Pilot Must be Proven Before the Main Fuel Valve Can Open
4. Pilot Turndown Test	If Pilot Must be Proven Before the Main Fuel Valve Can Open
5. Hot Refractory Hold-In Test	For All Photocell (Rectifying or Infrared Lead Sulfide) Applications
6. Hot Refractory Over-ride Test	For All Infrared (Lead Sulfide Photocell) Detector Applications
7. Ignition Spark Response Test	For All Ultraviolet Detector Applications
8. Flame Signal with Hot Combustion Chamber	For All Installations
9. Safety Switch Lockout Tests	For All Installations

Table 8-1 FLAME SAFEGUARD CHECKOUT SUMMARY

4.4 LOW AND HIGH GAS PRESSURE SWITCHES - If burner is equipped with low and high gas pressure switches, perform the following steps:

LOW GAS PRESSURE SWITCH ADJUSTMENT

a. Close the main manual gas shutoff valve and install a manometer in the upstream test port of the safety gas shutoff valve.

b. Reopen the main manual gas shutoff valve.

c. Cycle the burner to high fire and take gas pressure reading on manometer. Using the main manual gas shutoff valve, throttle down the gas flow to a point where the manometer reading is approximately 10% below the previous reading, then adjust the low gas pressure switch downward until it breaks and shuts down the burner. Restore main manual gas shutoff valve to full open.

d. To insure the switch is functionally sound and properly installed, recycle the burner to high fire and again use the main manual gas shutoff valve to throttle the gas flow. The low gas pressure switch should immediately break and shut down the burner at 10% reduced pressure.

e. Turn main manual gas shutoff valve to off, then remove manometer and reinstall test plug in gas safety shutoff valve. Restore main manual gas shutoff valve to full open.

f. Cycle the burner on-off several times to assure the switch will not cause nuisance shutdowns as the burner ignites.

HIGH GAS PRESSURE SWITCH ADJUSTMENT

a. Cycle the burner to high fire. Slowly adjust the switch downward until the switch breaks and shuts down the burner, then reverse the adjustment so the setting is approximately 10% greater than the reading at which the switch broke.

Example

If the switch broke and shut down the burner at 4.0" w.c., then set the switch at 4.5" w.c.

b. Cycle the burner on-off several times to assure the switch will not cause nuisance shutdowns as the burner ignites.

4.5 FINAL CO2 AND CO ANALYSIS - With gas input rate established, perform a final CO2 analysis and make air adjustments as necessary. The final air settings should produce a flue gas analysis of between 8½% and 9½% CO2 without CO.

CAUTION

Do not set fire visually on forced draft burners. Instruments are the only safe and reliable means to determine the proper adjustments.

4.6 MOTOR RUNNING CURRENT AND VOLTAGE CHECK

a. Measure motor running current after final air adjustments have been made. Current should not exceed motor service factor amps shown on motor nameplate.

b. Check control voltage on terminals 1 and 2 as motor starts. Voltage should not drop below 102 volts [even momentarily] or difficulty may occur in control operation. Extreme voltage drop indicates inadequate service wire size to the burner.

4.7 BURNER SAFETY CHECK

a. Start and stop the burner several times to insure proper operation. Check for proper functioning of low-water cutoff, high limit and/or operating control.

b. Check operation of flame safeguard by stimulating a flame failure, making certain the burner locks out on safety within the time limits of the control.

c. Using burner operating sequence, start the burner in accordance with the step by step operating sequence procedure. As the burner enters the flame safeguard sequence, verify each burner function at the timing indicated.

4.8 NORMAL OPERATION - Providing the setup and checkout operations outlined in Items 4 through 4.7 above have been properly completed and all tests have been found to be satisfactory, the burner is now ready for normal gas firing operations.

GAS FIRING NOTES

CAUTION

One of the most common oversights by an installer is failure to purge air, water, rust or other foreign matter from the Oil System. DAMAGE TO PUMPS AND OTHER COMPONENTS CAUSED BY RUST, WATER OR FOREIGN PARTICLES IS NOT COVERED BY WARRANTY.

A standard method for purging is to remove the system pressure gauge [or plug where gauge would normally be installed] and temporarily install a piece of copper tubing long enough to drain into a bucket or other container. The pump motor starter contacts are then manually depressed with a piece of wood or other non-conductor device and the pump allowed to run until purging is complete. There must be no sign of air, water, rust or other foreign matter in the flow.

If flow is not established with 2 minutes, the pump should be primed through the suction line. Reinstall gauge or plug after purging is complete.

5. OIL BURNERS - [See Par. 4 for Gas Burners]

5.1 REVIEW BURNER MATERIAL LIST IN THE INSTRUCTIONS MANUAL AND ANNOTATE THE FOLLOWING INFORMATION:
[1] Oil Firing Rate [GPH]
[2] Oil Pressure at Nozzle [PSIG]
[3] Bypass Oil Pressure [PSIG]

NOTE

The above information is pertinent to setting up the burner.

5.2 START-UP SETTINGS OF BURNER CONTROLS - Using the burner operating sequence, proceed up to the step where the manual oil valves are to be opened.

WARNING

During initial start-up, the operator must be on constant alert for emergency conditions such as fuel leaks, electrical malfunctions, etc. The location of all manual shutoff valves and switches should be clearly in mind so the burner can be quickly shut down if necessary. Should the burner fail to ignite, never manually manipulate the flame safeguard sequence which provides for purging of the combustion chamber.

5.3 Using the Manufacturers' Instructions Bulletin on the flame safeguard, proceed with checkout to insure proper function of the safeguard under burner operational conditions. Table 8-2 shows those checks that should be performed.

NOTE

While performing these checks, certain adjustments and readings must be made at the appropriate time. These include, but are not limited to:

a. Burner Combustion Air
b. Oil Pressure [supply and bypass]. Pressure controlled by oil pressure regulator and oil metering valve settings.
c. Boiler Limit Controls
d. Draft Controls
e. Other Controls electrically interlocked with the burner control system.
f. CO2 and smoke
g. Stack Temperature

5.4 FINAL CO2 AND SMOKE ANALYSIS

CAUTION

Do not set fire visually on forced draft burners. Instruments are the only safe and reliable means to determine the proper adjustment.

The Items Below Summarize the Flame Safeguard Checkout Tests Required for Each Type of Installation	
Checkout Item	When Performed
1. Preliminary Inspection	For All Installations
2. Flame Signal Measurement	For All Installations
3. Initial Lightoff Check with Proven Pilot	If Pilot Must be Proven Before the Main Fuel Valve Can Open
4. Pilot Turndown Test	If Pilot Must be Proven Before the Main Fuel Valve Can Open
5. Hot Refractory Hold-In Test	For All Photocell (Rectifying or Infrared Lead Sulfide) Applications
6. Hot Refractory Over-ride Test	For All Infrared (Lead Sulfide Photocell) Detector Applications
7. Ignition Spark Response Test	For All Ultraviolet Detector Applications
8. Flame Signal with Hot Combustion Chamber	For All Installations
9. Safety Switch Lockout Tests	For All Installations

Table 8-2 FLAME SAFEGUARD CHECKOUT SUMMARY

a. IF STRAIGHT OIL BURNER - Perform a final CO2 analysis and make air adjustments as necessary. The final settings should produce a flue gas analysis of between 10% and 12½% CO2 without smoke.

b. IF COMBINATION GAS-OIL BURNER Leave air adjustments set as they were for gas firing and adjust the high fire supply oil pressure to obtain a flue gas analysis of between 10% and 12½% CO2 without smoke.

NOTE

Above method of setting up combination burners assures a smooth transfer between fuels without further adjustments and allows for simplified capacity calculations.

5.5 LOW OIL PRESSURE SWITCH - If burner is equipped with a low oil pressure switch, the switch should be set 10% to 15% below the final adjusted high fire "supply" oil pressure. Perform the following steps:

a. Annotate the "supply" oil pressure [PSIG] while the burner is at high fire.

b. Adjust the switch 10% to 15% below this pressure.

c. With the burner at low fire, slowly adjust the oil pressure regulator to obtain a reduced "supply" pressure making sure the switch cuts off the burner flame as the oil pressure drops past the PSI setting.

d. Adjust the oil pressure regulator to a higher pressure to allow the burner to be recycled at high fire, then restore the high fire "supply" oil pressure annotated in step a. above.

5.6 CLEANING OF OIL SYSTEM COMPONENTS AFTER START-UP

NOTE

It is not uncommon for the oil system components to become dirty or clogged during initial start-up as foreign matter from the oil lines is pumped through the system.

a. Remove oil drawer assembly, disassemble oil nozzle and clean using solvent and wooden toothpick to avoid damage to the finely machined surfaces.

b. Reassemble oil nozzle and replace oil drawer assembly.

NOTE

Other components such as oil pressure regulators, check valves and strainers should also be disassembled and cleaned.

5.7 MOTOR RUNNING CURRENT AND VOLTAGE CHECK

a. Measure motor running current after final air adjustments have been made. Current should not exceed motor service factor amps shown on motor nameplate.

b. Check control voltage on terminals 1 and 2 as motor starts. Voltage should not drop below 102 volts [even momentarily] or difficulty may occur in control operation. Extreme voltage drop indicates inadequate service wire size to the burner.

5.8 BURNER SAFETY CHECK.

a. Start and stop the burner several times to insure proper operation. Check for proper functioning of low-water cutoff, high limit and/or operating control.

b. Check operation of flame safeguard by stimulating a flame failure, making certain the burner locks out on safety within the time limits of the control.

c. Using burner operating sequence, start the burner in accordance with the step by step operating sequence procedure. As the burner enters the flame safeguard sequence, verify each burner function at the timing indicated.

5.9 NORMAL OPERATION - Providing the set-up and checkout operations outlined in Items 5 thru 5.7 have been properly completed and all tests have been found to be satisfactory, the burner is now ready for normal oil firing operations.

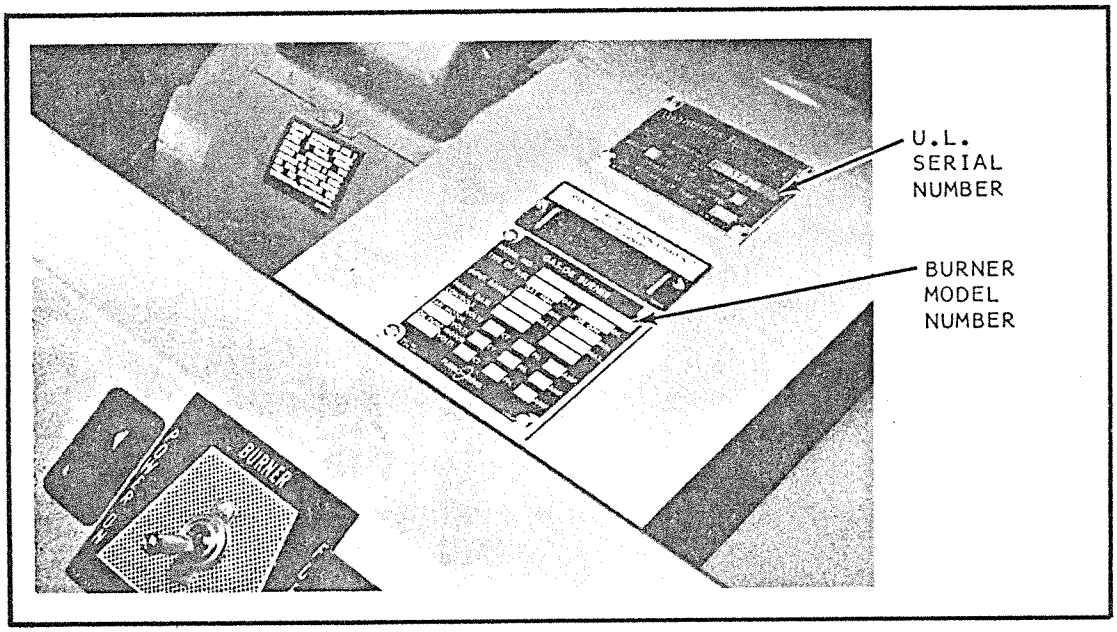
OIL FIRING NOTES

PART IX

ILLUSTRATED PARTS BREAKDOWN

Notice

Always Include U. L. SERIAL NUMBER When Ordering Parts !



HOW TO ORDER PARTS

Parts should be ordered from the authorized service representative who started and adjusted your burner. When ordering parts, the following guidelines should be used.

1. Always include burner serial number as shown on the U. L. label located on the burner housing.

2. If parts are required for electric controls, motors, pumps, etc., also include complete nameplate data taken from the item for which the parts are required.

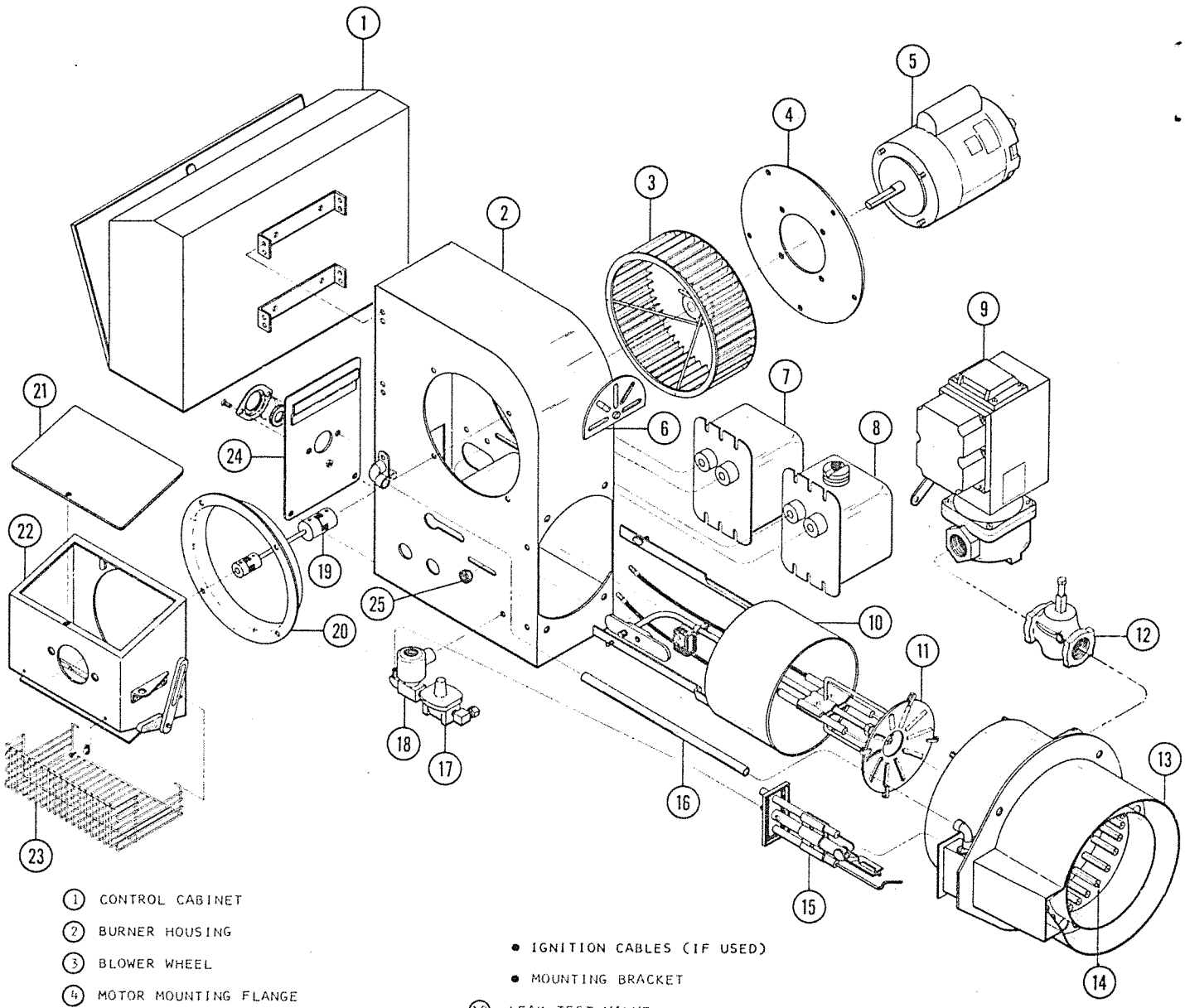
3. List the complete name and description of each part included in your order. Refer to the following illustration and particularly to the burner material list which accompanied your burner. List any specific characteristics such as size, voltage rating, etc.

4. State quantity desired of each item.

5. State whether shipment is to be made by express, parcel post or freight.

TYPICAL R6, R8 or R10 GAS-OIL BURNER

NOTE SEE PART IV FOR GAS SYSTEM COMPONENTS, PART V FOR OIL SYSTEM COMPONENTS AND PART VI FOR COMBUSTION CONTROLS



1. CONTROL CABINET
2. BURNER HOUSING
3. BLOWER WHEEL
4. MOTOR MOUNTING FLANGE
5. BLOWER MOTOR
6. LINKAGE CONTROL QUADRANT
7. OIL IGNITION TRANSFORMER
8. GAS PILOT IGNITION TRANSFORMER
9. MOTORIZED GAS VALVE
10. PRIMARY AIR CYLINDER
11. OIL DRAWER ASSEMBLY
    - AIR DIFFUSER
    - OIL NOZZLE
    - OIL NOZZLE ADAPTER
    - OIL IGNITION ELECTRODES (IF USED)
    - MAIN FUEL TUBE
    - FLAME DETECTOR
    - IGNITION CABLES (IF USED)
    - MOUNTING BRACKET
12. LEAK TEST VALVE
13. COMBUSTION HEAD
14. GAS ORIFICES
    - PRIMARY (OUTER CIRCLE)
    - SECONDARY (INNER CIRCLE)
15. GAS PILOT ASSEMBLY
    - FLAME ROD
    - PILOT HEAD ASSY
    - IGNITION ELECTRODE
    - ELECTRODE CLAMP
16. PILOT AIR TUBE
17. PILOT GAS PRESSURE REGULATOR
18. PILOT SOLENOID VALVE
19. OIL PUMP COUPLING
20. AIR INLET CONE
21. AIR INLET COVER
22. AIR INLET BOX
    - AIR LOUVER
    - AIR LOUVER SPRING
    - OIL CYLINDER MOUNTING BRACKET
    - LOUVER ACTUATOR ARMS
23. AIR INLET GUARD
24. BACK PLATE ASSEMBLY
25. PRIMARY AIR POSITIONING CONTROL KNOB