85 9439

4-mm-40

MECHANICAL OPERATION AND MAINTENANCE MANUAL

REPLACE BOILERS VARIOUS BUILDINGS
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT NO. N62470-85-C-6439

MECHANICAL CONTRACTOR:

Kinston Plumbing & Heating Company, Inc.
Post Office Box 637
Kinston, North Carolina 28501

Phone Number: (919) 522-4490

PHONE: 522-4490

STATE LICENSE NO. 741

Kinston Plumbing & Heating Co., Inc.

HWY. 258 N. - P.O. BOX 637

KINSTON, NORTH CAROLINA 28502-0637

Replace Boilers Various Buildings
Marine Corps Base
Camp Lejeune, North Carolina

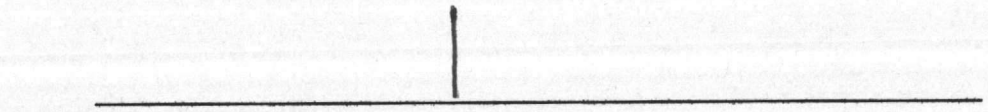
Contract No. N52470-85-C-6439

BUILDING CG -1

TABLE OF CONTENTS

TAB PLACEMENT HERE

DESCRIPTION:



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PHONE: 522-4490

STATE LICENSE NO. 741

Kinston Plumbing & Heating Co., Inc.

HWY. 258 N. - P.O. BOX 637

KINSTON, NORTH CAROLINA 28502-0637

Boiler Catalog Cut Sheets

Building CG-1

Contract N62470-85-C-6439

Replace Boilers
Buildings LCH-4014, LCH-4022, AS-3502 & CG-1
Marine Corps Base
Camp Lejeune, North Carolina
&
Marine Corps Air Station
New River, North Carolina

X APPROVED
☐ APPROVED AS NOTED
☐ NOT APPROVED
☐ REVISE & SUBMIT
KINSTON PLUMBING & HEATING CO
BY JCK DATE 3/30/87

CAMP LEJEUNE

BUILDING CG1

BOILER MODEL 3-4.7-75-W30

Form No: 3-6-86
Issued: 3/2/87

OSAGE 3 PASS WATER BOILERS

SUPERIOR BOILER WORKS, INC.
3524 East Fourth • Hutchinson, Kansas 67501 • Area Code 316-662-6693

RATINGS: WATER 30 PSIG

Sea Level To 2000' 4.5 sq. ft.

UNIT MODEL NUMBER	3-75	3-100	3-124	3-150	3-201	3-260	3-306	3-364	3-441	3-508	3-624	3-751	3-897	3-1021	3-1245	3-1513	3-1788
HORSEPOWER (Nominal)	16.7	22.2	27.7	33.5	44.8	57.8	68.1	81.1	98.0	113.1	138.8	166.9	199.4	227.0	276.7	336.2	397.3
OUTPUT MBH	559.0	746.5	927.3	1121.4	1499.7	1934.9	2279.6	2714.8	3280.6	3786.0	4646.3	5587.0	6674.9	7598.8	9262.5	11254.3	13299.6
NET RATING WATER MBH	447.2	597.2	741.8	897.1	1199.8	1547.9	1823.7	2171.8	2624.5	3028.8	3717.0	4469.6	5339.6	6079.0	7410.0	9003.4	10639.7
EDR WATER GROSS SQ. FT. (#1)	3891.1	5195.9	6454.1	7805.5	10438.4	13467.4	15867.3	18896.3	22834.0	26352.3	32340.4	38887.7	46460.2	52891.0	64471.1	78334.6	92570.9
EDR WATER NET SQ. FT. (#1)	3112.9	4156.7	5163.2	6244.4	8350.7	10773.9	12693.8	15117.0	18267.2	21081.8	25872.3	31110.2	37168.2	42312.8	51576.9	62667.7	74056.7
INPUT GAS (1,000 BTU.) CU. FT.	698.8	933.2	1159.1	1401.8	1874.6	2418.6	2849.5	3393.5	4100.8	4732.5	5807.9	6983.8	8343.6	9498.5	11578.1	14067.9	16624.5
OIL (140,000 BTU) GPH	5.0	6.7	8.3	10.0	13.4	17.3	20.4	24.2	29.3	33.8	41.5	49.9	59.6	67.8	82.7	100.5	118.7
OIL (150,000 BTU) GPH	4.7	6.2	7.7	9.4	12.5	16.1	19.0	22.6	27.3	31.6	38.7	46.6	55.6	63.3	77.2	93.8	110.8

DATA:

FIRESIDE HEATING SURFACE ASME SQ. FT.	75.38	100.62	124.68	150.91	201.76	260.29	306.58	364.95	441.42	508.96	624.87	751.06	897.72	1021.90	1245.16	1513.62	1788.13
WATERSIDE HEATING SURFACE SQ. FT.	81.64	109.03	135.14	163.81	219.28	282.99	333.63	397.37	476.07	549.31	674.75	811.49	969.92	1104.90	1347.05	1638.46	1934.84
FURNACE VOLUME CU. FT.	9.77	12.80	15.68	17.97	24.63	31.40	36.90	44.19	57.26	64.37	77.47	91.64	109.76	121.69	154.89	182.26	239.40
WATER VOLUME FULL GAL.	149	194	205	256	329	373	437	518	669	764	924	1105	1288	1470	1789	2149	2307
WATER WEIGHT FULL LB.	1238	1622	1709	2136	2750	3111	3643	4315	5579	6365	7706	9208	10735	12256	14916	17914	19232
SHIPPING WEIGHT - (#2)	2750	3000	3500	4000	4700	5400	6000	6800	9100	10400	11900	13600	16800	18600	28700	32000	32500

STANDARD FEATURES:

1. Units Designed And Fabricated To ASME Boiler And Pressure Vessel Code Requirements: Section IV - 30 psig. water.
2. Insulated with 2'' - 8 Lb. Density Mineral Fiber Insulation.
3. Jacket Material 22 Gauge Galvanized - Phosphate Coated Steel.
4. Rear Sight Port Model No. 3-75 thru 3-364; 17'' I.D. Rear Access Plug Model No. 3-441 & Larger
5. Top Flue Gas Outlet w/Removable Tube Access Plate - All Units
6. Lifting Eyes - All Units
7. Sealed for Forced Draft Firing.
8. Skid Type Base.
9. Floor Insulation.
10. Handholes 3''x4'' (3) Model 3-75 thru 3-1021 (2) Model 3-1245 & larger
11. Manway 12''x16'' (1) Model No. 3-1245 & Larger.

STANDARD TRIM (BOILER)

1. ASME Safety Relief Valves
2. Low Water Cutoff - Warrick Probe.
3. Operating Temperature Control
4. Limit Temperature Control (Manual Reset)
5. Firing Rate Temperature Control (Hi-Lo-Off or Modulating Firing Only)
6. Temperature Gauge
7. Pressure Gauge w/Shutoff and Inspector's Gauge Cocks.
8. Control Circuit Terminal Strips.

Notes:

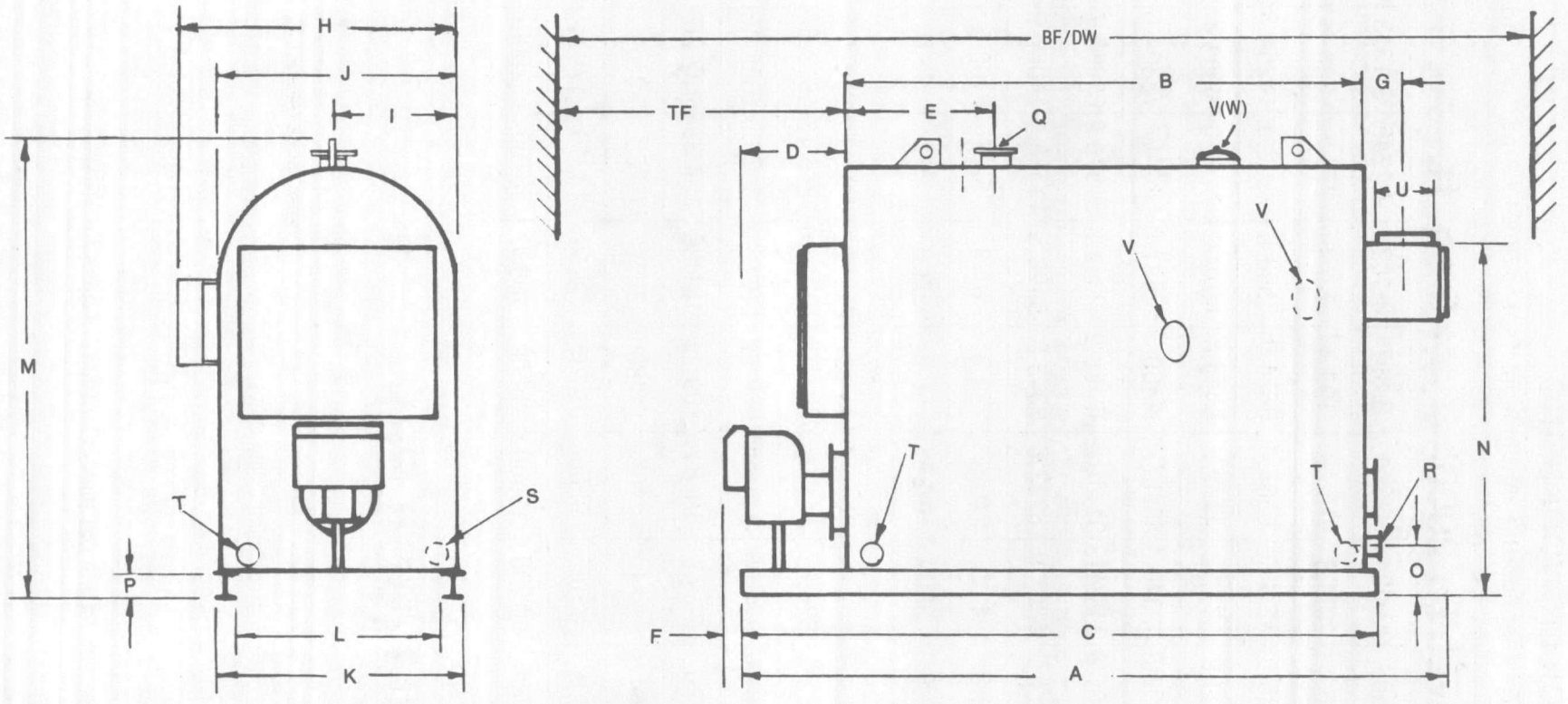
1. E.D.R. Water Net Output Based on MCA Rating.
2. Shipping Weights Are Based On Units With Natural Gas Burners. Weights Of Units For Air Atomized Oil Or Combination Gas/Oil Firing Will Be Higher.

SUPERIOR BOILER WORKS, INC.

OSAGE 3 PASS FIREBOX

4.5 SQ. FT. / BoHP

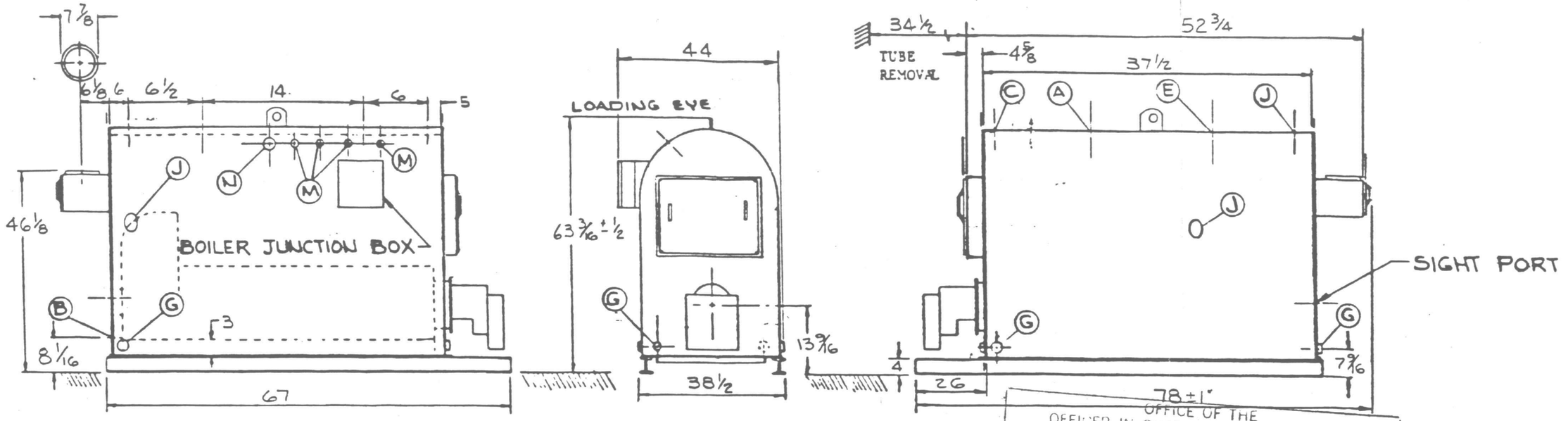
DIMENSIONAL DATA WATER BOILERS 30 PSIG



BOILER MODEL	DIM.	75	100	124	150	201	260	306	364	441	508	624	751	897	1021	1245	1513	1788
LENGTHS: Overall	A	78	90	85	92	108	104	115	130	137	148	168	188	176	193	208	237	231
Shell	B	37½	49½	42½	51	67½	60	70½	84	82½	94	114	136	117	134	146	175	162
Base	C	67	77	70¾	78	95	87½	100	114	116½	128	148	167½	152½	170	184	213	202
Front Plate To Base Extension	D	26	26	26	26	26	28	28	28	31	31	31	31	34	34	34½	34½	37
Front Plate To ℄ of Supply Nozzle	E	11	16½	11	20	20	25	31	31	29½	37	37	50	44	50	45	45	55
Front Of Base To End Of Burner																		
Gordon-Platt	F	3	3	6	6	6	4	4	4	3	3	3	8	6	4	7	7	4
Industrial Comb.		-	-	12	12	12	13	13	13	8	11	12	17	11	12	19	22	22
Rear Plate to ℄ Stack Connection	G	6⅛	6⅛	6 15/16	6 15/16	6 15/16	8 7/16	8 7/16	8 7/16	9 1/16	9 1/16	9 1/16	9 1/16	12	12	12	12	14
WIDTHS: Overall	H	44	44	50	50	50	58	58	58	65	65	65	65	70½	70½	76	76	80
Centerline To Lagging	I	18¼	18¼	20¾	20¾	20¾	25	25	25	28	28	28	28	30¾	30¾	33¼	33¼	36¼
Over Jacket	J	36½	36½	41½	41½	41½	50	50	50	56	56	56	56	61½	61½	66½	66½	72½
Base Width Outside	K	38½	38½	42¼	42¼	42¼	51	51	51	57	57	57	57	63	63	68½	68½	73½
Base Width Inside	L	30½	30½	34¼	34¼	34¼	43	43	43	49	49	49	49	55	55	60½	60½	65½
HEIGHTS: Overall	M	64	64	71	71	71	77	77	77	93	93	93	93	111	111	115	115	129
Base To Stack Conn	N	46	46	53½	53½	53½	60	60	60	70	70	70	70	85	85	87½	87½	109¾
Floor To Return ℄	O	8	8	8½	8½	8½	9	9	9	12¼	12¼	12¼	12¼	13¾	13¾	14	14	14
Height Of Runner	P	4	4	4	4	4	4	4	4	6	6	6	6	6	6	6	6	6
CONNECTIONS:																		
Supply Nozzle	Q	3	3	3	3	4	4	4	4	6*	6*	6*	6*	8*	8*	8*	8*	10*
Return Nozzle	R	3	3	3	3	4	4	4	4	6*	6*	6*	6*	8*	8*	8*	8*	10*
Drain	S	2	2	2	2	2	2	2	2	2½	2½	2½	2½	2½	2½	2½	2½	2½
Inspection (3)	T	2	2	2	2	2	2	2	2	2½	2½	2½	2½	2½	2½	2½	2½	2½
Stack Conn. OD	U	7⅞	7⅞	9⅞	9⅞	9⅞	11⅞	11⅞	11⅞	15⅞	15⅞	15⅞	15⅞	17⅞	17⅞	19⅞	19⅞	19⅞
ACCESS OPENINGS:																		
Handholes 3''x4''	V	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2
Manway 12''x16''	W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
MINIMUM CLEARANCES:																		
Tube Removal - Front	TF	34½	46½	40	48½	64½	57½	67½	81½	77	88½	108½	130½	110	127	139	168	153½
Minimum Boiler Room Length - Allowing For Tube Removal. BF Includes 3'-0'' Clearance At Rear.																		
Tube Removal - Front	BF	127	151	139	156	189	176	197	224	226	249	289	332	296	331	356	414	430
Dimension DW Includes 3'-0'' Clearance At Front And Rear																		
Thru Door or Window	DW	153	165	163	171	187	182	192	206	209	223	243	271	254	269	287	316	307

NOTE: * 150 PSIG RF Flange

NOTE: All dimensions are approximate and may be used for layout. Superior Boiler Works, Inc. reserves the right to change dimensions due to product revisions or job requirements.



M&M # 247 LOCO - LOOSE

OFFICE OF THE
OFFICER IN CHARGE OF CONSTRUCTION
CAMP LEJEUNE, NORTH CAROLINA

APPROVED

SUBJECT TO CONTRACT REQUIREMENTS

CONTRACT 85 6439

DATE 12 11 85

C. FINESMEYER
CDR. USN
Officer in Charge

BOILER CONNECTIONS		RATINGS & CAPACITIES		NOTES
A.(1) Supply Conn.	3"	Horsepower		1. All controls mounted as per specification sheet.
B.(1) Return Conn.	3"	Design Pressure	30 P.S.I. WATER	2. Specification sheet takes priority over R&D sheet.
C.(1) LWCO Conn.	1"	Design Temperature	250 °F	
D.( ) LWCO Conn.		Operating Pressure	PSI	
E.(1) Safety Valve Conn.	1"	Operating Temperature	°F	
F.( ) Safety Valve Conn.		Gross Output	MBH	
G.(4) Boiler Drain Conn.	2"	Heat Release	BTU/Cu.Ft.	
H.( )		Rated Input	MBH	
I.( ) Manway		Heating Surface (ASME)	75 Sq.Ft.	
J.(3) Handhole	3"x4"	Furnace Heating Surface	23.41 Sq.Ft.	
K.( ) Cleanout		Furnace Volume	9.77 Cu.Ft.	
L.( ) Vent Conn.		Water Capacity (Full)	149 Gal. 1238 Lbs.	
M.(4) Aquastat Conn.	½			
N.(1) Aquastat Conn.	¾	Shipping Weight	2750 Lbs.	
O.( )				
P.( )				
Q.( )				
R.( )				

BOILER DESIGN CODE
ASME SECTION IV

REPRESENTATIVE:
W.C. ROUSE & SON, INC.
P.O. BOX 10272
GREENSBORO, NC 27404

PROJECT:
BLDG # CG-1
CAMP LEJEUNE, NC.

LTR.	DATE	CHANGE	BY

SUPERIOR BOILER WORKS, INC.
HUTCHINSON, KANSAS

BOILER MODEL NO:
3- -75-W30

CHECKED BY
DRAWN BY
SCALE NO SCALE
DATE
DWG. NO:

SUPERIOR

CAMP LEJEUNE
BLDG. CG-1

NATIONAL BOARD #9992

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SUPERIOR BOILER WORKS, INC.

WARRANTY

Superior warrants all equipment manufactured by it and bearing its nameplate to be free from defects in workmanship and material, under normal use and service within one year from the date the equipment is first placed in use for any purpose, temporary or otherwise, or 18 months from the date of shipment, whichever shall be less. Except where a different expressed written warranty has been issued, no warranty of any kind, express or implied, is extended by Superior to any person or persons other than its direct buyer.

Superior shall have no responsibility for the performance of any product sold by it under conditions varying materially from those under which such product is usually tested under existing industry standards, nor for any damage to the product from abrasion, erosion, corrosion, deterioration or the like due to abnormal temperatures or the influences of foreign matter or energy, nor for the design or operation of any system of which any such product may be made a part or for the suitability of any such product for any particular application. Superior shall not be liable for any cost or expense, including without limitation, labor expense, in connection with the removal or replacement of alleged defective equipment or any part or portion thereof, nor for incidential or consequential damages of any kind. Any substitution of parts not of Superior's manufacture or not authorized by Superior, or any modification, tampering, or manipulation of Superior's product shall void any and all warranties. Alteration of any parts without express written permission of Superior for a purpose other than that intended shall void any and all warranties.

The foregoing warranties shall not apply to products or parts not manufactured by Superior.

There are no express or implied warranties which extend beyond those contained herein.

FINAL

SUPERIOR

SALES ORDER NO. 50090 NAT'L BOARD NO. 9992

DATE RECEIVED: 1/27/87 SHIPPING DATE: WK. OF 3/30/87

STATUS: W.A.&R. ☐ RELEASED ☒ DATE:

JOB: Camp Lejeune
Bldg. CG-1

SOLD TO: Kinston Plbg. & Htg. P.O. NO.
P. O. Box 637
Kinston, NC 28502-0637

SUBMITTAL REQ'D: 2 SETS CERTIFIED ☐

R & D SHEET ☒ W.D. ☐ NUMBER:

DATE REQ'D: MANUALS REQ'D: 9 SETS

☐ SPARE PARTS LIST - SEND TO:

BOILER: MODEL NO. 3-4.7-75-W30-M

NOMINAL H.P. 16 OUTPUT 540 MBH

DESIGN PRESSURE 30 P.S.I.G. STEAM ☐ WATER ☒

PER A.S.M.E. CODE SECTION IV

NAME PLATE: Osage PAINT: Blue

TURBULATORS: ☐ COMBUSTION RELIEF DOORS ☐

STEAM NOZZLE: STD ☐ SPL ☐

STACK DAMPER: PLAIN ☐ W/BEARINGS ☐

MOTORIZED ☐ ( )

STACK THERMOMETER: (L)

DIA. STEM LGTH. RANGE °F

SAFETY VALVE(S): Watts (L)

(1) #740 SIZE 3/4x1 SET@ 30 PSIG

( ) SIZE SET@ PSIG

( ) SIZE SET@ PSIG

WATER COLUMN BLOWDOWN VALVE(S) ( )

( ) TYPE SIZE

FEEDWATER VALVE(S): RS ☐ LS ☐ ( )

( ) TYPE SIZE

( ) TYPE SIZE

MOTORIZED: ON-OFF ☐ MODULATING ☐ SOLENOID ☐

SIZE ( )

3-VALVE BY-PASS: ( )

( ) TYPE SIZE

( ) TYPE SIZE

BLOWDOWN VALVE(S) RS ☐ LS ☐ ( )

( ) TYPE SIZE

( ) TYPE SIZE

SURFACE BLOWDOWN VALVE: RS ☐ LS ☐ ( )

SIZE

BLENDING PUMPS: ( )

SHUT-OFF VALVES TYPE SIZE ( )

FLOW SWITCHES ( )

CONTROL PACKAGE: VOLTAGE 115-60-1

BOILER JUNCTION BOX: N.E.M.A. RS ☐ LS ☐

WATER COLUMN: RS ☐ LS ☐ W/GAUGE GLASS ☐ TRYCOCKS ☐

( )

PRIMARY L.W.C.O.: RS ☐ LS ☐ TOP ☐

MM 247-2 (L)

AUX. L.W.C.O.: RS ☐ LS ☐ TOP ☐

( )

HIGH WATER: RS ☐ LS ☐ TOP ☐

CUTOFF ☐ ALARM ☐ ( )

GAUGE: PRESSURE ☐ W/ GAUGE/TEST COCKS ☐

TEMPERATURE ☐ TRIDICATOR ☐ RANGE

DIAL RANGE (L)

( ) OPERATOR RANGE ( )

( ) LIMIT RANGE ( )

( ) FIRING RATE RANGE ( )

( ) RANGE ( )

( ) RANGE ( )

OIL PREHEATER: RS ☐ LS ☐ STEAM ☐ STEAM/ELECTRIC ☐

ELECTRIC ☐ WATER/ELECTRIC ☐ KW VOLTAGE

( )

WATER PUMP: H.P. ( )

( ) SHUT-OFF VALVE(S) SIZE ( )

TEMP. REG. VALVE RG. SIZE ( )

PRESS. RED. VALVE RG. SIZE ( )

INLET PRESSURE PSIG DISCHARGE PRESSURE PSIG

TRAP SIZE ( )

STRAINER SIZE ( )

THERMOMETER RG. SIZE ( )

BY-PASS OIL RELIEF VALVE SIZE ( )

SET @ PSIG

( ) OIL PRESS. GAUGE RANGE ( )

( ) OIL STRAINER SIZE ( )

SPECIAL INSTRUCTIONS:

Unit to have rear smoke outlet - horizontal.

Burner mounting plate for GP R6.9-0-03 direct spark.

No aquastats or junction box.

COMPLETED BY: DATE

SALES: JER 1/27/87

ENG: ALS 1/29/87

SCHED: TJR 1/29/87

PURCH:

BOILER TO MEET THE FOLLOWING CODES: U.L. LABEL B ☐

FACTORY FIRETEST ☐ W/EFFICIENCY REPORT ☐

(M) SHIPPED MOUNTED (L) SHIPPED LOOSE

(P) PREPIPED/SHIPPED LOOSE

REVISIONS

REV.	DATE	BY

SBW 252-30.1

FORM H-2 MANUFACTURERS' DATA REPORT FOR ALL TYPES OF BOILERS EXCEPT WATERTUBE AND THOSE MADE OF CAST IRON

As Required by the Provisions of the ASME Code Rules

1. Manufactured and certified by SUPERIOR BOILER WORKS, INC.; 3524 E.4TH; HUTCHINSON, KS 67501 (name and address of manufacturer)

2. Manufactured for KINSTON PLBG. & HTG., P. O. BOX 637, KINSTON, NC 28502-0637 (name and address of purchaser)

3. Location of installation MARINE CORPS BASE, BLDG. #CG-1, CAMP LEJEUNE, NC 28542 (name and address)

4. Unit identification: FIREBOX (complete boiler, superheater, waterwall, economizer, etc.) | 9992 (mfr's serial no.) | ---- (CRN) | ---- (drawing no.) | 9992 (Nat'l. Bd. no.) | 1987 (year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction and workmanship conform to ASME Code, Section IV, 1986 (year) ---- (addenda (date)) ---- (Code Case no.)

6. Shells or drums: 1 (no.) | SA285C (mat'l. spec., gr.) | .312" (thickness (in.)) | 31½" (dia. (I.D.)) | 38¼" (length (overall)) | ---- (dia. (I.D.)) | ---- (length (overall))

7. Joints: WELDED (long (seamless, welded)) | 85% (eff. (as compared to seamless)) | ---- (girth (seamless, welded)) | 1 (no. of shell courses)

8. Tubesheet: (2)SA285C (mat'l. spec., grade) | .375" (thickness) Tube holes: 47 (no.) 2.025" (dia.)

9. Tubes: No. SA178A (mat'l. spec., grade) | STRAIGHT (straight or bent) Dia. 2" Length (if various, give max. & min.) 17 @ 38-3/4" 30 @ 20-3/8" Gauge 13 (or thickness)

10. Heads: SA285C (mat'l. specification no.) | .687" (thickness) | FLAT (flat, dished, ellipsoidal) | ---- (radius of dish)

11. Furnace: SA285C (mat'l. spec., gr.) | .312" (thickness) | 1 (no.) | 25-5/8"OD (size (O.D. or W x H)) | 15-11/16" (length (each section)) | 15-11/16" (total) | PLAIN (type (plain, corrugated, etc.)) Seams: WELDED (type (seamless, welded))

12. Staybolts: 28 (no.) | 3/4" (size (dia.)) | SA36 (mat'l. spec., gr.) | --- (size) | NONE (telltale) | .4418" (net area) | 9" (pitch (hor. and vert.)) | 30 (MAWP (psi))

13. Stays or braces:

Location	Mat'l Spec	Type	No. & Size	Pitch	Total Net Area	Fig. HG 343.1	Dist. Tubes to Shell	Area to be Stayed	MAWP psi.
(a) F.H. above tubes									
(b) R.H. above tubes									
(c) F.H. below tubes									
(d) R.H. below tubes	SA36	STR.	(9)3/4"	9¼"	3.98"	---	---	---	30
(e) Through stays	SA36	STR.	(2)3/4"	9"	.88"	---	---	---	30

14. Other parts 1. INNER TUBESHEET 2. CROWNSHEET & SIDEWALLS 3. WATERLEG BASE (brief description — i.e. dome, boiler piping, etc.) 4. BURNER TUBE

1. SA285C .687" 30 PSI
2. SA285C .312" 30 PSI
3. SA285C .312" 30 PSI
4. SA53B .375" 30 PSI 14"OD,7"L

(mat'l. spec., grade, type, material thickness, MAWP)

15. Nozzles, inspection and safety valve openings:

Purpose (inlet, outlet, drain, etc.)	No.	Dia. or Size	Type	How Attached	Mat'l	Nom. Thickness	Reinforcement Mat'l	Location
Handhole up to 3" x 4"	3	3"x4"	ELLIP.	NA	NA	NA	NA	SHELL
Manhole	----							
Outlet	1	3"	CPL.	WELDED	SA105	.327"	NA	SHELL
Safety Valve	1	1"	CPL.	WELDED	SA105	.196"	NA	SHELL
Inlet	1	3"	CPL.	WELDED	SA105	.327"	NA	REAR TUBESHEET
Drain	4	2"	CPL.	WELDED	SA105	.238"	NA	(2)SHELL (1)EA.TUBESHEET

16. Boiler supports: 1 (no.) STEEL SKID BASE (type (saddles, legs, lugs)) WELDED (attachment (bolted or welded))

17. Design pressure: 30 (psi) Based on HG301 (Code par. and/or formula) Heating surface 75 SQ.FT. (sq. ft. or kW (total)) Shop hydro. test 60 (psi (complete boiler))

FORM H-2 (Back)

18. **Remarks:** Manufacturers' Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of this report: ----------

(name of part, item number, mfr's. name and identifying stamp)

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this data report are correct and that all details of design, material, construction, and workmanship of this boiler conform to the ASME BOILER AND PRESSURE VESSEL CODE, SECTION IV.

"H" Certificate of Authorization no. 3967 expires MARCH 30, 19 88

Date Feb. 27, 1987 Name SUPERIOR BOILER WORKS, INC. Signed Bobby A. Smith

(manufacturer that constructed and certified boiler) (by representative)

CERTIFICATE OF SHOP INSPECTION

Boiler constructed by SUPERIOR BOILER WORKS, INC. at HUTCHINSON, KS

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the state or province of Kans. #144 and employed by H.S.B.I.&I. CO.

of HARTFORD, CT ~~XX~~ have inspected parts of this boiler referred to as data items 6 through 18 and have examined Manufacturers' Partial Data Reports for items ----------

and state that, to the best of my knowledge and belief, the manufacturer has constructed this boiler in accordance with the applicable sections of the ASME BOILER AND PRESSURE VESSEL CODE.

By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this Manufacturers' Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 2-27-87 Signed Dale Dunder Commissions NB 8286

(Authorized Inspector) (Nat'l Bd. (incl. endorsements) state, prov. and no.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the field assembly construction of all parts of this boiler conforms with the requirements of SECTION IV of the ASME BOILER AND PRESSURE VESSEL CODE.

"H" Certificate of Authorization no. _____ expires _____, 19____.

Date _____ Name _____ Signed _____

(assembler that certified and constructed field assembly) (by representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

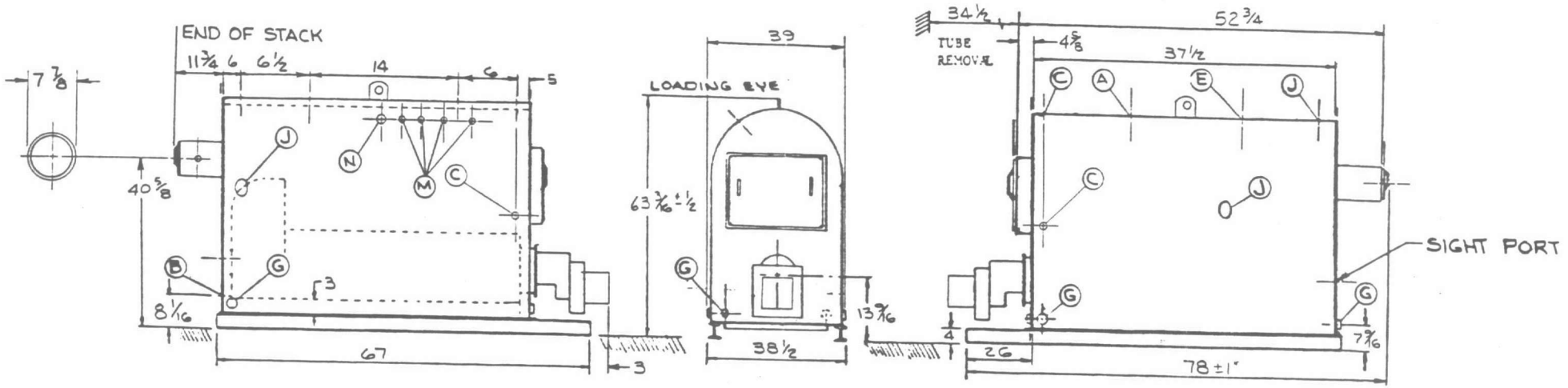
I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the state or province of _____ and employed by _____

of _____ have compared statements in this Manufacturers' Data Report with the described boiler and state that the parts referred to as data items _____, not included in the certificate of shop inspection, have been inspected by me and that to the best of my knowledge and belief the manufacturer and/or the assembler has constructed and assembled this boiler in accordance with the applicable sections of the ASME BOILER AND PRESSURE VESSEL CODE. The described boiler was inspected and subjected to a hydrostatic test of _____ psi.

By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this Manufacturers' Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date _____ Signed _____ Commissions _____

(Authorized Inspector) Nat'l Bd. (incl. endorsements) state, prov. and no.)



BOILER CONNECTIONS	
A. (1) Supply Conn.	3"
B. (1) Return Conn.	3"
C. (3) LWCO Conn.	1"
D. ( ) LWCO Conn.	
E. (1) Safety Valve Conn.	1"
F. ( ) Safety Valve Conn.	
G. (4) Boiler Drain Conn.	2"
H. ( )	
I. ( ) Manway	
J. (3) Handhole	3"X4"
K. ( ) Cleanout	
L. ( ) Vent Conn.	
M. (4) Aquastat Conn.	1/2"
N. (1) Aquastat Conn.	3/4"
O. ( )	
P. ( )	
Q. ( )	
R. ( )	

RATINGS & CAPACITIES		
Horsepower	16	
Design Pressure	30 P.S.I. WATER	
Design Temperature	250	°F
Operating Pressure		PSI
Operating Temperature		°F
Gross Output	540	MBH
Heat Release	69,089	BTU/Cu.Ft.
Rated Input	675	MBH
Heating Surface (ASME)	75	Sq.Ft.
Furnace Heating Surface	23.41	Sq.Ft.
Furnace Volume	9.77	Cu.Ft.
Water Capacity (Full)	149 Gal. 1238	Lbs.
Shipping Weight	2750	Lbs.

NOTES

1. All controls mounted as per specification sheet.
2. Specification sheet takes priority over R&D sheet.

LTR.	DATE	CHANGE	BY

BOILER DESIGN CODE
ASME SECTION IV

REPRESENTATIVE:
KINGSTON PLUMBING & HEATING

PROJECT:
CAMP LE JEUNE
BLDG. CG-1

SUPERIOR BOILER WORKS, INC.
HUTCHINSON, KANSAS

BOILER MODEL NO:
3-47-75-W30-M

CHECKED BY	SCALE	DWG. NO:
J. Seeker	N.T.S.	50090
DRAWN BY KEN RHODES	DATE 1-30-87	

RECOMMENDED SPARE PARTS LIST FOR MAINTENANCE OF

SUPERIOR BOILER WORKS MODEL 3-4.7-75-W30-M BOILER

BOILER NATIONAL BOARD NO. 9992

DESCRIPTION	PART NUMBER	QUANTITY REQUIRED
Handhole Gasket	904-001-002	4
Front Doors Gasket and Installation Kit	FGSKT 9991	1
Rear Door Gasket and Installation Kit	RGSKT 9991	1
Touch-Up Paint Aerosol Can	907-001-001	2
Anti-Seize, Aerosol Can	904-010-010	1
Flue Brush	910-002-004	1
Low Water Cut-Off Replacement Heat	36665	1

GOOD PRACTICE RECOMMENDATIONS FOR HOT WATER BOILERS

IMPORTANT: USE OF THIS HOT WATER BOILER FOR TEMPORARY HEATING OF AN UNFINISHED BUILDING IS NOT RECOMMENDED BY SUPERIOR BOILER WORKS, INC. USE OF THE BOILER PRIOR TO CLOSING THE BUILDING AND BALANCING OF THE HEATINGSYSTEM MAY LEAD TO THERMAL-SHOCK AND TUBE LEAKAGE. USE OF THE BOILER FOR TEMPORARY HEAT WILL RENDER THE WARRANTY VOID AGAINST TUBE LEAKAGE.

1. DO NOT PUT INTO SERVICE FOR ANY PURPOSE (PARTICULARLY TEMPORARY HEAT) WITHOUT PROPERLY BALANCING THE HEATING SYSTEM AND PROPERLY ADJUSTING THE BURNER.
2. MAKE CERTAIN THE LOW FIRE HOLD SWITCH (PROVIDED ON MODULATION AND HI/LO FIRE ONLY) IS SET AT 150°F (DEGREES FAHRENHEIT). THIS WILL ELIMINATE THE POSSIBILITY OF PUTTING HIGH FIRE INTO A COLD BOILER WHICH CREATES UNEVEN EXPANSION RESULTING IN TUBE LEAKAGE.
3. AFTER INITIAL START-UP, DO NOT OPERATE AT LESS THAN 180°F. OPERATION AT A MINIMUM OF 180°F. WILL HELP ELIMINATE THE CORROSION PROBLEMS CAUSED BY FLUE GAS CONDENSATION.
4. AFTER INITIAL START-UP, DO NOT PERMIT RETURN WATER UNDER 150°F TO ENTER THE BOILER.
5. THE TEMPERATURE DIFFERENCE BETWEEN THE SUPPLY AND RETURN WATER MUST NOT EXCEED 50°F NOR BE LESS THAN 10°F. GOOD PRACTICE DICTATES THAT TEMPERATURE DIFFERENTIAL SWITCHES BE INSTALLED TO SOUND AN ALARM WHEN THE DIFFERENTIAL EXCEEDS 50°F OR IS LESS THAN 10°F.
6. THE BURNER MUST BE ADJUSTED TO AVOID SHORT TERM CYCLING. THIS WILL HELP ELIMINATE THE PROBLEMS CONNECTED WITH RAPID EXPANSION AND CONTRACTION ASSOCIATED WITH SHORT CYCLING.
7. THE FIRING RATE OF THE UNIT MUST NOT BE EXCEEDED.
8. A FLOW SWITCH MUST NOT PERMIT THE BURNER TO FIRE UNLESS WATER FROM THE HEATING SYSTEM IS CIRCULATING THROUGH THE BOILER.
9. PRIOR TO INITIAL START-UP, THE ENTIRE HEATING SYSTEM MUST BE CLEANED OF ALL FOREIGN MATTER SUCH AS RUST, OIL, ETC.
10. PROPER WATER TREATMENT MUST BE USED.
11. BOILER OPERATING PERSONNEL SHOULD BE PROPERLY TRAINED IN MAINTENANCE AND OPERATING PROCEDURES.

OPERATOR INSTRUCTIONS FOR PUTTING BOILER IN SERVICE

I. Condition: Boiler Cold - System Cold

A. Use all boiler in system.

B. Open supply and return valves on each boiler.

C. Start system pump for each boiler.

D. Put manual low fire hold switch on each burner in low fire position.

E. Start each burner.

F. Leave on low fire operation until return system reached 170°F.

G. Release for automatic firing only the boilers necessary to maintain normal operating temperature.

H. Secure from the system any boiler not necessary for maintaining operating temperature. (See instructions for this procedure)

II. Condition: Boiler Cold - System Warm

A. Put burner low fire hold switch in low fire position.

B. Start burner.

C. Bring boiler temperature to 170°F.

D. Open supply and return header valves.

E. Start system pump.

F. Leave on low fire until boiler temperature and system temperature are the same.

G. Release burner to automatic.

III. Condition: Boiler Warm - System Warm

A. Start burner on low fire only.

B. Open supply and return headers and start system pump.

C. After boiler and system temperature are equal, release burner to automatic.

OPERATOR INSTRUCTIONS FOR TAKING BOILER OUT OF SERVICE

A. Put manual low fire hold switch in low fire hold position.

B. After burner is at low fire, open burner control switch and let burner cycle to off position.

C. Shut pump system off.

D. Close supply and return header valves.

SBW

FORM HWB79

BOILER INSTALLATION AND MAINTENANCE INSTRUCTIONS

RECEIVING THE BOILER

During the construction of your new boiler, over 100 separate inspections were made of the unit. These inspections started with the engineering drawing, which your unit was built to, and ended with the signing of the bill of lading by the freight carrier. These inspections were made by our Quality Control Department and our insurance inspection agency. At the time the freight carrier signed the bill of lading at our factory, he acknowledged that the unit was received by him in an undamaged condition. It is good practice for you, prior to signing the freight carrier's delivery receipt. to examine your boiler in detail to be sure that the unit has not been damaged in transit. If damage is evident, make a notation on the freight bill of the damage and file a claim against the carrier for the cost of replacement or repair. In the event your boiler-burner unit should have sustained so-called concealed damage (damage which is not outwardly evident), you have up to 15 days after receipt of the unit to file a claim covering repair or replacement of the concealed damage. Most of our units are shipped with certain fragile and easily damaged parts packaged in a separate box. The freight bill will describe the number of pieces shipped. Be sure that all pieces noted on the freight bill are received.

UNLOADING THE BOILER-BURNER UNIT

Your new boiler-burner unit is equipped with lifting eyes, located on the top center line. These are to be used for unloading. A crane is the best means of unloading and setting the new unit in place. DO NOT USE A LIFTING CABLE AROUND THE UNIT. DO NOT USE A FORK LIFT UNDER THE DRUM OF THE BOILER.

PUTTING THE BOILER IN PLACE

In the event a crane cannot be used to set the boiler in place, the skids furnished with the unit are sturdy enough to permit the use of pipe rolls. It is suggested that 3" pipe be used for this purpose.

THE BOILER ROOM

Local building codes and insurance requirements usually dictate the type of construction and the material to be used in the boiler room. The boiler room floor should be of adequate strength to support the weight of the boiler full of water. The boiler room floor should include a floor drain. It is advisable to use, when possible, wall and floor surfaces that permit hosing. Room should be provided in the boiler room to accomodate the boiler unit or units, boiler feed-water equipment, boiler water treating equipment, fuel oil pumps, and any other equipment that may be required in the boiler room. Space should be provided at the rear of the boiler to completely open the rear door. Room must be provided at either the front or rear end of the boiler to permit retubing. If possible, retubing room should be provided at the burner end of the new boiler, as tube removal is considerably easier from this end.

THE BOILER ROOM (Cont'd)

Adequate space should be provided around each boiler to permit cleaning and inspection of all piping supplied with the boiler and attached to the boiler at the job site. Each boiler room must be provided with a combustion air opening. One square inch of free flow combustion air opening is required for each 14,000 BTU input rating of the burner.

SETTING THE BOILER

After the boiler has been set in place, it is necessary that each unit be leveled. When boilers are out of level, it can permit some of the top row of tubes to be out of the water, thus creating uneven heating in the tubes which in turn will result in premature leakage. A boiler out of level, too, can reverse the functions of the primary and secondary low water cut-off switches, thus causing the auxiliary low water cut-off to turn the burner off before the feedwater pumps are actuated.

CONNECTING THE STEAM LINE

Most states and jurisdictional agencies have adopted the A.S.M.E. Code, thus it is good practice to install the steam line as per this code.

HIGH PRESSURE BOILER

Quoting from the A.S.M.E. Code, "each discharge outlet except safety valve, shall be fitted with a stop valve located at an accessible point in the steam delivery line, and as near the boiler nozzle as is convenient and practicable. When such outlets are over 2" pipe size, the valve or valves used in the connections shall be of the outside screw and yoke, rising spindle type so as to indicate from a distance by the position of its spindle whether it is closed or open, and the wheel may be carried either on the yoke or attached to the spindle. A plug cock type valve may be used, provided the plug is held in place by a guard or gland, the valve is equipped to indicate from a distance whether it is closed or open, and the valve is equipped with a slow opening mechanism."

TWO OR MORE HIGH PRESSURE BOILERS

"When boilers are connected to a common steam header, the connection from each boiler having a manhole opening shall be fitted with two (2) stop valves having an ample free flow drain between them. The discharge of this drain shall be visible to the operator while manipulating the valve. The stop valve shall consist preferably of one automatic valve of outside screw and yoke type or two valves of the outside and screw and yoke type shall be used."

LOW PRESSURE HOT WATER BOILERS

"Stop valve shall be placed in the supply and return pipe connections of a single hot water heating boiler installation to permit draining the boiler without emptying the system. When stop valves over two inches (2") are used, they shall be of the outside and screw yoke rising spindle type, or of such other type as to indicate at a distance by the position of its spindle or other operating mechanism whether is is closed or open. The wheel may be carried either on the yoke or attached to the spindle. If the valve is of the plug cock type, it shall be fitted with a slow opening mechanism and an indicating device, and the plug shall be held in place by a guard or gland. The steam design pressure of all steam valves used in steam headers should equal or exceed the design pressure of the boilers they are attached to.

BLOWDOWN PIPING

Your new boiler is located with blowdown tappings on the bottom center line of the drum, a surface blowdown tapping approximately two o'clock on the drum, and the water column (if supplied) is equipped with a blowdown valve. Normally, the water column blowdown valve, the manual blowdown valve, and the surface blowdown valve are piped into a common header for discharge to a safe place. It is good practice to discharge blowdown to be exhausted through the roof of the boiler room, and the liquid of the blowdown to be discharges into a drain. In some instances, the blowdown prior to discharging into the separator is piped through a preheater located in the feedwater.

BLOWDOWN VALVES

The A.S.M.E. Code dictates the type of valve to be used on blowdown lines.

LOW PRESSURE BLOWDOWN VALVES

"Each boiler shall have a bottom blowoff or drain pipe connection fitted with a valve or cock connected to the lowest water space practicable."

HIGH PRESSURE BOILERS

"Straight run blow valves of the ordinary type, and valves of such type that dams or pockets can exist for the collections of sediment shall not be used for boiler blowdown service. Straight way "Y" type glove valves or angle valves may be used in vertical pipes, or they may be used in horizontal runs of piping provided they are so constructed or installed that the lowest edge of the opening through the seat is at least 25% of the inside diameter below the center line of the valve. Blow-off valves and pipe between them and the boiler shall be of the same size except where a larger pipe for return of condensation is used. If a blow-off cock is used, the plug shall be held in place by a guard or gland. The plug shall be distinctly marked in the line with the passage. On all boilers having working pressures exceeding 100 PSI, each bottom blow-off pipe shall have two (2) slow opening valves, or one (1) slow opening valve and a quick opening valve or cock". All blow-off valves must have a design pressure to or exceeding the design pressure of the boiler on which they are installed.

VENT CONNECTION

Your new boiler-burner unit is supplied with a forced draft burner which is capable of supplying all the air for combustion as well as draft. It is, therefore, necessary to supply only a simple stack through the boiler roof to convey the products of combustion to a point of safe discharge. For a boiler installation in a one story building, the best and most economical stack is one of the same diameter as the stack outlet on the boiler directly through the boiler room roof.

WATER TREATMENT

Maximum trouble free boiler life is in most cases tied directly to proper boiler water treatment. Water treatment is a science of its own. The make up of water varies so much from one area to another, that there is no such thing as one treatment being effective in all areas. Treatment must be provided to prevent scale formation, corrosion, excess acidity, control of total dissolved solids, prevent caustic embrittlement, and so forth. We, therefore, recommend that you contact a reputable boiler treatment company operating in your area for advice in this field.

CALLING FOR INITIAL START-UP

The cost of start-up on your new unit has, in most cases, been included in the purchasing price. In some instances, start-up has been quoted as a separate item. In either event, to prohibit your having to pay for this service twice, it is strongly recommended that you fill out the Superior Boiler Works, Inc. "Prestart-Up Inspection" (attached form PSI-73) and mail it to your local Superior Boiler Works representative before asking for start-up service. This will eliminate the start-up man arriving at the job site before the unit is completely installed.

INITIAL START-UP

It is strongly recommended that only qualified personnel be allowed to work on your boiler. The design manufacture and assembly of your new unit is the result of years of engineering work and field testing. It is a sophisticated piece of equipment and can be properly serviced only by qualified people . We recommend that you contact your Superior Boiler Works representative for the names of experienced service personnel in your area.

In initiating start-up, it is necessary that the boiler be filled with water to the proper water level, be supplied with the proper electrical voltage with the motors turning in the proper direction, have the proper fuels at the proper pressures piped to the burner to the unit, have the boiler properly vented. All steam and water lines must be connected and have the people trained in the operation of the unit present.

BOILER-BURNER MAINTENANCE

Periodically, the water side surfaces of the boiler should be visably checked for scale formation, pitting, and corrosion. Scale collection should not be thicker than an egg shell, as scale is a good insulator and can considerably lower your boiler's over-all efficiency. When lowering the water level or draining the boiler for inspection, caution must be used. DO NOT DRAIN A HOT BOILER QUICKLY. Good practice would dictate draining the boiler only after it has been out of service at least 24 hours. IN NO CASE EVER FILL A WARM BOILER WITH COLD WATER. THIS WILL CAUSE TUBE LEAKAGE.

PRESTART-UP INSPECTION

Send to: _____

Address: _____

_____

Date: _____

Owner's Name _____ Location _____

Boiler Model _____ National Board No. _____

1. Voltage of _____ connected to boiler _____
2. Make-up water connected to unit _____
3. Gas connected to burner. Gas pressure _____ _____
4. Fuel oil suction line tested by installer _____
5. Fuel oil tank filled with #____ grade oil _____
6. Stack erectedor connected to breeching _____
7. Steam or water lines connected to boiler _____
8. Condensate return tank vented _____

The above have been checked by _____

as of the above date.

Requested start-up date _____

Signed _____

FORM PSI-73

BOILER BLOWDOWN PROCEDURE

Proper boiler blowdown is an essential part of firetube boiler operating procedure. It is necessary to control the amount of total dissolved solids in the boiler water. The total dissolved solids should not exceed 3500 parts per million in a scotch marine boiler. If boiler blowdown is not controlled, excessive dissolved solids will have tendency to increase and concentrate to a point that will cause a foaming or a carry over condition which will contaminate the steam. High concentrations of total dissolved solids in firetube boilers have a tendency to collect as scale on the heat transfer surfaces. Scale is an excellent insulator and its collection on the heat transfer surfaces of a boiler considerably lessen the heat transfer capabilities. This results in overheating the boiler tubes and tube sheets which in turn will result in tube leakage. The following chart shows the loss of efficiency of various types and thickness of scale.

Thickness of scale Inches	Soft Carbonate	Hard Carbonate	Hard Sulphate
1/50	3.5	5.2	3.0
1/32	7.0	8.3	6.0
1/25	8.0	9.9	9.0
1/20	10.0	11.2	11.0
1/16	12.5	12.6	12.6
1/11	15.0	14.3	14.3
1/9	----	16.0	16.0

Boiler blowdown can be accomplished either manually or automatically. Manual blowdown involves the operating personnel opening the boiler blowdown valves for a predetermined length of time at regular intervals. Automatic blowdown can be accomplished by many methods. The most common method is the use of a surface blowdown skimmer attached to a calibrated blowdown valve which permits a continuous preset amount of boiler water to be blown down.

The proper boiler blowdown rate can be easily figured when two things are known. It is necessary to know the total dissolved solids in the feedwater and it is also necessary to know the amount of make up water that the boiler is using. The amount of total dissolved solids in the feedwater can be determined from a water analysis. The amount of make up water being used is normally determined with the use of a water meter installed in the make up feedwater line. The correct amount of boiler blowdown, as a percentage of feedwater can be figured with the following formula.

$$\text{Percentage of boiler blowdown} = \frac{\text{Total dissolved solids in the feedwater}}{\text{3500 - total dissolved solids in the feedwater}} \times 100$$

An example of the use of the above formula assuming the total dissolved solids in the feedwater at 200 parts per million is shown below.

Example:

$$\frac{200}{3500 - 200} \times 100 = 6\% \text{ of make up}$$

IMPORTANT

BOILER WATER TREATMENT

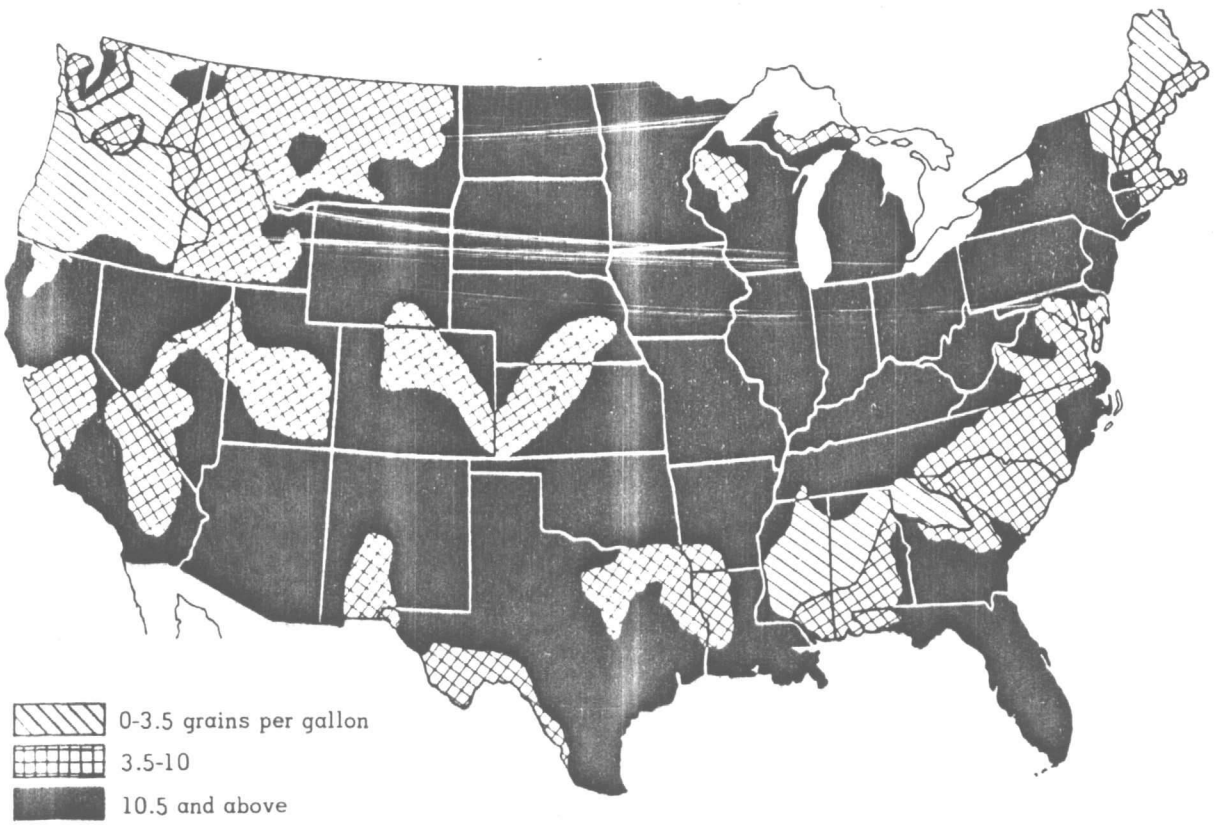
Proper boiler water treatment is the most important factor toward extended trouble-free service from your new boiler. There are no universal treatments, as water can vary drastically from one source to another in the same area.

The most common cause of boiler tube failure is calcium and magnesium hardness which forms scale on the boiler, reducing heat transfer and causing overheating of the tubes. This eventually causes tube leakage. This can occur in a boiler using a high percentage of makeup water in a matter of days. For example, a 30 day period without treatment in some areas has resulted in the necessity of completely retubing a new boiler. The ultimate in boiler water treatment is completely demineralized water; however, the expense of demineralizing prohibits its use except in the larger boilers such as power plants, etc. The method of softening water most generally used for commercial boilers is with the zeolite type water softeners. These softeners come in a variety of sizes and operating characteristics. The required softener size depends upon the hardness of the water being used, the size of your boiler, and the frequency of regeneration you desire. To give you some idea of the hardness in our water nationally, a map of the United States is below indicating hardness by area.

Lack of boiler blowdown closely follows hard water as a major cause of boiler tube failure. Most water contains minerals of several types, and when this water is heated to the point of making steam, these minerals are left behind in the boiler. It follows that in time the minerals have to be removed or soon they build up to the point (depending on the amount of minerals in your water) where the water in the boiler becomes thick and syrupy causing the boiler to foam, prime and pull water out with the steam. It is also factual that an overabundance of these minerals can keep the heat of the fire from transferring into the water, thus causing overheating and tube failure. Lack of boiler blowdown required the retubing of a new boiler in service only 4 months. Lack of boiler blowdown is also the cause of furnace tube replacements. The removal of these minerals is very simply achieved by a regular blowdown procedure, which can be accomplished either manually or automatically. The rate and frequency of blowdown again depends upon the size of your boiler, the amount of makeup water used, and the pressure at which your boiler is operated. Proper blowdown practice will maintain the total dissolved solids in your boiler below 3,500 parts per million.

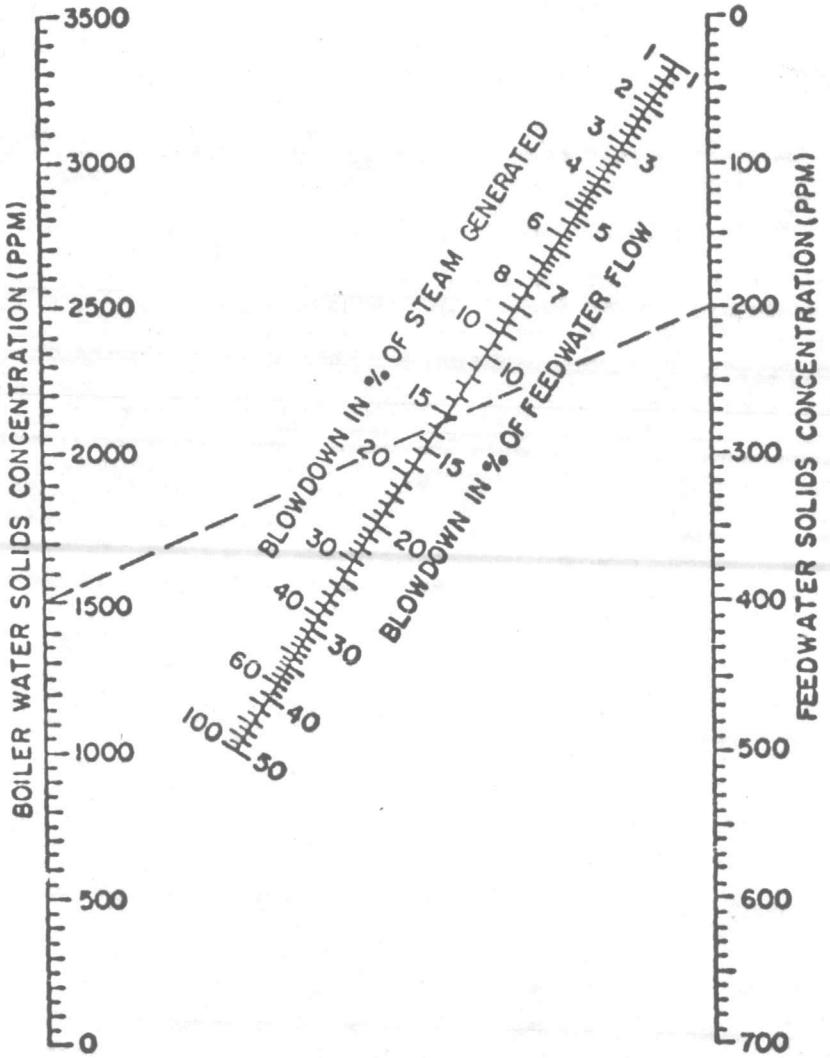
Hardness removal and proper blowdown are, in most cases, not sufficient for total treatment. The water in your boiler should be neither acid nor alkaline, sulfates, or Gyp water, when present, are a major cause of tube leakage, and oxygen, when present, must be removed to prevent internal corrosion.

We earnestly urge you to contact a reputable local water treatment firm to advise you on the proper treatment for your boiler. Water treatment is a science in itself and when properly applied to your boiler will save you many dollars that may other wise be required for maintenance.



NOMOGRAPH

Boiler Blowdown



Boiler Outlet Pressure (psig)	Total Solids Concentration (ppm)
0-300	3500
301-450	3000
451-600	2500
601-750	2000
751-900	1500
901-1000	1250
1001-1500	1000

PROBLEM: Boiler blowdown removes a portion of the water from the boiler to lower the suspended and dissolved solids content of the system. Solids introduced with the boiler feedwater will tend to increase in concentration with time. How can you easily estimate the amount of blowdown required to keep boiler water solids concentration within recommended limits?

SOLUTION: First find allowable boiler water solids concentration from the table above. Using the nomograph, place a straightedge connecting the allowable boiler water solids concentration on the left scale with the feedwater solids concentration on the right scale. The answer in percentage of steam generated or feedwater flow is read directly from the center scale.

EXAMPLE: With a boiler operating at 800 psig, what would be the necessary blowdown, both as a percentage of steam generated and boiler feedwater flow, if there are 200 ppm total solids in the feedwater? (Note: From the chart, allowable solids concentration for a boiler operating at 800 psig is 1500 ppm.)

Ans.: 15.3% of steam generated.
13.2% of feedwater flow.

Source: American Boiler Manufacturer's Association

Maintenance and Care Recommendations For Your New

SCOTCH MARINE BOILER

With proper operation and maintenance you can expect years of trouble free service from your new Boiler. The procedure for correct operation and care of your unit is not complicated, nor is it time consuming; thus, we are outlining in this bulletin the function of each component of your unit and recommendations for its care.

Preparations prior to use:

It is necessary to clean the inside of the new boiler of oil and grease used as tube rolling lubricates. Failure to remove these materials will result in your unit foaming, priming, and pulling over. This cleaning operation is easily accomplished by following the procedure as outlined below.

(a) Fill boiler to normal water line.

(b) Close valve in steam line.

(c) Remove safety relief valve.

(d) Add caustic soda through the top hand hole at the rate of 1 pound per 600 lbs. of steam capacity of your unit. The pounds of steam per hour rating of your boiler is stamped on the name plate affixed to the front smoke box.

(e) Connect a vent pipe to the safety relief valve port on the boiler and run this vent to a convenient drain.

(f) Fire the boiler at a low rate for 3 to 4 hours allowing the steam to discharge through the vent pipe installed in place of the safety relief valve.

(g) Drain the boiler while still warm. Remove top inspection plate, washout handhole, and two handhole plates in front head of boiler. Wash interior of boiler with tap water at full pressure through a nozzle. Wash until all evidence of dirt, mud, and impurities are removed through the bottom hand hole opening.

The boiler will be ready for service after replacing the safety valve and opening the steam valve.

The above cleaning operation also serves to dry the insulating refractory in your boiler.

Burner Controls and Operation are found in the attached burner manufacturer's instruction book.

Pressure and Temperature Controls

Your boiler is operated automatically by a pressuretrol if a steam boiler or aquastat if a water boiler. These operators serve two functions; to shut the burner off when the desired pressure or temperature is reached and turn the burner on when the pressure or temperature drops below the desired level. The adjustment of the pressuretrol is made by rotating the larger of two adjustment screws located on the top of the pressuretrol. Turn this screw until the indicator located on the side of the pressuretrol directly under the adjustment screw shows the desired pressure. This adjustment should be checked against the steam pressure gauge at the time the burner turns on. If the pressure gauge and the scale on the side of the pressuretrol do not agree, the scale on the pressuretrol should be moved up or down to agree with the pressure gauge. This is accomplished by loosening the four screws holding the scale to the pressuretrol. The second adjustment necessary for automatic operation is the adjustment of pressure at which the burner is to turn off. This is accomplished by rotating the smaller of the two screws located on top of the unit and is read on the scale directly under this screw. This scale is calibrated as difference and indicates the pounds per square inch above the burner turn on point at which you want the burner to turn off.

On a water boiler it is necessary only to adjust the aquastat to the desired operating temperature. This is indicated on the scale on the front of the aquastat. The unit then automatically maintains this preset temperature to within 10 degrees.

In all cases the operating controls should be set at the lowest levels possible that will allow the boiler to do its assigned job. To set the operators higher than necessary wastes fuel.

Low Water Cutoff

The function of this unit is to control the pump or solenoid supplying water to the boiler and to eliminate the possibility of firing the boiler without sufficient water.

Steam Boiler:

The low water cutoff is enclosed in the water column and is a float operated mechanism. If the water level in the boiler drops, the float also drops. When the water level in the boiler drops ¼" below normal, the float operated mechanism turns on the device supplying water to the boiler. If for some reason water is not supplied (pump or solenoid inoperative, water not available, etc.), the low water cutoff breaks the electrical circuit to the burner and

(Continued on Reverse Side)

turns it off. The burner cannot be turned on until the water in the boiler is returned to the normal operating level. To insure proper operation of this unit, periodic blowdown of the water column is recommended. Blowdown is performed by rapidly opening the water column blowdown valve two (2) full turns and quickly closing the valve. The burner should be on when the blowdown is begun and should turn off during the blowdown. Should the burner continue to burn through the blowing down operation, the low water cutoff is not functioning properly, indicating that the float chamber should be cleaned. With a boiler supplying steam for processing, the water column should be blown down daily. With a heating boiler blowdown should be performed monthly.

Water Boiler:

The low water cutoff on a water boiler is a probe unit located on the top of the boiler. It has a probe extending down into the water in the boiler to within three inches of the top row of tubes. If the water level in the boiler drops below the probe, the burner electrical circuit is broken and the burner shuts off. The burner cannot light until the proper water level in the boiler is restored and a reset button on the low water cutoff is pushed.

Blowdown:

Heating Boilers:

Under your boiler near the back is a blowdown line and valve. The purpose of blowdown is to remove precipitates that collect in the boiler. With the average heating system very little water has to be added to the boiler; thus, the same water is used over and over. The recommended boiler blowdown with a leak free heating system is the withdrawal of 2 gallons of water monthly from the boiler. In heating systems which require the addition of fresh water to the boiler frequently, it is good practice to blow the boiler down more frequently. This valve has a replaceable seat to facilitate repair in the event leakage appears.

Boilers Supplying Steam For Process:

The boiler blowdown operation is performed by opening the blowdown valve adjacent to the boiler all of the way then rapidly opening and closing the second valve two (2) full turns. Blowdown should be performed while the boiler is under a light load. Daily blowdown is recommended for this type of service.

Safety Valve

The purpose of this valve is to relieve any pressure in the boiler above its design limit. These valves are sized to relieve the BTU capacity of your boiler. It is good practice to manually open the safety relief valves on your boiler monthly if a heating boiler or weekly if steam is used for processing. This is done by rapidly lifting and releasing the handle provided on the valve 3 or 4 times.

Inspection and Washout Plates

These openings are placed in the boiler to facilitate visual inspection, cleaning and retubing your boiler. Upon evidence of leakage, the plate should be tightened by taking up the nut holding it in place. It is not uncommon for a new unit or a newly gasketed plate to start seeping after being in use a short time inasmuch as the gasket softens a bit upon exposure to moisture and heat. This seepage can be stopped as pointed out above. It is good practice to always use new gaskets on these plates after they have been removed. Be sure there are no foreign particles on the seating surface of the plate or boiler before installing new gaskets. The use of oil, graphite paste or pipe dope on both sides of a new gasket aids in getting a leakproof seal. Do not tighten nuts with pressure on the boiler.

Water Treatment

Heating Boilers:

Water treatment in a heating boiler is usually not a problem inasmuch as the same water is used over and over. Treatment is primarily to eliminate corrosion and pitting caused by alkalinity and oxygen. It is usually necessary to treat the water in a heating boiler once a year at the beginning of the heating season. Asking the advice of a competent water consultant about the treatment is recommended. The appearance of scale, corrosion or pitting is definite evidence that water treatment is needed.

Process Steam Boilers:

When the boiler supplies steam for processing it is necessary to replace steam used with makeup water. Water treatment for boilers supplying process steam varies with analysis of water available. It is therefore strongly recommended that the owner secure the services of a reputable boiler water chemist to run water analysis and recommend treatment.

Piping

The piping on a boiler (water column - blowdown - safety relief valve vent) should be kept leakproof. A small leak, if allowed to continue, soon becomes a major problem. All vent and blowdown piping running vertically up should have means for draining the vertical run.

Boilers out of service

When boilers are out of service for prolonged periods they should be drained, washed out, left open, and kept dry. All of the plates should be removed and left out while the boiler is out of service. If draining the boiler is not possible it should be filled completely full with water and kept full while out of service.

WATTS 174A-740 SERIES

ASME WATER PRESSURE RELIEF VALVES

for Pressure Protection of Hot Water Heating Boilers

Sizes: ¾" thru 2"

The 174A-740 Series was developed to offer a complete line of boiler safety relief valve sizes from ¾" through 2" inclusive and with corresponding high BTU discharge capacity ratings. Watts was the first to offer this full selection of sizes, which afford complete pressure protection for the great majority of all hot water heating and supply boilers with a single valve.

Sizes 1" to 2" inclusive are proportionately larger valves to the ¾" size. They are designed for larger institutional and industrial installations to protect high BTU rated boilers that need greater relief capacities.

Whenever plans call for the latest and finest in A.S.M.E. relief valves, you'll find them in the Watts line.

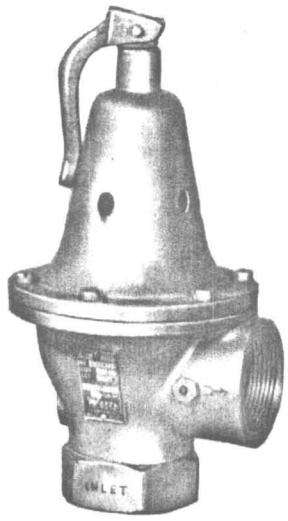
FEATURES

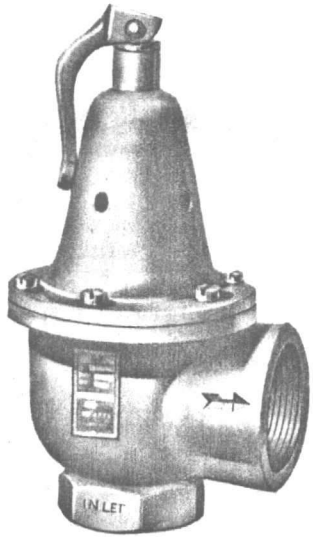
- Seat located above drain: water can't be trapped and sediment can't foul seat
- Non-mechanical seat-to-disc alignment will not stick or freeze
- Water seal of high temperature resisting material isolates spring working parts from water during relief
- No. 740 has the same design features as No. 174A except for difference in body construction and material

SPECIFICATIONS

BOILER RELIEF VALVES

Each hot water space heating boiler shall be equipped with a pressure relief valve set to relieve below the maximum boiler working pressure. The device shall be certified in accordance with the A.S.M.E. low pressure heating boiler code Section 4. The BTU rating of the valve must be in excess of the BTU output heating of the boiler. Watts Regulator Company Series 174A, 740 or equal.

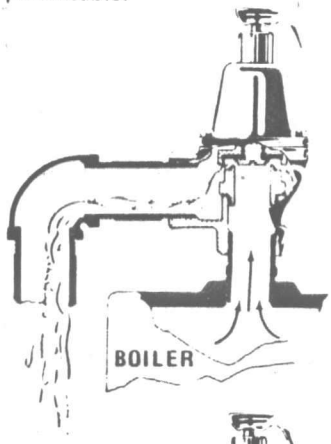




OPERATION: A hot water heating boiler operates normally full of water and steams only when there is trouble with the firing controls. When this occurs, it is good "safety" procedure to reduce the energy stored in the boiler by lowering the heat content of the boiler as rapidly as practicable.

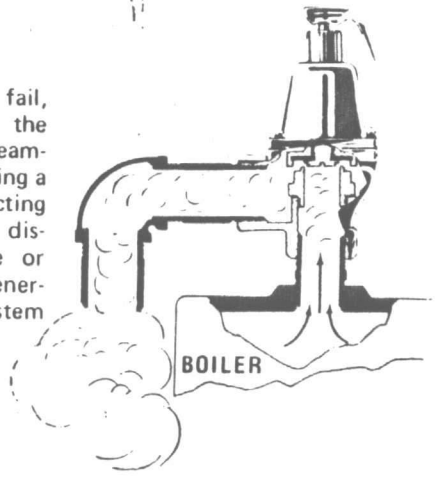
WATER DISCHARGE

As thermal expansion conditions develop, pressures may be built up to the setting of the relief valve. In this phase of operation, it acts as a **water relief valve,** discharging the small quantity of water which is expanded in the system.



STEAM DISCHARGE

Should operating controls fail, permitting run-away firing, the boiler water may reach steam-forming temperatures, creating a steam pressure condition. Acting as a **steam safety valve,** it discharges **steam** at the rate or faster than the boiler can generate it, thus restoring system pressure to a safer level.



WATTS REGULATOR

WATTS REGULATOR COMPANY
Box 628, Lawrence, MA 01842 (617) 688-1811
Telex: 94-7460
Toronto, Canada (416) 742-6891 Telex: 06527137

MATERIALS

74A Series

- Bronze body construction
- Non-metallic disc-to-metal seating

40 Series

- Iron body construction
- Non-metallic disc-to-metal seating

PRESSURE - TEMPERATURE

74A Series

Pressure range 30 lbs. to 150 lbs. with corresponding high BTU/HR ratings from 650,000 to 14,370,000 BTU/HR.

40 Series

Pressure range 30 lbs. to 75 lbs. with corresponding high ratings from 925,000 to 10,700,000 BTU/HR.

STANDARDS

HV ASME NB

ested and rated by A.S.M.E. National Board of oiler and Pressure Vessel Inspectors.

CAPACITY

No. 174A Series

SETTINGS and RELIEVING CAPACITIES
(National Board Certified Ratings)
BTU Steam Discharge Capacities

Size	30 lbs.	100 lbs.	125 lbs.	150 lbs.
¾"	650,000	1,695,000	2,070,000	2,445,000
1"	1,005,000	2,635,000	3,215,000	3,795,000
1¼"	1,682,000	4,399,000	5,370,000	6,340,000
1½"	2,020,000	5,290,000	6,460,000	7,630,000
2"	3,815,000	9,970,000	12,170,000	14,370,000

NOTE: We recommend No. 740 Series as best buy for hot water space heating boiler requirements between 30 through 75 lbs.

No. 740 Series

SETTINGS and RELIEVING CAPACITIES
(National Board Certified Ratings)
BTU Steam Discharge Capacities

Size	30 lbs.	45 lbs.	50 lbs.	75 lbs.
¼" x 1"	925,000	1,245,000	1,352,000	1,886,000
1" x 1¼"	1,300,000	1,749,000	1,899,000	2,649,000
1¼" x 1½"	2,105,000	2,830,000	3,075,000	4,285,000
1½" x 2"	2,900,000	3,903,000	4,238,000	5,910,000
2" x 2½"	5,250,000	7,050,000	7,650,000	10,700,000

NOTE: Valve settings, other than shown above, are available in 5 lb. increments between the pressure range of 30 through 75 lbs.

DIMENSIONS - WEIGHT

No. 174A Series

No.	Size	Model	Height	Length	Weight
174A	3/4" x 3/4"	M3	5 1/8"	2 1/2"	1 1/2 lbs.
174A	1" x 1"	M1	5 3/4"	3"	3 1/8 lbs.
174A	1 1/4" x 1 1/4"	M1	8 3/8"	4 3/4"	6 1/4 lbs.
174A	1 1/2" x 1 1/2"	M	9"	4 7/8"	7 1/4 lbs.
174A	2" x 2"	M	11 5/8"	6 1/4"	13 3/4 lbs.

No. 740 Series

No.	Size	Model	Height	Length	Weight
740	3/4" x 1"	M1	5 5/8"	3"	1 7/8 lbs.
740	1" x 1 1/4"	M	7 1/4"	3 1/2"	3 1/8 lbs.
740	1 1/4" x 1 1/2"	M	8 3/4"	4 5/8"	6 1/8 lbs.
740	1 1/2" x 2"	M	9 1/4"	5 1/4"	7 1/2 lbs.
740	2" x 2 1/2"	M	11 5/8"	6 3/4"	16 1/2 lbs.

WATTS REGULATOR
WATTS REGULATOR COMPANY

THE NAME THAT PROTECTS *YOUR* NAME
Box 628, Lawrence, MA 01842 (617) 688-1811
Toronto, Canada Soestduinen, The Netherlands
TELEX 94-7460 **CANADIAN TELEX 06527137**

-174A-740-2

PRINTED IN U.S.A.

INSTALLATION INSTRUCTIONS

McDONNELL Nos. 247, 247-2, 51, 51-2, 51-S, 51-S-2, 53 and 53-2 Boiler Water Feeders and Feeder Cut-Off Combinations

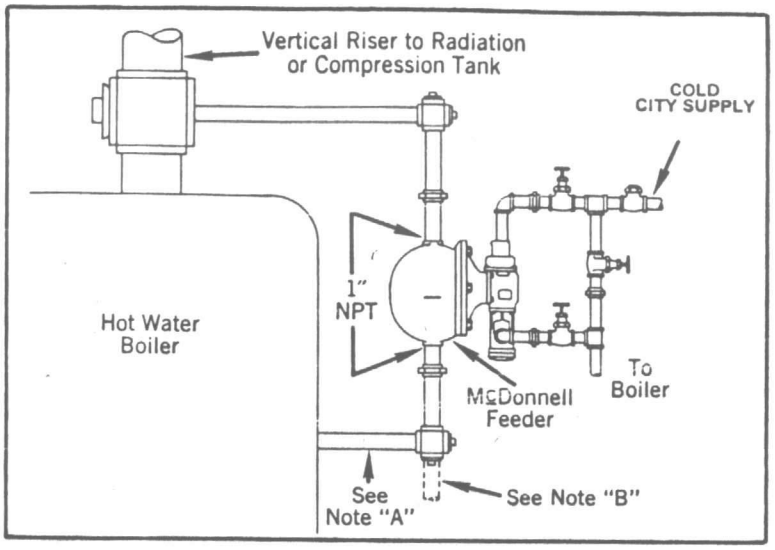
For Hot Water Boilers

For either cast iron or steel hot water heating boilers, McDonnell feeders and feeder cut-off combinations can easily be installed by following one of the drawings and instructions on this page. The purpose of the McDonnell Feeder Cut-off Combination is to maintain a minimum safe amount of water in the system, and to shut off the firing device should the water drop to an unsafe level. Any location of the feeder or feeder cut-off combination **above** the lowest safe water level established by the boiler manufacturer is suitable.

Feeder No.	247	51	51-S	53
Max. Boiler Pressure (psi)	30	35	35	75
Max. Water Supply Pressure (psi)	150	150	100	150
City Water Supply Pipe	½"	¾"	¾"	¾"

IMPORTANT

When hydrostatic testing boiler at pressures above the maximum boiler pressure rating of feeder (see above) be sure feeder is not piped to boiler.

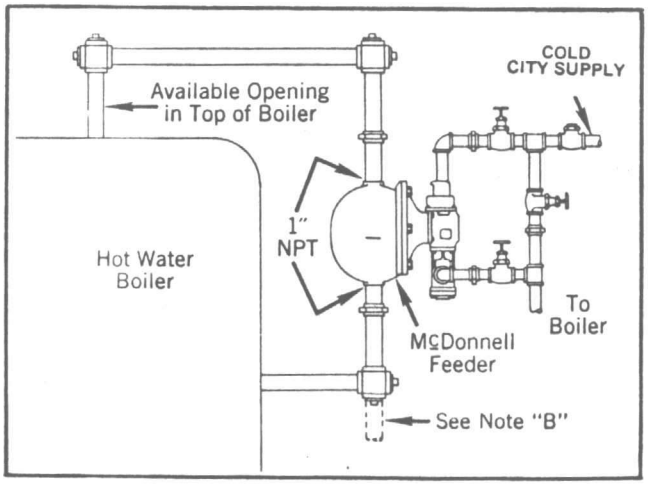


Connect the upper equalizing pipe to the riser going to radiation or compression tank, and the lower equalizing pipe to any available opening in side of boiler. For city water piping information see other side of this sheet.

Note "A"—If no opening is available in the side of the boiler, connect lower equalizing pipe into a tee at the drain connection, or to the return line.

Note "B"—Where it is necessary to drain the equalizing piping and float chamber a drain valve may be installed in a vertical pipe below the equalizing piping cross connection.

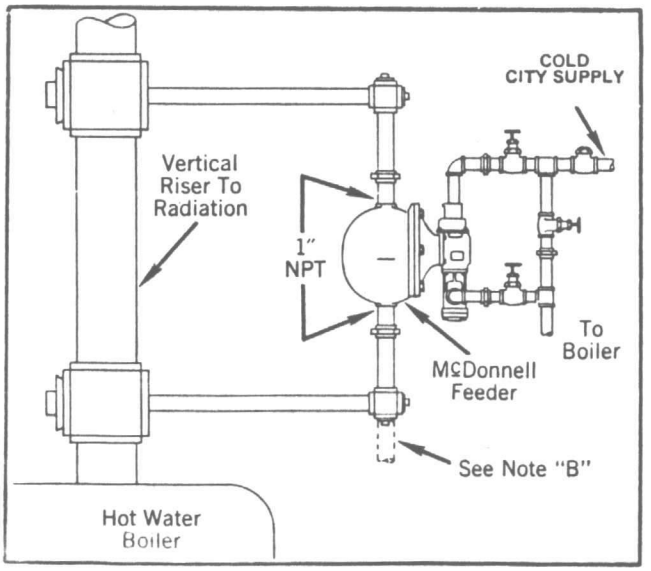
Alternate Methods of Installation



An alternate method of installation is to connect the upper equalizing pipe into an available opening in the top of boiler as indicated in the above drawing.

CAUTION: If this method is used the feeder **should be installed** below the top of the boiler as shown.

If the feeder is located above the top of the boiler an air pocket will be created, the cut-off will stay in the off position and the burner will remain off. An air vent must be installed in the top of the upper vertical equalizing pipe to eliminate the air pocket.

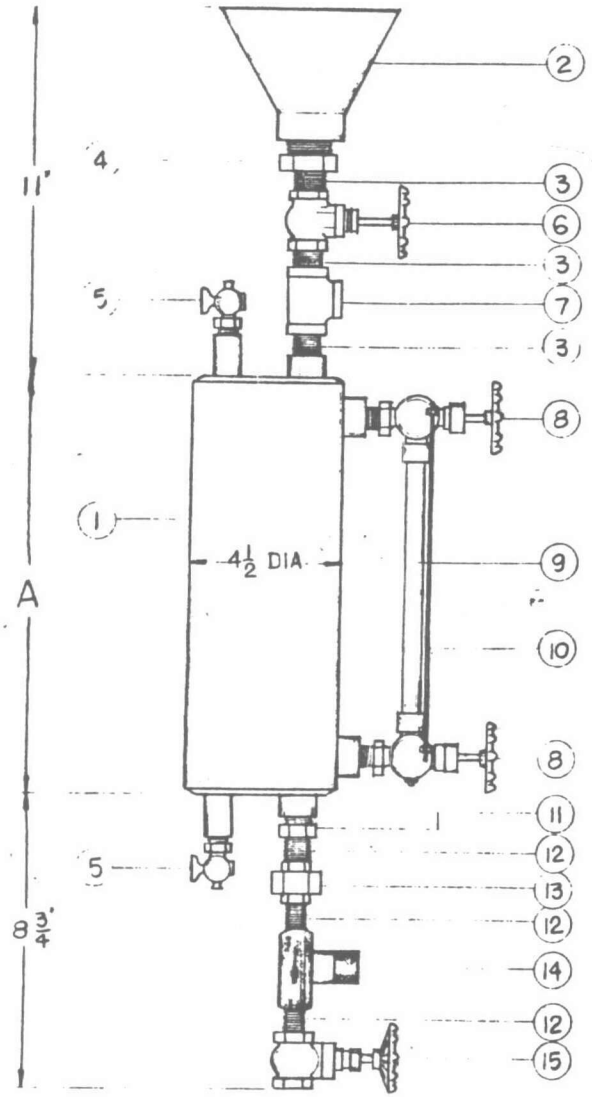


Still another alternate method of installation is to connect the upper and lower equalizing pipes into the riser supplying the radiation.

CAUTION: The horizontal upper equalizing pipe should **not** be above the horizontal run of the riser. If such an installation should be made an air pocket will be created and an air vent would be required to eliminate the air.

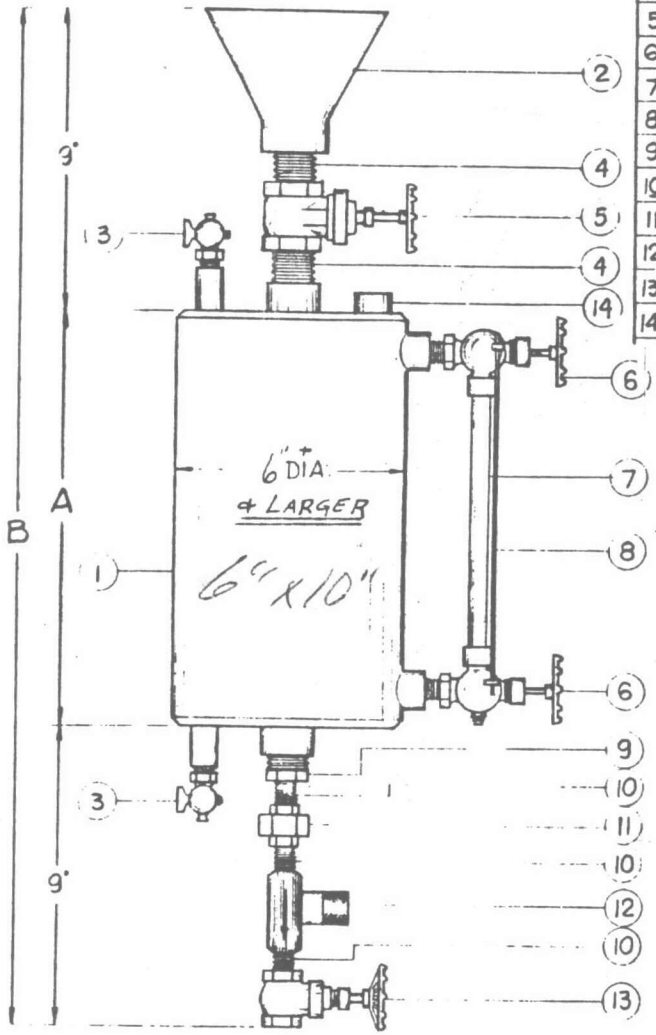
McDONNELL & MILLER ITT
3500 N. Spaulding Avenue, Chicago, Illinois 60618
Tel: (312) 267-1600

Bulletin I-Feeder
Printed in U.S.A.



Item	Part Description	Qty
1	Tank	1
2	Funnel	1
3	½" Pipe Nipple	3
4	1" to ½" Reducer Bushing	1
5	Petcocks	2
6	½" Valve	1
7	½" Tee	1
8	Gauge Valve	2
9	Sight Glass	1
10	Glass Guards	2
11	½" to ⅜" Reducer Bushing	1
12	⅜" Pipe Nipple	3
13	⅜" Union	1
14	Flow Control Valve	1
15	⅜" Valve	1

BY-PASS FEEDER



Item	Part Description	Qty
1	Tank 16 Gallon	1
2	Funnel	1
3	Petcock	2
4	1" Pipe Nipple	2
5	1" Valve	1
6	~~Gauge Valves~~	2
7	~~Sight Glass~~	1
8	~~Glass Guards~~	2
9	~~1" to ⅜" Reducer Bushing~~	1
10	~~⅜" Pipe Nipple~~	3
11	~~⅜" Union~~	1
12	~~Flow Control Valve~~	1
13	⅜" Valve	1
14	½" COUPLING	

BY-PASS FEEDER

DIRECTIONS FOR THE INSTALLATION OF THE
CONTINUOUS BY-PASS FEEDER

INSTALLATION:

The feeder should be installed in a convenient location as close to the equipment to be treated as possible. DO NOT connect feeder outlet piping too close to a pump suction, as it may affect the feeding rate, install feeder in accordance with all local plumbing codes and/ or ordinances.

FILLING AND ADJUSTING THE FEEDER

1. IMPORTANT - Backwash and flush out the feeder before every refilling. Close all valves including the Flow Regulator. Open the drain valve, open the inlet valve and thoroughly flush the feeder. Close the inlet valve. Open the outlet valve, note the dial setting on the Flow Regulator, and then open it completely. Flush the Flow Regulator for approximately 10 seconds. Close the outlet valve, drain valve and reset the Flow Regulator to the previous dial setting.

2. All valves should be closed. Open fill valve and petcock on gauge glass.

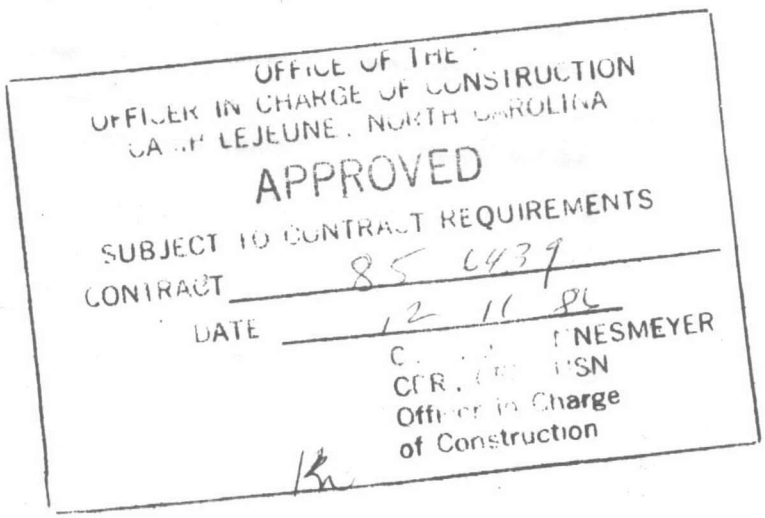
3. Pour formula into feeder.

4. Crack open the inlet valve and let water slowly into the feeder until it comes out the petcock.

5. Close the petcock and all valves.

6. Open the inlet and outlet valves completely.

7. The inlet and outlet valves should always be left wide open while the feeder is in operation. All flow adjustments must be made with the Flow Regulator.



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Gordon-Piatt
Energy Group
Inc.

Instruction Manual

This Book is the Property of .....
Bldg: CG-1
Camp Lejeune, NC

Burner Model No. R6-O
Burner Serial No. S66601
Boiler Mfr. & No. _____
Date Installed _____
Serviced By _____

_____

_____

Telephone No. _____

WARRANTY

FOR BURNERS AND AUXILIARY EQUIPMENT

WARRANTY: We will guarantee our equipment to be first class in every respect as to workmanship and material. Should any item manufactured by Gordon-Piatt Energy Group, Inc. prove defective within 18 months from the date of shipment (from our plant) due to faulty material or improper workmanship we will furnish, without charge to the purchaser, replacement or repair of said defective part or parts freight prepaid. **On items not of our manufacture, the manufacturer's warranty that is given to us as buyer is extended to you.** Associated labor and costs shall be borne by others. The defective part must be returned freight prepaid to Gordon-Piatt Energy Group, Inc., Winfield with a completed Return Goods Tag attached within 30 days after your receipt of the replaced device or full charges will be in order. The foregoing shall not apply to equipment that has been altered or repaired after shipment to you by anyone except our authorized employees, and the Company will not be liable in any event for alterations or repairs except those made with its written consent. This paragraph does not cover ordinary wear and tear, corrosion, erosion or improper handling or storage after leaving our point of shipment. If inspection by the Company does not disclose any defect in workmanship or material, the Company's regular charges will apply. Any refractories supplied with this order will be guaranteed as to quality and will be selected in accordance with good practice for the service intended. Due to operating conditions beyond their (and our) control, refractory manufacturers will not guarantee the service life of their products and we, therefore, are limited to the same degree in our terms of guarantee. **The foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties, or merchantability or otherwise, express or implied in fact or by law, and state our entire and exclusive liability and buyer's exclusive remedy for any claim of damages in connection with the sale or furnishing of goods or parts, their design, suitability for use, installation or operation. We will in no event be liable for any special or consequential damages whatsoever, and our liability under no circumstances will exceed the contract price for the goods for which liability is claimed.**

Gordon-Piatt Energy Group, Inc.

Strother Airport Industrial Park
P.O. Box 650 Winfield, KS 67156
Telephone (316) 221-4770 Telex 41-7452

GORDON-PIATT ENERGY GROUP, INC.
WINFIELD, KS 67156

ORDER ENTRY AND EQUIPMENT PRICING FORM

SO NO. 80702-B
CUSTOMER I.D. 37-0703

SHIP TO: Later

BILL TO: ABMA IBCI
Kinston Plb. & Heating
P.O. Box 637
Kinston, NC
28501

CUSTOMER ORDER # Later
2/20/87
REQUIRED DATE ~~LATER~~
SCHEDULED DATE
TERRITORY 2003

SHIP VIA (✓) TRUCK ( ) OTHER
( ) COLLECT ( ) PREPAY & CHARGE (✓) PREPAY & ALLOW
SPECIAL INSTRUCTIONS CALL 919-522-4490 24HRS. B/4 DELIVERY Ship #1 thru 3 TOGETHER

QUANTITY 1 EQUIPMENT MODEL NUMBER: R6-O-03-R7795A-F1-UL:

UNIT FIRED: MFGR. SUPERIOR MODEL 3-75-W30 TYPE Firebox NO. PASSES 3
HEATING SURFACE ____ SQ.FT. COMBUSTION CHAMBER WIDTH/DIA ____ LENGTH ____ BASE HEIGHT ____ HC DIM. ____

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

VOLTAGE, SUPPLY: POWER = 115 VOLTS, 60 HZ. 1 PH: FIRE THRU ( )DOOR ( )BASE STACK HT. ____ FT.
VOLTAGE CONTROL: 120/60/1

GAS: (1)TYPE ____ MBH INPUT ____ BTU/CF ____ CFH ____ SP.GR. ____ GAS PRESSURE AVAILABLE MIN. ____ MAX. ____
(2)TYPE ____ MBH INPUT ____ BTU/CF ____ CFH ____ SP.GR. ____ MIN. ____ MAX. ____

GAS TRAIN SELECTED, PIPE SIZE ____ MIN. INLET PRESSURE REQUIRED ____

OIL: GRADES 2 GPH 5.0 BTU/GAL 140000 SUPPLY PRESSURE ____ PSIG TEMP ____ °F

AGENCY APPROVAL: (✓) UL ( ) FM ( ) IRI ( ) CSA ( ) OTHER ____ ALTITUDE ____ FT. MSL (IF OVER 2000 FT. MSL)

ASSEMBLY DATA
GAS ORIFICE DRILL SIZE: PRI ____ SEC ____ TER ____
(1)GROSS ORIFICE PRESSURE ____
(2)GROSS ORIFICE PRESSURE ____
NOTE: (GROSS ORIFICE PRESSURE INCLUDES COMBUSTION CHAMBER PRESSURE)

OIL NOZZLE(S): NO/BURNER 1 TYPE S MODEL B RATED GPH 3.0 @ 100 PSIG ANGLE 90
NOZZLE FIRING PRESS. OIL 280 PSIG BYPASS ____ PSIG AIR/STM ____ PSIG APPROX. TEMP ____ °F

ENGINEERING DATA
SCHEMATIC WIRING DIAGRAM = 31-001375-20
GAS PIPING SCHEMATIC = ____
FIELD WIRING DIAGRAM = 32-000476-20
OIL PIPING SCHEMATIC = 1-GEN-80.1-Rev2
OPERATING SEQUENCE = 33-001215-40
INSTALLATION DRAWINGS = 1-R-30.11-Rev6
SUPPLEMENTAL DRAWINGS = 1-GEN-10.6-Rev3
REQ. # ____
TO BE SENT TO: W. C. Rouse

SUBMITTALS: QUANTITY 2
✓ LOOSE DRAWINGS
___ LOOSE SUBMITTALS
___ BOUND SUBMITTALS

TOTAL MANUALS FOR THIS ORDER; 7 SEND 1 MANUAL(S) 1 SET(S) DRAWINGS WITH (EACH) BURNER
JOB NAME ____
LOCATION ____
6 MANUAL(S) TO: W.C. Rouse
TAG/MARK SHIPMENT (JOB NAME):
W.C. Rouse 3296 BNC
Bldg. # CG-1

CHECKOUT												
BURNER UL NO.												
MOTORS: VOLTS	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
BLOWER-SFA ____: AMPS												
SER.NO.												
COMB. SAFEGUARD-SER NO.												
M.A./D.C. A.C. VOLTS												

ORDER ENTERED BY: Randy NB 11/14/86
WRITTEN BY: MP 11/19/86
CHECKED BY: [illegible] 11/19/86
11-20-86
11-27-87

NOTE SHADED AREAS TO BE COMPLETED BY G-PEG

FORM 1196J

FINAL MATERIAL LIST

SO NUMBER S080702B QUANTITY 1 ML #500227-2010 PAGE 1 OF 2

MODEL NUMBER R 6 - 0 - 3 - R7795A - - - F1 -UL

	TYPE & SIZE	FUEL S	MOTOR HP	SAFEGUARD SYSTEM	GAS SYSTEM	GAS TRAIN	OIL SYSTEM	AGENCY APPROVAL

CUSTOMER I.D. TAG 090128-0000 RATING TAG 090211-0000 U.L. TAG 094211-0000

ITEM NAME	SHIP	LINE	QUAN	PGP PART OR VENDOR NUMBER	
COMB. HEAD NOSE LENGTH 5 1/2		001	1	031000-0010	
PRIMARY AIR SLEEVE		002	1	072000-0010	
PRIMARY ORIFICES		003			
SECONDARY ORIFICES		004			
SAFETY GAS PILOT ASSY.		005			S
BLOWER HOUSING		006	1	040030-0000	
MOTOR HP-RPM-FRM-HZ-PH-VOLT		007	1	.33-3600A56C-61-115H	
MOTOR MOUNTING PLATE		008	1	050079-0000	
BLOWER WHEEL 5C8X324X.63		009	1	BW0045	S
AIR INLET CONE		010	1	150026-0000	
SWIRLER		011			
AIR DIFFUSER		012	1	151040-2000	
OIL IGNITION ELEC. ASSY		013	1	210049-0000	S
OIL IGNITION ELEC. ASSY		014	1	210050-0000	S
AIR VANE		015			
OIL NOZZLE		016	1-	TYPE-B-3.00GPH-90	S
AIR INLET ASSY		017	1	250246-3000	
OIL PUMP BURNER MOUNTED		018	1	H3PAN-C150H	S
OIL PUMP COUPLING ASSY.		019	1	160017-2000	S
SAFETY OIL VALVE		020	2	S311AF02V7AC9	S
BYPASS OIL VALVE		021	2	S311AF02V7AC9	S
OIL PRESS. REGULATING VALVE		022	1	0V0814	
OIL METERING VALVE		023			
OIL CYLINDER ACTUATOR D/C----------		024			S
OIL PRESSURE GAUGE		025	1-	LFC220-LIQ-BK-600#-2.5C	S
OIL PRESSURE GAUGE		026			S
AIR FLOW SWITCH		027			S
GAS PILOT IGN. TRANSFORMER, 600CV		028			S
OIL IGN. TRANSFORMER, 10,000V		029	1	A10-SV22	S
AIR-FUEL CONTROL MOTOR		030			S
BUTTERFLY GAS VALVE		031			
GAS PILOT SOLENOID		032			S
GAS PILOT PRESSURE REGULATOR		033			
FLAME DETECTOR		034	1-	C7027A1049	S
		035	-		
		036			
OIL STRAINER		037			
OIL CHECK VALVE		038			
CONTROL - WATER TEMP 100-240	L	039	1-	L4006A1017	
CONTROL - WATER TEMP 110-290	L	040	1-	L4006E1109	
PEDESTAL	L	041	1-	060567-0000	
Linkage Rod		042	1	320518-0031	
Linkage Cam		043	1	320618-0004	
Connector		044	2	54597-0101	
		045			

SHIP INDICATE L SHIP LOOSE IF ITEM IS NOT TO BE MOUNTED ON BURNER.
"S" INDICATES SUGGESTED SPARE PARTS TO BE STOCKED. PLS ORDER BY PART NO.

SO NUMBER S0607C2B QUANTITY 1 ENTERED 14.30.09 1/28/87 PRINT 2/02/87

ITEM NAME		LINE	QUAN	PGP PART OR VENDOR NUMBER	
GP1613 CONTROL CABINET	WITH KEY	201	1	180171-05C0	
COVER ASS'Y INCLUDES		202			
COVER PLATE		203	1	140CC0-1C10	
FUSE HOLDER		204	1	2C311	
FUSE		205	1	TR15R	S
CONTROL SWITCH		206	1	7501K15	
ALARM SILENCE SWITCH		207			
MAN-AUTO SWITCH		208			
FUEL TRANSFER SWITCH		209			
POTENTIOMETER, FIRING RATE CONTROL		210			
SIGNAL LAMP RED-POWER ON		211	1	73-BK-RD	S
SIGNAL LAMP RED-FUEL ON		212	1	73-BK-RD	S
IDENTIFICATION TAG FOR LAMPS		213	1	S-445-5	
INSERT ASS'Y INCLUDES		214			
INSERT PLATE		215	1	280C01-3C00	
FLAME SAFEGUARD BASE		216	1	Q795A1C12	
FLAME SAFEGUARD CHASSIS		217	1	R7795A10C1	S
FLAME SAFEGUARD AMPLIFIER		218			S
FLAME SAFEGUARD TIMER		219	1	ST795A1C31	S
CONTACTOR		220			
BURNER FAN MOTOR STARTER		221			
OVERLOAD HEATER, FOR ABOVE		222			
CONTROL TRANSFORMER		223			
CONTROL RELAY, SPDT		224			S
CONTROL RELAY, DPDT		225			S
TIME DELAY		226			
TERMINAL SECTION		227	11	615	
TERMINAL SECTION, END		228	2	630	
WIRE TRACK		229	13	E.75X1.5LG6	
WIRE TRACK COVER		230	13	C.75LG6	
OIL PRESSURE SWITCH		231			
ALARM		232			
TERMINAL TRACK		233			
		234			
		235			
		236			
		237			
		238			
		239			
		240			
		241			
		242			
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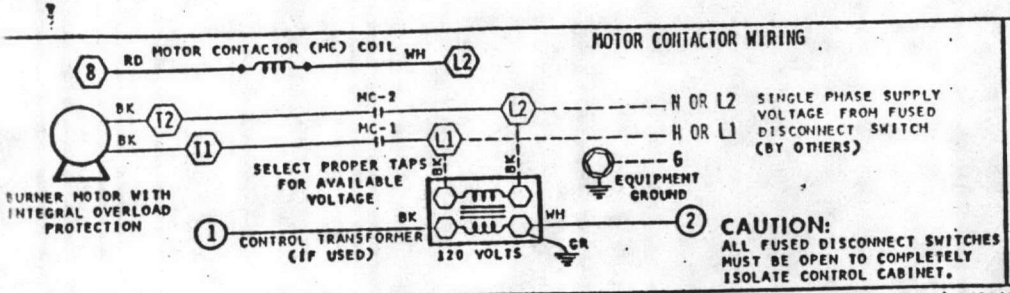
		244			
		245			

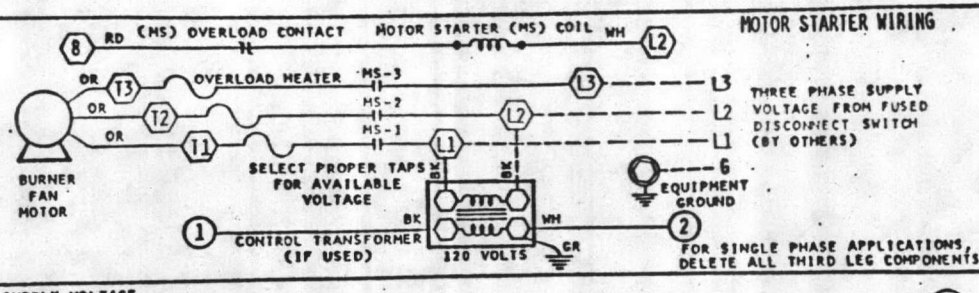
"S" INDICATES SUGGESTED SPARE PARTS TO BE STOCKED. PLS ORDER BY PART NO.

MOTOR CONTACTOR WIRING

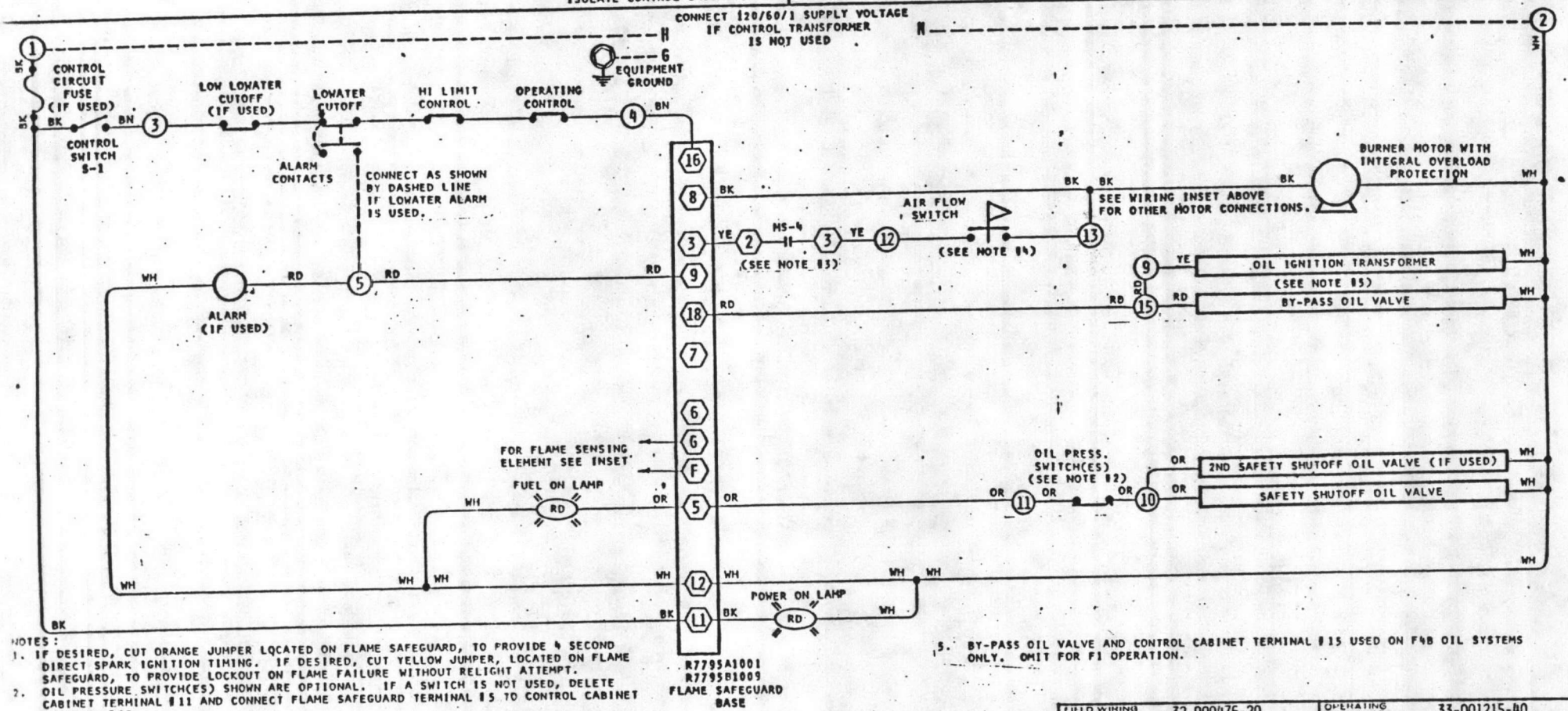


CAUTION: ALL FUSED DISCONNECT SWITCHES MUST BE OPEN TO COMPLETELY ISOLATE CONTROL CABINET.

MOTOR STARTER WIRING



FOR SINGLE PHASE APPLICATIONS, DELETE ALL THIRD LEG COMPONENTS.



NOTES:

1. IF DESIRED, CUT ORANGE JUMPER LOCATED ON FLAME SAFEGUARD, TO PROVIDE 4 SECOND DIRECT SPARK IGNITION TIMING. IF DESIRED, CUT YELLOW JUMPER, LOCATED ON FLAME SAFEGUARD, TO PROVIDE LOCKOUT ON FLAME FAILURE WITHOUT RELIGHT ATTEMPT.
2. OIL PRESSURE SWITCH(ES) SHOWN ARE OPTIONAL. IF A SWITCH IS NOT USED, DELETE CABINET TERMINAL #11 AND CONNECT FLAME SAFEGUARD TERMINAL #5 TO CONTROL CABINET TERMINAL #10.
3. IF DIRECT DRIVEN BURNER MOTOR OR BURNER MOTOR CONTACTOR IS USED, DELETE MS-4 AUXILIARY CONTACT AND CONNECT FLAME SAFEGUARD TERMINAL #3 TO CONTROL CABINET TERMINAL #12.
4. IF AIR FLOW SWITCH IS NOT USED, DELETE CONTROL CABINET TERMINALS #12 AND #13. CONNNECT FLAME SAFEGUARD TERMINAL #3 TO #8 AND DELETE MS-4 AUXILIARY CONTACT.
5. BY-PASS OIL VALVE AND CONTROL CABINET TERMINAL #15 USED ON F4B OIL SYSTEMS ONLY. OMIT FOR F1 OPERATION.

COLOR CODE

WH-WHITE	OR-ORANGE	BK-BLACK	DB-DARK BLUE
YE-YELLOW	PI-PINK	BL-BLUE	GR-GREEN
AM-AMBER	PL-PURPLE	BN-BROWN	GY-GRAY
RD-RED			
TA-TAN			

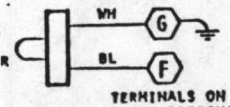
CONTROL CABINET TERMINAL (2)

COMPONENT TERMINALS (2)

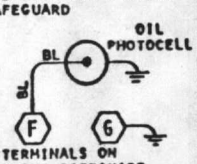
ALL WIRING MUST BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL CODES AND THE NATIONAL ELECTRIC CODE FOR CLASS 1 REMOTE CONTROL SIGNAL CIRCUITS.

31-000056-40
31-000083-40
31-000041-40
38-000015-20
UL REF DWGS.

C7027A ULTRAVIOLET FLAME SCANNER USED WITH R7795A1001 FLAME SAFEGUARD

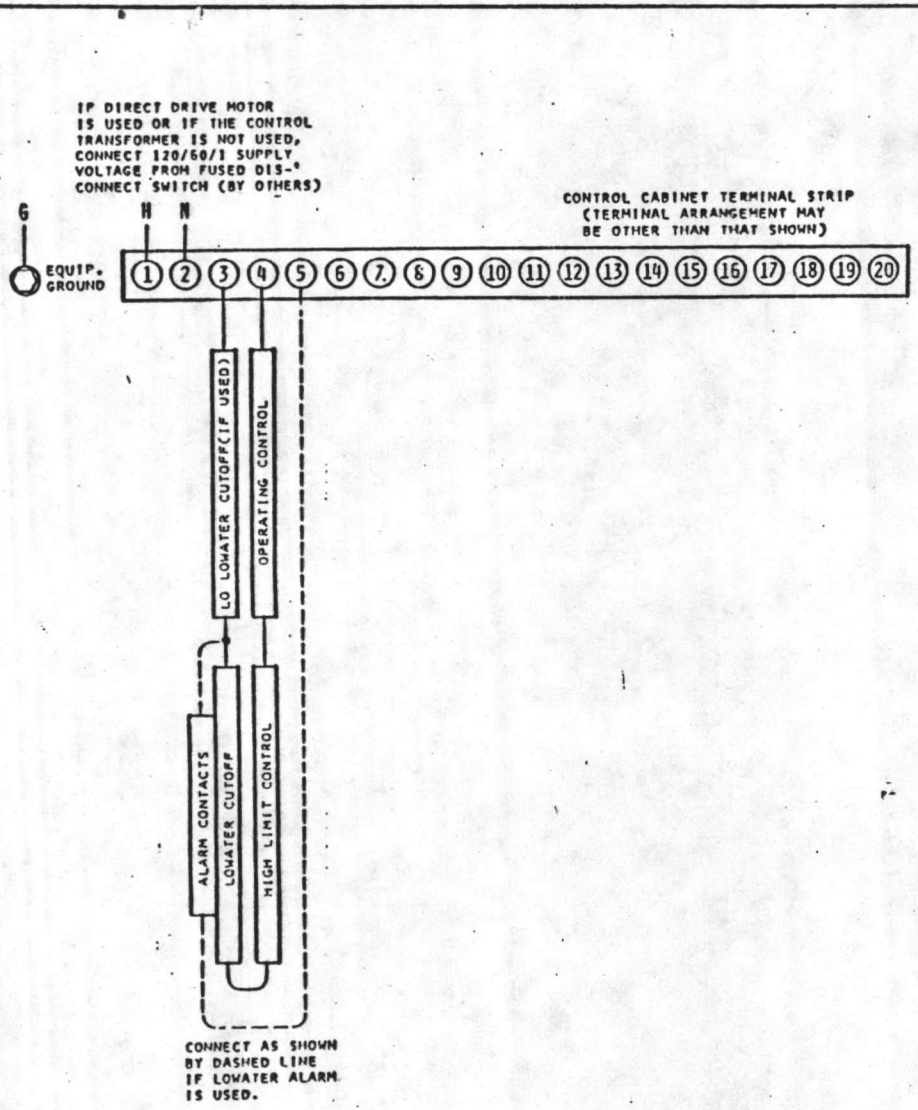


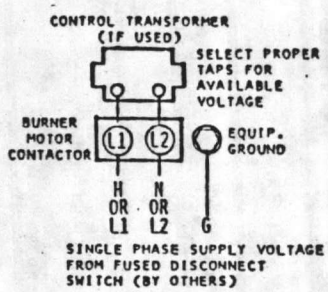
OIL PHOTO CELL USED WITH R7795B 1009 FLAME SAFEGUARD



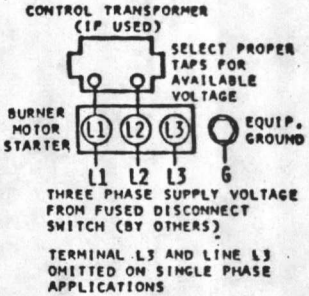
FIELD WIRING DIA. NO.	32-000476-20	OPERATING SEQUENCE	33-001215-40				
	DR. JRF	CK.	TEST	REV	CO	ECN	CK
	DATE 6-28-84	DATE 6-28-84	DATE				
	FO-R7795A1001-F1 -CT-O D R7795B1009 F4B 3M CONTROL SYSTEM SCHEMATIC WIRING						
NONE	Gordon-Piatt Energy Group			01		E9903	
COMPONENT DRAWINGS	DIAGRAM NO. 31-001375-20			00			

P.O. Box 850 Winfield, Kansas 67156.... Manufacturers Of Combustion Equipment





MOTOR CONTACTOR WIRING



MOTOR STARTER WIRING

NOTE

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

DR. XX	CK. RW	TEST	REV	CD	ECN
DATE 6-29-84	DATE 7-3-84	DATE			

BURNER FIELD WIRING

FO- -F1 F4B -D CT-PG-0 3M CONTROL SYSTEM

P.O. Box 650 Winfield, Kansas 67156.... Manufacturers Of Combustion Equipment

Peabody Gordon-Piatt

DIAGRAM NO. 32-000476-20 00

BURNER OPERATING SEQUENCE

FO-R7795A1001-F1 -O CONTROL SYSTEM R7795B1009 F4B

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

2. Open manual oil valve.

3. Close control switch S-1. With all limit and operating controls calling for heat, the burner will follow the Flame Safeguard Sequence given below.

FLAME SAFEGUARD SEQUENCE

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

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

C. When purge timing is completed, the flame safeguard 1K relay pulls in. The selectable 10 or 4 second trial for ignition starts.

The oil ignition transformer is energized. Provided oil pressure is proven, if the oil pressure switch(es) are used, the safety shutoff oil valve and second safety shutoff oil valve, if used, is energized to open. Fuel On lamp lights.

F4B OIL SYSTEMS ONLY: The by-pass oil valve is energized.

D. At the end of the trial for ignition, if the flame detector proves main oil flame, the flame safeguard 2K relay pulls in.

The oil ignition transformer is de-energized.

If F1 oil system is used: The burner continues to fire at full fire rate until heat demand is satisfied.

If F4B oil system is used: The by-pass oil valve is de-energized, increasing oil flow and air flow to the full fire rate.

Burner continues to fire until heat demand is satisfied.

AUTOMATIC SHUTDOWN

Limit or operating controls open:

The flame safeguard control is de-energized, relays 1K and 3K drop out. Relay 2K drops out in 2-4 seconds. All fuel valves close and the burner motor stops. Fuel On lamp goes off. Burner is ready for automatic start-up on the next call for heat.

MANUAL SHUTDOWN

1. Turn the control switch to the off position.

   Burner shuts down as in Automatic Shutdown.

2. When burner motor stops, close all manual fuel valves.

SAFETY SHUTDOWN

1. If an oil flame is not proven at the end of the 10 or 4 second trial for ignition, the safety shutoff oil valve and oil ignition transformer are de-energized. A safety lockout will occur, the burner motor stops and the alarm, if used, sounds.

   A. The flame safeguard safety lockout switch must be manually reset, after a waiting period of approximately 1 minute, before the burner will fire again.

2. If a flame failure occurs during a firing period, all fuel valves close within 4 seconds.

   If the lockout on flame failure mode is used, the flame safeguard will lock out in approximately 15 seconds. The burner motor stops and the alarm, if used, sounds.

   If the recycle mode of operation is used, the burner motor continues to run and purge timing restarts if air flow is proven. When the purge timing is complete, the burner will attempt to relight. If a flame is not proven in the 10 or 4 second flame establishing period, the flame safeguard will lock out as in Para. #1.

   A. If lockout occurs, the flame safeguard safety lockout switch must be manually reset, after a waiting period of approximately 1 minute, before the burner will fire again.

3. If air flow fails at any time during the operating cycle, if switch is used, all fuel valves close and the oil ignition transformer is de-energized. The burner motor will continue to

run. If air flow is re-established, the purge timing restarts and start-up sequence is repeated.

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

4. 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.

5. If, while firing on oil and the oil pressure switch(es) are used and an abnormal oil pressure condition occurs, the oil valve(s) close and the burner shuts down on Flame Failure as in Para. #2 of Safety Shutdown.

OIL PIPING INFORMATION

Gordon-Piatt Energy Group

CAUTION

The following information pertains to two-pipe oil systems for No. 1 or No. 2 fuel oil which can be burned without preheating. Systems designed for two-pipe operation CANNOT be used with a one-pipe system.

OIL TANK LOCATION - The Rules of the National Board of Fire Underwriters [Pamphlet No. 31] and local codes and regulations should be followed in locating and installing Oil Storage Tanks and Burners.

Some localities require that the tank be located below the burner level. **If any part of the tank is above the level of the burner,** an anti-siphon device must be used to prevent flow of oil in case of a break in the oil line. The illustration shows a typical installation of an outside tank which should be covered with not less than 24" of earth. A concrete anchor base is advisable to prevent shifting of buried tank during wet weather. An auxiliary oil pump is recommended if oil suction line exceeds 200 feet in length or 12 feet of lift.

OIL PIPING - Connections to buried tanks must be made with swing joints or copper tubing to prevent the pipes from breaking in case the tanks settle. If local requirements stipulate that iron pipe be used, swing joints made up with elbows and nipples several inches long should be used on both the suction and return lines as close to the tank as possible. The swing joints should be made up so that they will tighten as the tank settles. Nonhardening pipe joint compounds should be used on all threaded joints.

OIL PUMP SUCTION AND RETURN LINE SIZING - The size of the oil suction line is dependent upon the type of oil, amount of lift, length of suction line and the suction capacity of the pump.

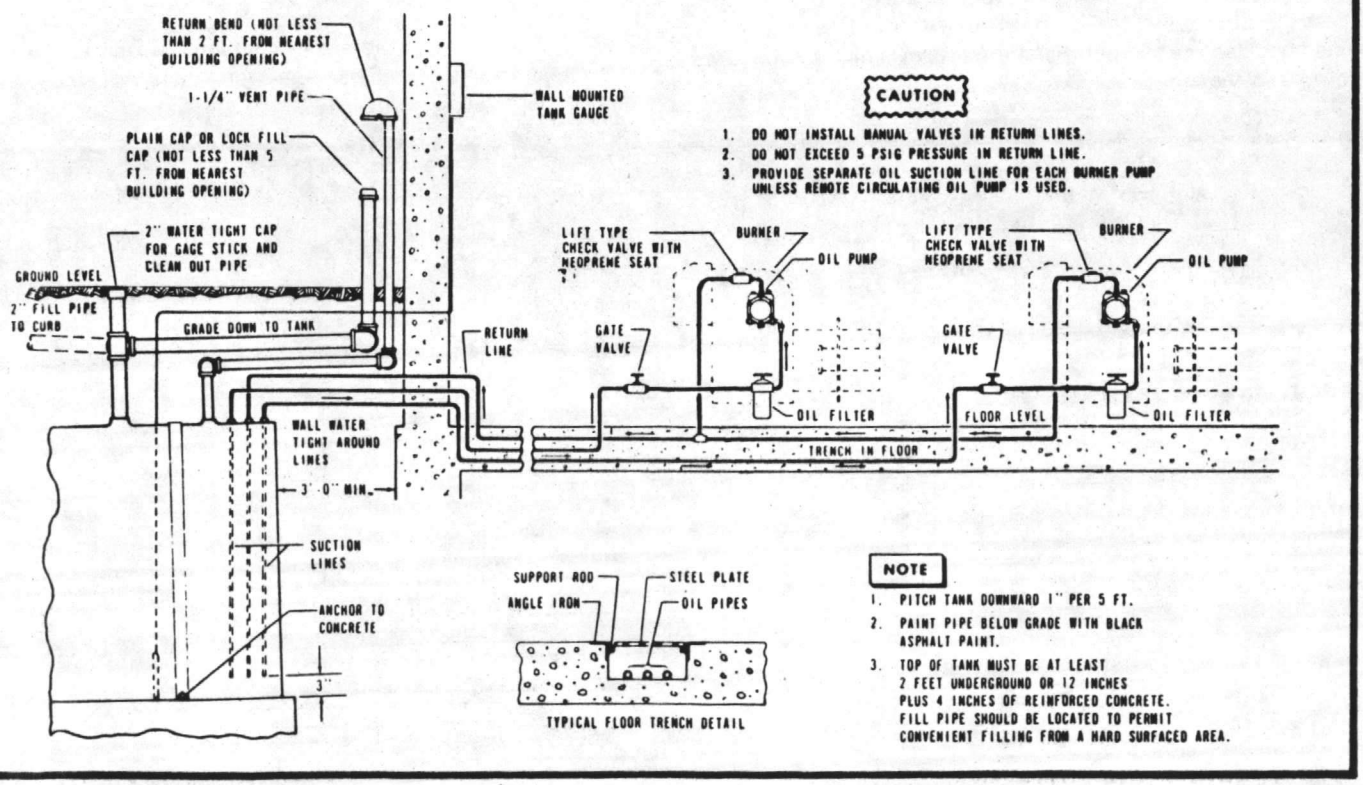
On single pump installations, the return line should be the same size as the suction line.

On multiple pump installations, **each pump should have its own individual suction line.** One return line may be used as long as it is "appropriately sized" since all pumps may share a common return line.

Refer to 'manufacturers' bulletins for proper line sizings.

Copper tubing should be used in preference to iron pipe, as it requires less work, is neater, has less possibility of leaks and does not scale off on the inside. Flare type fittings are recommended, as the soldered type may melt in case of fire.

The lines from the tank to the burner should be sized from data contained in the pump manufacturers specification sheet, but in NO INSTANCE should they be smaller than 1/2" O. D. copper tubing. Install tank slip fittings (Chase No. 329 or equal) in the top of the tank for both the suction and return



TYPICAL OIL PIPING INSTALLATION

ıe connections. Push both the suction and return lines down ırough the fittings until they touch the bottom of the tank ıd then pull them up three inches and lock in position with ımpression nuts so either line may be used as a suction line.

NOTE

Maximum pressure allowable on suction side of pump is 3 psig.

IL SHUTOFF VALVE - A hand shutoff valve should be ·ovided in the suction line near the burner.

NOTE

Hand valves must not be installed on discharge side of pump or return line without a bypass relief to tank.

HECK VALVE AND STRAINER - If the top of the tank is ·low the burner level, use a lift type check valve with neo- ·ene seat. An oil strainer is recommended for those installa- ɔns which do not have oil pumps with built-in filtering de- ces.

NOTE

Select a check valve of the soft seated type suitable for No. 2 oil, which will seat tightly with a low head.

IL SUCTION LINE - Suction piping should be pitched back · the tank slightly whenever possible and particular care ıould be taken not to create an air trap in the line. There is ways a slight amount of air in suspension in oil, and if traps e present, they will gradually fill with air, and the pump ill lose its prime. Removal of air is generally very difficult.

lways provide a tee and plug in the suction line at the ghest possible point to aid in priming the pump and in ex- ·lling air. Also see the pump manufacturer's instructions for iming and venting.

A two-pipe system is required for all installations. Both the suction and return piping should be run in a trench under the floor level where possible.

CAUTION

Overhead suction lines should be avoided unless an auxiliary oil circulating pump set installation of the type shown below is used. Maximum standpipe height above the burner pump is 7½ feet unless special devices are installed to prevent hydraulic shock from causing pump seal leakage.

OIL TANK FILL PIPE - The fill pipe 2" I.P.S. to the oil tank must terminate at least five feet from any window or other building opening. It should slope continuously toward the tank and be equipped with a tight-closing metal cover designed to prevent tampering. The fill pipe should terminate at least one foot above the ground to prevent flood water from seeping into the pipe. A flush type fill cap inserted in the ground should be enclosed in a water-tight well. If the fill pipe does not run vertically above the tank, it is desirable to place a tee at the tank and run a standpipe vertically so that a gauge stick may be used for measuring the oil in the tank.

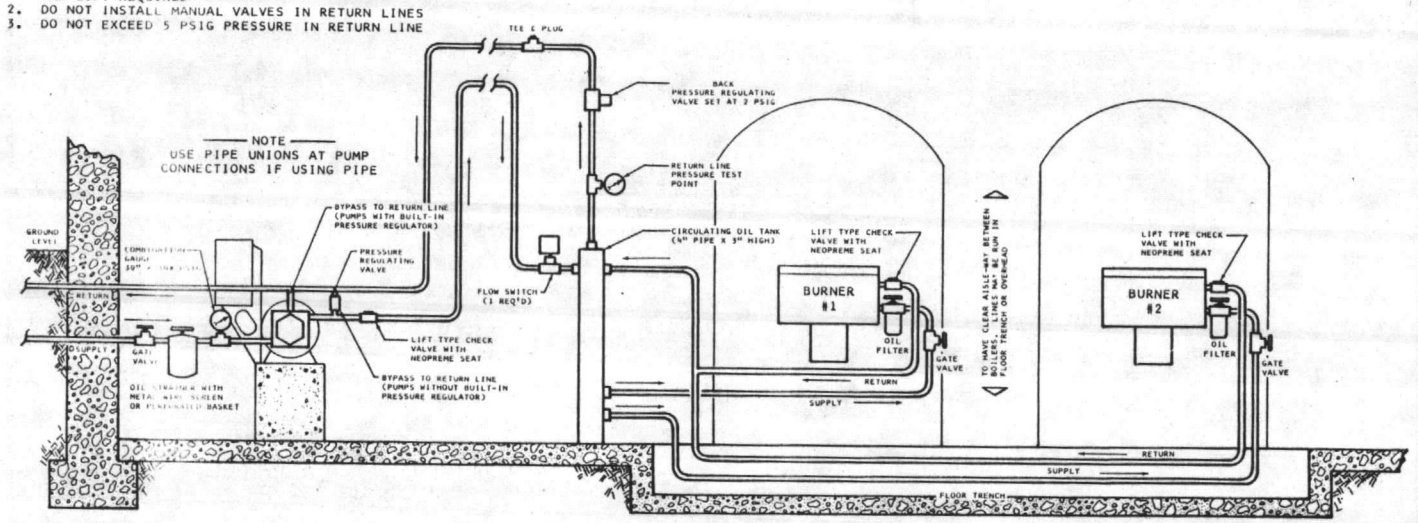
OIL TANK VENT - The oil tank vent line should not be smaller than 1¼" standard weight pipe and should terminate outside of the building at a point not less than two feet measured vertically or horizontally from any window or other building opening. The top of the air vent must have a return bend or some approved cap, and it should extend above the ground high enough to prevent being obstructed by either snow or ice. In some localities, city regulations specify the height of the return bend above the ground level. All vent piping should be pitched slightly downward toward the tank. An oil gauge is recommended for all installations.

CAUTION

A foot valve at the end of the suction line in the tank is not recommended.

NOTE

1. INSTALL CIRCULATING OIL PUMP AS CLOSE TO TANK AS POSSIBLE FOR MINIMUM SUCTION LINE LENGTH AND LIFT REQUIRED
2. DO NOT INSTALL MANUAL VALVES IN RETURN LINES
3. DO NOT EXCEED 5 PSIG PRESSURE IN RETURN LINE



TYPICAL AUXILIARY - REMOTE CIRCULATING OIL PUMP INSTALLATION

MODEL R & S BURNER
INSTALLATION INSTRUCTIONS
FOR FIREBOX, HRT & CAST IRON BOILERS

1	S	30-22	Rev 6
10-85	Replaces	1-82	

Gordon-Piatt Energy Group

GENERAL INSTRUCTIONS

These instructions provide illustrations of typical R & S burner installations in various kinds of boilers. They should be carefully read and the example selected that most nearly fits the job before attempting the installation.

The furnace or boiler should be thoroughly cleaned if not already done. The heating surfaces should have all scale, soot and ashes removed.

The combustion chamber illustrations are general in nature and show approximate chamber dimensions and recommended types and thickness of insulating materials.

CAUTION

It is the installing contractors responsibility to include and provide expansion joints, refractory supports, wall ties, etc., as may be required for a proper installation. Consult your refractory supplier for construction details and requirements for these items.

Fig. 1 provides minimum chamber dimensions and pertinent burner dimensions necessary for a correct installation for the various size burners. Compare those dimensions given for your burner firing rate to be certain that adequate clearances and base heights exist.

FIRING FIREBOX BOILER THROUGH THE BASE

Fig. 2 illustrates a type "R" burner installed in a firebox boiler with a conventional base and combustion chamber. This is also applicable to the "S" burner where the boiler base height is sufficient to allow clearance for the blower housing illustrated in Fig. 5.

When installing a burner that will be firing on oil, the opening centerline height (nozzle height "Hc" in Fig. 2) above the combustion chamber floor should be maintained as stated or higher. The nozzle height is based on recommended practice for efficient oil combustion. Lower nozzle height may be used, but at reduced efficiency with tendency toward smoke and flame impingement on floor which may cause carbon buildup.

When the burner will be firing only on gas, the "Hc" nozzle height dimension may be reduced to one-half of the burner head diameter plus one inch. In cases of an extremely low boiler base, the burner head may be located up against the boiler water leg.

The burner opening should be made in accordance with the proper illustration in Fig. 3.

The burner head must be wrapped with asbestos rope before the plastic refractory is put in place. Seal between the burner mounting flange and boiler frontplate with asbestos rope gasket.

Fig. 2 illustrates a combustion chamber floor thickness of 1" block insulation, 2-1/2" insulating firebrick and 2-1/2" of standard No. 1 (high duty) firebrick for installations at firing rates of 2,800,000 Btu/Hr or 20 GPH and above. For firing with low to medium furnace temperatures at inputs below 20 GPH, the center layer 2-1/2" of insulating firebrick is not required.

The insulation fill material, used between the refractory walls and the steel boiler base, should be block insulation or other insulating material that will not settle.

Firebrick should be laid with high temperature bonding mortar, such as Hiloset, Sairset, or as recommended by the refractory manufacturer.

Expansion joints should be 3/32" wide per linear foot in any direction. If more than 1" is required, two joints should be installed.

Burner Size	Oil GPH	Recommended Minimum Dimensions for Combustion Chamber (Inches)			
		Width W	Length L	Nozzle Height Hc	Base Height Hb
R6 S6	3 to 4	11	22	6	14
	4½ to 5½	13	26	7	15
	6 to 7	15	30	8	16
R8 S8	8 to 9	17	34	9	17
	10 to 11	19	38	9	18
	12 to 13	21	42	10	19
	14 to 16	23	46	11	20
	17 to 19	25	50	12	21
	20 to 22	27	54	12	21
R10 S10	15 to 16	23	46	10	25
	17 to 18	25	50	11	26
	19 to 20	26	52	11	27
	21 to 22	27	54	12	28
	23 to 24	28	56	12	29
	25 to 26	30	60	13	30
	27 to 28	31	62	13	31
	29 to 30	32	64	14	32
	31 to 32	33	66	14	33
R12 S12	33 to 36	35	70	15	34
	37 to 40	37	74	15	35
	41 to 44	39	78	16	36
	45 to 48	41	82	17	38
	49 to 52	43	86	18	39
	53 to 55	45	90	19	40

L – Minimum length of combustion chamber (normally made full length of boiler firebox).

Hc – Dimension applies to oil firing only. (For gas firing, dimension is one-half of burner head diameter plus one inch).

Hb – Minimum base height without pitting combustion chamber.

Figure 1. COMBUSTION CHAMBER DIMENSIONS

Combustion chamber width and length dimensions may vary from Dimension Table (Fig. 1) to fit job conditions. The floor area may be reduced to a minimum of 70 sq. inches per GPH of oil or 50 sq. inches per 100 MBh input, at some sacrifice of refractory life. Floor area increases are permissable, but reduce combustion chamber temperatures. Combustion chamber length should be no less than 1-1/3 times the width. Combustion chamber height should be approximately twice the nozzle height of the burner from the floor.

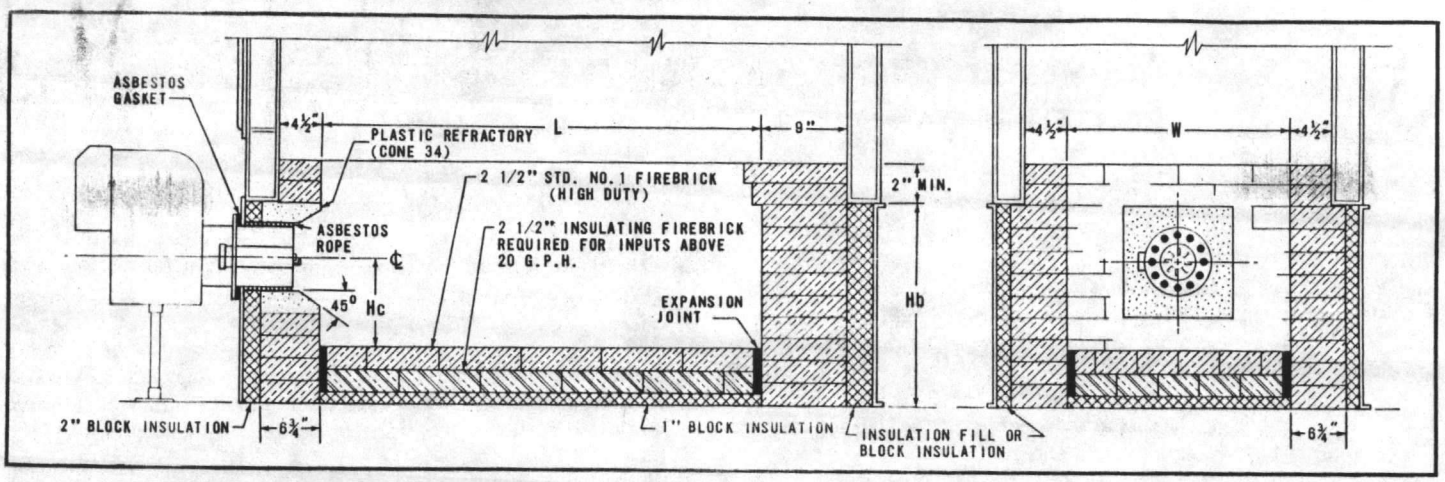
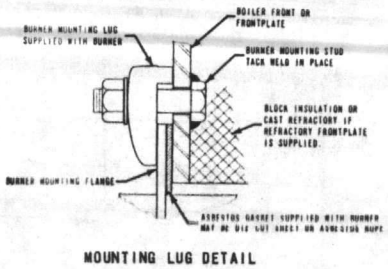


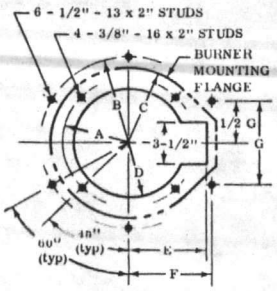
Figure 2. TYPE "R" BURNER INSTALLATION FIRING FIREBOX BOILER THROUGH FRONT OF BASE.

FRONTPLATE CUTOUT AND MOUNTING DETAIL

In instances where the frontplate is not supplied with the burner, the burner opening size and mounting stud locations should be determined from the appropriate boiler frontplate cutout and mounting dimensions, Fig. 3.

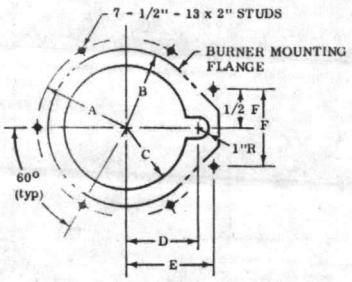


MOUNTING LUG DETAIL



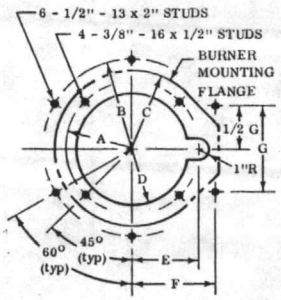
Head Diameter (inches)	Nose Length (inches)	Bolt Circle Radius Flange Mounted A	Bolt Circle Radius Lug Mounted B	Burner Flange Radius O.D. C	Cutout Radius D	Dimensions (inches) E	F	G
6	Any Standard Length	4-3/4	-	5-1/2	3-1/4	4-3/4	-	-
7		4-3/4	6	5-1/2	3-3/4	5-1/2	6	4-3/4
8		4-3/4	-	5-1/2	4-1/4	5-3/4	-	-
10		5-3/4	7	6-1/2	5-1/4	7-1/16	6-7/8	8

MOUNTING DIMENSIONS FOR FLANGE AND LUG MOUNTED "R" AND "S" BURNERS WITH "GP214" PILOT



Head Diameter (inches)	Nose Length (inches)	Bolt Circle Radius Lug Mounted A	Burner Flange Radius O.D. B	Cutout Radius C	Dimensions (inches) D	E	F
12	5-1/2	8	7-1/2	6-1/4	7-1/8	8-3/4	5
	8	8	7-1/2	6-1/4	8-1/16	8-3/4	5
	12	8	7-1/2	6-1/4	7-1/8	8-3/4	5

MOUNTING DIMENSIONS FOR LUG MOUNTED "R12" AND "S12" BURNERS WITH "GP216" PILOT



Head Diameter (inches)	Nose Length (inches)	Bolt Circle Radius Flange Mounted A	Bolt Circle Radius Lug Mounted B	Burner Flange Radius O.D. C	Cutout Radius D	Dimensions (inches) E	F	G
6	4	4-3/4	6	5-1/2	3-1/4	4-7/16	6	4-3/4
	5-1/2	4-3/4	6	5-1/2	3-1/4	4-7/16	6	4-3/4
	8	4-3/4	-	5-1/2	3-1/4	5-7/16	-	-
7	4	4-3/4	6	5-1/2	3-3/4	4-7/16	6	4-3/4
	5-1/2	4-3/4	6	5-1/2	3-3/4	4-7/16	6	4-3/4
8	4	4-3/4	6	5-1/2	4-1/4	5-1/8	6	4-3/4
	5-1/2	4-3/4	6	5-1/2	4-1/4	5-1/8	6	4-3/4
	8	-	6	5-1/2	4-1/4	6-1/16	6	5-3/4
	12	4-3/4	6	5-1/2	4-1/4	5-1/8	6	4-3/4
10	5-1/2	-	7	6-1/2	5-1/4	6-1/8	6-7/8	6
	8	-	7	6-1/2	5-1/4	7-1/16	6-7/8	7
	12	-	7	6-1/2	5-1/4	6-1/8	6-7/8	6

MOUNTING DIMENSIONS FOR FLANGE AND LUG MOUNTED "R" AND "S" BURNERS WITH "GP216" PILOT

Figure 3. MOUNTING DETAILS

FIRING FIREBOX BOILER THROUGH THE FIRING DOOR

"Through the Firedoor" installations are recommended where conditions allow. This method will prevent the need for expensive pitting when insufficient base height is available to permit the installation of a standard combustion chamber, or when it is desired to fire over a stoker which is used as the standby fuel burner. See Fig. 4.

In some cases, it may be desirable to provide a new access opening in the side or rear of the boiler firebox to avoid having to remove the burner to get into the firebox, particularly if there is only one firedoor for the boiler.

When the boiler has two firing doors the burner may be installed in one door but angled to fire towards the opposite corner of the chamber. See Fig. 7. Note that "angled" installations require an extra long head length and in some cases may require as much as 12" head length. HEAD MUST EXTEND THROUGH TO INSIDE EDGE OF WATER LEG.

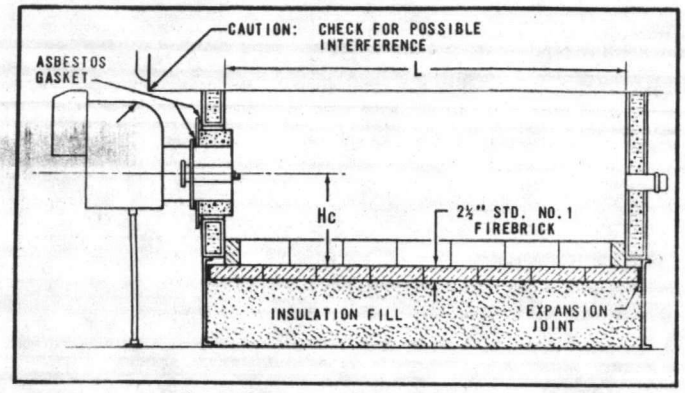


Figure 4. TYPE "R" BURNER INSTALLATION FIRING FIREBOX BOILER THROUGH THE DOOR

Fig. 5 shows an "S" burner which is designed for use where clearance for boiler smokebox doors would not be sufficient to permit installation of a standard type "R" burner.

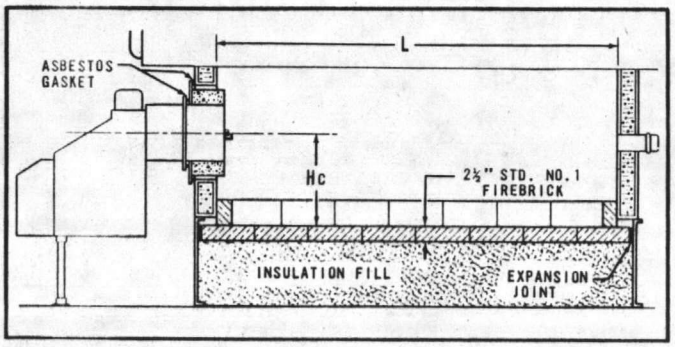


Figure 5. TYPE "S" BURNER INSTALLATION FIRING FIREBOX BOILER THROUGH THE DOOR

In instances where the burner head is too large to allow proper refractory between its head and the boiler firing door opening, or where a special frontplate is desired, a reflector frontplate may be supplied. See Fig. 6. For installation procedure of reflector frontplate, see Fig. 7 and 8.

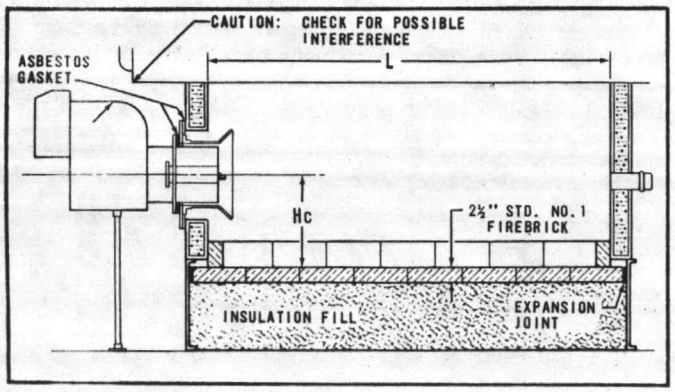


Figure 6. TYPE "R" BURNER INSTALLATION WITH REFLECTOR FRONTPLATE

REFLECTOR FRONTPLATE INSTALLATION

Before installation of the reflector frontplate can be made, the existing boiler firing door and frame must be removed. The reflector frontplate and cone are shipped as an assembled unit and may be installed as a unit. In instances where the reflector cone diameter is larger than the opening, the reflector cone must be detached from the frontplate, with the removal of the 10-32 flat head machine screws, Fig. 7 and 8. A cord is attached to the reflector cone for use in retrieving the cone for mounting. The cone is then placed through the opening and inside the boiler.

Mounting holes are then drilled in the frontplate mounting flange, as required to fit the existing door frame mounting studs. With the Fiberfrax insulating paper in position, bolt the frontplate to the mounting studs. The reflector cone, if detached, is repositioned on the frontplate and mounted with the 10-32 flat head machine screws. An asbestos gasket is placed between the burner mounting flange and the reflector frontplate, and the burner mounted in place.

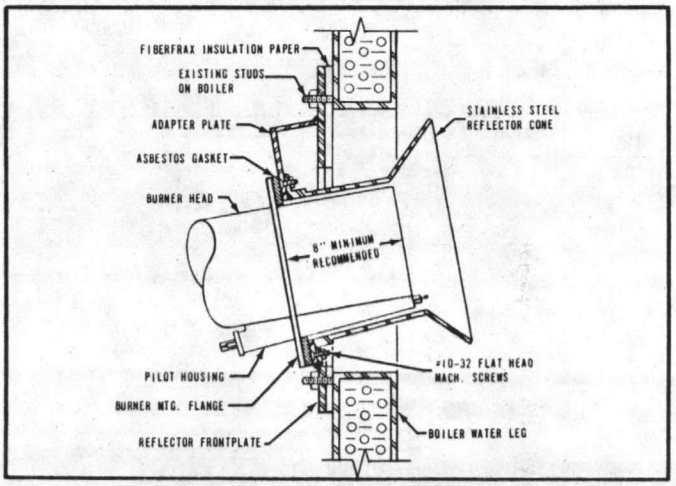


Figure 7. TOP VIEW REFLECTOR FRONTPLATE THROUGH RIGHT HAND FIRING DOOR

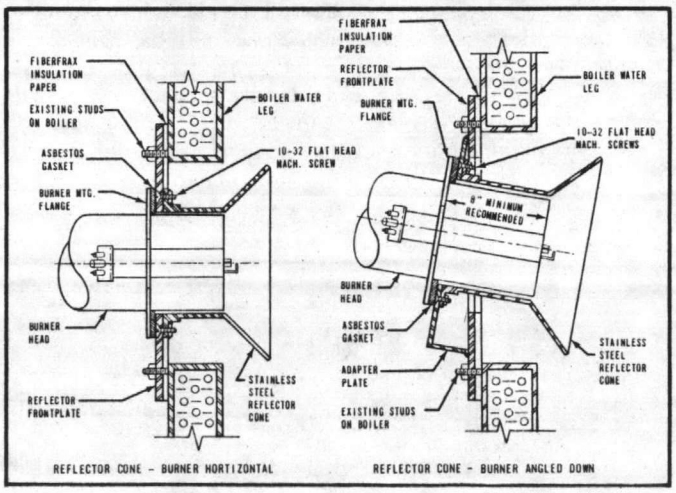


Figure 8. REFLECTOR FRONTPLATE INSTALLATION BOILER WITH SINGLE FIRING DOOR

RING FORCED DRAFT BOILER

e burner installation in a firebox type boiler designed for rced draft firing requires no refractory other than in the or of the firebox and the boiler frontplate, Fig. 9. The re- actory floor is normally furnished with the boiler and the fractory frontplate may or may not be with the burner. The rner centerline height ("Hc" dimension) above the refractory or should be approximately the same as those shown in g. 1.

l pressurized or forced draft fired boilers require an asbes- s gasket seal between the boiler and the refractory-lined ontplate and between the refractory-lined frontplate and the rner mounting flange to prevent leakage of high temperature mbustion gases at this point. In the absence of asbestos sket, asbestos rope may be used for sealing.

CAUTION

When used, asbestos rope must be wrapped around the burner head, inside the mounting studs, to provide a complete gas tight seal. Wrapping the rope around the outside diameter of the mounting studs will allow leakage around the stud openings in the frontplate. Damage to the burner, due to high temperature gas leakage, will not be covered by the warranty.

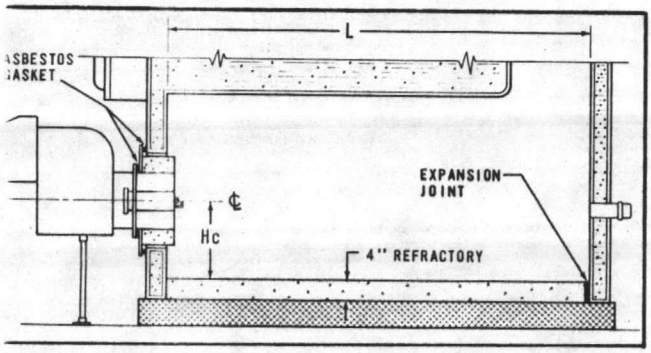


Figure 9. TYPE "R" BURNER INSTALLATION FIRING FORCED DRAFT BOILER

RING CAST IRON BOILERS SINGLE DOOR

st iron boilers having low crowns may require burner in- llations as shown in Fig. 10 or 11. When the distance from e burner horizontal centerline to the crown sheet is less than 5 x Hc then the burner must be installed at an angle that will event the flame from impinging on the cast iron boiler sec- ons. Significant impingement on cast iron sections can cause mage to the sections.

CAUTION

Standard nose length is 5-1/2 inches. Angled installations require that the burner nose reach to the inside edge of the water leg and usually requires 8 or more inches nose length.

The refractory chamber floor is to be A. P. Green greencast -97-L (3300°F) or equal castable refractory on top of high temperature block insulation. Super duty fire clay brick P. C. E. cone 33-34 A. P. Green "Clipper" or equal may be used in lieu of castable refractory. Use A. P. Green "Sairset" or equal high temperature mortar with firebrick. All exposed brick surfaces must be scrubbed with thin wash before setting. Loose insulating fill is not a requirement, but is recommended for minimum heat loss through the boiler base. The burner head must be wrapped with asbestos rope before installing plastic refractory.

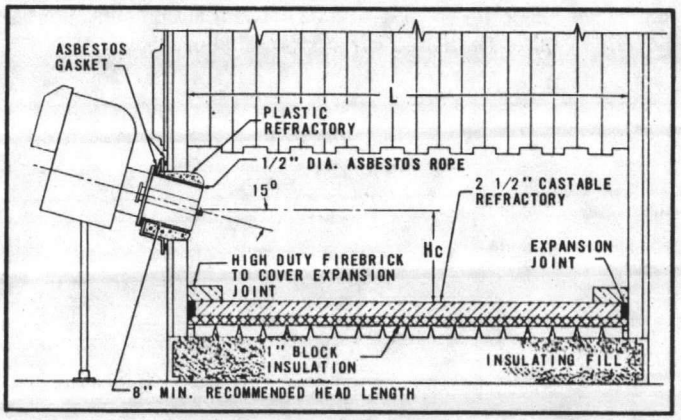
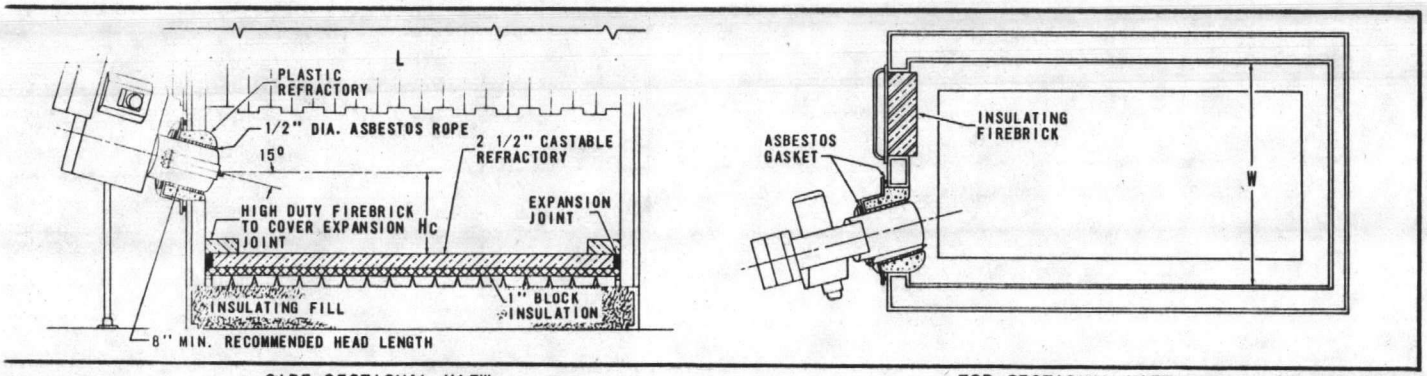


Figure 10. TYPE "R" BURNER INSTALLATION FIRING CAST IRON BOILER WITH SINGLE DOOR

FIRING CAST IRON BOILER WITH DOUBLE DOORS

When firing a cast iron boiler with double doors, the burner may be installed through either door at an angle as to allow the centerline of the burner to point at the opposite rear corner of the combustion chamber as shown in the top section view of Fig. 11. If the cast iron boiler has a low crown the burner must also be installed at a downward angle (Fig. 11 Side View), to prevent the flame from impinging on the cast iron sections. Installation of Firebrick in unused firedoor is necessary to prevent heat loss through the door opening. Installation is otherwise identical to installing burner in a cast iron boiler with a single firedoor, Fig. 10.



SIDE SECTIONAL VIEW TOP SECTIONAL VIEW

Figure 11. TYPE "R" BURNER INSTALLATION FIRING CAST IRON BOILER WITH DOUBLE DOORS

FIRING HRT BOILER

When installing an R burner in an HRT boiler, Fig. 12, the minimum combustion chamber dimensions Hc, L and W must be maintained as given in Fig. 1. The existing side and rear walls may be reused if in good condition and equal to 18 inches of standard No. 1 high duty firebrick. All expansion joints are to be filled with a compressible insulating material and must be kept free of material that will not compress.

It is recommended that the combustion chamber floor be raised to obtain the minimum Hc dimension and the area below filled with insulating fill material, reducing heat loss to a minimum. It is possible, that when replacing a stoker, the combustion chamber floor may be laid on top of the existing grates, if the minimum Hc dimension may be obtained.

The proper burner opening cutout and burner mounting stud location must be determined from the appropriate chart, Fig. 3. The burner head must be wrapped with asbestos rope before the plastic refractory is put in place.

CAUTION

The bridgewall must not be directly under a girth seam or girth seam leakage may result. The girth seams located within the combustion zone must be protected by an inverted refractory arch.

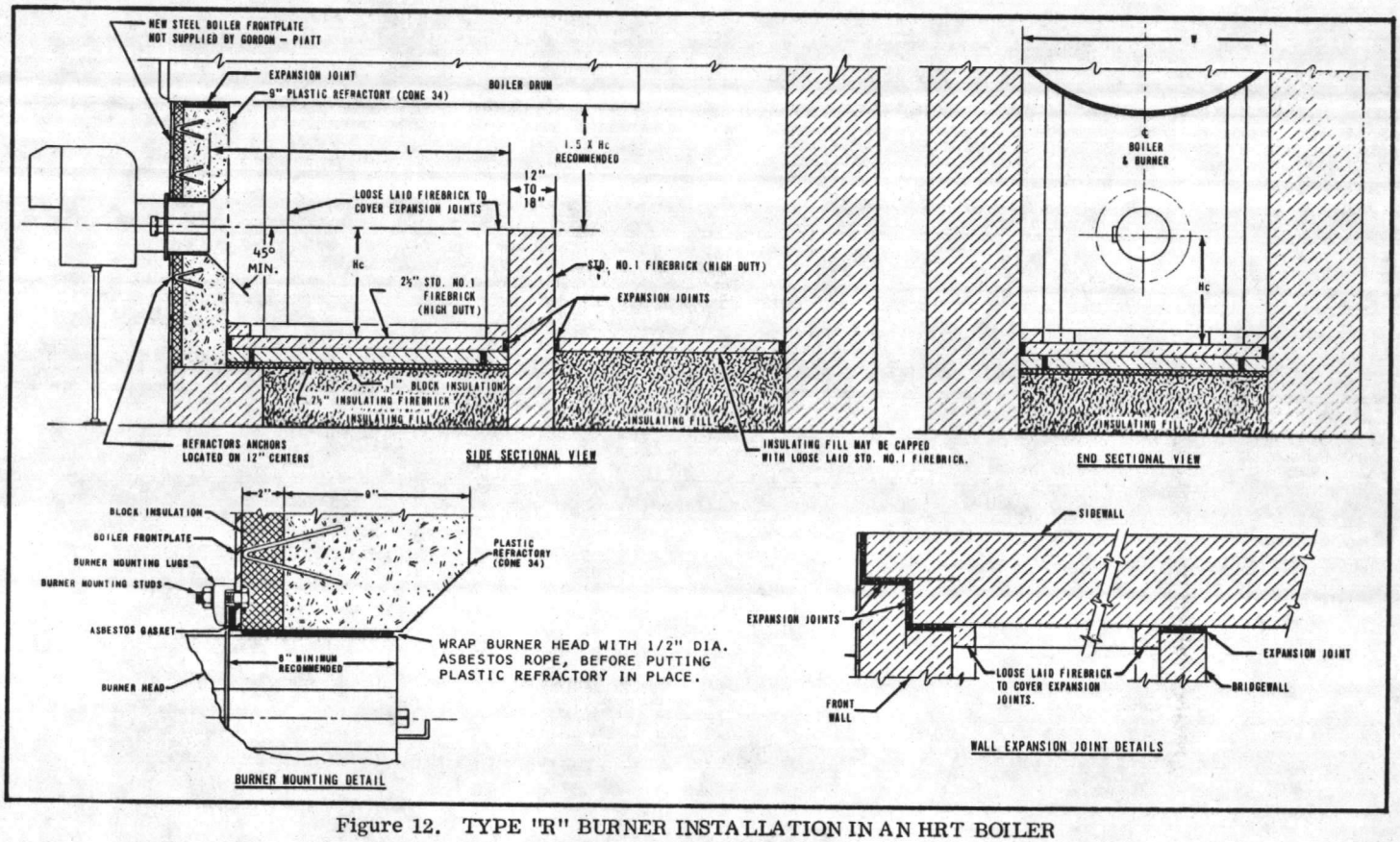


Figure 12. TYPE "R" BURNER INSTALLATION IN AN HRT BOILER

MODEL R

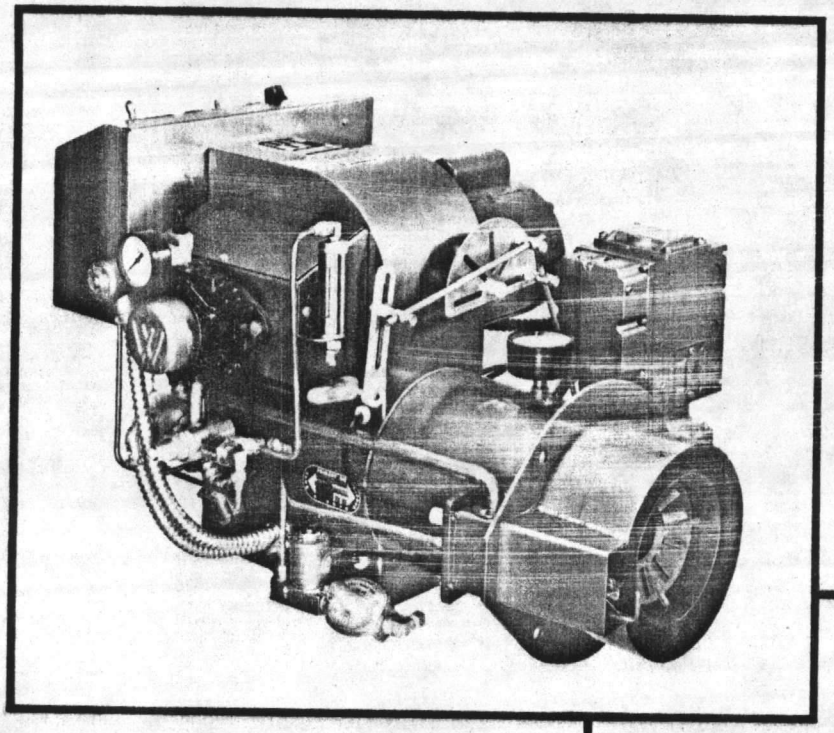
Burner Instruction Manual

FOR

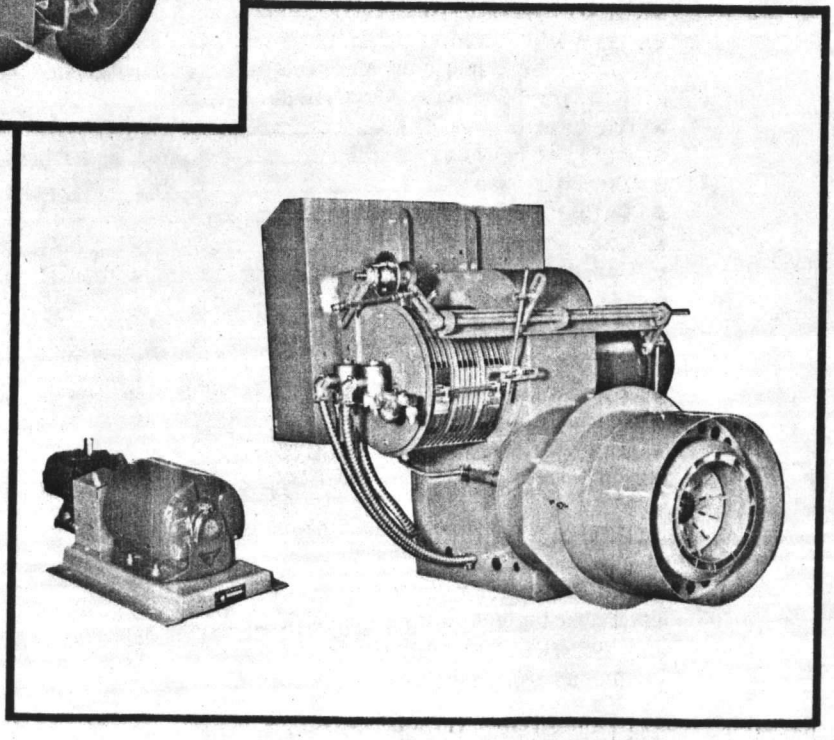
GAS AND PRESSURE ATOMIZING LIGHT OIL FUEL SYSTEMS

MANUFACTURED BY GORDON-PIATT ENERGY GROUP, 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.

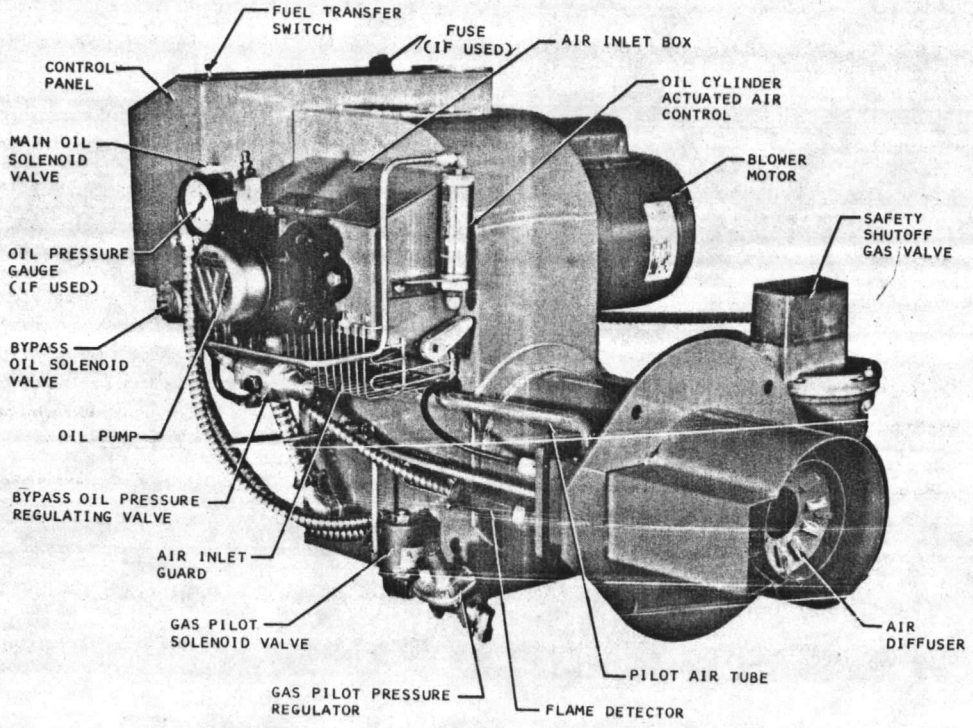
These burners are listed by UL, CSA, The New York Board of Standards and Appeals, the State Fire Marshal of the Commonwealth of Massachusetts and others. Burners and controls are also available which comply with FM, IRI, City of Minneapolis, Iowa and Illinois Gas Co., and most other special Agency Codes.

TABLE OF CONTENTS

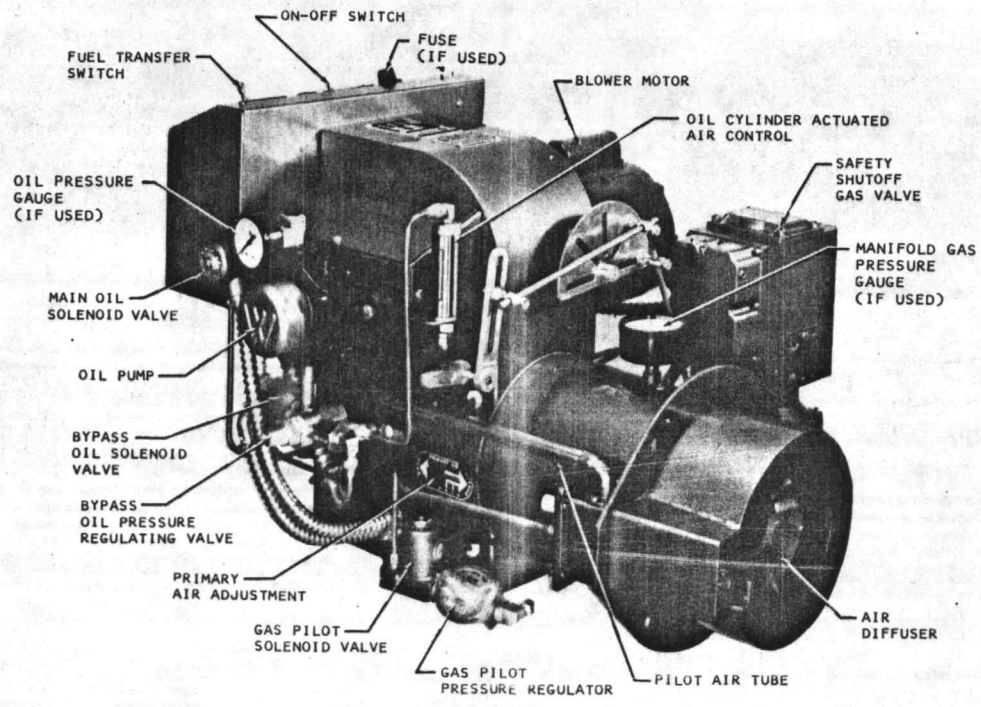
PART I

BURNER FAMILIARIZATION AND PRELIMINARY INSPECTION

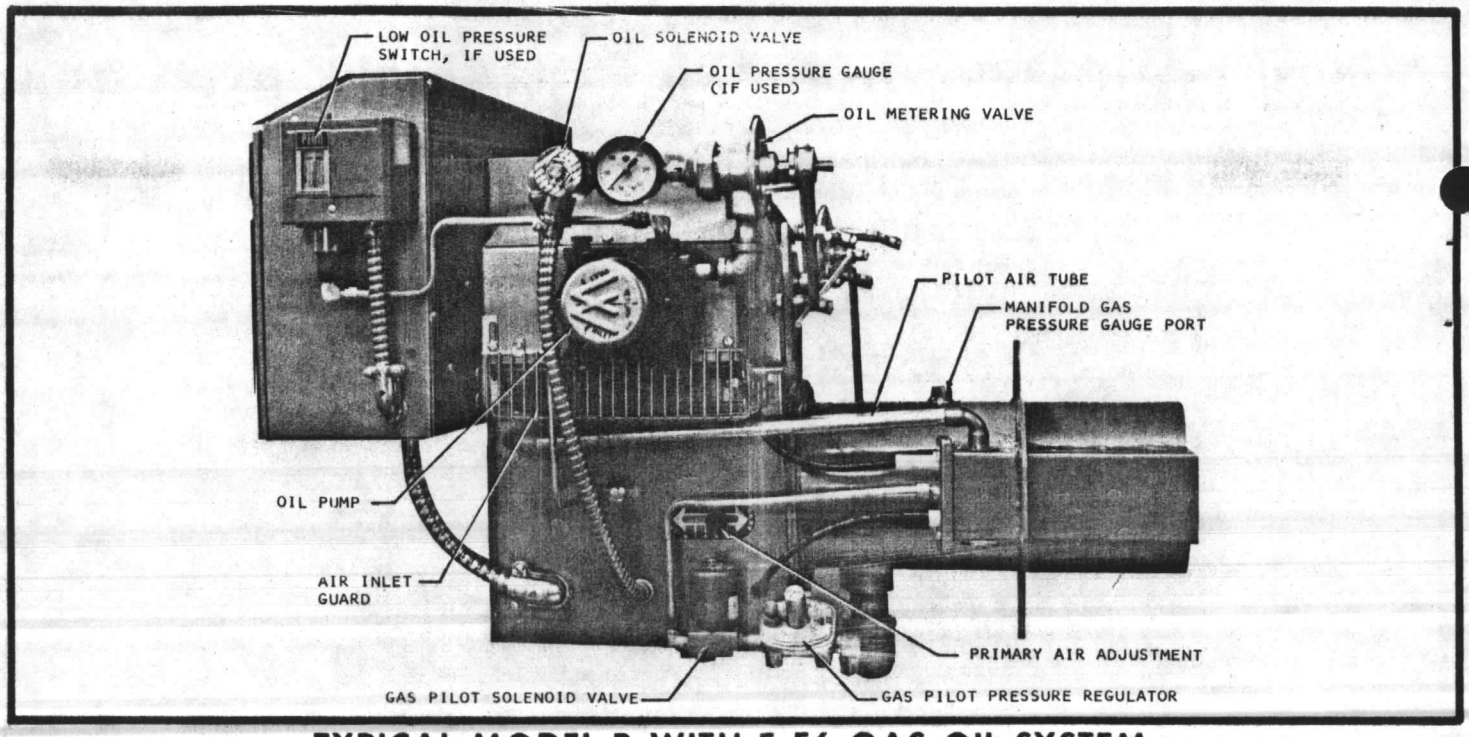
BURNER FAMILIARIZATION - Study the following burner illustrations and determine the one which matches your unit. Take special note of the **PART NAMES** as shown in the call-outs. Fuel Systems are described in detail in Parts IV and V.



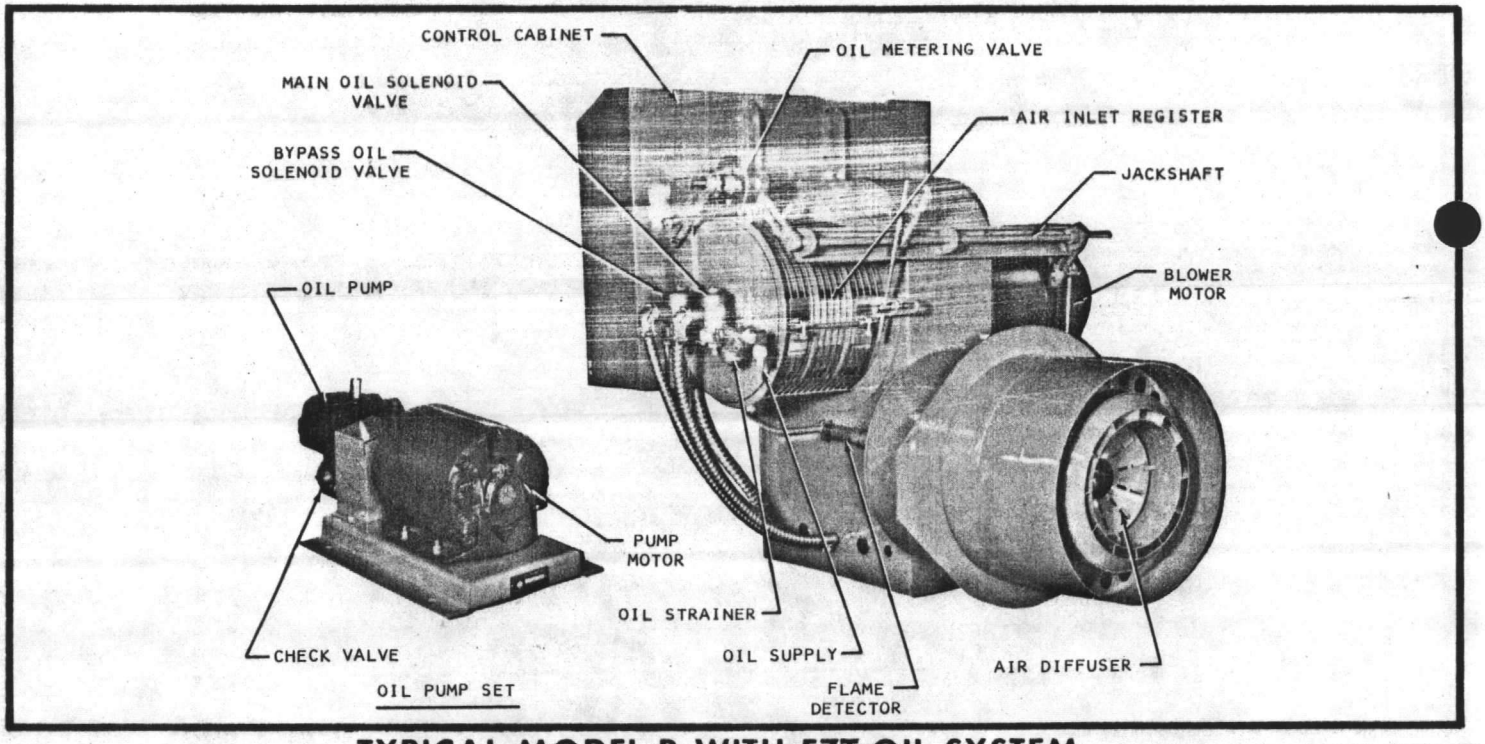
TYPICAL MODEL R WITH B-F4B GAS-OIL SYSTEM



TYPICAL MODEL R WITH H-F4H GAS-OIL SYSTEM



TYPICAL MODEL R WITH E-F6 GAS-OIL SYSTEM



TYPICAL MODEL R WITH F7T OIL SYSTEM

PRELIMINARY INSPECTION - The burner should be visually checked for damage and loose components as these conditions can occur during shipment, through improper handling, by tampering or through improper care and storage at the job site.

CHECK FOR:

- ☐ Obvious damage to housing, air inlet, and components mounted thereon.
- ☐ Tightness of fasteners, tube fittings, plugs, etc.
- ☐ Tightness of electrical terminals and connections.
- ☐ Tightness of adjustment mechanisms such as ball-joint swivel connectors and control arms.
- ☐ Accumulations of oil, dust, dirt, water or other foreign matter on, in, or near the burner.

PART II

INTRODUCTION

WARNINGS

If you smell gas:

1. **Open windows.**
2. **Don't touch electrical switches.**
3. **Extinguish any open flame.**
4. **Immediately call your gas supplier.**

The use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of this appliance is hazardous.

Improper servicing of this equipment may create a potential hazard to equipment and operators.

SERVICING MUST BE DONE ONLY BY FULLY TRAINED AND QUALIFIED PERSONNEL.

Before disconnecting or opening up a fuel line and before cleaning or replacing parts of any kind.

- **Turn OFF the main manual fuel shutoff valves including pilot gas cock, if applicable. If a multiple fuel burner, shut OFF all fuels.**
- **Turn OFF all electrical disconnects to the burner and any other equipment or systems electrically interlocked with the burner.**

Do NOT use Teflon Tape as an oil or gas pipe sealant. Teflon Tape can cause valves to fail creating a safety hazard. Warranties are nullified and liability rests solely with the installer when Teflon Tape is used. Use a pipe joint compound rather than Teflon Tape.

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 Gordon-Piatt Energy Group, 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

WARNING Do NOT use teflon tape as an oil or gas pipe sealant. Teflon tape can cause valves to fail creating a safety hazard. Warranties are nullified and liability rests solely with the installer when teflon tape is used. Use a pipe joint compound rather than teflon tape.

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 American National Standard, ANSI Z223.1 and any other local codes which may apply. All gas piping should be tested after installation with air pressure or inert gas for at least three times the gas pressure that will be used. The piping ahead of the main manual shutoff shall 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

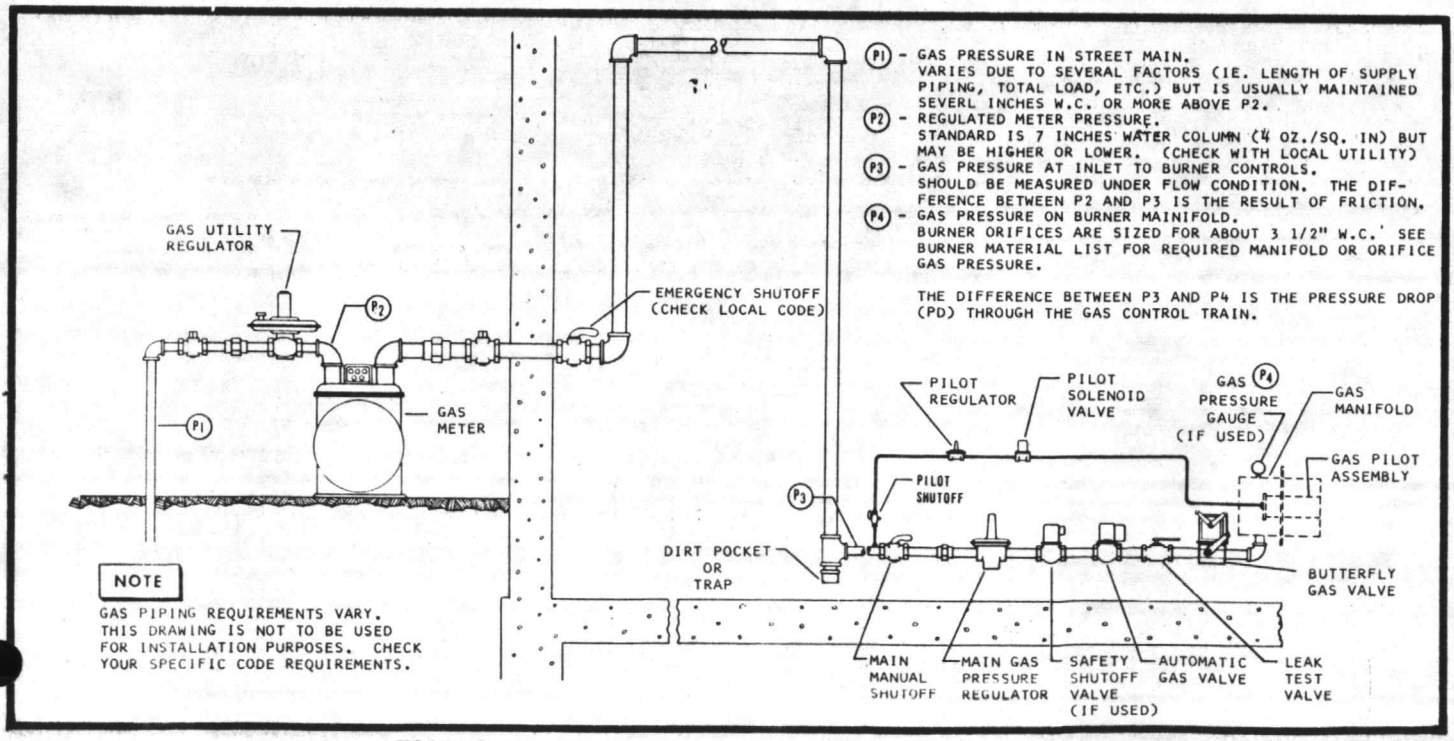
NOTE: Use multiplier at right for other specific gravities and pressure drops.

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 - Gordon-Piatt Energy Group burners are supplied with UL approved gas trains as standard equipment. FM, IRI, CSA or other special Agency approved gas trains are supplied when specified.

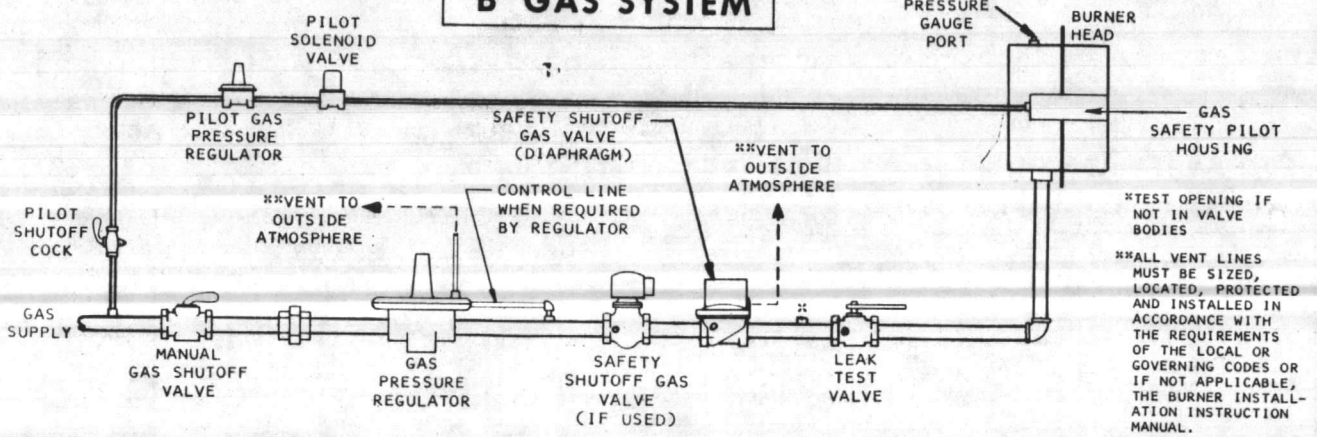
The following schematics depict the three UL approved systems used on burners with **Input Range 400 through 2500 MBH** commonly used on **R** and **S** models. The diaphragm gas valve shown in the **E** system schematic may be used for this range only.

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 Gordon-Piatt Energy Group catalog sheet **1-Gen-10.5** for further information.

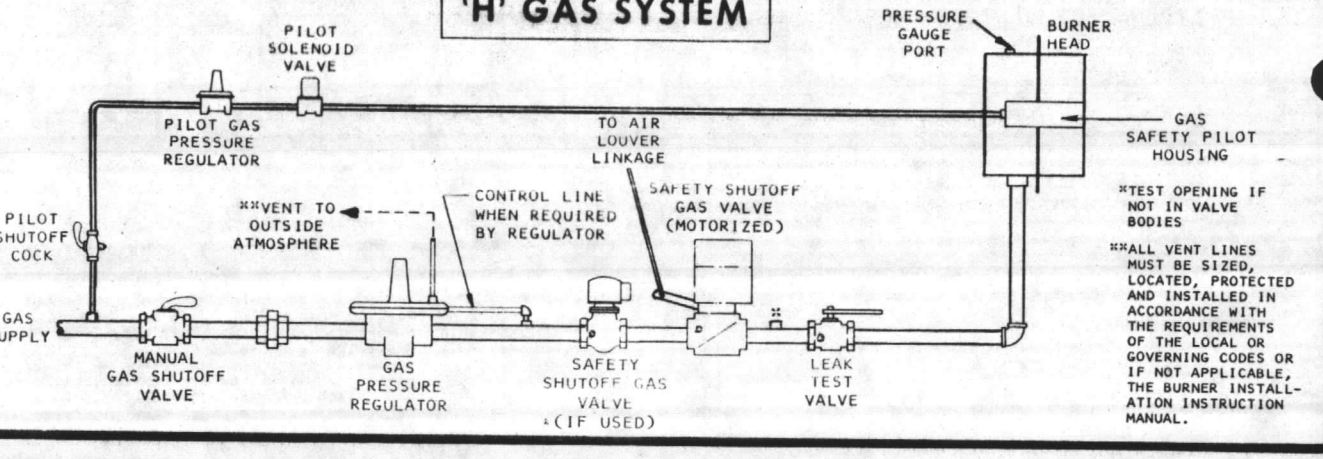
'B' GAS SYSTEM



*TEST OPENING IF NOT IN VALVE BODIES

**ALL VENT LINES MUST BE SIZED, LOCATED, PROTECTED AND INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL OR GOVERNING CODES OR IF NOT APPLICABLE, THE BURNER INSTALLATION INSTRUCTION MANUAL.

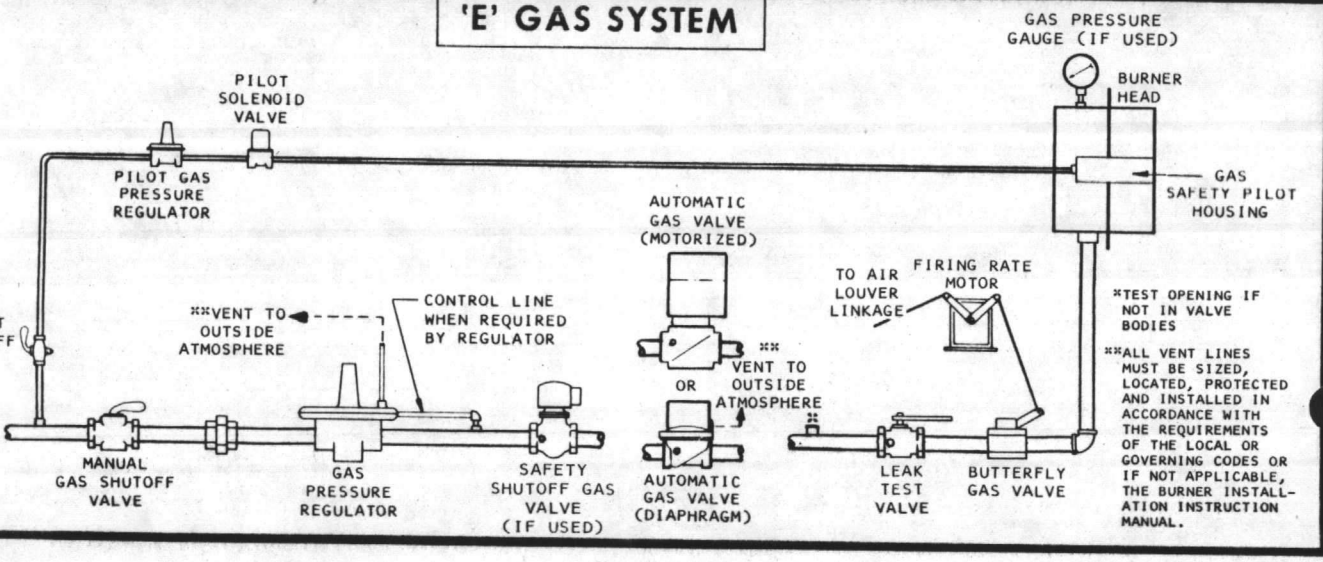
'H' GAS SYSTEM



*TEST OPENING IF NOT IN VALVE BODIES

**ALL VENT LINES MUST BE SIZED, LOCATED, PROTECTED AND INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL OR GOVERNING CODES OR IF NOT APPLICABLE, THE BURNER INSTALLATION INSTRUCTION MANUAL.

'E' GAS SYSTEM



*TEST OPENING IF NOT IN VALVE BODIES

**ALL VENT LINES MUST BE SIZED, LOCATED, PROTECTED AND INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL OR GOVERNING CODES OR IF NOT APPLICABLE, THE BURNER INSTALLATION INSTRUCTION MANUAL.

PART V

OIL PIPING INFORMATION AND BURNER OIL SYSTEMS DESCRIPTION

WARNING Do NOT use teflon tape as an oil or gas pipe sealant. Teflon tape can cause valves to fail creating a safety hazard. Warranties are nullified and liability rests solely with the installer when teflon tape is used. Use a pipe joint compound rather than teflon tape.

CAUTION

The following information pertains to two-pipe oil systems for No. 1 or No. 2 fuel oil which can be burned without preheating. Systems designed for two-pipe operation CANNOT be used with a one-pipe system.

OIL TANK LOCATION - The Rules of the National Board of Fire Underwriters [Pamphlet No. 31] and local codes and regulations should be followed in locating and installing Oil Storage Tanks and Burners.

Some localities require that the tank be located below the burner level. **If any part of the tank is above the level of the burner,** an anti-siphon device must be used to prevent flow of oil in case of a break in the oil line. The illustration shows a typical installation of an outside tank which should be covered with not less than 24" of earth. A concrete anchor base is advisable to prevent shifting of buried tank during wet weather. An auxiliary oil pump is recommended if oil suction line exceeds 200 feet in length or 12 feet of lift.

OIL PIPING - Connections to buried tanks must be made with swing joints or copper tubing to prevent the pipes from breaking in case the tanks settle. If local requirements stipulate that iron pipe be used, swing joints made up with elbows and nipples several inches long should be used on both the suction and return lines as close to the tank as possible.

The swing joints should be made up so that they will tighten as the tank settles. Nonhardening pipe joint compounds should be used on all threaded joints.

OIL PUMP SUCTION AND RETURN LINE SIZING - The size of the oil suction line is dependent upon the type of oil, amount of lift, length of suction line and the suction capacity of the pump.

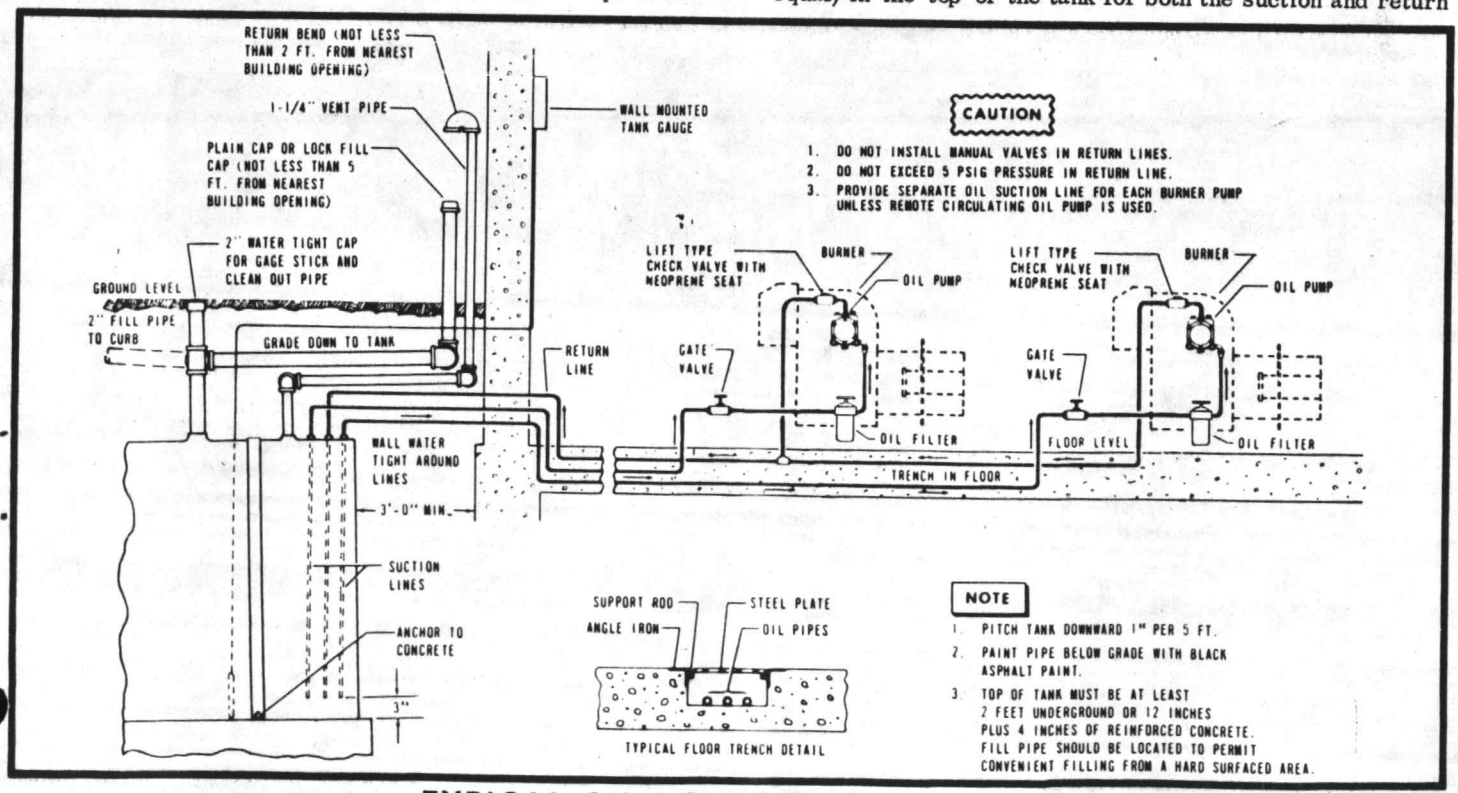
On single pump installations, the return line should be the same size as the suction line.

On multiple pump installations, **each pump should have its own individual suction line.** One return line may be used as long as it is "appropriately sized" since all pumps may share a common return line.

Refer to manufacturers' bulletins for proper line sizings.

Copper tubing should be used in preference to iron pipe, as it requires less work, is neater, has less possibility of leaks and does not scale off on the inside. Flare type fittings are recommended, as the soldered type may melt in case of fire.

The lines from the tank to the burner should be sized from data contained in the pump manufacturers specification sheet, but in NO INSTANCE should they be smaller than 1/2" O. D. copper tubing. Install tank slip fittings (Chase No. 329 or equal) in the top of the tank for both the suction and return



TYPICAL OIL PIPING INSTALLATION

line connections. Push both the suction and return lines down through the fittings until they touch the bottom of the tank and then pull them up three inches and lock in position with compression nuts so either line may be used as a suction line.

NOTE

Maximum pressure allowable on suction side of pump is 3 psig.

OIL SHUTOFF VALVE - A hand shutoff valve should be provided in the suction line near the burner.

NOTE

Hand valves must not be installed on discharge side of pump or return line without a bypass relief to tank.

CHECK VALVE AND STRAINER - If the top of the tank is below the burner level, use a lift type check valve with neoprene seat. An oil strainer is recommended for those installations which do not have oil pumps with built-in filtering devices.

NOTE

Select a check valve of the soft seated type suitable for No. 2 oil, which will seat tightly with a low head.

OIL SUCTION LINE - Suction piping should be pitched back to the tank slightly whenever possible and particular care should be taken not to create an air trap in the line. There is always a slight amount of air in suspension in oil, and if traps are present, they will gradually fill with air, and the pump will lose its prime. Removal of air is generally very difficult.

Always provide a tee and plug in the suction line at the highest possible point to aid in priming the pump and in expelling air. Also see the pump manufacturer's instructions for priming and venting.

A two-pipe system is required for all installations. Both the suction and return piping should be run in a trench under the floor level where possible.

CAUTION

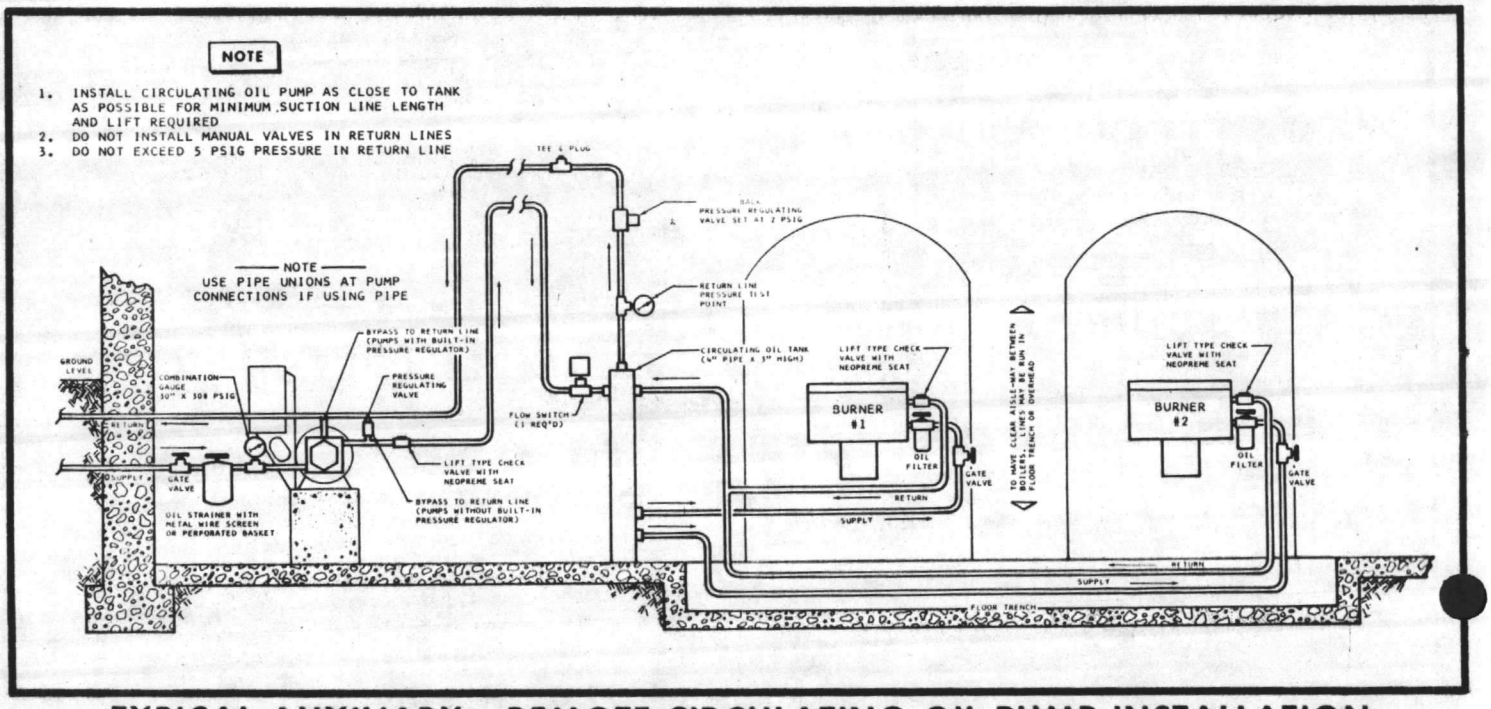
Overhead suction lines should be avoided unless an auxiliary oil circulating pump set installation of the type shown below is used. Maximum standpipe height above the burner pump is 7½ feet unless special devices are installed to prevent hydraulic shock from causing pump seal leakage.

OIL TANK FILL PIPE - The fill pipe 2" I.P.S. to the oil tank must terminate at least five feet from any window or other building opening. It should slope continuously toward the tank and be equipped with a tight-closing metal cover designed to prevent tampering. The fill pipe should terminate at least one foot above the ground to prevent flood water from seeping into the pipe. A flush type fill cap inserted in the ground should be enclosed in a water-tight well. If the fill pipe does not run vertically above the tank, it is desirable to place a tee at the tank and run a standpipe vertically so that a gauge stick may be used for measuring the oil in the tank.

OIL TANK VENT - The oil tank vent line should not be smaller than 1¼" standard weight pipe and should terminate outside of the building at a point not less than two feet measured vertically or horizontally from any window or other building opening. The top of the air vent must have a return bend or some approved cap, and it should extend above the ground high enough to prevent being obstructed by either snow or ice. In some localities, city regulations specify the height of the return bend above the ground level. All vent piping should be pitched slightly downward toward the tank. An oil gauge is recommended for all installations.

CAUTION

A foot valve at the end of the suction line in the tank is not recommended.



TYPICAL AUXILIARY - REMOTE CIRCULATING OIL PUMP INSTALLATION

TWO PIPE OPERATION - The following described oil systems are designed for two-pipe operation.

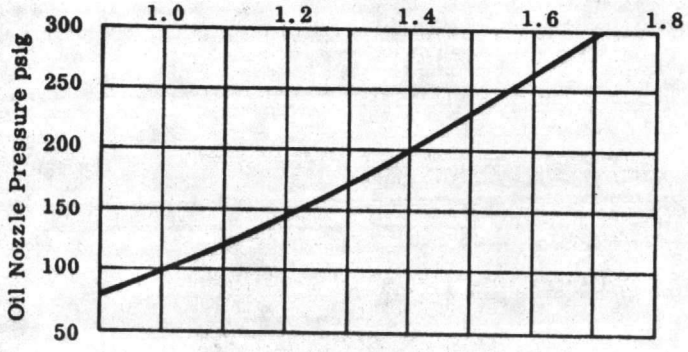
CAUTION

If operated with a single pipe system, the motor will stall and possibly damage the pump, motor and coupling.

NOZZLE RATINGS - The F1, F4B, F4H and F6 oil systems use a simplex type oil nozzle which is rated and stamped by the manufacturer with the GPH delivery at 100 psig.

Since these systems function at pressures well above 100 psig, the nozzle is actually delivering considerably more than the rate shown on the nozzle. Use the following chart to determine GPH flow at higher pressures.

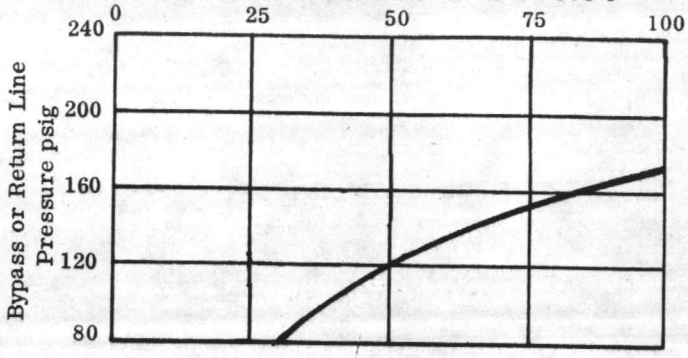
OIL NOZZLE CAPACITY ABOVE 100psig



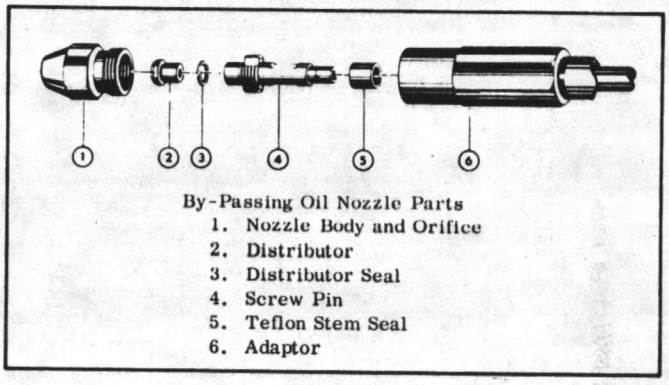
The F7 and F7T Systems use vari-flow bypassing type oil nozzles which allows for close matching of fuel-air ratios throughout the range of modulation. Supply pressure is normally maintained at 300 psig and bypass pressure is regulated to obtain the desired firing rate (GPH).

The Chart shown below gives an approximation of rated nozzle flow in relation to the bypass return line pressure. See F7 or F7T oil system bulletins for specific flow and return line pressures by nozzle part number.

BYPASS OIL NOZZLE CAPACITY

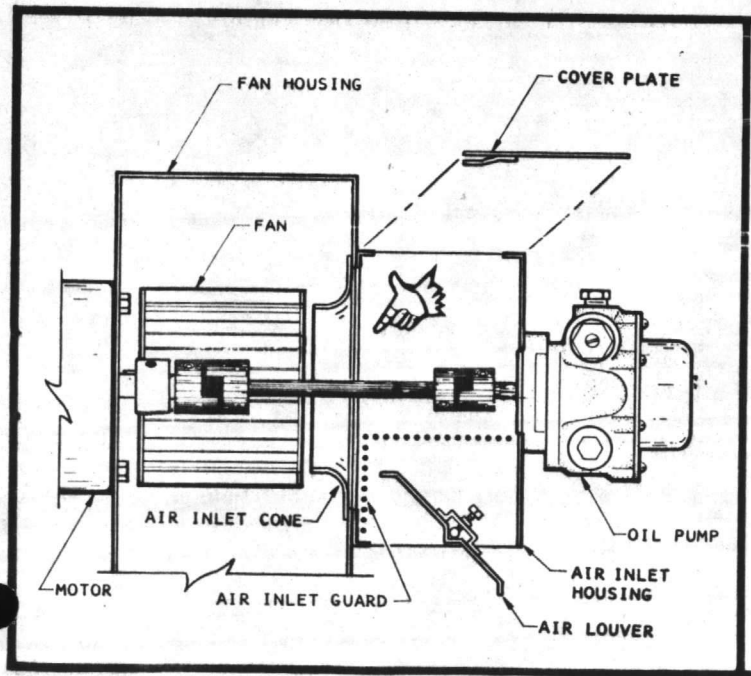


BYPASS OIL NOZZLE

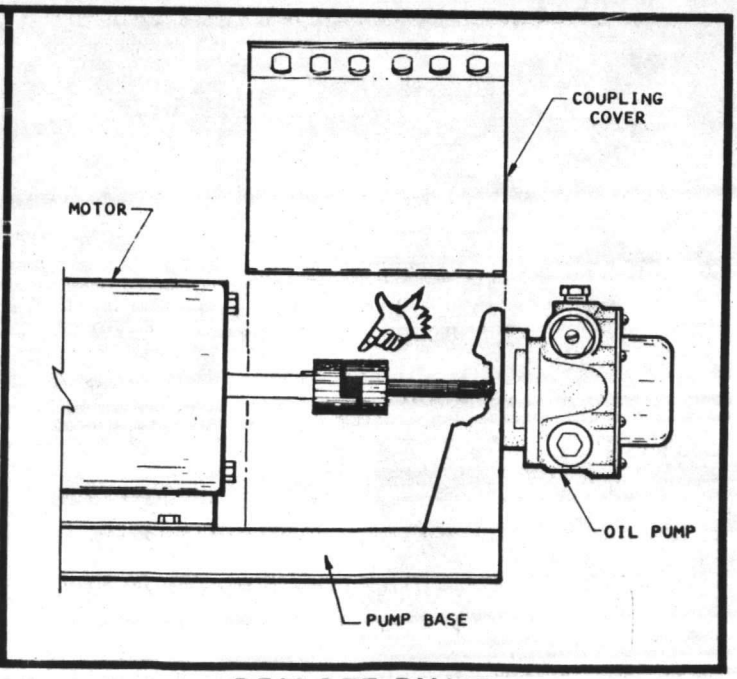


By-Passing Oil Nozzle Parts
1. Nozzle Body and Orifice
2. Distributor
3. Distributor Seal
4. Screw Pin
5. Teflon Stem Seal
6. Adaptor

OIL PUMP COUPLING - The oil pump is direct driven through a flexible coupling. The coupling is a vital part of the oil system and should be periodically inspected for wear, damage and loose components. Details are shown below.



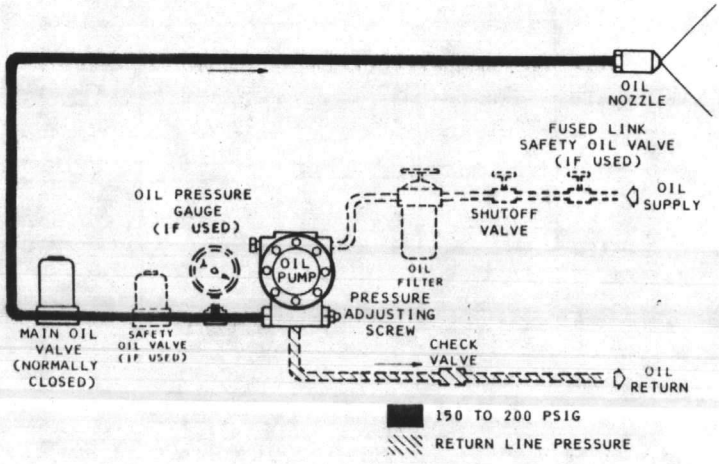
BURNER MOUNTED PUMP



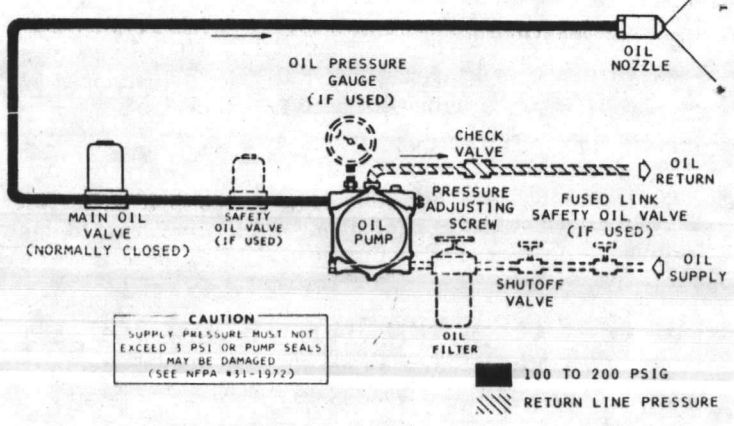
REMOTE PUMP

BURNER OIL SYSTEM DESCRIPTION

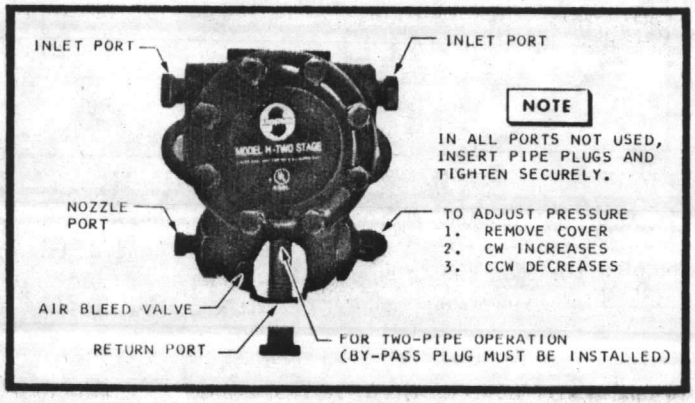
F1 OIL SYSTEM

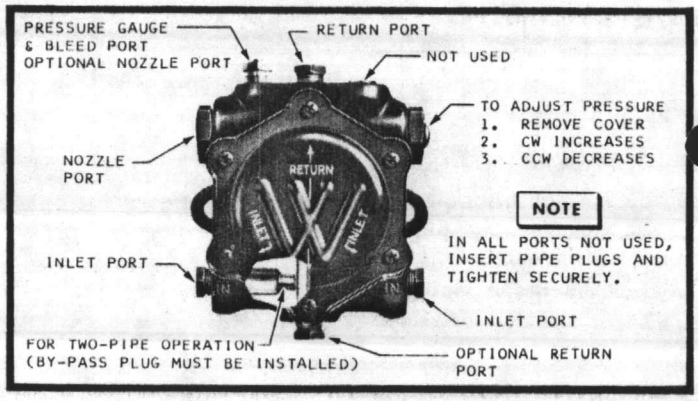


SUNDSTRAND PUMP



WEBSTER PUMP





APPLICATION - The F1 Oil System is used for On-Off firing of No. 2 fuel oil. It is commonly used on burner with 3 to 9 GPH capacity and is used in conjunction with the "B" gas system for combination gas-oil burners.

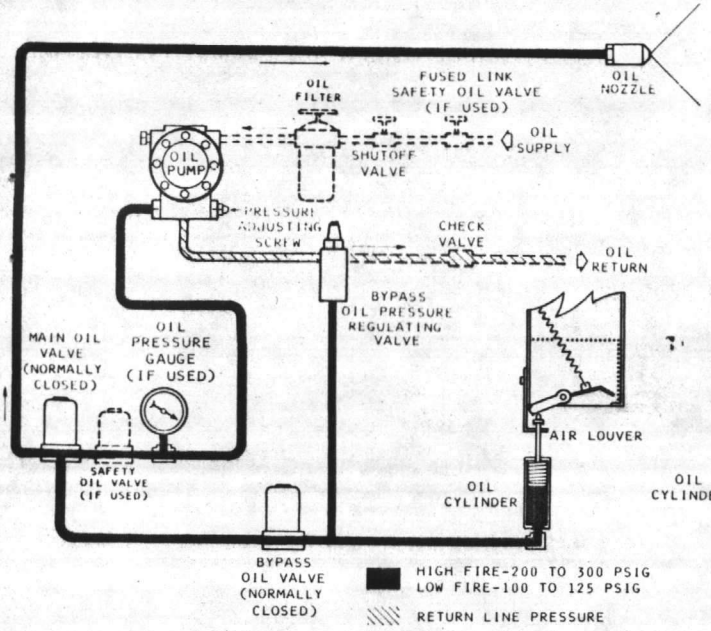
DESCRIPTION - The F1 System uses a simplex type nozzle and an oil solenoid valve to control flow. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling. Pump pressure is adjusted and maintained by the pump's integral pressure regulating valve. Combustion air available to the burner is fixed in an open [high fire] position.

OPERATING SEQUENCE - The burner motor and oil pump start on a call for heat by the operating control and the pre-purge cycle begins. Oil is returned to the tank through the oil pump return line.

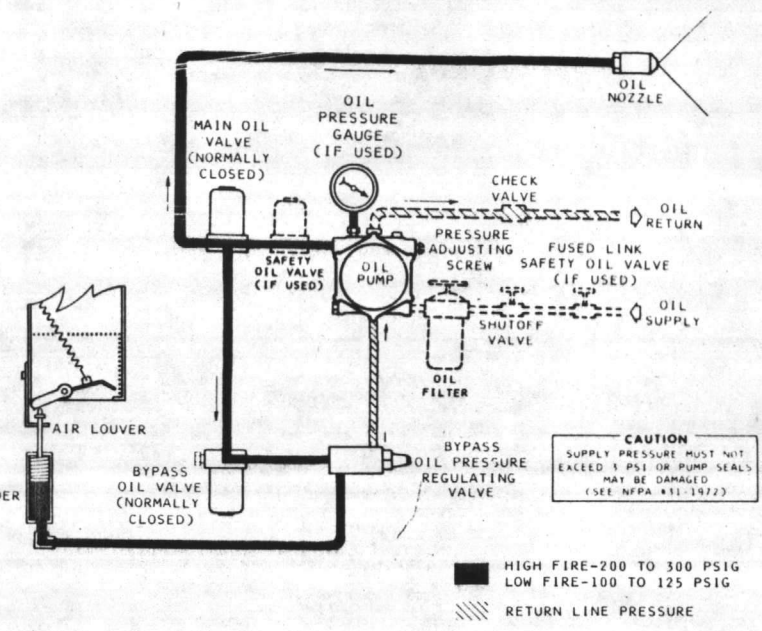
At the end of pre-purge, the ignition transformer is energized. Simultaneously, the oil solenoid valve opens supplying oil to the nozzle at the pressure setting of the pump's integral pressure regulating valve and the burner ignites.

The flame detector proves the flame and the ignition transformer is de-energized.

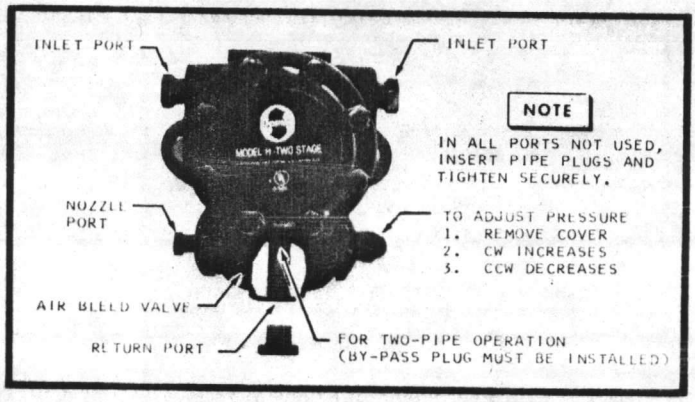
When the operating control is satisfied, the oil solenoid valve closes and the burner motor is switched off, causing the burner to shut down and await the next call for heat.

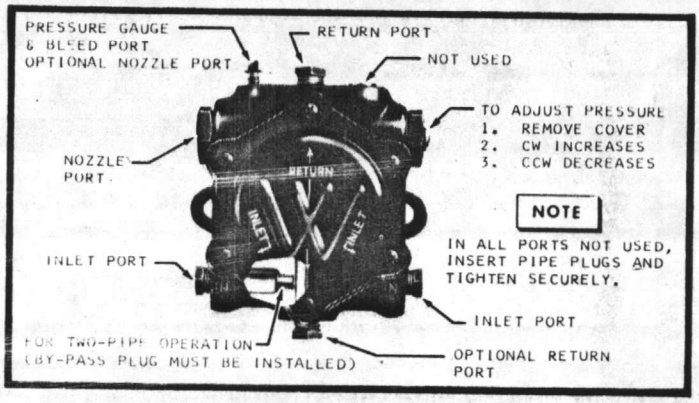


SUNDSTRAND PUMP



WEBSTER PUMP





APPLICATION - The F4B Oil System is used for On-Off Low Fire Start control in firing No. 2 fuel oil. It is commonly used on burners with 4 to 34 GPH capacity and is used in conjunction with the "B" gas system for combination gas-oil burners.

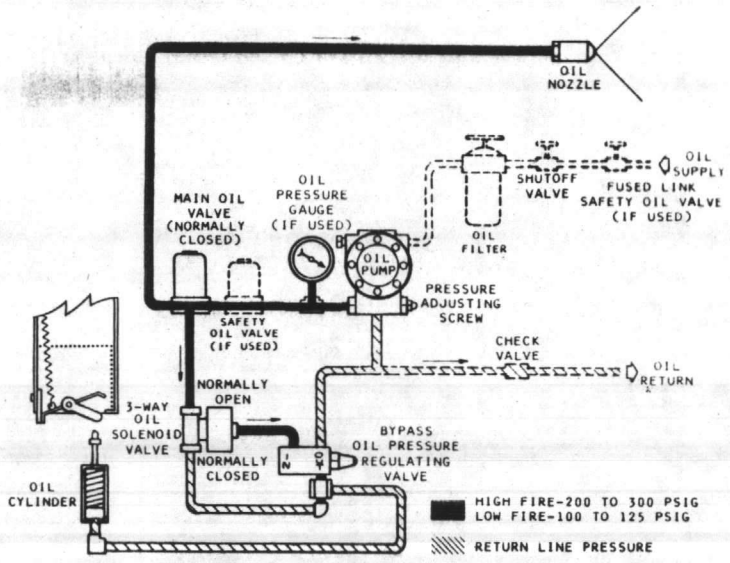
DESCRIPTION - The F4B System uses a simplex type nozzle and an oil valving arrangement to provide a low fire and a high fire oil pressure to the nozzle and simultaneously control the combustion air available to the burner through the action of an oil cylinder assembly. The burner air inlet louver is spring loaded in the full open [high fire] position. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling. Pump pressure is adjusted and maintained by the pump's integral pressure regulating valve. Low fire oil pressure is adjusted and maintained by the bypass oil pressure regulating valve.

OPERATING SEQUENCE - The burner motor and oil pump start on a call for heat by the operating control and the prepurge cycle begins. Both the main and bypass oil solenoid valves remain closed. The oil cylinder piston remains in the retracted position allowing high fire combustion air through the louver. Oil is returned to the tank through the oil pump's return line.

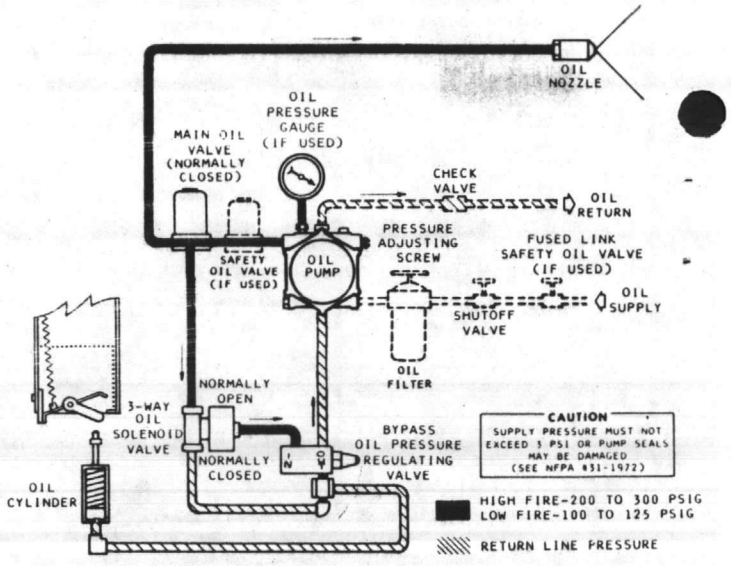
At the end of pre-purge, the ignition transformer is energized. The main and bypass oil solenoid valves open supplying oil to the nozzle at the low fire pressure setting of the bypass pressure regulating valve. When the bypass oil solenoid valve opens, the oil cylinder piston extends and drives the air louver closed for low fire combustion air and the burner ignites.

The flame detector proves the flame and the ignition transformer is de-energized. After the flame is proven, the bypass oil solenoid valve closes stopping the flow through the bypass pressure regulating valve thus raising the nozzle pressure to the high fire setting of the pump's integral pressure regulating valve. When the bypass oil solenoid valve closes, the oil cylinder piston retracts allowing the air louver spring to pull the louver to the full open position and the burner goes to high fire.

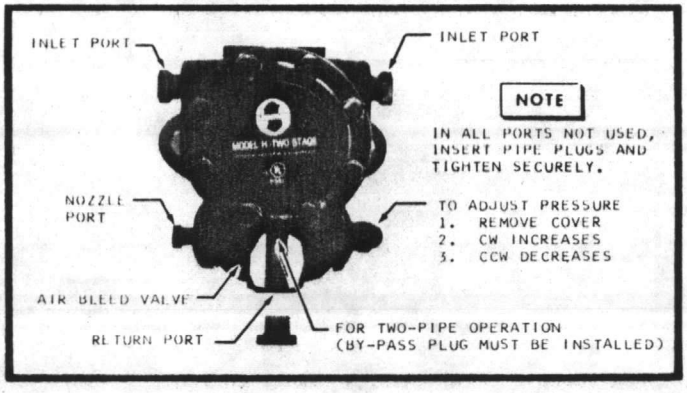
F4H OIL SYSTEM

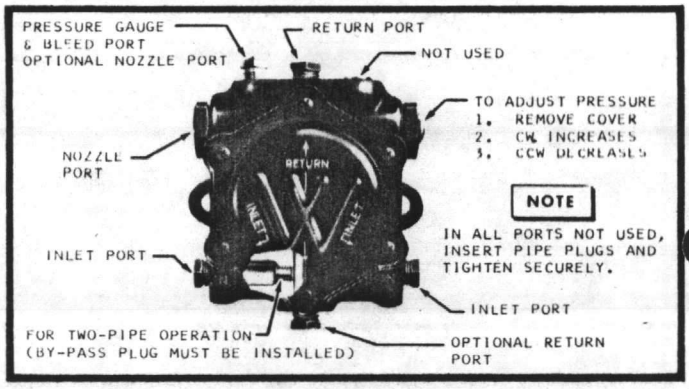


SUNDSTRAND PUMP



WEBSTER PUMP





APPLICATION - The F4H Oil System is used for On-Off or High-Low, Low Fire Start Control in firing No. 2 fuel oil. It is commonly used on burners with 4 to 34 GPH capacity and is used in conjunction with the "H" gas system for combination gas-oil burners.

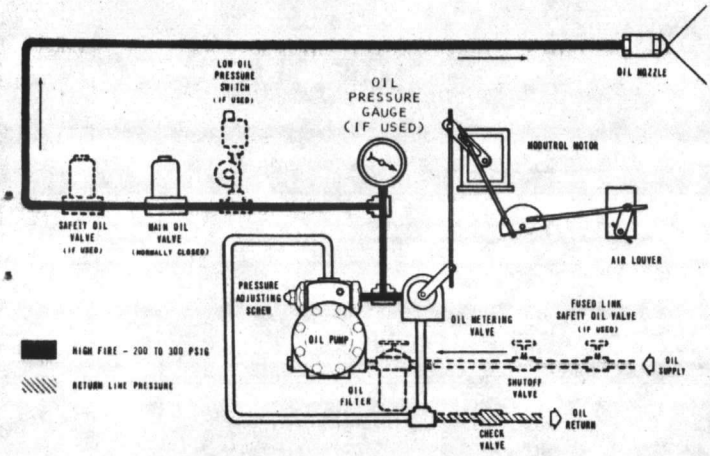
DESCRIPTION - The F4H system uses a simplex type nozzle and an oil valving arrangement to provide a low fire and a high fire oil pressure to the nozzle and simultaneously control the combustion air available to the burner through the action of an oil cylinder assembly. The burner air inlet louver is spring loaded in the closed [low fire] position. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling. Pump pressure is adjusted and maintained by the pump's integral pressure regulating valve. Low fire oil pressure is adjusted and maintained by the bypass oil pressure regulating valve.

OPERATING SEQUENCE - The burner motor and pump start on a call for heat by the operating control and the prepurge cycle begins. The normally open port of the 3-way oil solenoid valve allows oil to flow through the bypass pressure regulating valve and return to the tank. The oil cylinder piston remains in the retracted position allowing low fire combustion air through the louver.

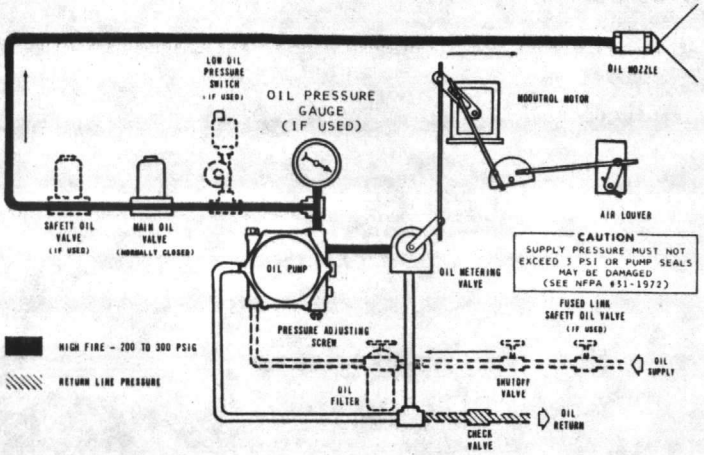
At the end of pre-purge, the ignition transformer is energized. The main oil solenoid valve opens supplying oil to the nozzle at the low fire pressure setting of the bypass pressure regulating valve. The air inlet louver remains closed and the burner ignites at low fire rate.

The flame detector proves the flame and the ignition transformer is de-energized. After the flame is proven, the normally open port of the 3-way oil solenoid valve closes stopping the flow through the bypass pressure regulating valve thus raising the nozzle pressure to the high fire setting of the pump's integral pressure regulating valve. Simultaneougly, when the open port closes the normally closed port opens causing the oil cylinder piston to extend and drive the air louver to the full open position and the burner goes to high fire.

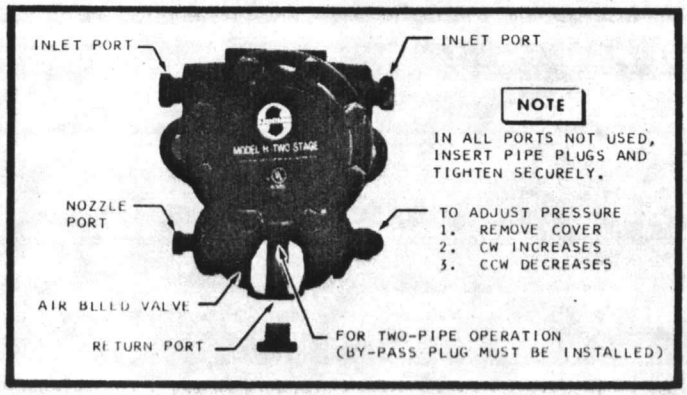
HIGH-LOW OPERATION - On High-Low Control Systems, the High Fire Controller, when satisfied, restores the 3-way valve to its normal position, allowing flow through the bypass pressure regulating valve causing the nozzle pressure to drop to the low fire setting. Simultaneously, this allows the oil cylinder piston to retract and the air louver spring pulls the louver to the closed [low fire] position. If low fire cannot maintain pressure or temperature in the boiler, the high fire controller will re-energize the 3-way oil solenoid valve and the burner will sequentially return to high fire.

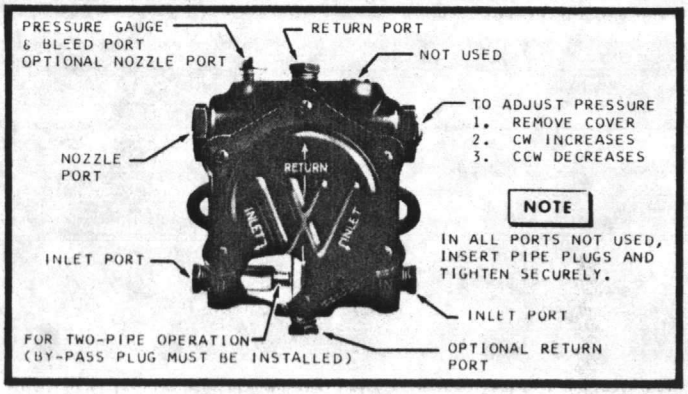


SUNDSTRAND PUMP



WEBSTER PUMP





APPLICATION - The F6R Oil System is used for modulating or High-Low, Proven Low Fire Start Control in firing No. 2 fuel oil. It is commonly used on burners with 7 to 37 GPH capacity and is used in conjunction with the "E" gas system for combination gas-oil models.

DESCRIPTION - The F6R Oil System uses a simplex type nozzle and a modulating motor to provide a low fire and a high fire oil pressure to the nozzle and simultaneously regulate the combustion air available to the burner. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling or by a remote burner pump set located in close proximity to the burner. Pump pressure is adjusted and maintained by the pump's integral pressure regulating valve. Nozzle pressure is regulated by an oil metering valve linked to the modulating motor. The nozzle supply line is opened by the oil metering valve for high fire and oil is delivered to the nozzle at the pressure setting of the pressure regulating valve. The air louver is also linked to the modulating motor thus combustion air is increased proportionately as the nozzle pressure increases.

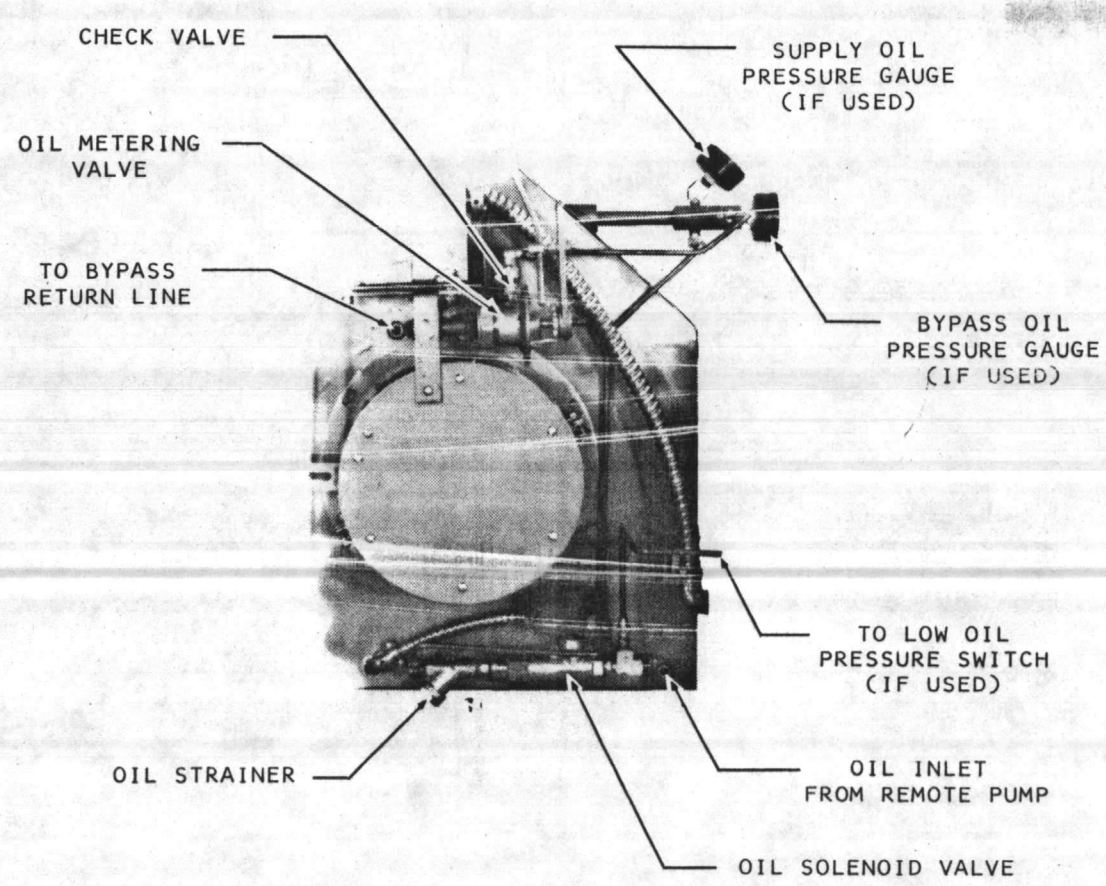
OPERATING SEQUENCE [Modulating Systems] - The burner motor and pump start on a call for heat by the operating control and the pre-purge cycle begins. Oil is returned to the tanks through the oil return line. The air louver is in the closed [low fire] position and must remain there for the low fire guarantee switch to close and allow ignition at the end of pre-purge.

At the end of pre-purge, the ignition transformer is energized. The main oil valve opens [after proof of pilot when using gas pilot ignition of oil] supplying oil to the nozzle at the low fire pressure setting of the oil metering valve and the burner ignites at the low fire rate.

The flame detector proves the flame and the ignition transformer is de-energized or the gas pilot solenoid valve closes shutting off the gas pilot. After a short delay, the modulating motor is switched to the control of a potentiometer controller which drives the motor from the low fire position toward the high fire position to match the boiler load. Since both the air inlet louver and oil metering valve are linked to the motor, the combustion air is increased proportionately as oil nozzle pressure increases.

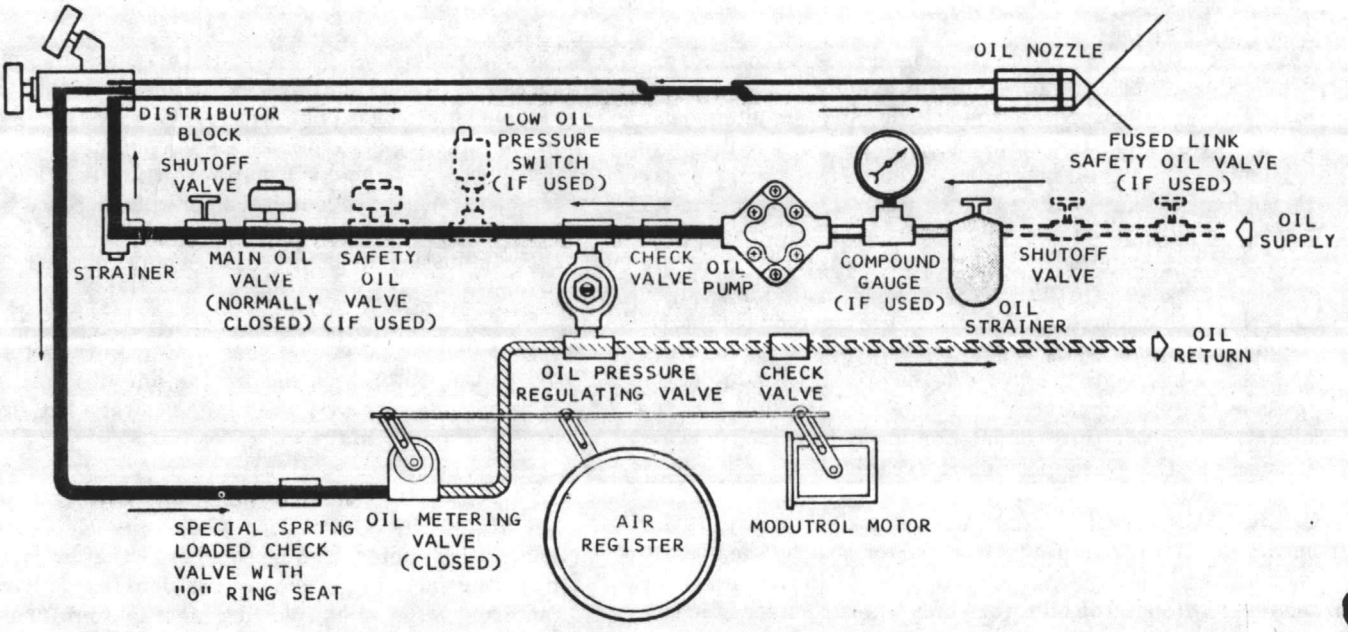
As the boiler load is overcome, the potentiometer controller drives the motor back toward the low fire position and the burner modulates over the range between low fire and high fire in response to the boiler load.

HIGH-LOW OPERATION - On High-Low Control Systems, the High Fire Controller, when satisfied, energizes the modulating motor. The motor drives the air louver and oil metering valve to the low fire position. [Air louver closed, oil metering valve open allowing more oil to return to the tank and causing nozzle pressure to drop proportionately.] If low fire cannot maintain pressure or temperature in the boiler, the high fire controller will re-energize the motor and the burner returns to high fire.

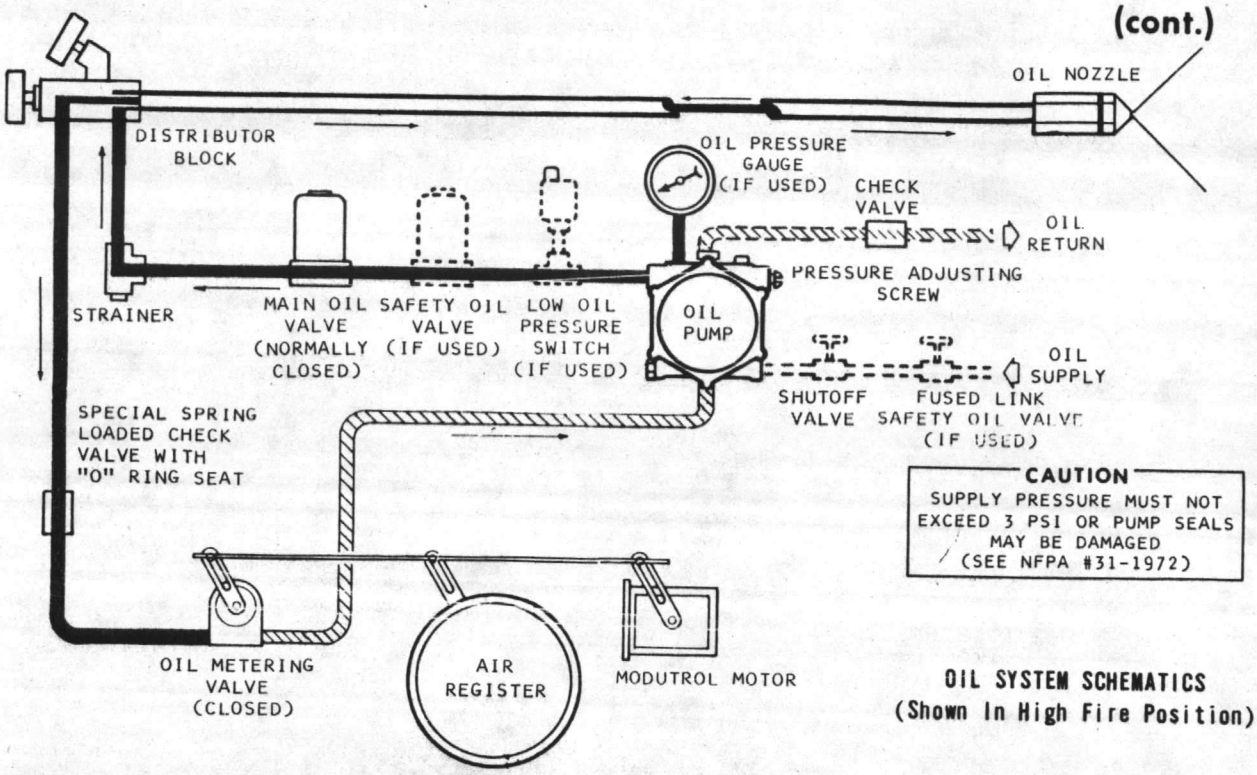


MECHANICAL PRESSURE ATOMIZING

REMOTE BURNER PUMP



BURNER MOUNTED PUMP



OIL SYSTEM SCHEMATICS
(Shown In High Fire Position)

APPLICATION - The F7 Oil System is used for modulating or High-Low, Proven Low Fire Start Control in firing No. 2 fuel oil. It is commonly used on burners with 20 to 225 GPH capacity and is used in conjunction with the "E" gas system for combination gas-oil models.

DESCRIPTION - The F7 Oil System uses a bypassing type nozzle and a modulating motor to control the amount of oil available for atomization by the nozzles and simultaneously regulate the combustion air available to the burner. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling or by a remote burner pump set located in close proximity to the burner. Pump pressure is adjusted and maintained by an oil pressure regulating valve. Oil flow through the nozzle is regulated by an oil metering valve in the bypass return line which is actuated by the motor. The bypass return line is closed by the oil metering valve for high fire and all the oil delivered to the nozzles is atomized into the combustion chamber. The air louver is linked to the modulating motor, thus combustion air is increased proportionately as the oil firing rate increases. A spring loaded check valve with O-Ring seat prevents oil flow back through the nozzle during the burner OFF period.

Variations as shown in the following tabulation are normally made between small and large GPH burners.

Item	Small Units	Large Units
Integral Pump Pressure Reg. Valve	X	
Separate Pressure Regulating Valve		X
Burner Mounted Oil Pump	X	
Separate Oil Pump Set		X

OPERATING SEQUENCE [Modulating Systems] - The burner motor and pump start on a call for heat by the operating control and the pre-purge cycle begins. For smaller burners, the oil is returned to the tank through the pump return line. For larger units, the oil is returned to the tank by way of the separate pressure regulating valve. The air louver is in the closed [low fire] position and must remain there for the low fire guarantee switch to close and allow ignition at the end of pre-purge.

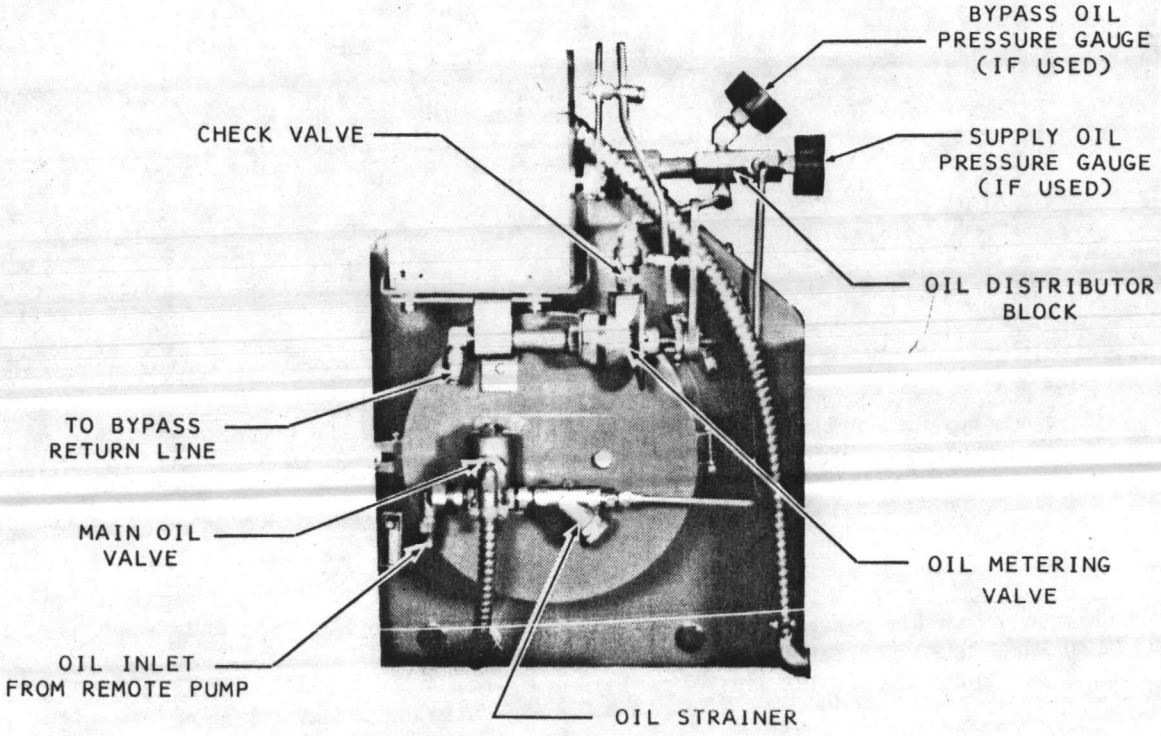
At the end of pre-purge, the gas pilot ignition transformer is energized, the gas pilot solenoid valve opens and the pilot ignites. After proof of pilot by the combustion control, the main oil solenoid valve opens supplying oil to the nozzle at the low fire pressure setting of the oil metering valve and the burner ignites at low fire rate.

The flame detector proves the flame and the gas pilot solenoid valve closes shutting off the gas pilot. After a short delay, the modulating motor is switched to the control of a potentiometer controller which drives the motor from the low fire position toward high fire position to match the boiler load. With air louver and oil metering valve linked to the motor, the combustion air is increased proportionately as the oil firing rate increases.

As the boiler load is overcome, the potentiometer controller drives the motor back toward the low fire position and the burner modulates over the range between low fire and high fire in response to the boiler load.

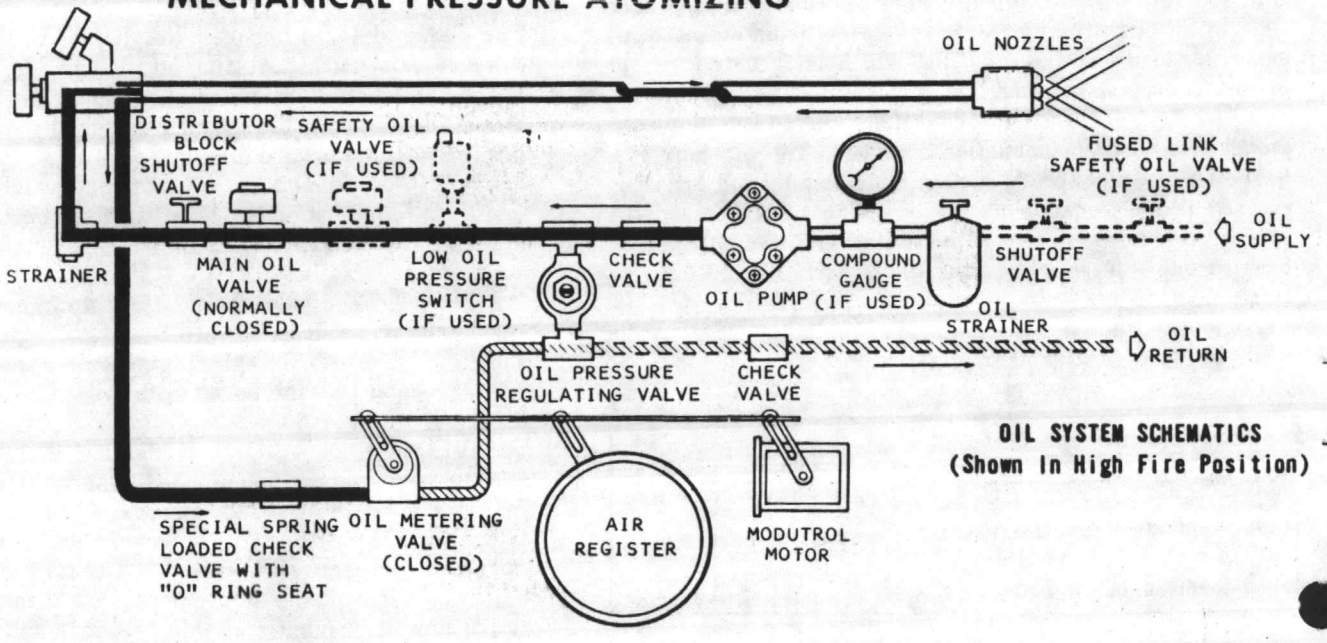
HIGH-LOW OPERATION - On high-low control systems, the high fire controller, when satisfied, energizes the modulating motor. The motor drives the air louver and oil metering valve to the low fire position. [Air louver closed, oil metering valve open allowing more oil to return to the tank and causing the amount of oil available for atomization to drop proportionately.] If low fire cannot maintain pressure or temperature in the boiler, the high fire controller will re-energize the modulating motor and burner returns to high fire.

F7T OIL SYSTEM



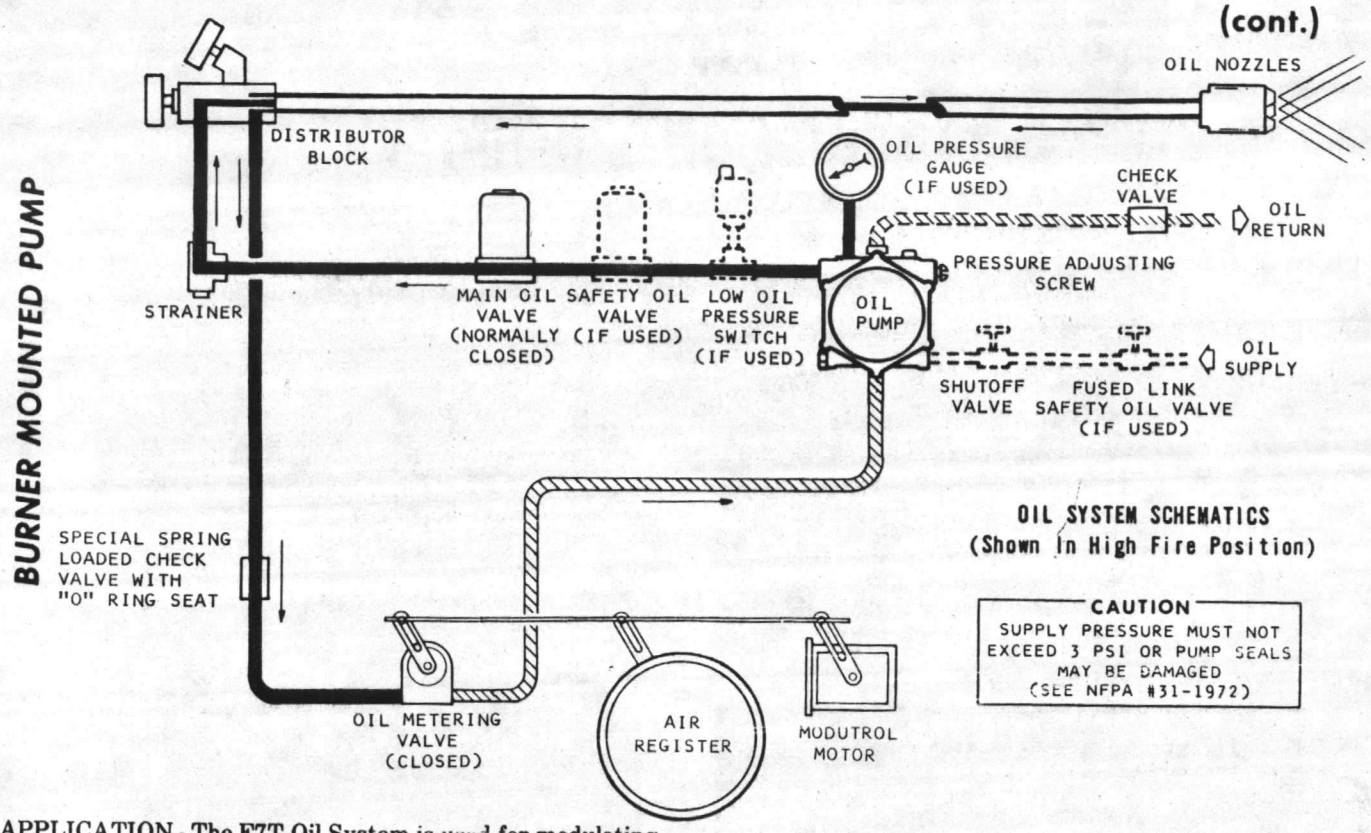
MECHANICAL PRESSURE ATOMIZING

REMOTE BURNER PUMP



OIL SYSTEM SCHEMATICS
(Shown In High Fire Position)

F7T OIL SYSTEM (cont.)



OIL SYSTEM SCHEMATICS
(Shown In High Fire Position)

CAUTION
SUPPLY PRESSURE MUST NOT EXCEED 3 PSI OR PUMP SEALS MAY BE DAMAGED (SEE NFPA #31-1972)

APPLICATION - The F7T Oil System is used for modulating or High-Low, Proven Low Fire Start Control in firing No. 2 fuel oil. It is commonly used in conjunction with the "E" gas system for combination gas-oil models.

DESCRIPTION - The F7T Oil System uses bypassing type nozzles and a modulating motor to control the amount of oil available for atomization by the nozzles and simultaneously regulate the combustion air available to the burner. Pressure is generated by an oil pump connected to the burner motor through a flexible coupling or by a remote burner pump set located in close proximity to the burner. Pump pressure is adjusted and maintained by an oil pressure regulating valve. Oil flow through the nozzles is regulated by an oil metering valve in the bypass return line which is actuated by the motor. The bypass return line is closed by the oil metering valve for high fire and all the oil delivered to the nozzles is atomized into the combustion chamber. The air louver is linked to the modulating motor, thus combustion air is increased proportionately as the oil firing rate increases. A spring loaded check valve with O-Ring seat prevents oil flow back through the nozzle during the burner OFF period.

Variations as shown in the following tabulation are normally made between small and large GPH burners.

Item	Small Units	Large Units
Integral Pump Pressure Reg. Valve	X	
Separate Pressure Regulating Valve		X
Burner Mounted Oil Pump	X	
Separate Oil Pump Set		X

OPERATING SEQUENCE [Modulating Systems] - The burner motor and pump start on a call for heat by the operating control and the pre-purge cycle begins. For smaller burners, the oil is returned to the tank through the pump return line. For larger units, the oil is returned to the tank by way of the separate pressure regulating valve. The air louver is in the closed [low fire] position and must remain there for the low fire guarantee switch to close and allow ignition at the end of pre-purge.

At the end of pre-purge, the gas pilot ignition transformer is energized, the gas pilot solenoid valve opens and the pilot ignites. After proof of pilot by the combustion control, the main oil solenoid valve opens supplying oil to the nozzle at the low fire pressure setting of the oil metering valve and the burner ignites at low fire rate.

The flame detector proves the flame and the gas pilot solenoid valve closes shutting off the gas pilot. After a short delay, the modulating motor is switched to the control of a potentiometer controller which drives the motor from the low fire position toward high fire position to match the boiler load. With air louver and oil metering valve linked to the motor, the combustion air is increased proportionately as the oil firing rate increases.

As the boiler load is overcome, the potentiometer controller drives the motor back toward the low fire position and the burner modulates over the range between low fire and high fire in response to the boiler load.

HIGH-LOW OPERATION - On high-low control systems, the high fire controller, when satisfied, energizes the modulating motor. The motor drives the air louver and oil metering valve to the low fire position. [Air louver closed, oil metering valve open allowing more oil to return to the tank and causing the amount of oil available for atomization to drop proportionately.] If low fire cannot maintain pressure or temperature in the boiler, the high fire controller will re-energize the modulating motor and burner returns to high fire.

PART VI

COMBUSTION CONTROLS

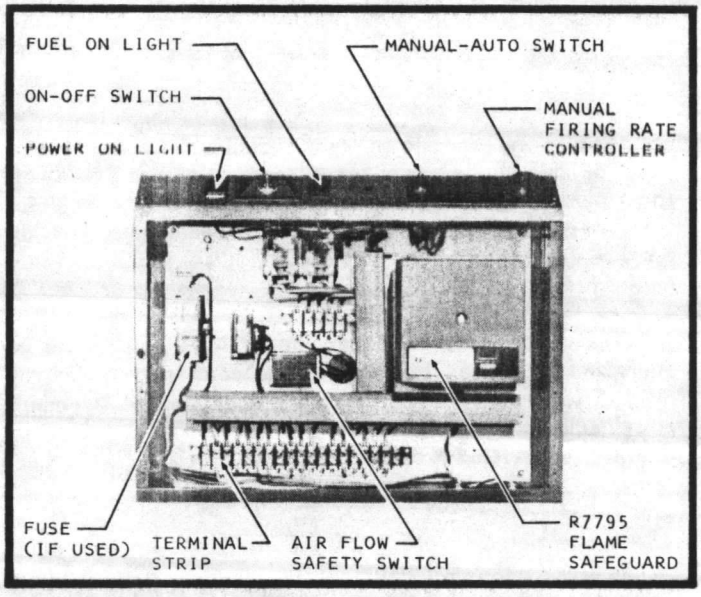
GENERAL - Different control systems are available to satisfy different needs. The most commonly used systems are briefly described in this part to outline the functional characteristics of the various flame safeguards. For further information, consult the specific bulletin covering the flame safeguard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

R7795 FLAME SAFEGUARD



TYPICAL R7795 CONTROL PANEL

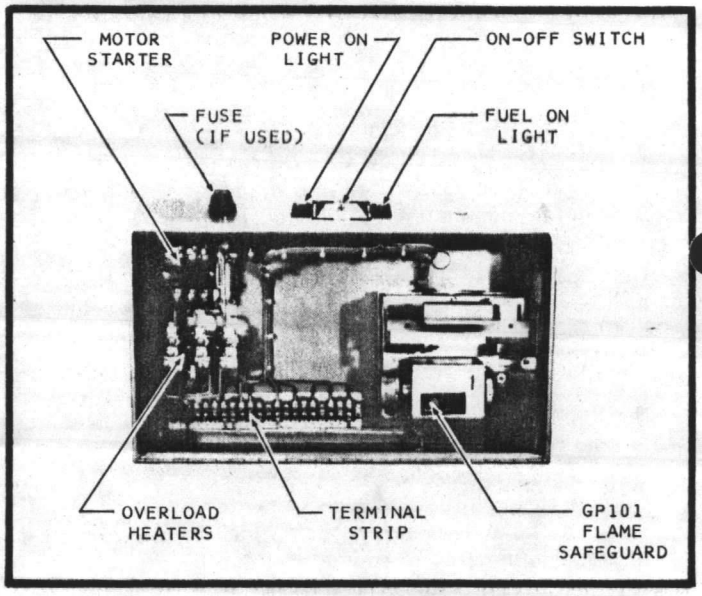
The R7795 flame safeguard control provides flame-out protection plus automatic sequencing of the burner motor, pilot valve, ignition spark, and main fuel valve for commercial and industrial gas and oil burners.

A plug in solid state timer in the R7795 provides control of the operating sequence.

The R7795 may only be used with rectifying and UV flame detectors.

The R7795 flame safeguard control is Underwriters Laboratories Inc. listed, Factory Mutual approved, and Canadian Standards Association certified for automatic fired burners.

GP101 FLAME SAFEGUARD



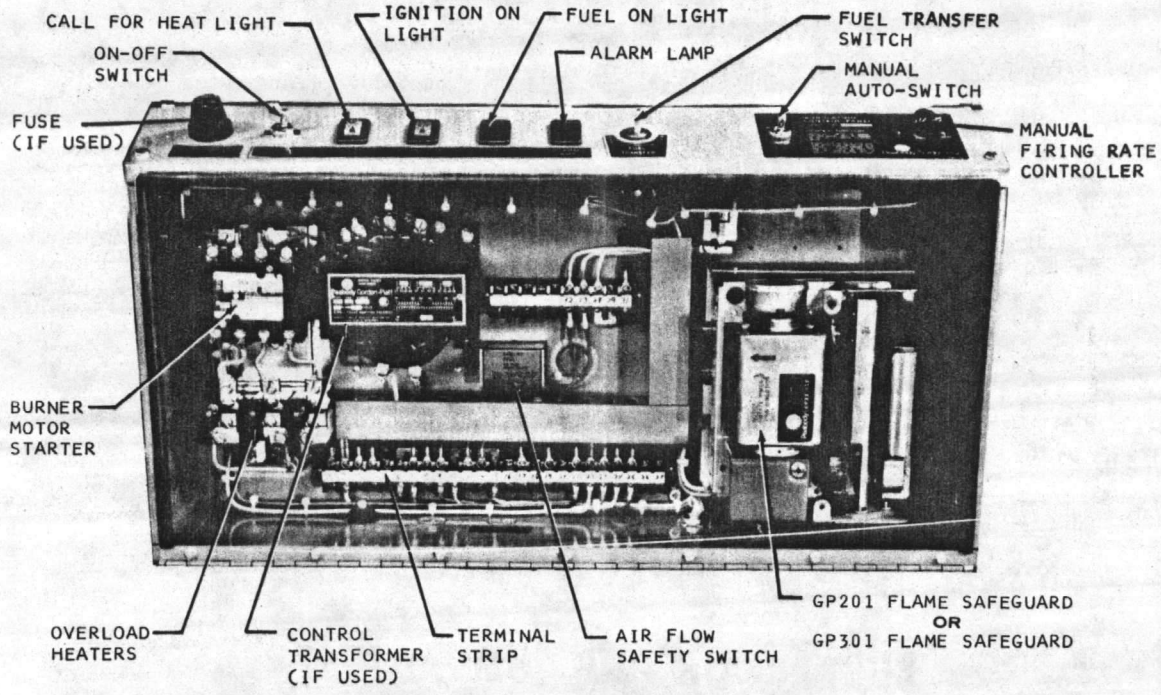
TYPICAL GP101 CONTROL PANEL

The GP101 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 GP101 to be used with rectifying, infrared or ultraviolet flame detectors.

The GP101 flame safeguard control is Underwriters Laboratories, Inc. [UL] component recognized, Factory Mutual approved and Canadian Standards Association certified for automatic fired burners.

GP201 & GP301 FLAME SAFEGUARD



The GP201 flame safeguard control provides flameout protection plus automatic sequencing of burner motor, firing rate 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 GP201 to be used with rectifying, infrared, or ultraviolet flame detectors.

The GP201 flame safeguard control is Underwriters Laboratories, Inc. [UL] component recognized, Factory Mutual approved and Canadian Standards Association certified for automatic fired burners.

The GP301 flame safeguard control provides flameout protection plus automatic sequencing of burner motor, damper motor, pilot valve, ignition spark, and main fuel valve on gas, oil or combination gas-oil burner.

A selection of color-coded, solid-state, interchangeable plug-in amplifiers allows the GP301 to be used with rectifying, infrared, or ultraviolet flame detectors.

The GP301 flame safeguard control meets Underwriters Laboratories, Inc., Factory Mutual and Canadian Standards Association requirements for automatic fired burners. With auxiliary equipment, the GP301 also meets IRI single burner/boiler requirements.

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.

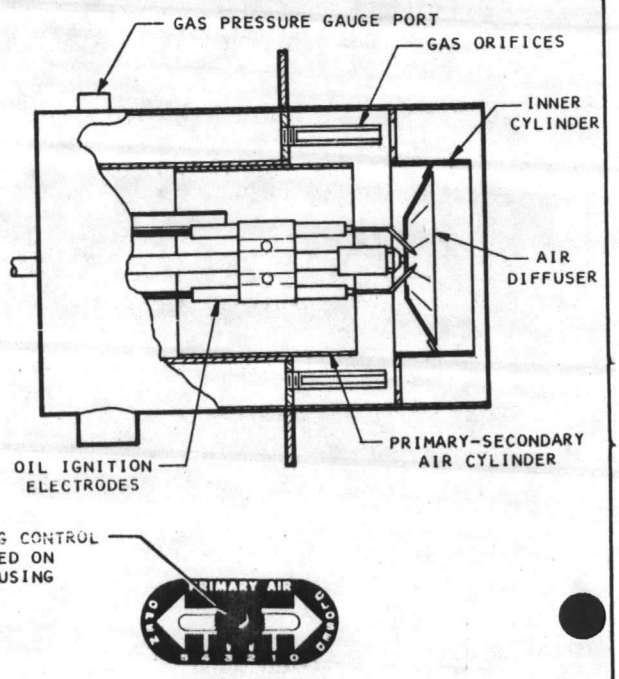
ADJUSTMENT PROCEDURE

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.

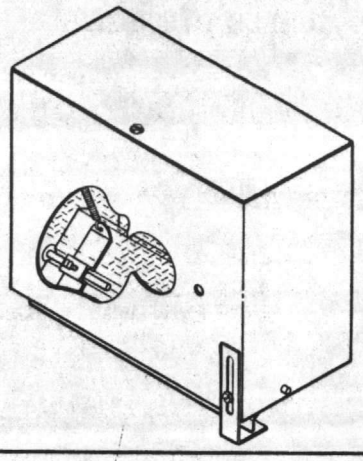
TYPICAL GAS-OIL BURNER HEAD



ADJUSTMENT OF AIR INLET LOUVER

Item 2

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



DESCRIPTION

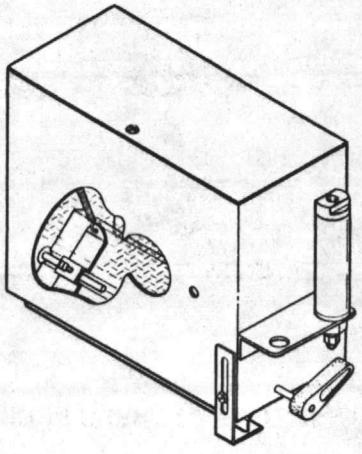
These systems use an air louver which is spring loaded OPEN against an adjustable stop bracket. The system function when firing gas or oil is ON-OFF, FIXED AIR and FUEL.

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 $\frac{1}{2}$" 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 $1\frac{1}{4}$" 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

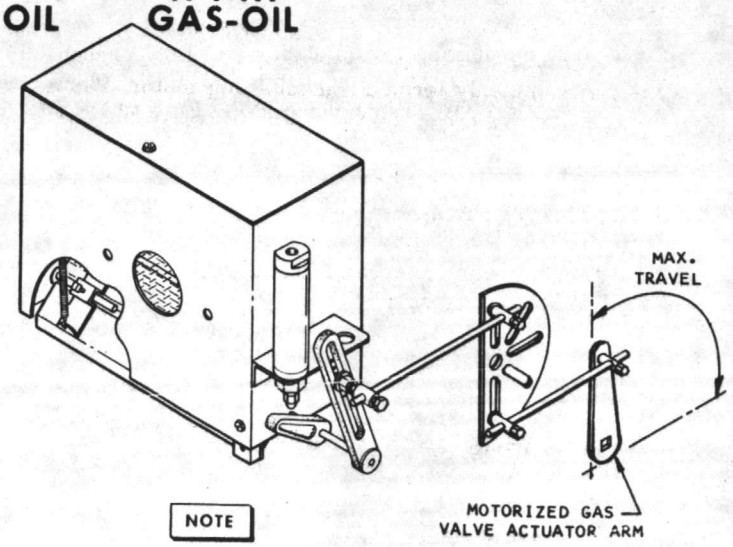
APPLICABLE TO THESE FUEL SYSTEMS — **H GAS** — **F4H OIL** — **H-F4H GAS-OIL**

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 arrangment 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 $\frac{1}{4}$" 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 $1\frac{1}{4}$" 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

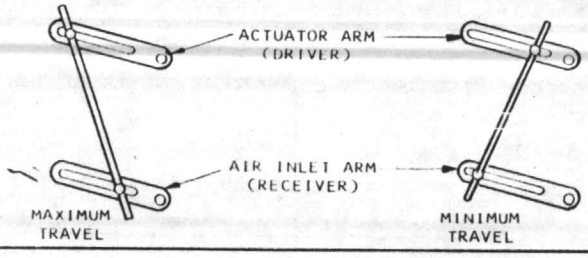
E2	F6R.2	F7.2	F7T.2	E2-F6R.2	E2-F7.2	E2-F7T.2
GAS	OIL	OIL	OIL	GAS-OIL	GAS-OIL	GAS-OIL

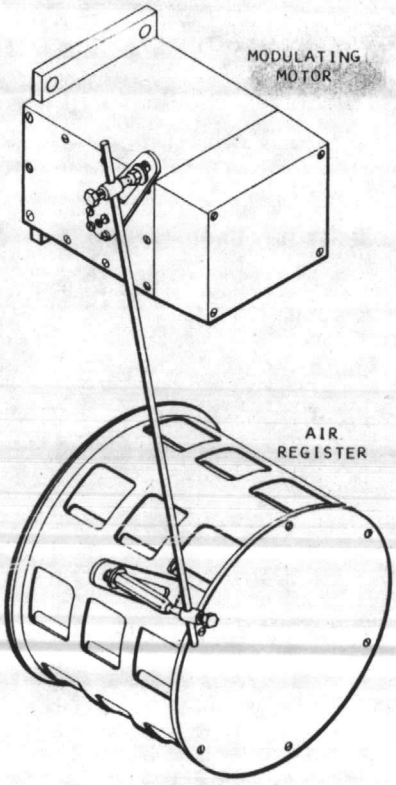
DESCRIPTION

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.





ADJUSTMENT OF RECTANGULAR LOUVER BOX

APPLICABLE TO THESE FUEL SYSTEMS

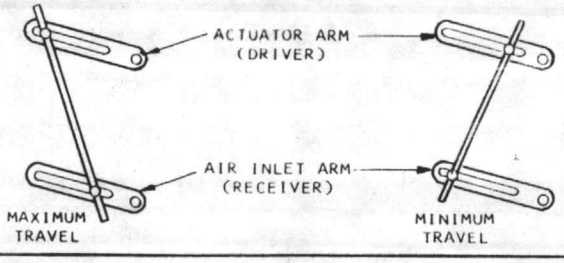
E2	F6R.2	F7.2	F7T.2	E2-F6R.2	E2-F7.2	E2-F7T.2
GAS	OIL	OIL	OIL	GAS-OIL	GAS-OIL	GAS-OIL

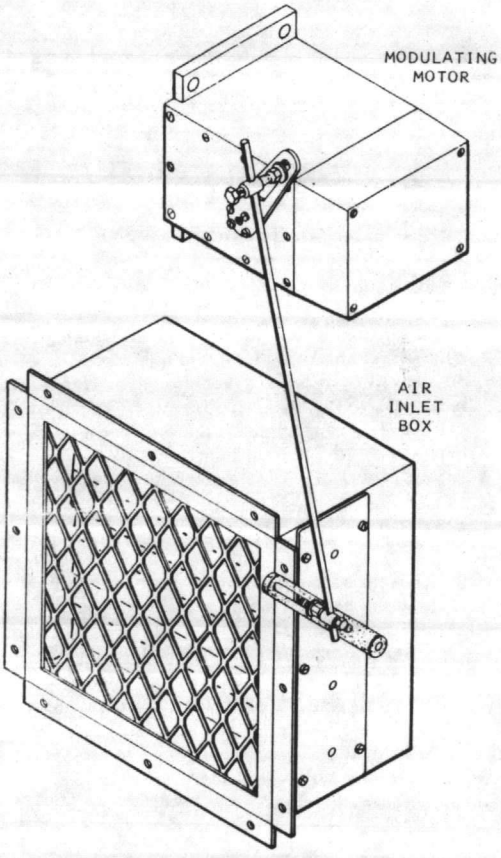
DESCRIPTION

These systems use an air inlet box 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 one louver open 3/8" for low fire.





ADJUSTMENT OF GAS PILOT AIR SUPPLY

Item 4

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.

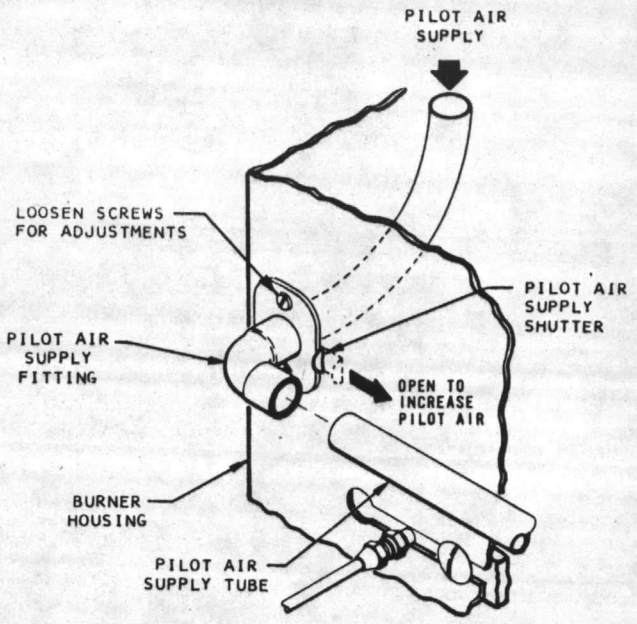
ADJUSTMENT PROCEDURE

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.



ADJUSTMENT OF BURNER OIL DRAWER ASSEMBLY

Item 5

[OIL OR COMBINATION GAS-OIL BURNERS ONLY]

NOTE

On straight gas burners, the overall drawer assembly requires no adjustment. The air diffuser is positioned midway in the inner cylinder of the burner head and under normal firing conditions, requires no adjustment.

DESCRIPTION

There are two versions of this assembly, the main difference being in the routing of the pipe which supports the various components. On the one, the piping comes out the side of the burner housing while on the other, it comes straight out the back.

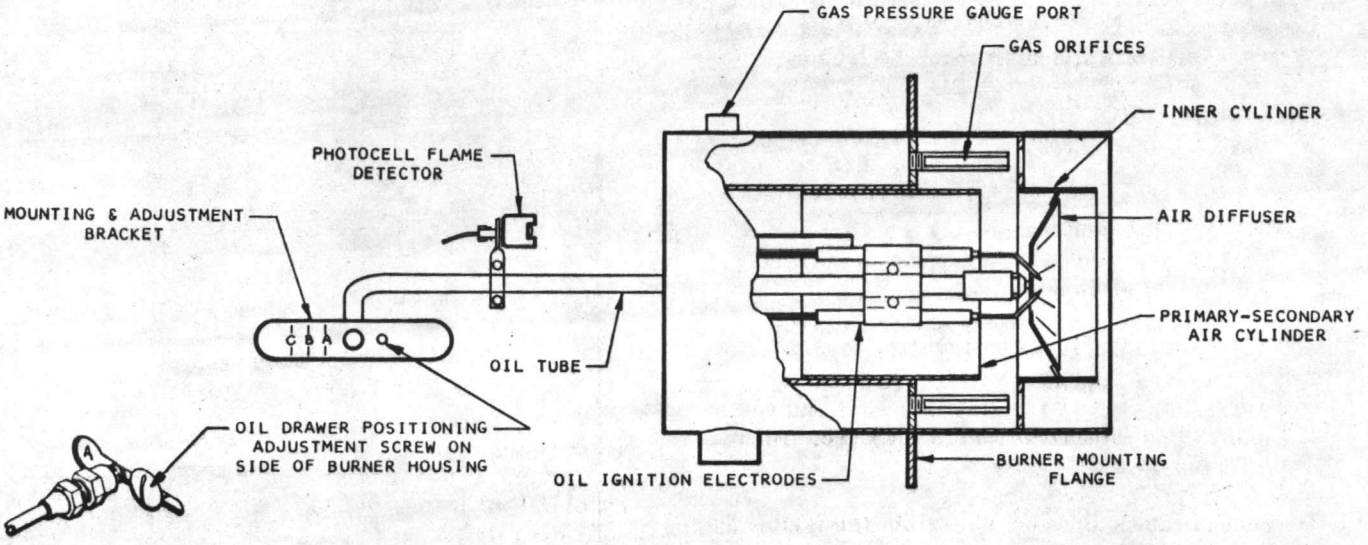
The basic assembly is made up of support piping, an air diffuser, and mounting provisions. For oil burners, a nozzle adapter and oil nozzle are added to make up the oil drawer assembly.

Direct spark oil ignition electrodes and photocell are also added to the assembly when the burner is ignited by direct spark and uses a rectifying photocell type flame detector.

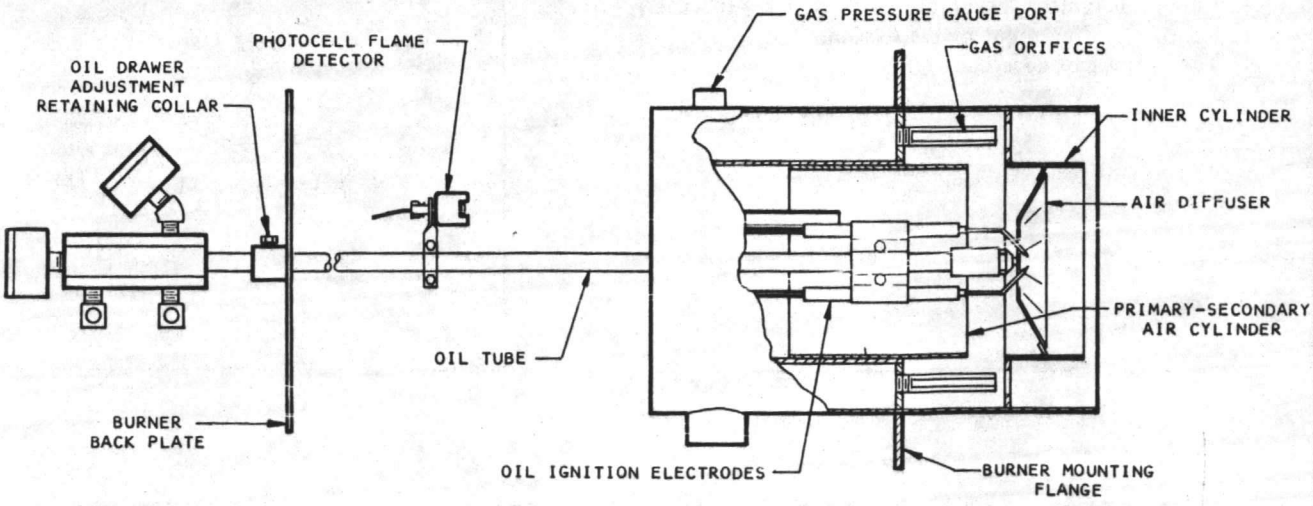
NOTE

Adjustment requirements cannot be finally established until after the burner is fired. Generally, the oil drawer assembly should be positioned as far to the rear [away from boiler] as possible without impinging the oil spray on the inner surfaces of the burner firing tube or choke ring.

ADJUSTMENT PROCEDURE [Oil Piping Out The Side]



ADJUSTMENT PROCEDURE [Oil Piping Out The Back]



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

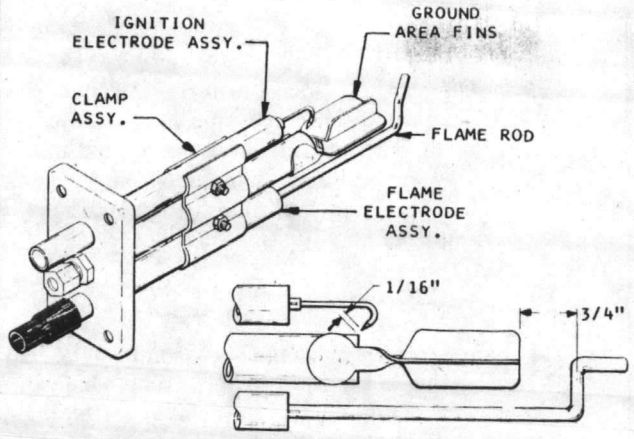
The gas pilot igniter assembly is a vital part of the burner and must be kept clean and properly adjusted at all times.

WARNING

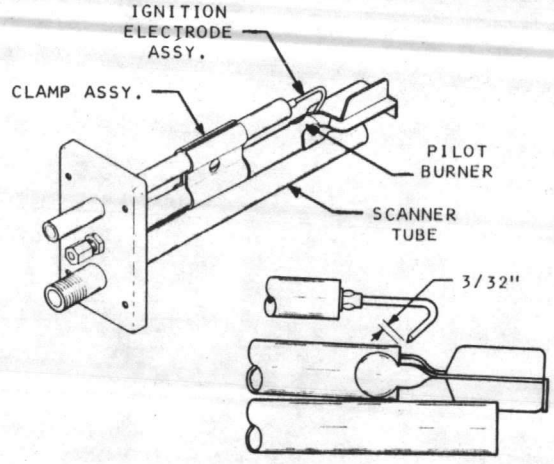
Turn off power at the master switch and remove flame safeguard from the subbase. Turn pilot gas cock OFF.

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.
4. Turn pilot gas cock back ON.

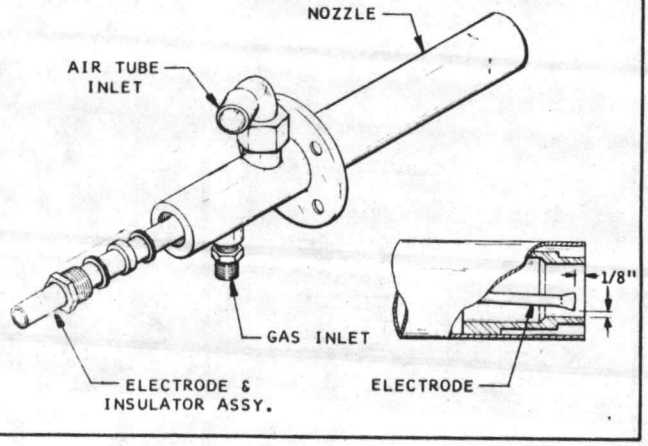
[TYPICAL] **Type 214B6B**



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



[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.

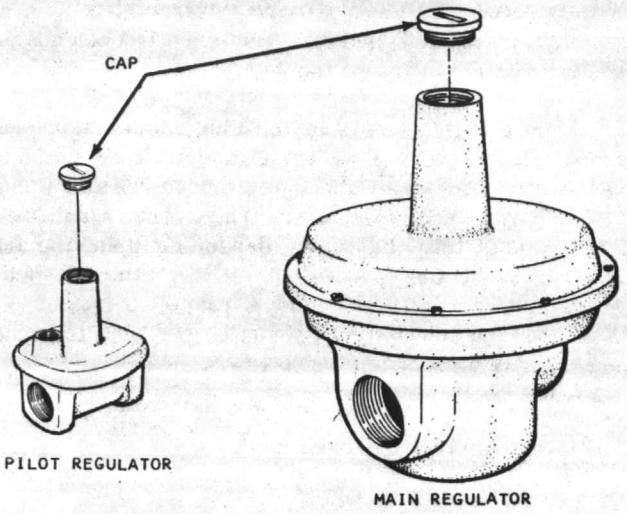
ADJUSTMENT PROCEDURE

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:

GAS PRESSURE REGULATOR



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.

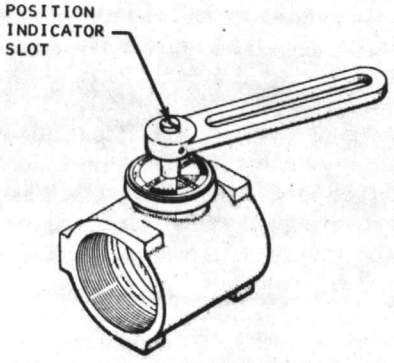
A centrally located disc turns within a cylindrical body which regulates the gas flow to the main burner flame. The butterfly valves used are the non-tight shutoff type.

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.

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.

BUTTERFLY GAS VALVE



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.

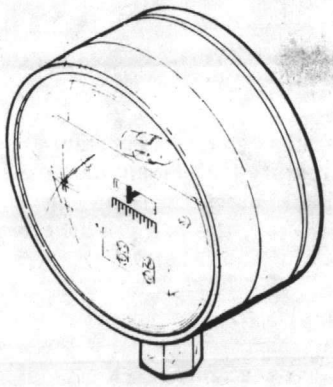
Item 9 ADJUSTMENT OF GAS PRESSURE SWITCHES

DESCRIPTION

Gas pressure switches are pressure-actuated electrical switching devices designed for safety shutoff when gas pressures are either too low or too high.

The pressure switch senses any change in gas pressure and, if properly adjusted, will transmit an electrical signal to the automatic shutoff valve and/or other interlocking devices when an unsafe condition exists. The burner will then recycle or completely shut down depending upon the flame safeguard used. Gas pressure switches are designed to operate over a specified pressure range; therefore, each switch must be selected to be compatible with the burner operating gas pressure and also to obtain the desired electrical features.

GAS PRESSURE SWITCH



(Typical)

ADJUSTMENT PROCEDURE

NOTE

See gas pressure switch manufacturers instructions for detailed procedures. Units with mercury switching device must be properly leveled.

1. For initial start-up:
   a. Low Gas Pressure Switch - Adjust to a lower pressure than that to be experienced for normal operation to allow the burner to be set up.
   b. High Gas Pressure Switch - Adjust to a higher pressure than that to be experienced for normal operation to allow the burner to be set up.

NOTE

Final adjustment must be done after the burner has been test fired. See burner start-up procedures.

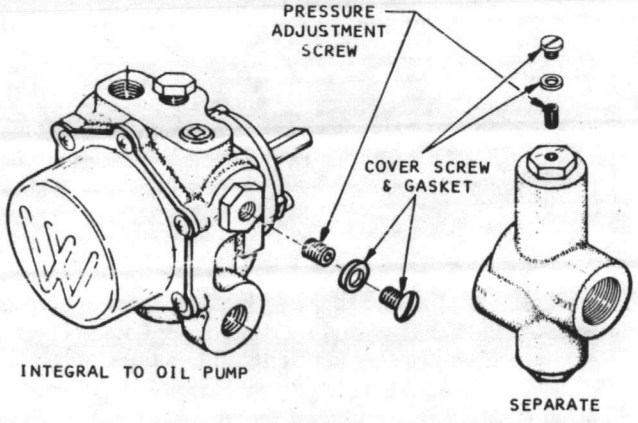
Item 10 ADJUSTMENT OF OIL SUPPLY PRESSURE REGULATOR

DESCRIPTION

Oil burners require a close regulation of the pressure at which oil is delivered to the nozzle. Small GPH burners normally use an oil pump which has a pressure regulator built-in, while larger capacity burners employ a separate pressure regulating valve.

Burner oil pumps are generally identified by the rate at which they can deliver [GPH], the pressure of the delivery [PSIG], and the speed of rotation [RPM]. The pump is usually capable of delivering more fuel than is required to meet firing requirements; therefore, the amount of oil delivered to the nozzle must be controlled. This control is accomplished through use of an adjustable pressure regulating valve which reduces flow to the nozzle by causing more oil to be returned to the tank. Like most regulators, flow is controlled by an adjustable spring and each regulator has a pressure range over which it will reliably operate.

OIL PRESSURE REGULATOR



ADJUSTMENT PROCEDURE

NOTE

See oil pressure regulator or oil pump manufacturer's instructions for detailed procedures.

1. Using screw driver, remove cover screw and gasket thereunder to gain access to the adjustment mechanism.
2. Use 1/8" Allen wrench to turn pressure adjusting screw clockwise to increase pressure and counter-clockwise to decrease.
3. For initial start-up:

NOTE

Pressure at which oil will be delivered to the nozzle cannot be determined until the burner is test fired. Be prepared to adjust the regulator as the burner is cycled through its firing sequence.

ADJUSTMENT OF BYPASS PRESSURE REGULATOR VALVE

DESCRIPTION

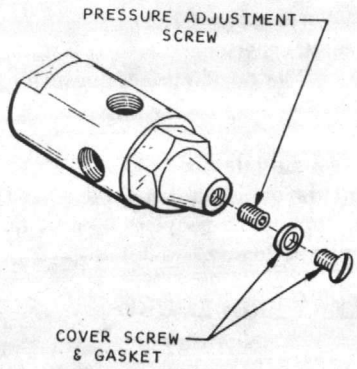
Oil burners which have low fire start fuel control systems must deliver oil to the nozzle at reduced pressure for low fire. This is normally accomplished by diverting a portion of the oil pump delivery through a bypass return line to the tank.

The amount of oil delivered to the nozzle versus that returned to the tank is controlled by a device which limits or meters flow, thus an oil bypass regulating valve or an oil metering valve is used for this purpose.

ADJUSTMENT PROCEDURE

1. Using screw driver, remove cover screw and gasket to gain access to the adjustment mechanism.
2. Use 1/8" Allen wrench to turn pressure adjusting screw clockwise to increase pressure and counter-clockwise to decrease.

BYPASS PRESSURE REGULATING VALVE



3. For initial start-up:

NOTE

Pressure at which oil will be delivered to the nozzle cannot be determined until the burner is test fired. Be prepared to adjust the regulator as the burner is cycled through its firing sequence.

ADJUSTMENT OF OIL METERING VALVE

DESCRIPTION

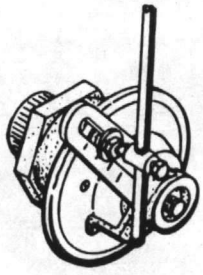
Most oil metering devices work on the principle of limiting flow by constricting the area through which the oil must pass. In order to vary the orifice area, mechanical movement must take place, thus the oil metering valve requires an actuator to do its job. By interconnecting a common actuator to the combustion air control and the oil metering valve, this allows the fuel [oil] to be proportioned in precise ratio to the amount of air available for combustion. This feature is essential on modulating type fuel control systems.

ADJUSTMENT PROCEDURE

NOTE

Valves vary by the amount of rotation required to cover the full range of regulation. Most valves will have a range from 0° to 90° or 0° to 120°. The maximum travel that can be realized from a 90° actuator and mechanical linkage arrangement is about 120°. The amount of travel to be used is dependent upon the required turndown ratio [flow rates] between high-fire and low-fire and the flow characteristics of the particular valve.

OIL METERING VALVE



(typical)

For initial start-up:

NOTE

Adjustment requirements cannot be finally established until after the burner is fired. Generally, the valve should work from a mostly open position when located in the bypass return line or from a mostly closed position when located in the supply line. This allows limited flow to the nozzle for low fire start.

Item 12 ADJUSTMENT OF LOW OIL PRESSURE SWITCH

DESCRIPTION

Low oil pressure switches are often times used to insure the oil pressure at the nozzle is adequate for proper atomization of the oil.

A pressure sensing device within the switch controls an electrical circuit normally interlocked with the flame safeguard causing the burner to recycle or shut down when the pressure sensed falls below the setting.

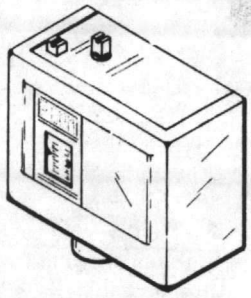
ADJUSTMENT PROCEDURE

NOTE

See pressure switch manufacturer's instructions for detailed procedure.

1. From burner material list determine "Oil Pressure at Nozzle" [PSIG] requirement.
2. For initial start-up: Adjust to a pressure well below the "Oil Pressure at Nozzle" [PSIG] shown to allow the burner to be set up.

LOW OIL PRESSURE SWITCH



(typical)

NOTE

Final adjustment must be done after the burner has been test fired. See burner start-up procedures.

ADJUSTMENT OF OIL NOZZLE AND IGNITION ELECTRODE

Item 13

A considerable amount of oil burner service is associated with poor ignition or failure to obtain ignition.

This condition is oftentimes caused by an out-of-tolerance adjustment of the oil ignition electrodes in relation to the nozzle and/or the nozzle to the air diffuser. The spark gap must also be properly set.

The following information is furnished as a guide for obtaining those settings that will insure reliable performance of the oil ignition system and also prevent unnecessary build-up of soot and carbon on the electrodes and air diffuser.

GENERAL

There are several factors which affect the adjustments and general maintenance of the oil ignition system. These are:

1. The type of nozzle used.
2. The number of nozzles used.
3. The nozzle spray angle.
4. The diameter of the center (nozzle) hole in the air diffuser.
5. The velocity of the air moving through the burner head.

TYPE OF NOZZLE

The simplex nozzle is used with oil systems which have a supply pipe ONLY while the variflow (or bypassing) oil nozzle is used with a TWO-PIPE arrangement, one for supply and the other for return.

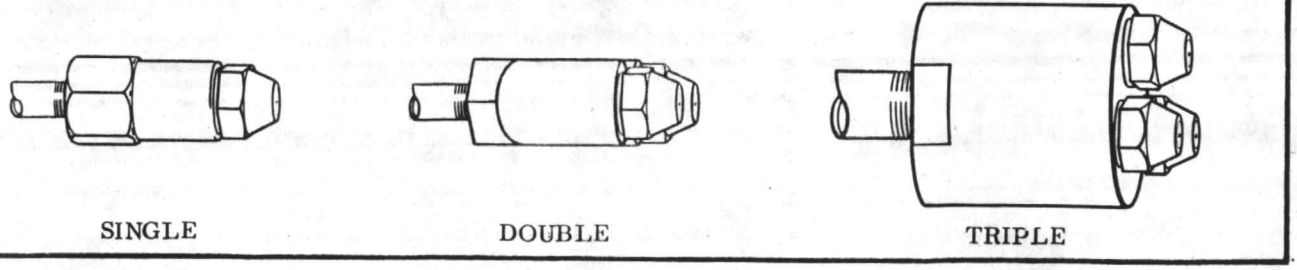
NOTE

The table at right shows the type of nozzle(s) used in the various Gordon-Piatt Energy Group oil systems which may have direct spark ignition.

OIL SYSTEM	TYPE NOZZLE	
	SIMPLEX	VARIFLOW
F1	x	
F4B	x	
F4H	x	
F6	x	
F6R	x	
F7		x
F7T		x

NUMBER OF NOZZLES

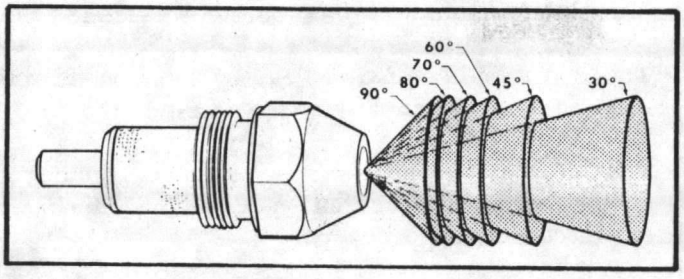
The number of nozzles used varies by application except for the F7T oil system which always has three variflow nozzles. The use of multiple nozzles inturn normally requires the use of an air diffuser with a larger center hole diameter to preclude impingement of the oil on the diffuser cone.



NOZZLE ARRANGEMENTS

NOZZLE SPRAY ANGLES

There are a number of commerically available nozzles with different spray angles. Like the number of nozzles used, the spray angle also varies by application. Replacement nozzles should always have the same spray angle as those being replaced.

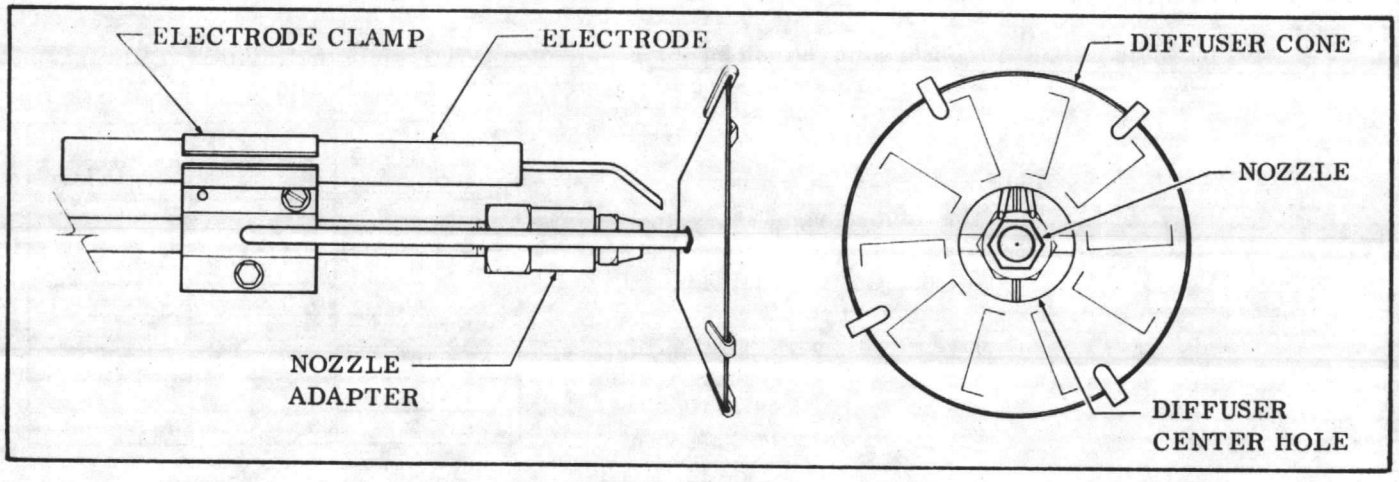


NOTE

Gordon-Piatt Energy Group pressure atomizing burners use only Delavan brand oil nozzles.

AIR DIFFUSER CENTER HOLE DIAMETER

Center hole diameters vary by the number of nozzles used, the nozzle spray angle and the velocity of the combustion air. This is determined at the factory by application but from time to time the diffuser and nozzle spray angle may be changed in the field to obtain best results.



TYPICAL AIR DIFFUSER, NOZZLE AND ELECTRODE ARRANGEMENT

ADJUSTMENT PROCEDURE

CAUTION

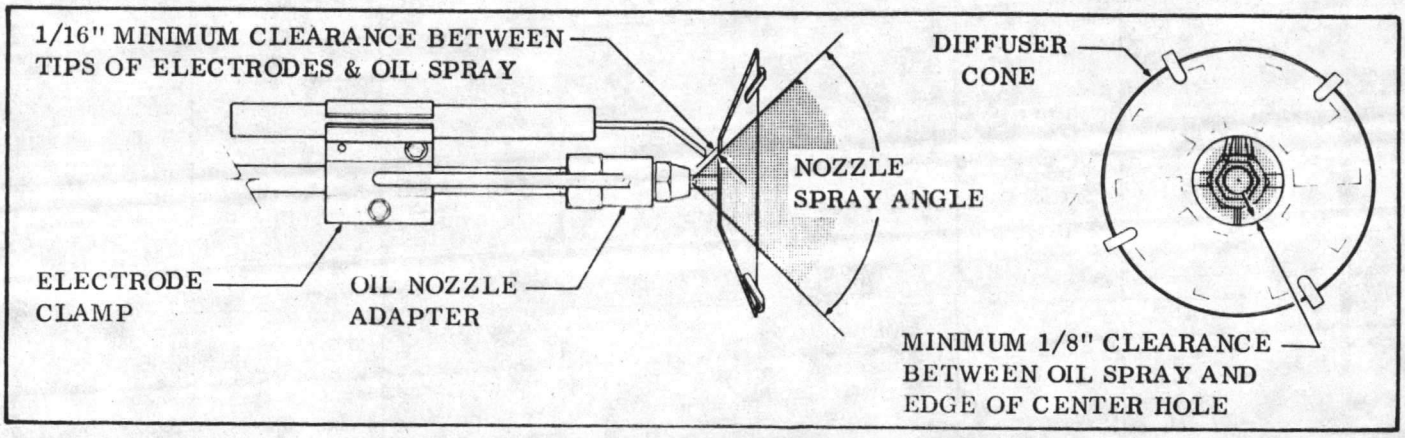
The final adjustments must not allow the fuel oil to impinge on the air diffuser or oil ignition electrodes.

There are two adjustments which control the function of the direct spark oil ignition system:

1. The location of the nozzle in relation to the air diffuser.
2. The location of the ignition electrodes in relation to the nozzle.

The ultimate objective of these adjustments is to:

1. Position the nozzle so that the fuel oil spray clears the inside hole diameter of the air diffuser by at least one-eighth (1/8) inch.
2. Position the tips of the oil ignition electrodes so they are within one-sixteenth (1/16) inch of the fuel oil spray.



OPTIMUM ADJUSTMENTS

The following dimensional data applies to the adjustment of the JACOB'S LADDER type ignition electrodes used on Gordon-Piatt Energy Group burners since November, 1975.

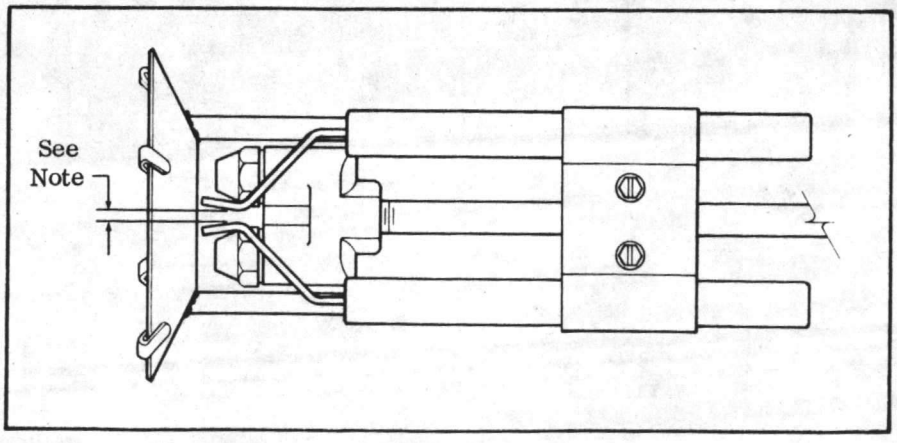
A. Determine These Things:

1. Center hole size in your air diffuser.
2. The type of nozzle used, simplex or variflow.
3. The nozzle spray angle.
4. The number of nozzles used, one, two or three.

B. Refer to the following dimensional data table and typical oil nozzle arrangements illustration for adjustments.

NOTE

The spark gap between electrodes is 1/8" for 12,000 volt transformers and 1/16" for 10,000 volt transformers.



SPARK GAP

DIMENSIONAL DATA

DIFFUSER CENTER HOLE SIZE	NOZZLE DATA			ADJUSTMENT SETTINGS (SEE ILLUSTRATIONS)		
	TYPE	SPRAY ANGLE	QUANTITY	A	B	C
1	Simplex	30°, 45°, 60°	1	1/4	1/8	3/8
1-3/8	Simplex	90° 60°	1 1	1/4 3/8	3/16 1/4	7/16
1-1/2	Simplex	90° 60°	1 1	3/8 5/8	3/16 1/4	7/16
1-3/4	Simplex	90° 60° 90° 60°	1 1 2 2	7/16 5/8 1/16 5/16	3/16 1/4 Flush 1/4	7/16
1-13/16	Simplex	90° 60° 90° 60°	1 1 2 2	7/16 3/4 1/4 7/16	3/16 1/4 3/16 3/16	7/16
2-1/16	Simplex	90° 60°	2 2	1/4 9/16	1/4 5/16	7/16
	Variflow	90° 60° 45°	1 1 1	9/16 7/8 1-3/8	5/16 1/2 3/4	1/2
		90° 60° 45° 30°	3 3 3 3	1/4 3/8 1/2 1/2	5/16 7/16 1/2 1/2	5/8
2-1/4	Simplex	90° 60°	2 2	3/8 9/16	1/4 5/16	7/16
		90° 60°	3 3	1/4 3/8	5/16 7/16	1/2
	Variflow	90° 60°	3 3	1/4 7/16	5/16 7/16	5/8

[1] All dimensions shown are in inches.

Regardless of dimensions shown, there should be NO IMPINGEMENT of the oil on the ignition electrodes or air diffuser.

CAUTION

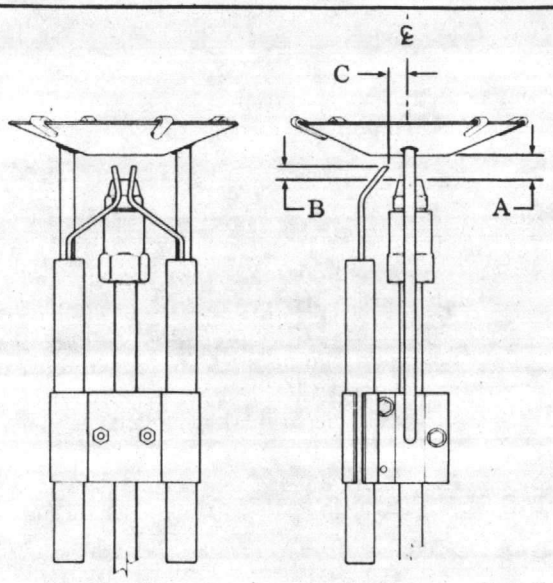
Manufacturing tolerances in both the nozzle and the oil drawer assembly may cause variations in the above dimensions.

It is recommended that after all adjustments have been made and the burner has been test fired that the oil drawer assembly be removed and examined for wetting or excessive carbon build-up. Evidence of these conditions requires re-adjustment.

NOTE

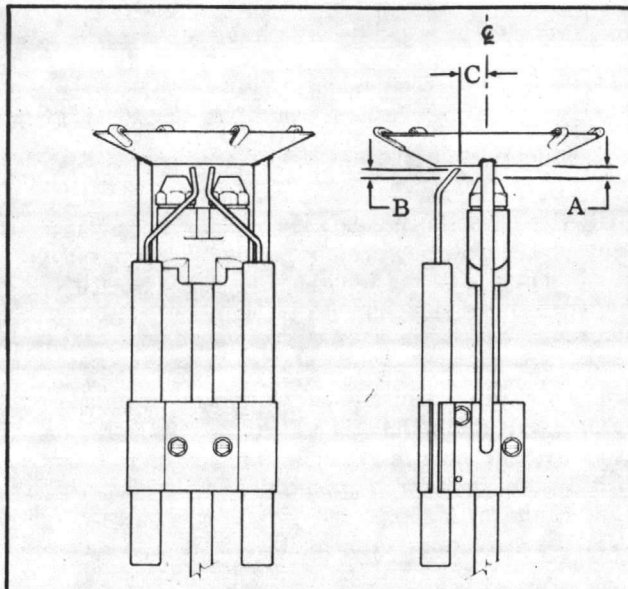
See Next Page for Illustrations

TYPICAL OIL NOZZLE ARRANGEMENTS



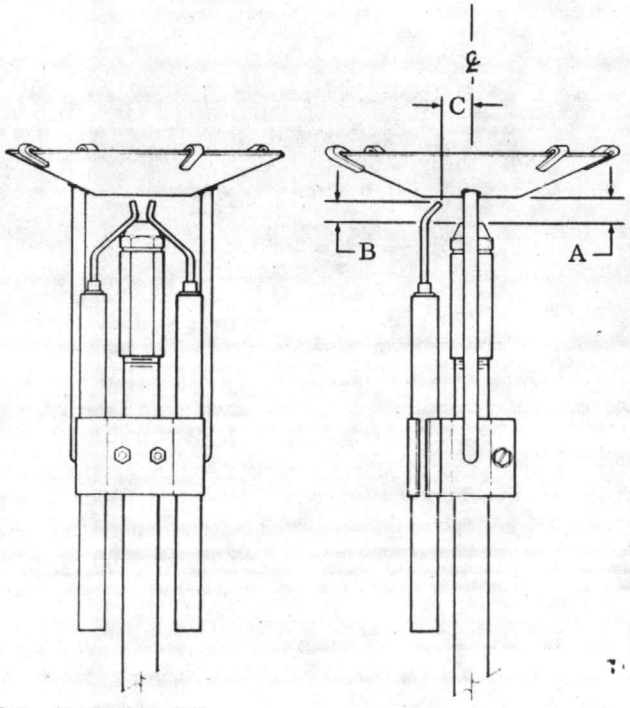
OIL SYSTEMS F1, F4B, F4H & F6

SINGLE SIMPLEX



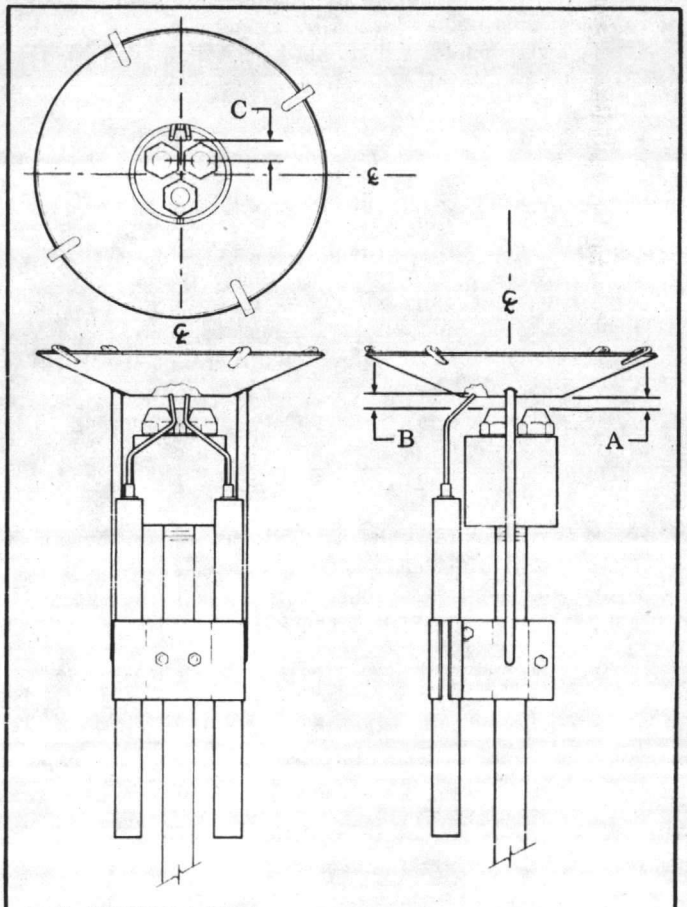
OIL SYSTEMS F1, F4B, F4H & F6

DUAL SIMPLEX



OIL SYSTEM F7

SINGLE VARIFLOW



OIL SYSTEM F7T

TRIPLE VARIFLOW

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 within 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, it should be adjusted so that it will recycle (or shutdown) the burner when oil pressure drops by 10 to 15%.

SIMPLEX OIL SYSTEMS F1, F4B, F4H, F6 & F6R

NOTE

With exception of "F1", these oil systems have low fire start.

a. After the low and high fire rates have been established and recorded, set the low oil pressure switch 10 to 15% below the low fire rate (pressure).

b. With the burner at low fire, slowly adjust the oil pressure regulator to a lower pressure making sure the low oil pressure switch recycles (or shuts down) the burner as the pressure drops below the setting.

c. Adjust the oil pressure regulator so that the firing rates (pressures) that were recorded in step a. are restored.

BYPASSING OIL SYSTEMS F7 AND F7T

NOTE

These oil systems operate at 300 PSIG

a. Set the low oil pressure switch at 270 PSI.

b. With the burner at low fire, slowly adjust the oil pressure regulator to a lower pressure making sure the low oil pressure switch recycles (or shuts down) the burner as the pressure drops below 270 PSIG as read on the oil pressure gauge at the oil drawer assembly.

c. Adjust the oil pressure regulator so that the firing rate (pressure) of 300 PSIG is restored.

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.

WARNING

Turn OFF the main manual fuel shutoff valves including pilot gas cock, if applicable. If a multi-fuel burner, shut OFF all fuels.

Turn OFF all electrical disconnects to the burner and any other equipment or systems electrically interlocked with the burner.

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.

c. Restore manual fuel valves and electrical disconnects to ON.

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 5.8 have been properly completed and all tests have been found to be satisfactory, the burner is now ready for normal oil firing operations.

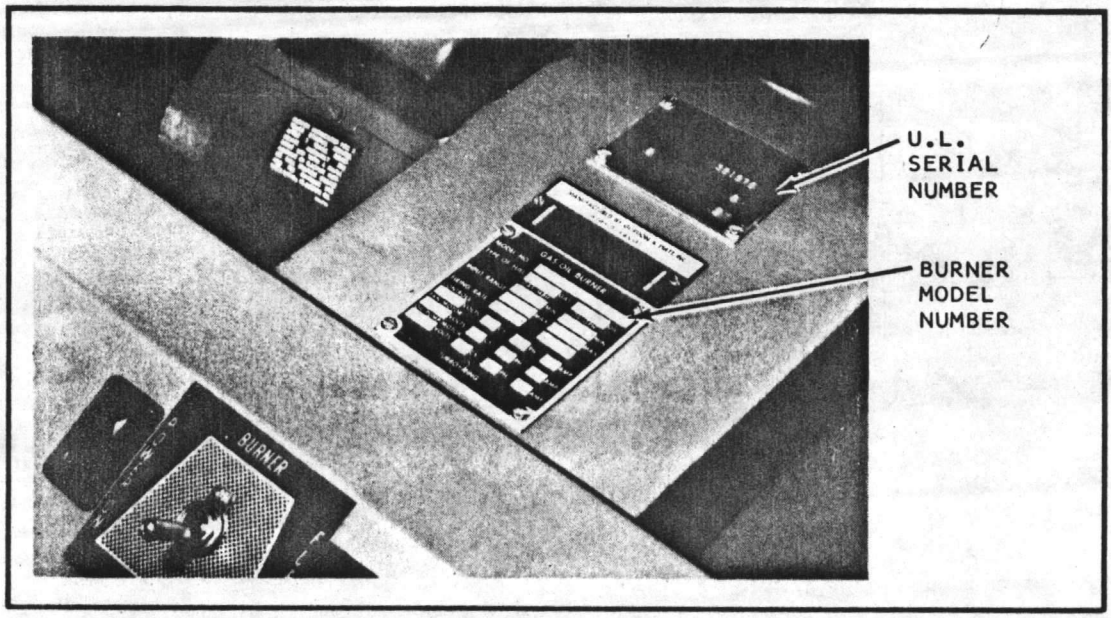
OIL FIRING NOTES

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.

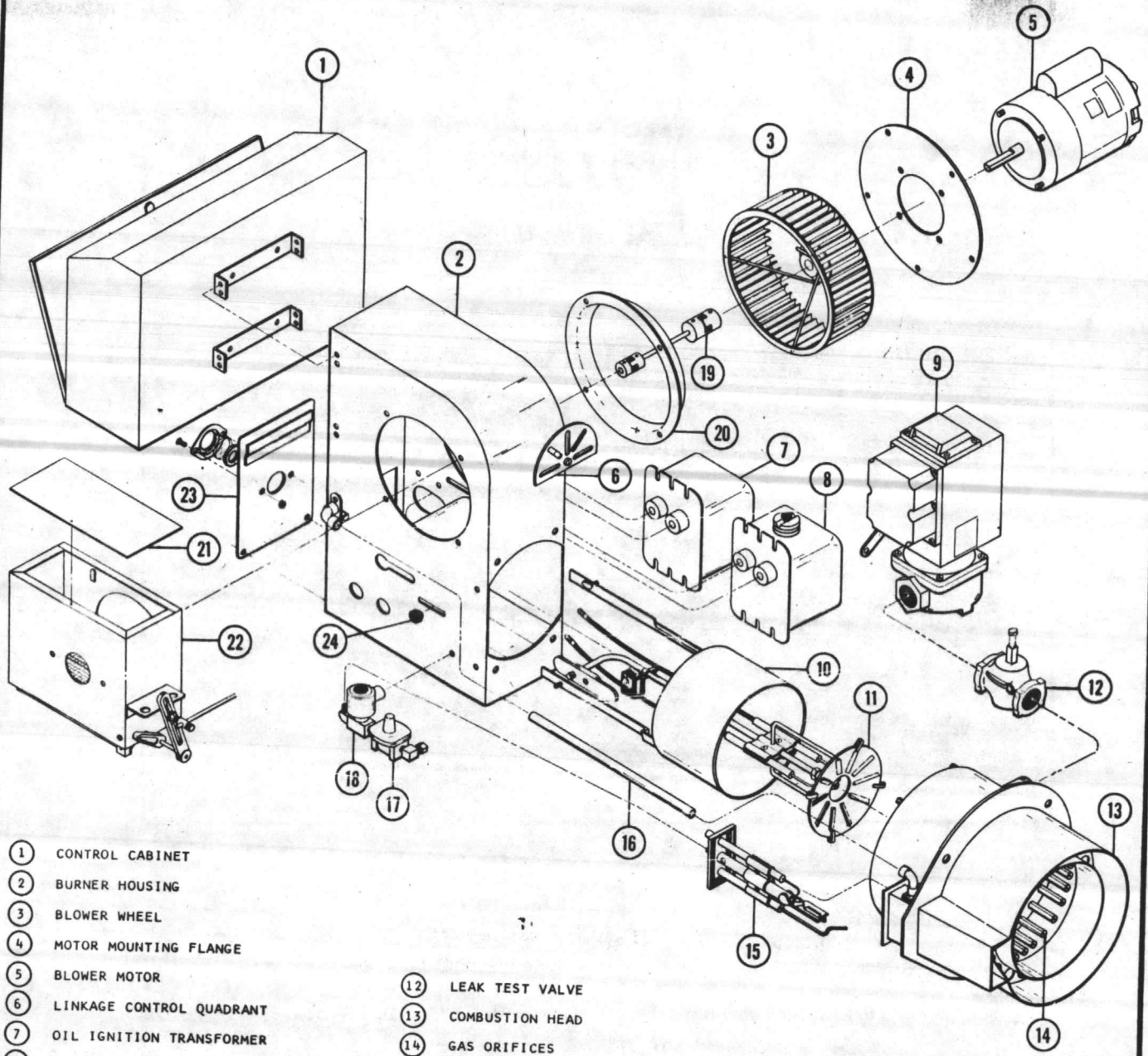
3. List the complete name and description of each part included in your order. Refer to the following illustration and particularly to the burner material list which accompanied your burner. List any specific characteristics such as size, voltage rating, etc.

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

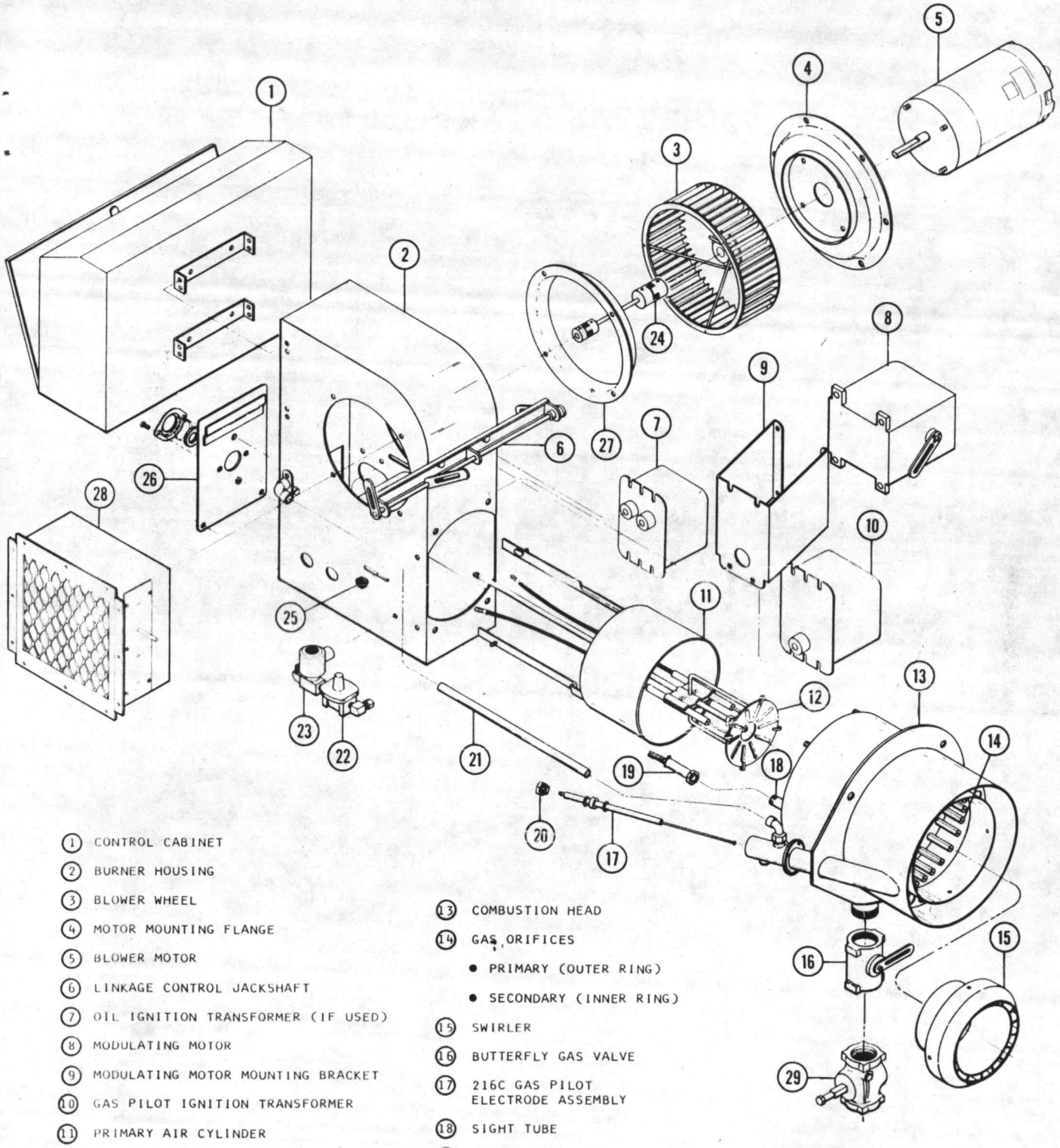
NOTE SEE PART IV FOR GAS SYSTEM COMPONENTS, PART V FOR OIL SYSTEM COMPONENTS AND PART VI FOR COMBUSTION CONTROLS



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
    - AIR INLET GUARD
23. BACK PLATE ASSEMBLY
24. PRIMARY AIR POSITIONING CONTROL KNOB

TYPICAL R12 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 JACKSHAFT
7. OIL IGNITION TRANSFORMER (IF USED)
8. MODULATING MOTOR
9. MODULATING MOTOR MOUNTING BRACKET
10. GAS PILOT IGNITION TRANSFORMER
11. PRIMARY AIR CYLINDER
12. OIL DRAWER ASSEMBLY
    - AIR DIFFUSER
    - OIL NOZZLE
    - OIL NOZZLE ADAPTER
    - OIL IGNITION ELECTRODES (IF USED)
    - MAIN FUEL TUBE
    - IGNITION CABLES (IF USED)
13. COMBUSTION HEAD
14. GAS ORIFICES
    - PRIMARY (OUTER RING)
    - SECONDARY (INNER RING)
15. SWIRLER
16. BUTTERFLY GAS VALVE
17. 216C GAS PILOT ELECTRODE ASSEMBLY
18. SIGHT TUBE
19. FLAME DETECTOR
20. 216C PILOT PACKING NUT
21. PILOT AIR TUBE
22. PILOT GAS PRESSURE REGULATOR
23. PILOT GAS SOLENOID VALVE
24. BURNER OIL PUMP COUPLING (IF USED)
25. PRIMARY AIR POSITIONING CONTROL KNOB
26. BACK PLATE ASSY
27. AIR INLET CONE
28. AIR INLET BOX
29. LEAK TEST VALVE

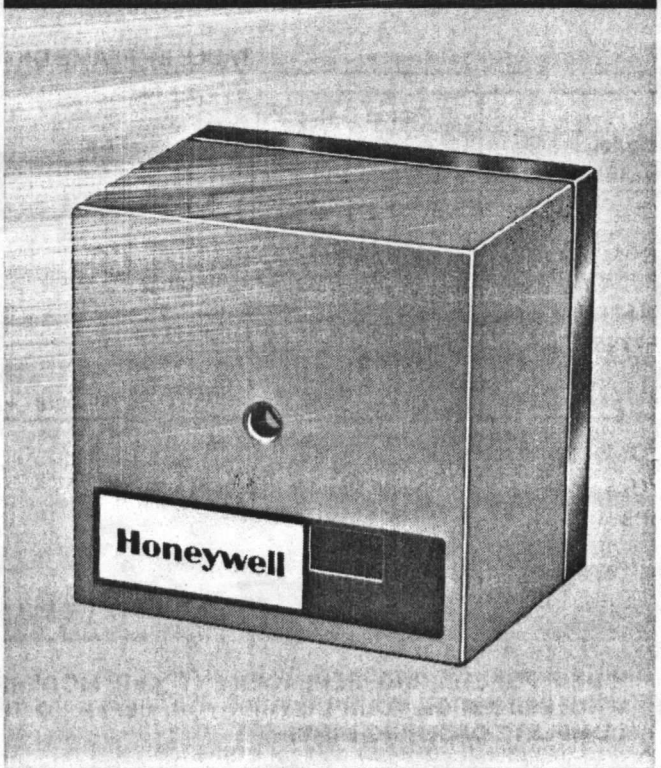
PART X

SUPPLEMENTARY DATA

This manual should be kept with other literature on your boiler room equipment as a complete reference source for maintenance and service.

Honeywell

FLAME SAFEGUARD PRIMARY CONTROLS



R7795A,B,C,D

THE R7795 FLAME SAFEGUARD PRIMARY CONTROL PROVIDES FLAMEOUT PROTECTION PLUS AUTOMATIC CONTROL OF COMMERCIAL AND INDUSTRIAL GAS AND OIL BURNERS. MODELS PROVIDE INTERMITTENT PILOT OR INTERRUPTED PILOT WITH DELAYED MAIN VALVE.

- ☐ Integral solid state color-coded flame amplifiers: R7795A,C for ultraviolet detection systems (purple). R7795B,D for rectification detection systems (green).
- ☐ Solid state plug-in ST795A Purge Timers provide prepurge timings of 1.5, 7, 10, 30, 60, or 90 seconds.
- ☐ Includes terminals for connection of a line voltage airflow switch to prove airflow from the start of prepurge through the run period.
- ☐ Mounts on a Q795A Subbase with 2 captive screws. All electrical connections are automatically provided between the device and subbase. Wiring terminals are accessible for testing.
- ☐ Meter jack on amplifier board for measuring flame signal with system in operation.
- ☐ Internal light-emitting diode (LED) indicates presence of flame signal.
- ☐ Field selectable 10 or 4 second trial for pilot flame ignition.
- ☐ Powered alarm terminal to operate an external line voltage alarm on safety lockout.
- ☐ R7795 models are available with either intermittent pilot (interrupted ignition) or interrupted pilot and delayed main valve.
- ☐ Run-Test switch on interrupted pilot/delayed main valve models.
- ☐ Safe-start feature prevents startup with lockout if flame or a flame simulating failure exists.
- ☐ Recycle or lockout on flame failure is field selectable.
- ☐ Safety switch must be manually reset after lockout.
- ☐ Meets Underwriters Laboratories, Canadian Standards Association, and Factory Mutual requirements.

R.J.
5-84●

Form Number 66-2001

SPECIFICATIONS

TABLE I—R7795 MODELS AVAILABLE

R7795	Flame Detection Type	Amplifier Color	Flame Establishing Period (sec)		Flame Failure		RUN/TEST Switch
			Pilot a	Main	Nominal Response (sec)	Device Reaction b	
R7795A	U.V.	Purple	10/4	Intermittent Pilot	3	Recycle or Lockout	No
R7795B	Rectification	Green					
R7795C	U.V.	Purple		10			Yes
R7795D	Rectification	Green					

a Field selectable:
10 sec with the orange jumper wire unclipped.
4 sec with the orange jumper wire clipped.

b Field selectable:
Recycle with the yellow jumper wire unclipped.
Lockout with the yellow jumper wire clipped.

TABLE II—FLAME DETECTION SYSTEMS

Model	Flame Detection Amplifier Type	Fuel	Applicable Flame Detectors	
			Type	Models
R7795A,C	Ultraviolet (purple)	Gas, oil	U.V. (Minipeeper)	C7027, C7035, C7044
R7795B,D	Rectification (green)	Gas	Rectifying flame rods	Holders:[a] C7004, C7007, C7011 Complete Assy.: C7005, C7008, C7009, Q179
		Oil	Rectifying photo cells[b]	C7003, C7010, C7013, C7014
		Gas, oil, coal	U.V. (Purple Peeper)	C7012A,C

[a]Order flame rod separately.

[b]Use Honeywell Photocell, Part No. 38316, only.

(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.

1. **Order Number.**
2. **Accessories, if required.**
3. **Order additional system components and accessories separately.**

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

1. **YOUR HONEYWELL RESIDENTIAL SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY).**
2. **RESIDENTIAL DIVISION CUSTOMER SERVICE**
   HONEYWELL INC., 1985 DOUGLAS DRIVE NORTH
   GOLDEN VALLEY, MINNESOTA 55422-3992 (612)542-7500

   (IN CANADA—HONEYWELL LIMITED/HONEYWELL LIMITEE, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9). INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

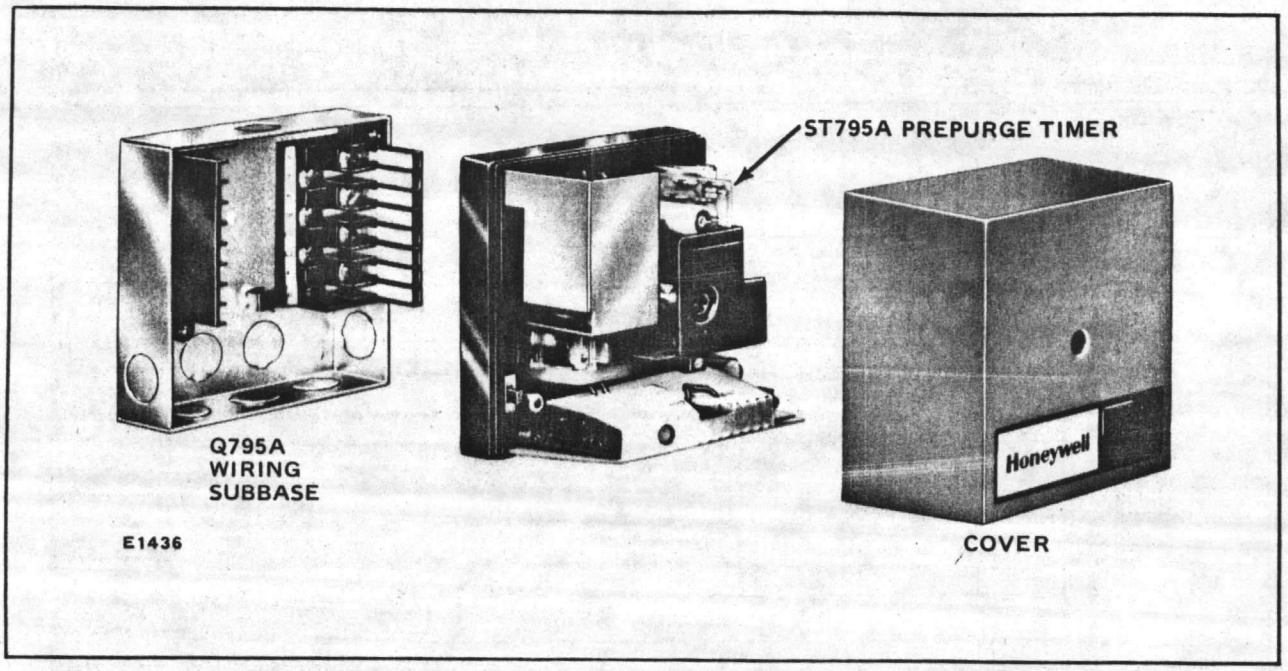


FIG. 1—R7795 SYSTEM COMPONENTS.

ELECTRICAL RATINGS:

Voltage and Frequency—120 Vac, (+10, −15%), 50/60 Hz.

Power consumption—
R7795A,C—17 VA (maximum).
R7795B,D—15 VA (maximum).

TABLE III—TERMINAL RATINGS

TERMINAL	LOAD	MAXIMUM RATING AT 120 Vac
5	Pilot Valve	125 VA pilot duty
18	Ignition	360 VA
6,7	Main Fuel Valve(s)	125 VA pilot duty or 25 VA pilot duty plus one or more motorized valves with a total rating of 500 VA opening, 250 VA holding
8	Fan or burner motor	9.8 A full load; 58.8 A locked rotor
9	Alarm	1.0 A

NOTE: Allowable inrush can be up to 10 times the pilot duty rating.

Example—Pilot duty rating =125 VA
At 120 V, running current is 125/120=1.05 A
Maximum allowable inrush is 10 times 1.05=10.5 A

AMBIENT TEMPERATURE RANGES:
Operating— −40 F [−40 C] to +135 F [+57 C].

FLAME FAILURE RESPONSE: 3 sec nominal.

DIMENSIONS: Approximately 5 x 5 x 5-1/4 in. [127 x 127 x 133.5 mm].

WEIGHT: 1-1/2 lb. [0.7 kg].

MOUNTING: Two captive screws in device for mounting onto Q795A subbase (order separately).

APPROVALS:
Underwriters Laboratories Inc. listed File No. MP268, Guide No. MCCZ.
Canadian Standards Association certification pending.
Factory Mutual Listing pending.

ACCESSORIES:
1. W136A Test Meter — (includes 196146 Meter Connector Plug).
2. 196146 Meter Connector Plug for older W136A Test Meters.
3. 123514A Flame Simulator for rectification systems.
4. 123514B Flame simulator for ultraviolet systems.
5. Q624A Solid State Spark Generator.
6. Q795A Wiring Subbase.
7. ST795A Plug-in Purge Timer—models available with 1.5, 7, 10, 30, 60, and 90 sec timings.
8. FSP5004A with adapter for operational check of the R7795.
9. R1061012 Ignition Cable for ignition installations in high temperature environments; rated at 350 F [177 C] for continuous duty, and up to 500 F [260 C] for intermittent use; tested to 20,000 volts RMS.
10. R1239001 High Tension Ignition Cable; for ignition installations in a contaminating environment; very resistant to severe conditions of oil, heat, and corona. Tested to withstand high voltages up to 25,000 volts RMS in a salt bath for 1 minute without breakdown. Rated at 200 F [93 C] for continuous duty, and up to 350 F [177 C] for intermittent use.
11. R1298020 Cable; for flame detector ("F" leadwire) installations in a high temperature environment; rated up to 400 F [204 C] for continuous duty; tested for operation up to 600 V and breakdown up to 7500 V.

DETAILED OPERATING SEQUENCE

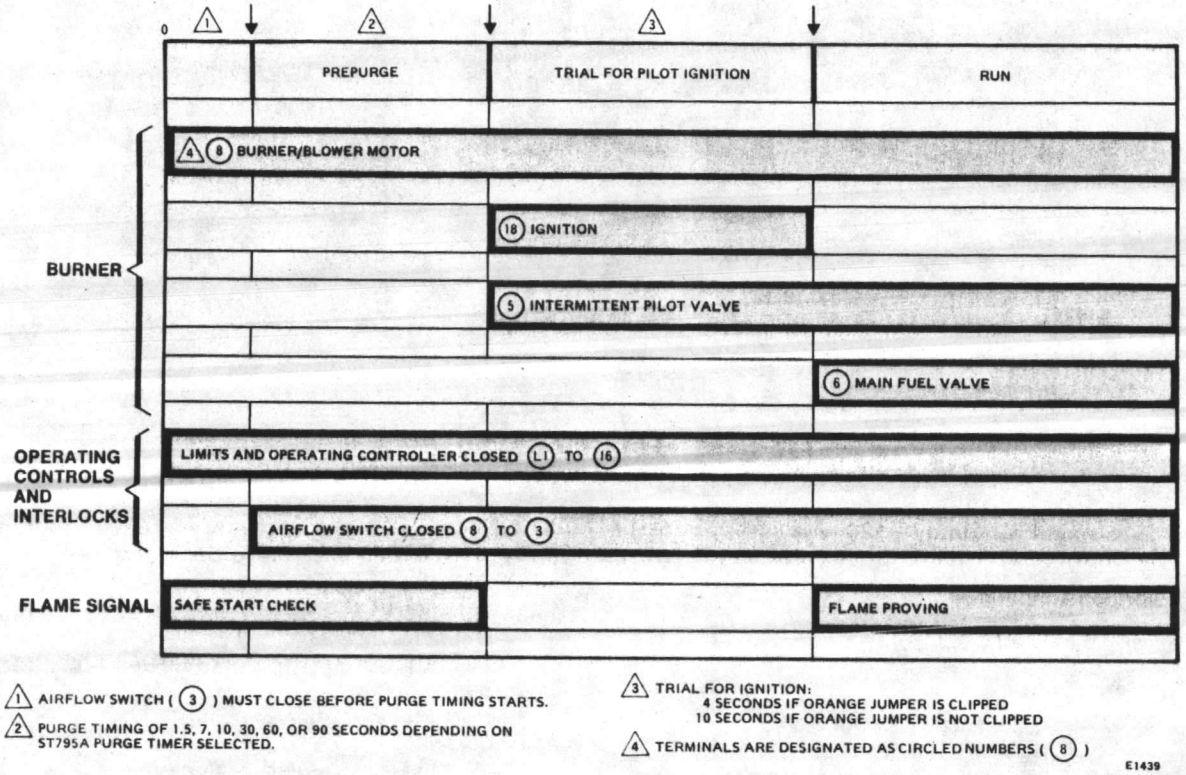


FIG. 2—OPERATING SEQUENCE FOR THE R7795A,B WITH INTERMITTENT PILOT.

The R7795A,B provides the following operational sequence when used with the appropriate flame detector.

STANDBY

The R7795 Primary Control is ready to start up when the burner controller closes (limits are closed).

NORMAL START-UP

1. With power applied (limits and controller closed and no flame signal present) the 3K relay pulls in and the burner motor (terminal 8) is energized.
2. As soon as the airflow switch closes (terminals 3 to 8), the ST795A Prepurge Timer starts to time out (prepurge begins).

NOTE: The ST795A Prepurge Timer returns to zero any time the airflow switch opens. The prepurge restarts when the airflow switch recloses.

3. PILOT FLAME ESTABLISHING PERIOD.
   At the end of prepurge (ST795A timed out) the 1K relay pulls in, energizing the ignition transformer (terminal 18) and the intermittent pilot valve (terminal 5). This starts the 10 or 4 second pilot flame establishing period. Safety shutdown and lockout will occur if presence of flame is not proven within:
   10 seconds if the ORANGE jumper IS NOT clipped.
   4 seconds if the ORANGE jumper IS clipped.
4. MAIN FLAME IGNITION TRIAL
   At the end of the pilot flame establishing period (10 or 4 seconds), and with pilot flame present the main valve (terminal 6) is energized.

The R7795 is now in the normal burner run mode of operation and will remain so until an external command directs it to do otherwise.

5. NORMAL SHUTDOWN
   When the burner controller opens, the pilot valve (terminal 5), the main valve (terminal 6) and the burner/blower motor (terminal 8) are immediately deenergized. The R7795 goes into the standby mode, terminating the operating cycle.

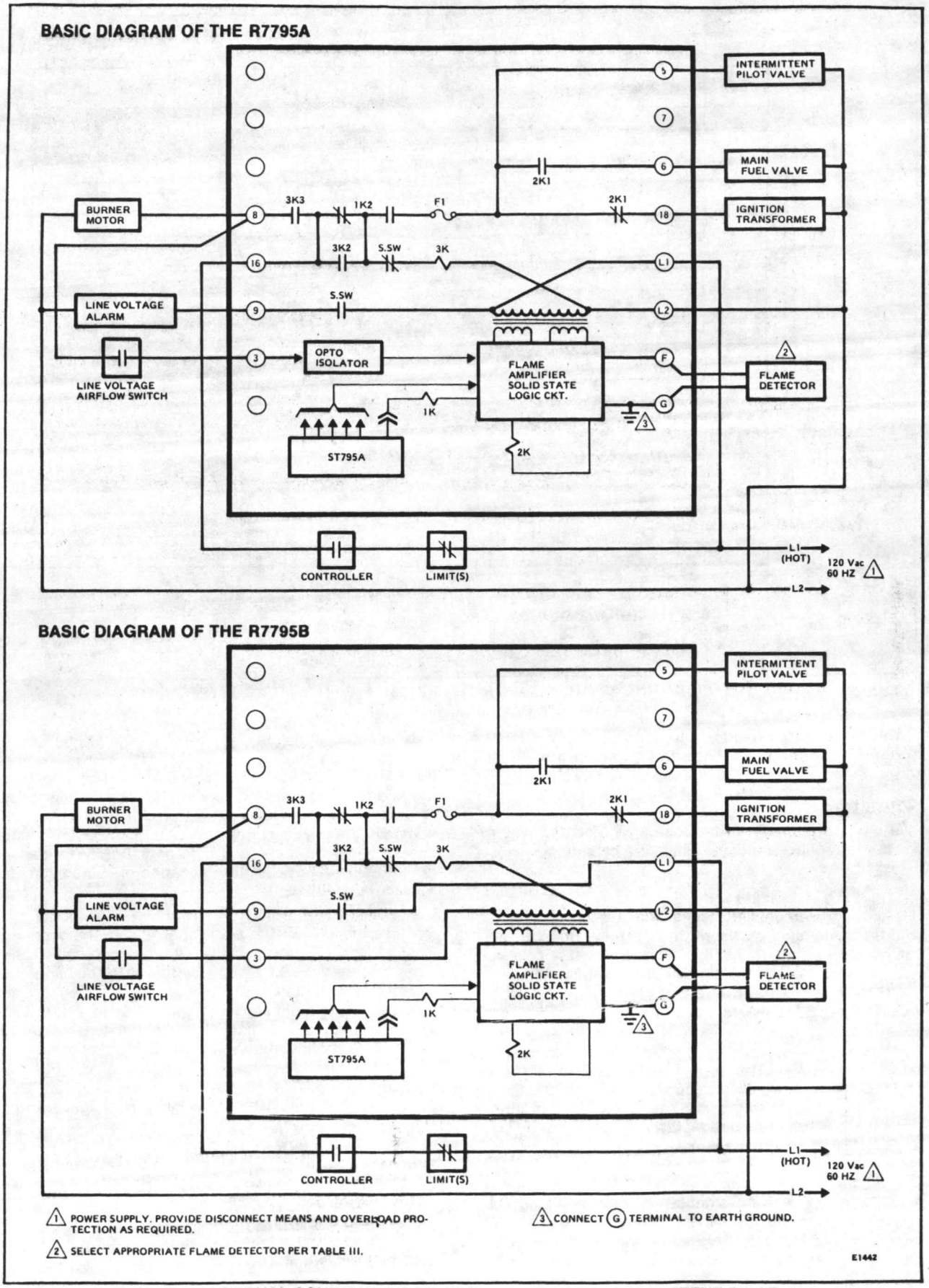


FIG. 3—INTERNAL SCHEMATIC OF THE R7795A,B WITH INTERMITTENT PILOT.

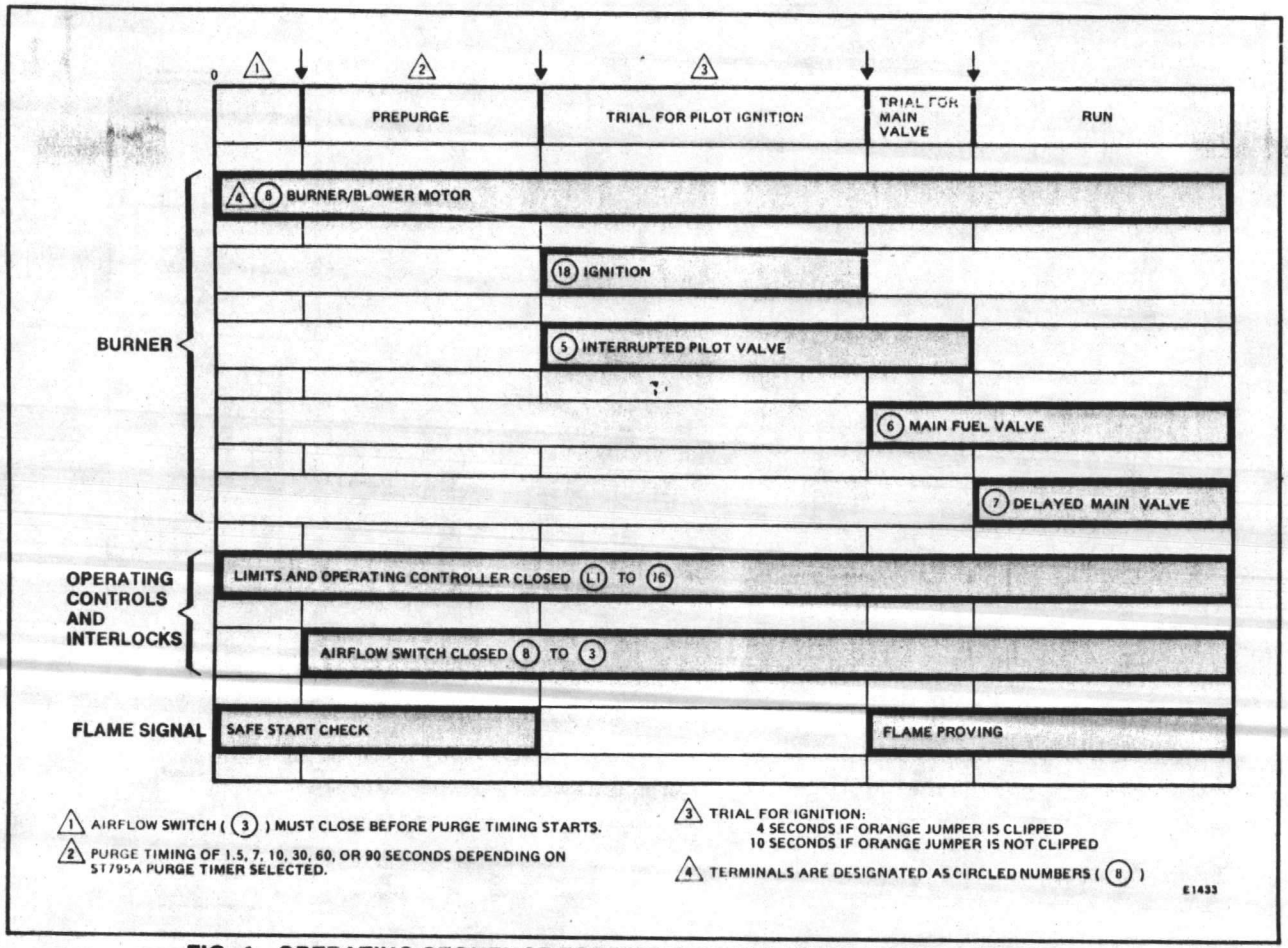


FIG. 4—OPERATING SEQUENCE FOR THE R7795C,D WITH INTERRUPTED PILOT.

The R7795C,D provides the following operational sequence when used with the appropriate flame detector.

STANDBY

The R7795 Primary Control is ready to start up when the burner controller closes (limits are closed).

NORMAL START-UP

1. With power applied (limits and controller closed and no flame signal present) the 3K relay pulls in and the burner motor (terminal 8) is energized.

2. As soon as the airflow switch closes (terminals 3 to 8) and with the RUN/TEST switch in the RUN position, the ST795A Prepurge Timer starts to time out (prepurge begins).

NOTE: The ST795A Prepurge Timer returns to zero any time the airflow switch opens or the RUN/TEST switch is moved to the TEST position. The prepurge restarts when the airflow switch recloses or the RUN/TEST switch is returned to the RUN position.

3. At the end of prepurge (ST795A timed out) the 1K and 4K relays pull in, simultaneously energizing the ignition transformer (terminal 18) and the interrupted pilot valve (terminal 5). This starts the 10 or 4 second pilot flame establishing period. Safety shutdown and lockout will occur if presence of flame is not proven within:

10 seconds if the ORANGE jumper IS NOT clipped.
4 seconds if the ORANGE jumper IS clipped.

If the RUN/TEST switch is moved to the TEST position during the pilot flame establishing period, the sequence is stopped in trial for pilot flame. The safety switch heater is energized during this pilot flame establishing period whenever flame is not present. Safety shutdown and lockout will occur if the absence of flame exceeds 15 seconds (nominal).

4. MAIN FLAME IGNITION TRIAL

At the end of the pilot flame establishing period (10 or 4 seconds), with pilot flame present, and the RUN/TEST switch in the RUN position the ignition transformer (terminal 18) is deenergized and the main valve (terminal 6) is energized starting the main flame ignition trial.

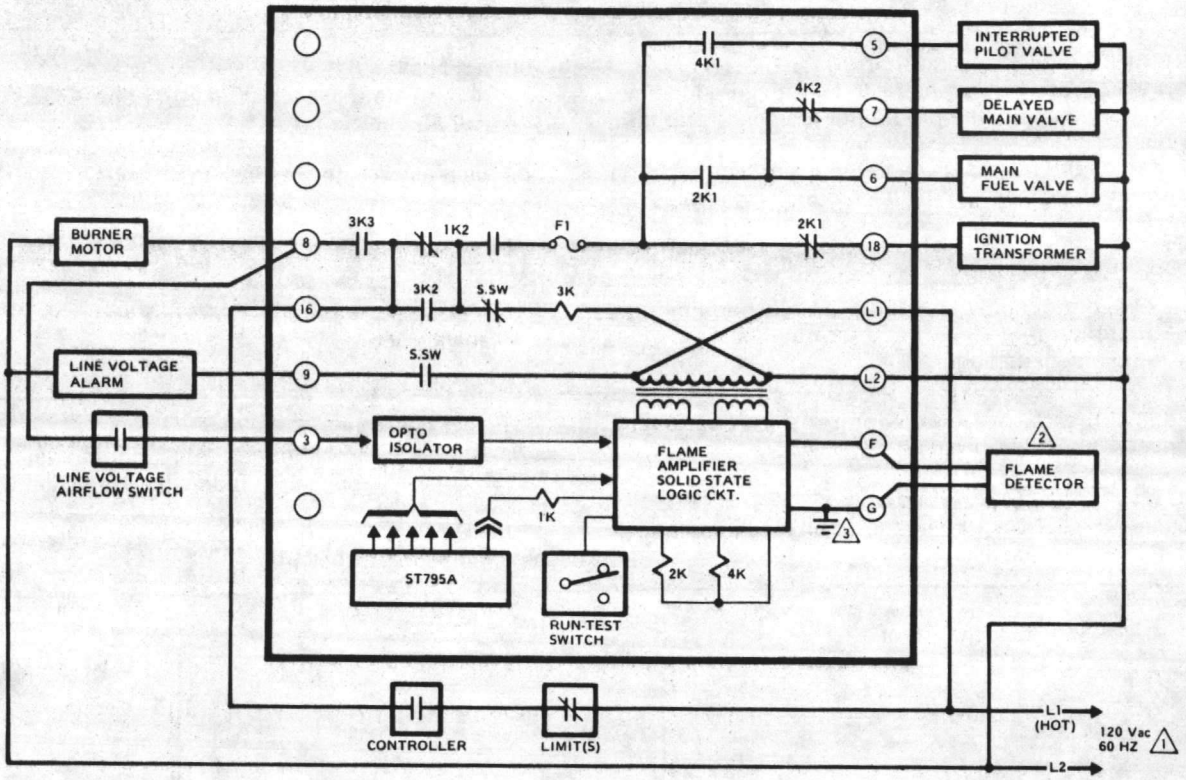
Ten seconds into the main flame ignition trial the pilot valve (terminal 5) is deenergized and the delayed main valve (terminal 7) is energized. This completes the 10 second main flame ignition trial period.

The R7795 is now in the normal burner run mode of operation and will remain so until an external command directs it to do otherwise.

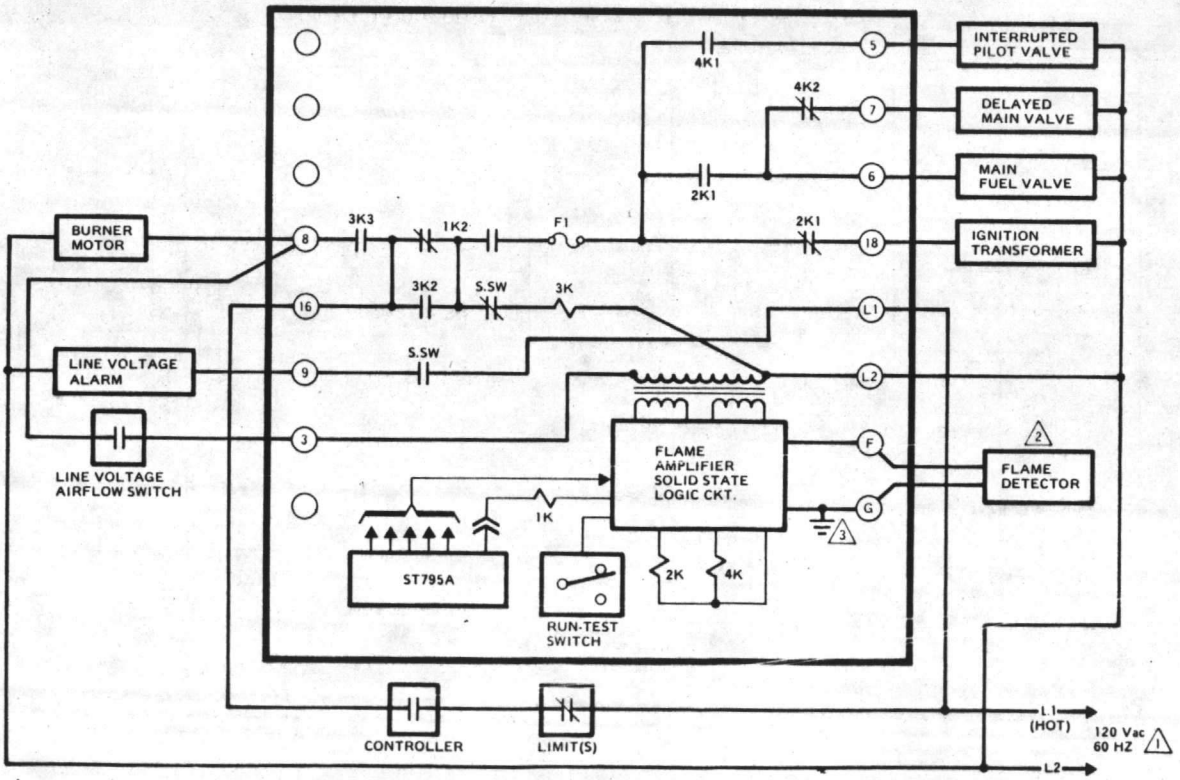
5. NORMAL SHUTDOWN

When the burner controller opens, the main valve(s) (terminals 6 and 7) and the burner/blower motor (terminal 8) are immediately deenergized. The R7795 goes into the standby mode, terminating the operating cycle.

BASIC DIAGRAM OF THE R7795C



BASIC DIAGRAM OF THE R7795D



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 SELECT APPROPRIATE FLAME DETECTOR PER TABLE III.

3 CONNECT (G) TERMINAL TO EARTH GROUND.

E1441

FIG. 5—INTERNAL SCHEMATIC OF THE R7795C,D WITH INTERRUPTED PILOT.

INSTALLATION

WHEN INSTALLING THIS PRODUCT. . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced flame safeguard technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

1. Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.
2. Perform a thorough checkout before leaving installation.

Follow the burner manufacturer's instructions if supplied. Otherwise, proceed as follows.

MOUNTING THE SUBBASE

Locate the subbase where the ambient temperature is within the specified limits.

The Q795A subbase may be mounted in any angle such that condensation cannot accumulate in the R7795 cover. See Fig. 6 for mounting dimensions of the Q795A subbase.

Use the Q795A subbase as a template to mark the mounting screw locations.

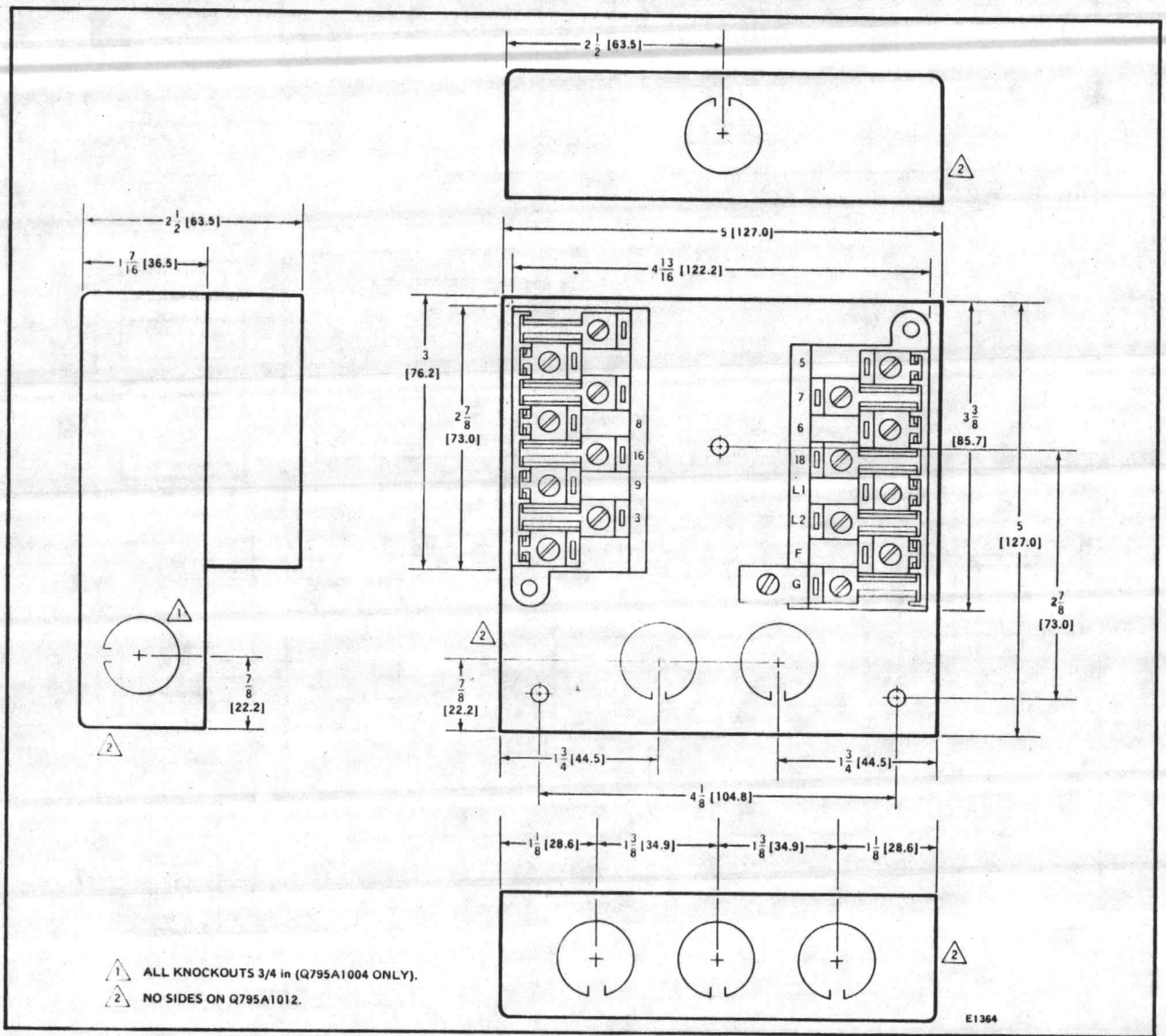


FIG. 6—MOUNTING DIMENSIONS OF THE Q795A SUBBASE ARE SHOWN IN in. [mm ARE SHOWN IN BRACKETS].

WIRING TO THE SUBBASE

1. Disconnect power supply before beginning installation to prevent electrical shock or equipment damage. All wiring connections to the subbase must comply with applicable codes, ordinances, and regulations. All wiring to the subbase must be NEC Class 1 (line voltage) wiring.

2. For *normal installations* use moisture resistant wire suitable for at least 194 F [90 C].

3. For *high temperature* applications, use moisture resistant wire selected for a temperature rating above the maximum operating temperature for all but the ignition and "F" leadwires.

   a. *For the ignition* use Honeywell Spec No. R1061012 Ignition Cable or equivalent. (This wire is rated at 350 F [175 C] for continuous duty and up to 500 F [260 C] for intermittent use.)

   b. *For the flame detector "F" leadwire* use Honeywell Spec No. R1298020 or equivalent. (This wire is rated up to 400 F [205 C] for continuous duty. It is tested for operation up to 600 volts and breakdown up to 7500 volts.)

IMPORTANT

To avoid possible ignition interference and nuisance shutdowns, do not run high voltage ignition transformer wires in the same conduit with the flame detector wiring.

5. *For ignition installations in a contaminating environment* use Honeywell Spec No. R1239001 High Tension Ignition Cable or equivalent. This wire is very resistant to severe conditions of oil, heat, and corona, and is tested to withstand high voltages up to 25,000 volts RMS in a salt bath for 1 minute without breakdown. It is rated at 200 F [93 C] for continuous duty and up to 300 F [175 C] for intermittent use.)

WIRING HOOKUPS

The following typical wiring hookups show the connections to the Q795A subbase.

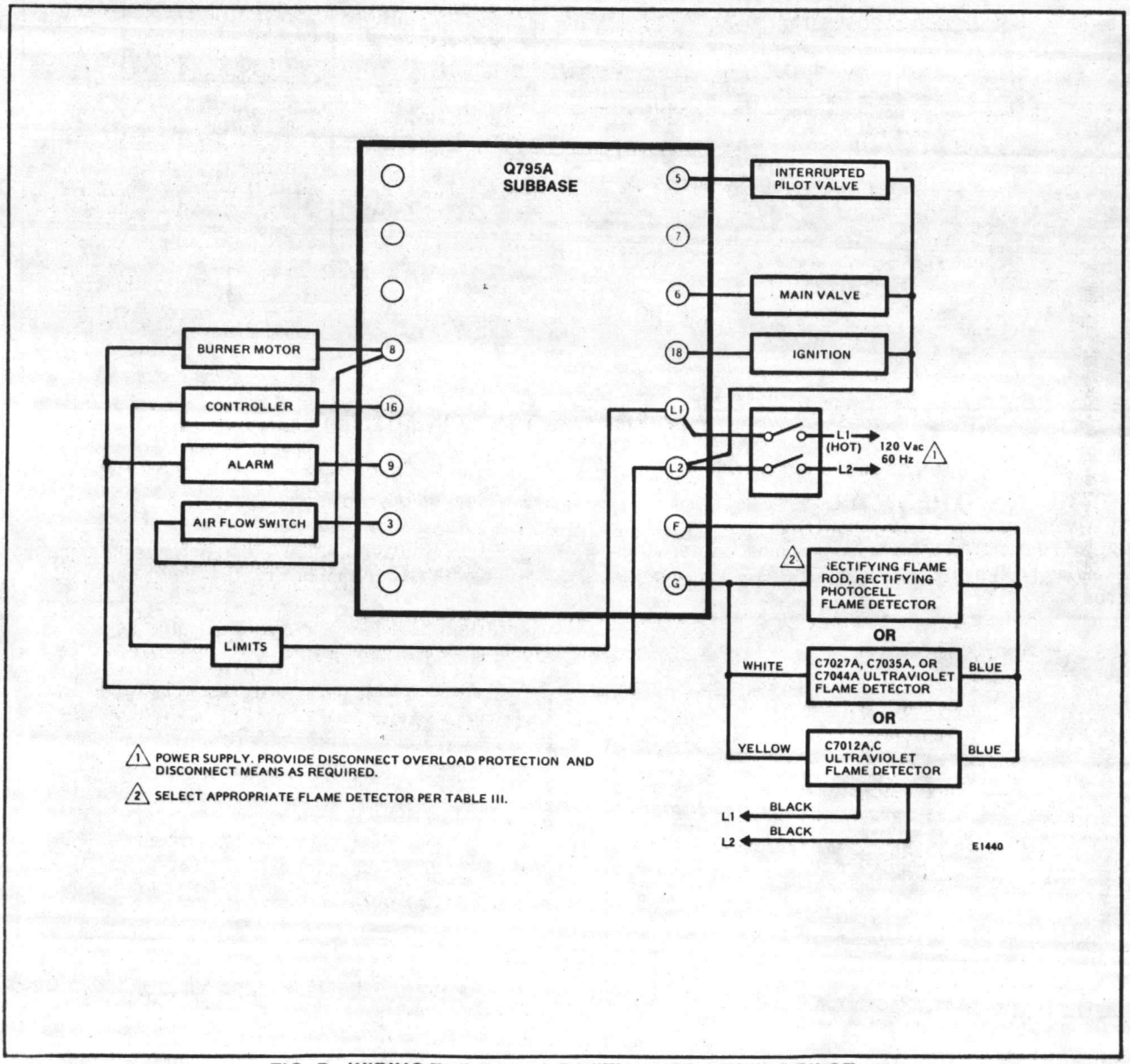


FIG. 7—WIRING THE R7795A,B WITH INTERMITTENT PILOT.

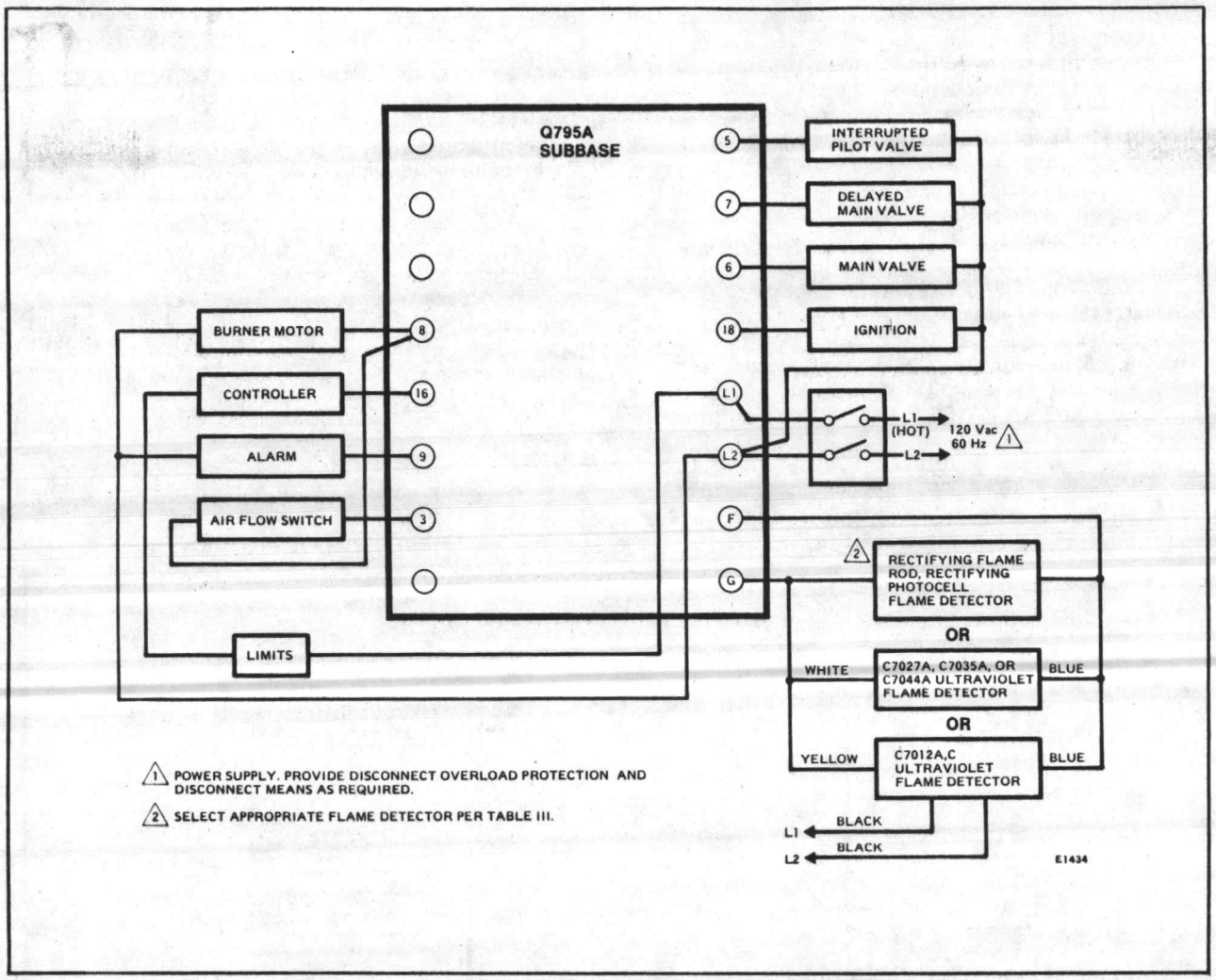


FIG. 8—WIRING THE R7795C,D WITH INTERRUPTED PILOT.

INSTALLING THE R7795

1. Remove the cover from the R7795.
2. Position the R7795 over the terminal barrier strips as shown in Fig. 1 and press the R7795 onto the subbase.

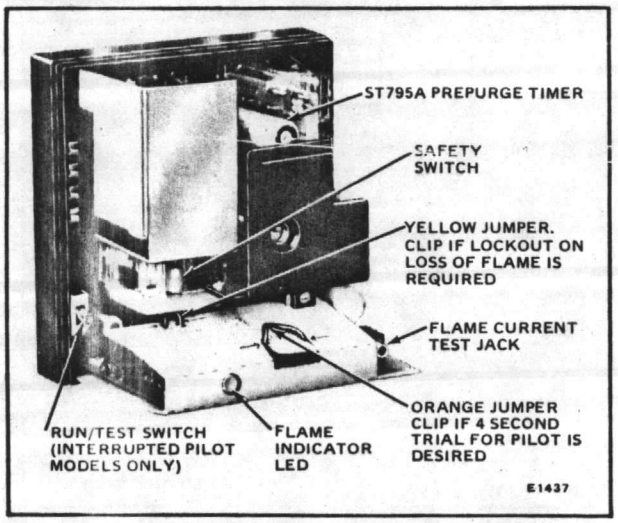


FIG. 9—LOCATION OF R7795 JUMPERS.

3. Tighten the 2 captive screws.

NOTE: Do not overtighten these screws. Maximum recommended torque is 10 lb.-in. (1.13 N·m).

4. Install the ST795A Purge Timer into its slot (see Fig. 9).

CAUTION

CLIPPING THE JUMPER WIRE(S) TO SELECT ONE OR BOTH OF THE FOLOWING OPTIONS IS NONREVERSIBLE:

1. 4 second pilot flame trial (clip orange jumper, see Fig. 9).
2. Lockout on loss of flame (clip yellow jumper wire, see Fig. 9).

NOTE: To prevent the ends of the clipped jumper wire from touching each other, make sure that the jumper is clipped in two places. To prevent internal electrical shorts DO NOT allow the clipped portion of the jumper to fall into the R7795.

CHECKOUT

WARNING

IF FUEL ENTERS THE COMBUSTION CHAMBER FOR MORE THAN A FEW SECONDS WITHOUT IGNITING, AN EXPLOSIVE MIXTURE COULD RESULT. THE FOLLOWING TIME LIMITS ARE RECOMMENDED:
Trial for PILOT: 10 seconds.
Trial for MAIN FLAME: 5 seconds.
In any case, DO NOT EXCEED THE MANUFACTURER'S SPECIFIED NORMAL LIGHTOFF TIME. Close the manual main fuel shutoff valves if the flame is not burning at the end of the specified time.

CAUTION

1. Use the utmost care when checking the system. Line voltage is present on most terminals when power is on.
2. Open the master switch before installing or removing the R7795 on the subbase, before installing or removing any jumpers, or before making any adjustments.
3. Make sure *all* manual fuel shutoff valves are closed before starting the Initial Lightoff Check or the Pilot Turndown Test.
4. If the low fuel pressure limits are bypassed for any of the tests, make sure that the jumpers are removed before putting the system into operation.
5. Do not put the system into operation until you have satisfactorily completed all applicable tests described in this section and any others required by the burner manufacturer.

EQUIPMENT REQUIRED

1. Voltmeter (Honeywell W136A or equivalent)—with 0 to 300 Vac scale.

2. Microammeter (Honeywell W136A or equivalent)—with 0 to 25 microamp range and SPL scale with damping.

3. Meter connector plug—Part No. 196146 or equivalent.

4. Jumper wires (2)—No. 14 wire, insulated, 12 in. [304.8 mm] long, with insulated alligator clips at both ends.

5. Manometer (or pressure gauge)—to measure pilot gas pressure.

6. Thermometer or thermocouple—to measure temperatures at the flame detector.

CHECKOUT SUMMARY

The following list summarizes the checkout tests required for each type of installation. Instructions for each test are included in this section; also consult the burner installation instructions.

- Preliminary inpsection—all installations.
- Flame signal measurement—all installations.
- Initial lightoff check for proved pilot—all installations using proved pilot.
- Initial lightoff check for direct spark ignition of oil—oil burners not using a pilot.
- Pilot turndown test—all installations using a pilot.
- Ignition interference test—all installations using a flame rod.
- Hot refractory hold-in test—all installations using a rectifying photocell.
- Ultraviolet response test—all installations using ultraviolet flame detectors.
- Flame signal with hot combustion chamber—all installations.
- Safe shutdown tests—all installations.

Refer to Figs. 7 and 8 for terminal locations, and to Figs. 1 and 9 for the location of component parts. Remove the device cover by loosening the screw.

PRELIMINARY INSPECTION

Perform this inspection to avoid common problems. Make certain that:

1. Wiring connections are correct and all terminal screws are tight.

2. The flame detector(s) is (are) clean and installed and positioned properly. Consult the installation instructions for the flame detector.

3. The burner is completely installed and ready to fire (consult the manufacturers instructions); fuel lines are purged of air.

4. Combustion chamber and flues are clear of fuel and fuel vapors.

5. Power is connected to the master disconnect switch.

6. Lockout switch is reset (push in and release the reset button).

7. RUN/TEST switch is in the RUN position (interrupted pilot models only).

8. System is in the standby condition.

9. All limits and interlocks are reset.

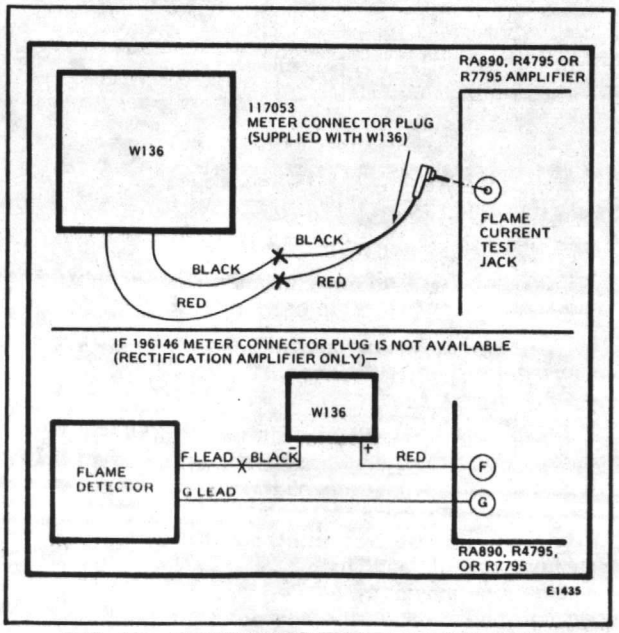


FIG. 10—MEASURING THE FLAME SIGNAL.

FLAME SIGNAL MEASUREMENT (Figs. 9 and 10)

(All Installations)

The flame signal measurement is the best indicator of proper flame detector application. This check should be performed when:

—The system is initially set up.
—Any service is done to the system.
—At least once a month while the system is in operation.

This will prevent shutdowns due to poor flame signal. Use the 196146 Meter Connector and a W136A meter (or equivalent). Connect the RED plug-in tip to the RED (+) meter lead and the BLACK plug-in tip to the BLACK (−) meter lead. Insert the gray plug into the amplifier flame current jack on the R7795 amplifier board (see Fig. 9). When reading the flame current, ensure that 2 important criteria are met:

1. The flame current must be steady. The meter reading must not vary by more than the needle width.

2. The flame current must be at least 2 microamperes for the R7795B,D models and at least 3.5 microamperes for the R7795A,C models (refer to Table IV).

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

1. Check the supply voltage at terminals L1-L2 on the wiring subbase. Make sure the master switch is closed, connections are correct, and the power supply is the correct voltage and frequency.

2. Check the flame detector wiring for defects, including—
—incorrect connections.
—wrong type or size of wire.
—deteriorated wire.
—open circuits.
—short circuits.
—high resistance shorts caused by accumulated moisture, soot or accumulated dirt.

3. For a flame rod make sure that—
—there is enough ground area.
—the flame rod is located in the flame properly.
—temperature at the flame rod insulator is no greater than 500 F [260 C].
—there is no ignition interference (see the ignition interference test in this section).

4. For all other detectors, clean the detector lens, filter, viewing window, and the inside of the sighting pipe (as applicable).

5. With the burner running, check the temperature at the detector. If it exceeds the detector's maximum rated temperature—
—add additional insulation between the wall of the combustion chamber and the detector.
—add a shield or screen to reflect radiated heat away from the detector, or
—add cooling (refer to Sighting Pipe Ventilation in the detector instruction sheet).

6. Make sure that the flame adjustment is not too lean.

7. Make sure that the detector is sighting the flame properly.

8. If necessary resight or reposition the flame detector.

If proper operation canot be obtained, replace the flame detector and/or the R7795.

TABLE IV—FLAME SIGNAL

Flame Detector	R7795 Model	Minimum Acceptable Steady Currents (microamperes)	Maximum Currents Expected (microamperes)
C7027, C7035, C7044 Ultraviolet Minipeeper	A,C	3-1/2	7-1/2
Rectifying Flame Rod or Rectifying Photocell	B,D	2	5
C7012A,C Ultraviolet (Purple Peeper)		2	6

INITIAL LIGHTOFF CHECK FOR PROVED PILOT

(All Installations Using a Pilot)

Perform this check on all installations using a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used *could be open.* If so, bypass them with jumpers during this check.

1. Open the master switch.

2. Make sure the manual main fuel shutoff valve(s) is closed. Open the manual pilot shutoff valve. (If the pilot takeoff is downstream of the manual main fuel shutoff valve, make sure the main fuel is shut off just upstream of the burner inlet, or disconnect the power from the automatic main fuel valve[s]).

3. Close the master switch and start the system with a call for heat (raise the set point of the burner controller).

4. Let the sequence advance through the prepurge. During the ignition trial period spark should occur and the pilot should light. If ignition occurs, proceed to step 7.

5. If the pilot flame is not established in 10 seconds (4 seconds if the orange jumper is clipped), safety shutdown will occur. Let the sequence complete its cycle.

6. Reset the lockout switch and let the system recycle once. If the pilot still fails to ignite, make the following ignition/pilot adjustments:
a. *Open the master switch* and remove the R7795 from the subbase.
b. Jumper subbase terminal L1 to the ignition terminal 18.
c. Close the master switch. This energizes the ignition transformer only.

d. If the ignition spark is not strong and continuous, *open the master switch* and adjust the ignition electrode spark gap to the manufacturer's recommendation.
e. Make sure the ignition electrodes are clean.
f. Close the master switch and observe the spark.
g. Once a continuous spark is obtained, *open the master switch* and add a jumper from L1 to the pilot terminal 5.
h. Close the master switch. This energizes both the pilot valve and ignition transformer.
i. If the pilot does not ignite with continuous spark, adjust the pilot gas pressure regulator until a pilot is established.
j. Open the master switch, remove the jumpers, and reinstall the R7795 onto the subbase. Close the master switch and let the system recycle.

7. When the pilot ignites, measure the flame signal. If necessary, adjust the flame or detector to give the proper flame signal.

8. Recycle the system to recheck lightoff and the pilot flame signal.

NOTE: The next steps require 2 people—one to open the manual main shutoff valve(s) and one to watch for ignition.

9. When entering the main flame ignition trial period, make sure that the automatic main fuel valve(s) are open; then smoothly open the manual main fuel shutoff valve (and manually opened safety shutoff valve, if used) and watch for main burner flame ignition. If the main burner flame is not established within 5 seconds (or the time specified by the burner manufacturer), *close the manual main fuel shutoff valve(s), open the master switch and continue with step 10.* If the main burner flame is established, proceed to step 13.

10. Wait about 3 minutes, close the master switch, and let the R7795 recycle to the main flame ignition trial period. *Smoothly* open the manual main fuel shutoff valve(s) and try lightoff again. The first attempt may have been necessary to purge the fuel lines and bring sufficient fuel to the burner.

11. If the main burner still does not light off within 5 seconds (or the time specified by the burner manufacturer), *close the manual main fuel shutoff valve(s) and open the master switch.* Check all burner adjustments.

12. Repeat steps 10 through 12 until the main flame establishes properly, then go on to step 13.

13. When the main flame is established the sequence will stay in run. Make burner adjustments for flame stability and input rating.

14. Shut down the system by lowering the set point of the controller.

Make sure that—
—the main burner flame goes out.
—the intermittent pilot (if used) goes out.
—all automatic fuel valves close.

15. If used remove the bypass jumpers from the low fuel pressure limit.

16. Restart the system by raising the controller set point. Observe that the pilot is established during the trial for pilot flame period within the normal lightoff time specified by the burner manufacturer.

17. Measure the flame signal. Continue to check for the proper signal (Table IV) through the run period.

18. Run the burner through another sequence, observing the flame signal for—
—pilot alone (if applicable).
—pilot and main burner.
—main burner flame alone (unless monitoring an intermittent pilot).

Also observe the main flame lightoff time.

19. Make sure that all readings are in the required ranges before proceeding.

INITIAL LIGHTOFF CHECK FOR DIRECT SPARK IGNITION OF OIL

(Oil Burners Not Using a Pilot)

This check applies to oil burners not using a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used, could be open. If so bypass them with jumpers during this test.

1. Open the master switch.

2. Complete the normal "ready to fire" checkout of the oil supply and equipment as recommended by the oil burner manufacturer.

3. Close all manual fuel shutoff valves. Check that the automatic fuel valve(s) are closed. *Make sure oil is not entering the combustion chamber.*

4. Close the master switch and start the system with a call for heat (raise the set point of the controller). The program sequence will start.

5. Let the sequence advance through prepurge. When entering the ignition trial period, watch for ignition spark and listen for the click of the first stage oil solenoid.

6. Let the program sequence complete its cycle.

7. Open the manual first stage oil valve.

8. Reset the lockout switch and recycle the system through prepurge.

9. When entering the ignition trials, watch for the first stage burner flame to establish.

If the first stage oil burner flame does not establish within 5 seconds (or the normal lightoff time specified by the manufacturer, *close the manual first stage oil valve and open the master switch,* and continue with step 10. If flame is established, proceed to step 14.

10. Purge the combustion chamber to remove any unburned oil; check all burner adjustments.

11. Wait about 3 minutes, close the master switch, open the manual first stage oil valve, and try lightoff again. The first attempt may have seen necessary to purge the fuel lines and bring sufficient fuel to the burner.

12. If the first stage oil burner flame is not established within 5 seconds (or the time specified by the burner manufacturer), *close the manual first stage oil valve and open the master switch.*

13. If necessary, repeat steps 10 through 12 to establish the first stage burner flame. Then proceed to step 14.

14. When the first stage oil burner flame is established, the sequence advances to the normal burner run period. Make burner adjustments for flame stability and input rating. *If a second stage is used, make sure the automatic second stage oil valve has opened.*

15. Shut down the system by lowering the set point of the burner controller. *Make sure that the flame has gone out and all automatic oil valves close.*

16. *If used, remove the bypass jumpers from the low fuel pressure limits.*

17. *If a second stage oil valve is used,* check the lightoff as follows. Otherwise go to step 18.

a. Open the manual second stage oil valve.
b. Restart the system by raising the set point of the burner controller.
c. When the first stage burner flame is established, watch for the automatic second stage oil valve to open. Observe that the second stage flame lights off properly.
d. Make burner adjustments for flame stability and input rating.
e. Shut down the system by lowering the set point of the burner controller. *Make sure the burner flames go out and all of the automatic oil valves close.*

18. Restart the system by raising the set point of the burner controller. Observe that the burner flame is established during the ignition trial period within the normal lightoff period specified by the burner manufacturer.

19. Measure the flame signal. Continue to check for the proper signal (Table IV) into the normal run period. Check the signal at the high and low firing rate positions, if applicable. Any pulsating or unsteady readings require further adjustments.

20. Make sure all readings are in the required ranges before proceeding.

PILOT TURNDOWN TEST

(All Installations Using a Pilot)

Perform this check on all installations using a pilot. This test makes sure that the main burner can be lighted by the smallest pilot flame that will hold in the flame relay. Clean the detector to ensure that it will detect the smallest acceptable pilot flame.

NOTE: Low fuel pressure limits, if used, *could be open.* If so, bypass them with jumpers during this test.

1. Open the master switch.
2. Close the manual main fuel shutoff valve(s).
3. Connect a manometer or pressure gauge to measure the pilot gas pressure during the turndown test.
4. Open the manual pilot shutoff valve.
5. Close the master switch and start the system with a call for heat (raise the set point of the burner controller). The sequence should start.

NOTE: INTERMITTENT PILOT MODELS should continue with step 6. INTERRUPTED PILOT MODELS proceed to step 7.

6. INTERMITTENT PILOT MODELS—After the sequence has entered the normal burner run period, turn the pilot gas pressure down very slowly, reading the manometer (or gauge) as the pressure drops. Stop immediately when the Flame Indicator LED goes out. Note the pressure at this point.

a. If the orange jumper IS NOT CLIPPED: Allow the R7795 to recycle through prepurge. If the orange jumper IS CLIPPED: Reset the safety switch and allow the R7795 to recycle through prepurge.
b. As the control attempts to relight the pilot, turn the pilot gas pressure back up slowly until the Flame Indicator LED comes on. (You must complete this step within the 4 or 10 second pilot flame establishing period or lockout will occur.)
c. Turn the pilot back down slightly but not enough to cause the Flame Indicator LED to go out. (Keep the pilot gas pressure just above the reading noted in step 6 above.)

NOTE: The next step requires 2 people—one to open the manual main fuel valve(s) and one to watch for ignition.

d. With the sequence in the normal burner run mode, make sure that the automatic main fuel valve(s) are open. Smoothly open the manual main fuel shutoff valve and watch for main burner lightoff.

If the main flame is not established within 5 seconds or the normal lightoff period specified by the burner manufacturer, *close the manual main fuel shutoff valve and open the master switch.* Then proceed to step 8. If the burner flame is established in the normal lightoff period, proceed to step 14.

7. INTERRUPTED PILOT MODELS—When the sequence enters the pilot flame ignition trial period, set the RUN/TEST switch to the TEST position to stop the sequence. The Flame Indicator LED will come on when the pilot ignites. Turn the pilot gas pressure down very slowly, reading the manometer or gauge as the pressure drops. Stop immediately when the Flame Indicator LED goes out. Note the pilot gas pressure at this point.

a. Immediately increase the pilot gas pressure until the Flame Indicator LED comes back on. Slowly decrease the pilot gas pressure to just above the pressure noted in step 7 above.
b. Set the RUN/TEST switch to the RUN position and allow the sequence to go on.

NOTE: The next step requires 2 people—one to open the manual main fuel shutoff valve and one to watch for ignition.

c. When the sequence enters the trial for main flame period, make sure that the automatic main fuel valve(s) is (are) open. Smoothly open the manual main fuel shutoff valve and watch for main flame ignition.

If the main flame is not established within 5 seconds or the normal lightoff period specified by the burner manufacturer, *close the manual main fuel shutoff valve, open the master switch and proceed to step 8.*

If the main burner flame is established in the normal lightoff period, proceed to step 14.

8. Purge the combustion chamber to remove any unburned fuel; check all burner adjustments.

9. Wait about 3 minutes. Close the master switch and allow the sequence to go through the prepurge. Repeat step 6 or 7.

10. If the second attempt is unsuccessful, adjust the flame detector so that a larger pilot flame is necessary to make the Flame Indicator LED come on. This may require relocation of the flame detector to sense farther out on the pilot flame or adding an orifice plate.

11. Measure the pilot flame signal after adjusting the flame detector to make sure that it is stable and is within the limits set in Table IV.

12. Repeat steps 5 through 12 until the main burner positively lights with the pilot just causing the Flame Indicator LED to remain on.

13. Repeat the main burner lightoff several times with the pilot at turndown.

14. When the main burner lights reliably with the pilot at turndown, disconnect the manometer or gauge and turn the pilot up to normal.

15. *If used, remove the bypass jumpers from the low fuel pressure limits.*

16. Run the system through another cycle to check for normal operation.

IGNITION INTERFERENCE TEST

(All Flame Rods)

Test to make certain that a false signal from a spark ignition system is not superimposed on the flame signal.

Ignition interference can decrease or increase the actual flame signal. If it decreases the signal enough it could cause safety shutdown. If the signal is increased enough, it could cause the Flame Indicator LED to come on when the true flame signal is below the minimum acceptable value.

TEST

Start the burner and measure the flame signal with both the ignition and pilot (or main burner) on, and then with the pilot (or main burner) only. Any difference greater than 1/2 microamp indicates ignition interference.

TO ELIMINATE IGNITION INTERFERENCE

1. Make sure there is enough ground area.
2. Be sure that the ignition electrode and the flame rod are on opposite sides of the ground area.
3. Check for correct spacing on the ignition electrode:

   6,000 volt systems—1/16 to 3/32 in. [1.6 to 2.4 mm].

   10,000 volt systems—1/8 in. [3.2 mm].
4. Make sure the leadwires from the flame rod and ignition electrode are not too close together.
5. Replace any deteriorated leadwires.
6. If the problem cannot be eliminated, you may have to change to an ultraviolet flame detection system.

HOT REFRACTORY HOLD-IN TEST

(Rectifying Photocells)

Test to make certain that hot refractory will not cause the Flame Indicator LED to remain on after the burner goes out. This condition would delay response to flame failure and also prevent a system restart as long as the hot refractory is detected.

First check the R7795 flame signal amplifier by starting the burner cycle. As soon as the sequence stops in the run period, lower the burner controller set point to shut down the system while the refractory is cool. Measure the time necessary for the Flame Indicator LED to go out after the flame extinguishes. If it takes more than 4 seconds, open the master switch and replace the R7795.

To check rectifying photocells for hot refractory hold-in, operate the burner until the refractory reaches its maximum operating temperature. Then lower the set point of the burner controller to terminate the firing cycle, or set the fuel selector switch to off. DO NOT OPEN THE MASTER SWITCH. Observe the flame go out.

NOTE: Some burners continue to purge the oil lines between the valve(s) and nozzle(s) even though the fuel valve(s) is (are) closed. Termination of the firing cycle rather than opening the master switch will allow purging of the combustion chamber, if available. This will reduce a buildup of fuel vapors in the combustion chamber caused by oil line purging.

If the Flame Indicator LED remains on for more than 4 seconds after the flame disappears, the photocell is sensing hot refractory.

If the detector is sensing hot refractory add an orifice plate ahead of the cell to restrict the viewing area of the detector or resight the detector to a more distant, cooler part of the combustion chamber.

NOTE: If the detector is resighted the flame must still be properly sighted.

Continue adjustment until hot refractory hold-in is eliminated.

ULTRAVIOLET RESPONSE TESTS

(All Ultraviolet Detectors)

Ignition Spark Response Test

Make sure that ignition spark is not causing the Flame Indicator LED to come on.

1. Close the pilot and main fuel manual shutoff valves.
2. Start the burner and run through the ignition period. Ignition spark should occur, but the Flame Indicator LED must not come on.
3. If the Flame Indicator LED does come on, resight the detector farther out from the spark. Measure the flame current. It should not be more than 1/4 microampere.

NOTE: The Honeywell Q624A Solid State Spark Generator will prevent detection of ignition spark when properly applied with the C7027, C7035, or C7044 Minipeeper Ultraviolet Flame Detectors. The Q624A is for use only with gas pilots.

RESPONSE TO OTHER ULTRAVIOLET SOURCES

Some sources of artificial light produce small amounts ultraviolet radiation. Under certain conditions an ultraviolet detector may respond to them as if it were detecting flame. DO NOT USE AN ARTIFICIAL LIGHT SOURCE TO CHECK THE RESPONSE OF AN ULTRAVIOLET DETECTOR.

FLAME SIGNAL WITH HOT COMBUSTION CHAMBER

(All Installations)

With all initial tests and burner adjustments completed, operate the burner until it is at maximum expected temperature. (Observe the burner manufacturer's warmup instructions.) Recycle the burner under these hot conditions and measure the flame signal.

Check the pilot alone, the main burner flame alone, and the main burner and pilot flames together (unless monitoring only the pilot flame when using intermittent ignition, or only the main burner flame with direct spark ignition). Check the signal at both high and low firing rate, if applicable.

Also check the flame failure response time. Lower the set point of the burner controller and observe the time it takes for the Flame Indicator LED to go out after the burner flame extinguishes (should be within 4 seconds).

If the flame signal is too low, or is unsteady, check the flame detector temperature. Relocate the flame detector if the temperature is too high. If necessary, realign the sighting to obtain the proper signal and response time. If the response time is still too slow, replace the R7795. If the detector is relocated or resighted, or the R7795 is replaced, repeat all applicable tests in this section.

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 TESTS

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 light setting and the burner should go through the normal prepurge, ignition, and run cycle.

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

Flame Failure

Let the burner operate 5 minutes; then manually shut off the fuel supply to simulate flame failure. The flame indicator LED should go out and the fuel valves close. If the lockout on flame failure mode is chosen, the R7795 will lock out in about 15 seconds. If the recycle mode of operation is chosen, the system will purge and then attempt to relight the pilot. After this attempt, the system will lock out.

Power Failure

Let the burner run for 5 minutes. Simulate power failure by opening the line switch. All relays should drop out and the fuel valves should close. Close the power switch. The R7795 should go through the complete normal cycle.

IMPORTANT

At the completion of all Checkout tests make sure that the R7795 is not on safety lockout, that the pilot is turned up to the correct level, and all limit settings are correct. Operate the system through a normal cycle. Replace the device cover and tighten the screw securely.

TROUBLESHOOTING

The first step in troubleshooting the R7795 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 OPERATION section of this sheet for details of the normal operating sequence. Observe the operation carefully to determine exactly when the trouble occurs. Refer to the list below and follow the procedures outlined.

IMPORTANT

At the completion of any troubleshooting procedure, be sure to perform the checkout tests listed in the CHECKOUT section of this sheet.

EQUIPMENT REQUIRED

1. Voltmeter (Honeywell W136A or equivalent)—with 0 to 300 Vac scale.
2. Microammeter (Honeywell W136A or equivalent)—with 0 to 25 microamp range and SPL scale with damping.
3. Meter connector plug, Part No. 196146 or equivalent.
4. 123514A Flame Simulator—for use with the R7795B,D (rectification models).
5. 123514B Flame Simulator—for use with the R7795A,C (ultraviolet models).
6. Watch or clock—with second hand.
7. Manometer (or gauge)—to measure pilot gas pressure.
8. Thermometer or thermocouple—to measure temperature at the flame detector.
9. Orifice plates (aperture discs) or filters—to adjust the sensitivity of flame detector(s).

PRELIMINARY INSPECTION

1. Disconnect the power to the R7795 by opening the system disconnect switch.
2. Reset the safety switch.

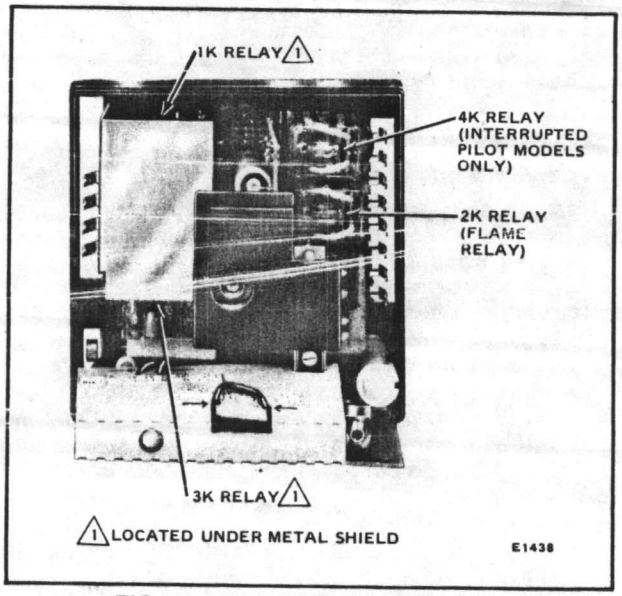


FIG. 11—R7795 RELAY LOCATION.

TROUBLE LIST

Compare the following list of possible system troubles with the actual deviations from the normal operating sequence. Select the appropriate symptoms by letter and proceed to that troubleshooting procedure.

A. Relay 3K doesn't respond to a call for heat.
B. Relay 3K pulls in but the burner motor doesn't start.
C. Control locks out during prepurge.
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 does not light, ignition does not occur, or the pilot valve does not open.
F. Pilot lights but the Flame Indicator LED does not come on (control locks out without lighting main burner).
G. Pilot lights and the Flame Indicator LED comes on but the main burner does not light.
H. Flame Indicator LED remains on after the flame goes out.

TROUBLESHOOTING PROCEDURES

CAUTION

1. Be very careful when troubleshooting the R7795; line voltage is present on most contacts when the power is on.
2. To prevent electrical shock or equipment damage, disconnect the power supply before cleaning any contacts, or removing and reinstalling the R7795 from the subbase.

IMPORTANT

1. Output terminals MUST NOT BE SHORTED TO L2. Shorted output terminals will cause permanent damage to the R7795.
2. If, after performing an applicable troubleshooting procedure, proper operation cannot be obtained, replace the R7795 (except the ST795A purge timer, unless noted).

A. Relay 3K Doesn't Respond to A Call For Heat—

1. Make sure that the safety switch is reset.
2. Check the power at terminals L1 and 16 with the controller calling for heat.
   a. Voltage must be between plus 10 and minus 15% of the rated voltage for dependable operation.
   b. If the voltage is zero, check the power supply and the continuity of the limit and controller contacts. Look for blown fuses, open switches, and bad wiring connections.
2. If the voltage at terminals 16 and L1 are correct and relay 3K does not pull in, replace the R7795.

B. Relay 3K Pulls In But The Burner Motor Does Not Start.

1. Check for power at terminal 8 when the 3K relay pulls in.
   a. If terminal 8 is not powered, replace the R7795.
   b. If terminal 8 is powered, check the fan or burner motor circuit and wiring.

C. Control Locks Out During Prepurge

If the flame indicator LED lights during the prepurge period and remains lighted for 6 seconds or longer, the control will lock out electrically (the device holds at the start of prepurge with the blower energized). If the flame on condition corrects itself after 6 seconds, the safety switch will trip, causing a mechanical lockout. The line voltage alarm (terminal 9) is energized and the burner/blower (terminal 8) is deenergized. Check for a flame simulating failure.

1. R7795B,D (rectification) models.
   a. Disconnect 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 board. Do not ground the other end of the plug or simulator.
   b. Restart the system. If the flame indicator LED lights, replace the R7795. If not, check the flame detector and external flame detection circuit. Look for light reaching the detector, hot refractory hold-in, defective wiring, or a defective detector.
2. R7795A,C (UV) models.
   a. Measure the flame current during prepurge. The flame current should not exceed 1/4 microampere during the prepurge period.
   b. If excessive flame current is present, check the flame detector circuit for wiring problems. If no wiring problems are found, replace the flame detector. Recheck the flame current during prepurge. If the excessive flame current persists, replace the R7795.

D. Burner Motor Starts But Prepurge Does Not Stop At The End Of The Purge Timing (Relay 1K Does Not Pull In).

1. If the R7795 is an interrupted pilot model; check that the RUN/TEST switch is in the RUN position.
2. Check the seating of the ST795A Purge Timer.
3. Check for line voltage on the airflow switch (terminals 3 to L2).
4. Check the condition of the flame indicator LED. If it is lighted, look for a flame simulating failure (see C, above).
5. Replace the ST795A with one of the same timing. If the problem still persists, replace the R7795.

E. Relay 1K Pulls In But The Pilot Does Not Light, Ignition Spark Does Not Occur, Or The Pilot Valve Does Not Open.

1. Make sure that all manual fuel valves are opened.
2. Check the voltage at the pilot (or first stage oil) valve terminal 5 and the ignition terminal 18. Check must be made before device locks out.
3. If the voltage is zero replace the R7795.

NOTE: If terminals 5 and/or 18 are shorted to L2, the R7795 will be permanently damaged. This shorted condition must be corrected before repowering the system.

4. If the terminals are powered, check the pilot and ignition circuits for faulty wiring or defective devices.

F. Pilot Lights But Flame Indicator LED Does Not Come On.

1. Use the appropriate flame simulator (UV or rectification) to check the Flame Indicator LED. Follow the instructions supplied with the simulator.
2. If no simulator is available, check the flame current as instructed on page 10. If the current is satisfactory, replace the R7795. If the flame current is not satisfactory, check the items listed on page 10.

G. Pilot Lights and Flame Indicator LED Comes On But The Main Burner Does Not Light.

1. Check that the manual main fuel valves are open.
2. Check the voltage at terminal 6.
   a. If the voltage is normal, check the main valve and its external circuitry.
   b. If the voltage is zero replace the R7795.

NOTE: If any of the terminals are shorted to L2, the R7795 will be permanently damaged. This shorted condition must be corrected before repowering the system.

H. Relay Flame Indicator LED remains on after the flame is extinguished.

RECTIFICATION MODELS:

1. If the flame detector is a rectifying flame rod, install a new R7795.
2. If the detector is a rectifying photocell or a C7012A, plug the jack end of the flame simulator into the flame current jack on the amplifier board.
   a. If the flame indicator LED does not go out, replace the R7795.
   b. If the flame indicator LED goes out, the trouble is caused by hot refractory hold-in, detector failure or other flame simulating conditions.
      (1) Remove the flame simulating condition such as false light.
      (2) Resight the photocell to a cooler, more remote area of the combustion chamber.
      (3) Check the flame current as recommended on page 10. Replace the detector if necessary.
      (4) Check for a short or high resistance between terminals F and G.

ULTRAVIOLET MODELS:

a. Remove any flame simulating condition such as false light.
b. Resight the detector to a cooler, more remote area of the combustion chamber.
c. Replace the detector if necessary.
d. Check for a short or high resistance between terminals F and G.

SERVICE

GENERAL

1. Only qualified personnel should attempt to service heating equipment or controls.
2. Do all the checks required under CHECKOUT when replacing or servicing the R7795 or when restoring power or relighting the system after shutdown.
3. On each service call check the controller for approximate calibration and differential. Make sure that it is mounted securely.
4. *Never use oil on any part of the R7795.*
5. *DO NOT PUSH IN THE R7795 RELAYS MANUALLY.* Damage may result or important safety features of the device may be overridden. Clean contacts only as instructed below.

PERIODIC MAINTENANCE

The specific maintenance schedule depends on a number of factors, including the types of equipment controlled, operating conditions, and the cost of nuisance shutdowns. The following must be included in any program:

Perform flame failure and pilot turndown tests 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. More often where a shutdown may be costly.

Clean contacts *only* when required by a failure to operate.

CONTACT CLEANING

CAUTION

Open the master switch before removing the cover or cleaning contacts. Line voltage is present on most contacts when the 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 the utmost care to avoid bending the contacts or changing the configuration in any way.
4. Do not use abrasive materials 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. The Honeywell chemical analysis laboratory finds this cleaner to be acceptable for this task. Follow the directions listed on the can.

Do not use other types of contact cleaners. Analysis shows that other pressurized contact cleaners are undesirable for these reasons:

1. Some have solvents that deteriorate plastic parts or wire insulation.

2. Some leave oily residues which collect dust or dirt. The residue further breaks down to form various carbonaceous products. Either result in early contact failure.

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

1. Some relay contacts are plated with gold for increased reliability. Burnishing removes the plating.

2. The radii or points of the contacts are designed with specific shapes to best serve the intention of the contacts. Burnishing can alter these contact configurations.

3. Use of abrasives loosens fine particles of the contact materials which adhere to the surface of the contact increasing its resistance.

4. Contact specifications (pressures, press-backs, and gaps) are carefully controlled during manufacturing to ensure maximum contact life. Burnishing can easily change these specifications.

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Honeywell

AQUASTAT CONTROLLERS

AQUASTAT CONTROLLERS ARE IMMERSION TYPE DEVICES FOR LIMITING OR REGULATING THE TEMPERATURE OF LIQUIDS IN BOILERS, STORAGE TANKS, AND OTHER APPLICATIONS WHERE TEMPERATURE CONTROL IS REQUIRED.

☐ L4006,7 and 8 provide spst switching for high or low limit or circulator control.

☐ L6006,7 and 8 provide spdt switching for high or low limit and circulator control.

☐ L4006,7; L6006,7 include immersion well, direct immersion, or surface mount models.

☐ L4008,6008 include remote bulb for mounting controller at a location away from the sensing element.

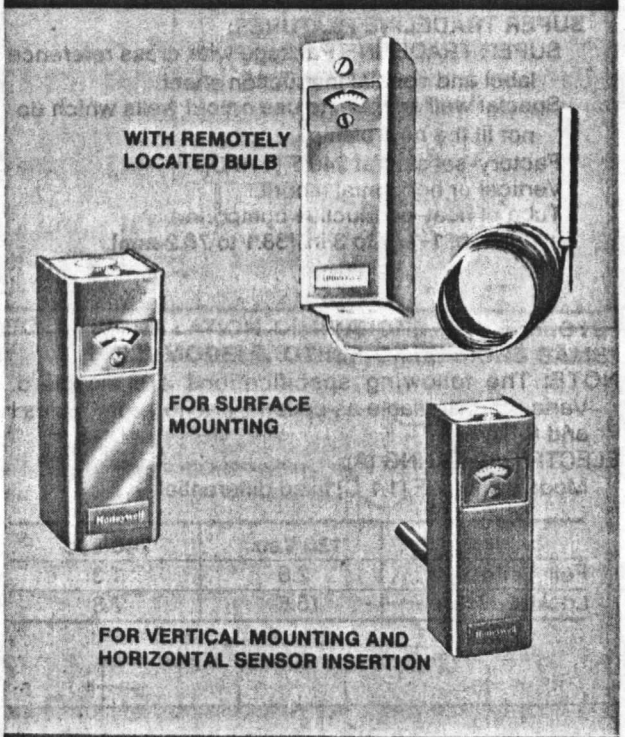
☐ Totally enclosed Micro Switch snap-acting switches operate on temperature rise to set point.

☐ Models calibrated for high limit use are also suitable for low limit control if a separate high limit controller is used.

☐ Visible control point scale and external adjustment screw permit easy setting.

☐ Models are available for either horizontal or vertical insertion of the sensing element. Models are also available for either direct immersion or well immersion of the sensing element.

☐ Remote bulb models may be used to sense air temperature in ducts and in outside air sensing applications.



L4006,7,8; L6006,7,8

S.M.
REV. 6-86●
Form Number 60-2104—5

SPECIFICATIONS

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

SUPER TRADELINE/TRADELINE MODELS

SUPER TRADELINE controls offer features not available on TRADELINE or standard models, and are designed to replace a wide range of Honeywell and competitive controls.

TRADELINE models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. Specifications of SUPER TRADELINE and TRADELINE controls are the same as those of standard models except as noted below.

SUPER TRADELINE MODEL:
L4006A Aquastat Controller.

SUPER TRADELINE FEATURES:
SUPER TRADELINE Package with cross reference label and special instruction sheet.
Special well adapter, to use on old wells which do not fit the new clamp.
Factory-set stop at 240 F [116 C].
Vertical or horizontal mount.
Tube of heat-conductive compound.
Insulation: 1-1/2 to 3 in. [38.1 to 76.2 mm].

TRADELINE MODELS
L4006A,B,E; L4008E; L6006C; L6008A Aquastat Controllers.

TRADELINE FEATURES AVAILABLE:
TRADELINE package with cross reference label and special instruction sheet.
Special well adapter.
Factory-set stops at 180 F, 240 F, or 250 F [82 C, 116 C, or 121 C].
Vertical or horizontal mount.
Tube of heat-conductive compound.
Insulation depths of 1-1/2 or 3 in. [38.1 or 76.2 mm].
Well included or less well and spud.

NOTE: The following specifications are standard. Variances, available as options, are noted in Tables I and II.

ELECTRICAL RATING (A):

Models with 2 F [1.1 C] fixed differential—

	120 Vac	240 Vac
Full Load	2.6	1.3
Locked Rotor	15.6	7.8

Models with 5 F [2.8 C] fixed differential or 5 F to 30 F [2.8 C to 16.7 C] adjustable differential—

	110/120 Vac	200/240 Vac	[a]277 Vac
Full Load	8.0	5.1	4.2
Locked Rotor	48.0	30.6	25.2
Millivoltage	0.25 at 0.25 to 12 Vdc		

[a]L6008G only.

(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, OR SPECIFY—

1. **Order number.**
2. **Operating range.**
3. **Differential; adjustable, nonadjustable, or manual reset.**
4. **Capillary length.**
5. **Boiler tapping and insulation depth.**
6. **Accessories.**

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 DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).**
2. **RESIDENTIAL DIVISION CUSTOMER SERVICE**
   HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
   GOLDEN VALLEY, MN 55422-4386 (612)542-7500

IN CANADA—HONEYWELL CONTROLS LIMITED/HONEYWELL LIMITEE, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9. INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

PRESSURE RATING:
Capillary Bulb (direct immersion)—200 psi [1378.9 kPa].
Immersion Well—255 psi [1758.2 kPa].
SENSING BULB MATERIAL: Copper.
SENSING BULB FILL: Liquid—toluene or silicone oil.
SENSING BULB DIMENSIONS: 2-7/8 in. [73.2 mm] long, 3/8 in. [9.6 mm] diameter.
PROVISION FOR WIRING: Screw terminals.
MAXIMUM AMBIENT TEMPERATURE: 150 F [66 C].
UNDERWRITERS LABORATORIES INC:
Remote bulb devices and well-mounted devices shipped less well are component recognized: File No. MP466, Guide No. MBPR2.
L4006A shipped with well, L4007A,B; L6006C for surface mounting, L6006B for direct immersion mounting, and L6007A are listed: File No. MP466, Guide No. MBPR.
L6008G is listed: File No. E4436, Guide No. XAPX.
CANADIAN STANDARDS ASSOCIATION: File No. LR1620, Guide No. 400-E-O.
MOUNTING: Horizontal and vertical models mount directly to an immersion well installed in a boiler fitting. L6006C contains bracket and clamp for surface mounting on pipe or tank. Remote bulb models have 3 mounting holes in rear of case for screw mounting to a vertical surface. The L6006B direct immersion also mounts directly to a boiler fitting.
FINISH: Gray.
INSTALLATION DIMENSIONS: See Figs. 1, 2, and 3.
IMMERSION WELL DIMENSIONS: See Fig. 4.
BOILER FITTING AND BULB DIMENSIONS: See Fig. 5.
ACCESSORIES AND PARTS:
137536A Scale Lock Assembly includes:
One 137536-767 Scale Lock.
One 80844C-767 Screw, No. 3-48 x 3/16.
Q615A1004 Weatherproof Enclosure (for remote bulb devices only).
107408 4-oz. Can of Heat-Conductive Compound.
104488 Spring Clip (stainless steel).
Immersion Well Assemblies and Compression Fittings—see form 68-0040, "Wells and Fittings for Temperature Controllers," for list and ordering information.

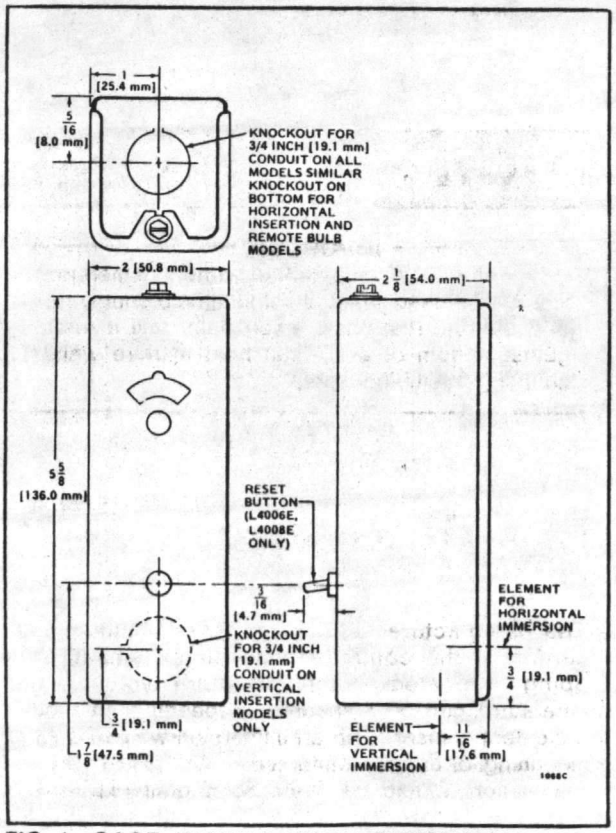


FIG. 1—CASE INSTALLATION DIMENSIONS FOR DIRECT INSERTION MODELS.

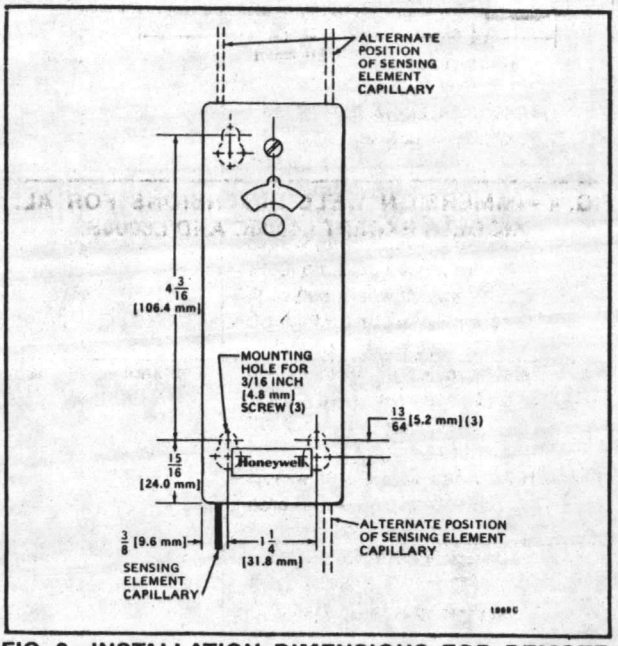


FIG. 2—INSTALLATION DIMENSIONS FOR REMOTE BULB MODELS. OTHER DIMENSIONS SAME AS FIG. 1.

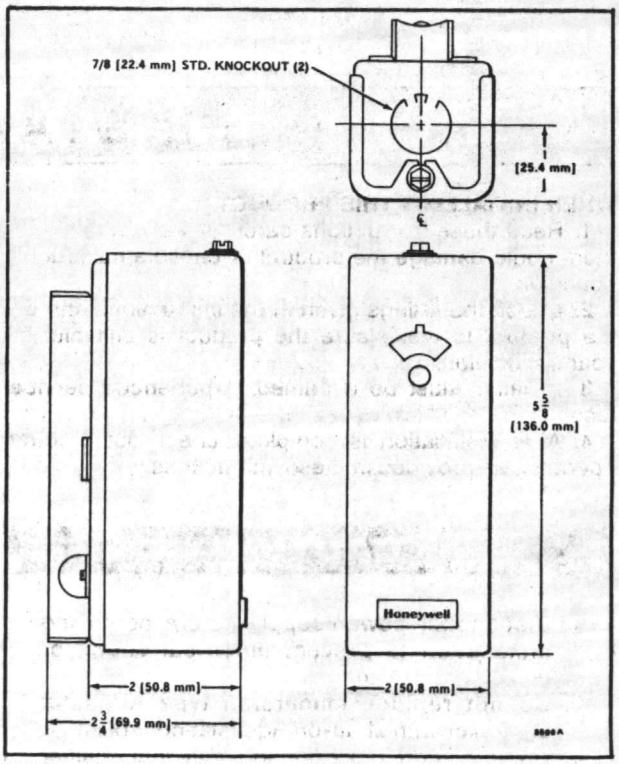


FIG. 3—INSTALLATION DIMENSIONS IN in. [mm IN BRACKETS] FOR SURFACE MOUNT MODEL (L6006C).

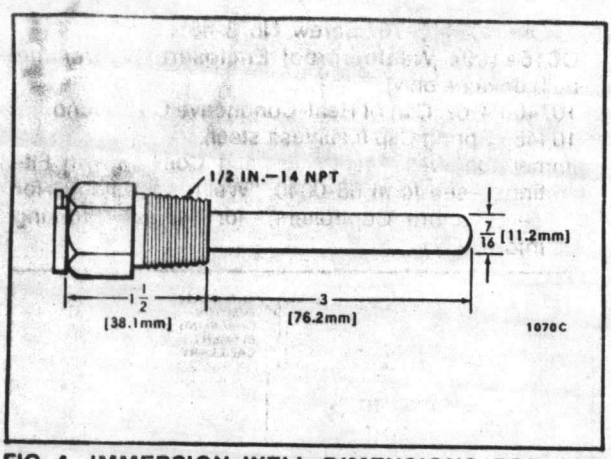


FIG. 4—IMMERSION WELL DIMENSIONS FOR ALL MODELS EXCEPT L4006C AND L6006B.

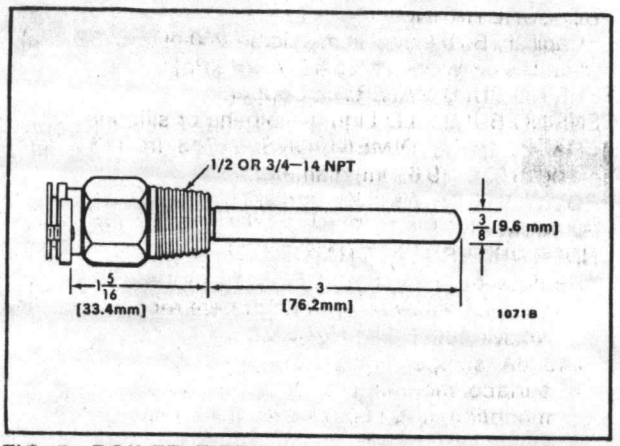


FIG. 5—BOILER FITTING AND BULB DIMENSIONS FOR L4006C AND L6006B.

INSTALLATION

WHEN INSTALLING THIS PRODUCT. . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

1. Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.
2. Do not replace immersion type Aquastat controller with strap-on Aquastat controller.
3. Do not secure draw nut so tightly that retainer clamp could collapse tubing.

IMPORTANT

Controller may be used with or without immersion well. Well, if used, must fit sensing bulb snugly for good thermal response. Insert bulb until it rests against bottom of well, then hold it there while tightening the tubing clamp.

The manufacturer usually provides a tapping for insertion of the controller's sensing element. This tapping is located at a point where typical water temperature can be measured. Depending on model, the element is inserted in an immersion well, through a boiler fitting, or directly immersed.

Installation should be made by a qualified service technician. Follow the instructions furnished by the system manufacturer, if available. Otherwise, refer to appropriate procedure listed below.

STANDARD MODELS

TABLE I—L4006, L4007, L4008 CONTROLLERS WITH SPST SWITCHING

MODEL	APPLICATION	RANGE F[C]	MIDSCALE DIFFERENTIAL F[C]	INSERTION[a]	SWITCHING ON TEMP. RISE	AVAILABLE OPTIONS
L4006A	high or low limit	40 to 180 [4 to 82] or 100 to 240 [38 to 116]	2 or 5 fixed [1.1 to 2.8] or 5 to 30 adj. [2.8 to 17]	horizontal	breaks	—TRADELINE models available. —NPT brass spud 1/2 or 3/4 in. —Special capillary assembly. —Insertion 3-3/8 or 5 in. [85.7 or 127.0 mm]. —Celsius scale markings. —Factory-set stops at 160, 180, 185, 200, 220, or 230 F [71, 82, 85, 93, 104, or 110 C]. —Insulation depths of 1-1/2, 3 or 4 in. [38.1, 76.2, or 101.6 mm]. —Screw and mounting brackets. —Plastic tubing over well. —Modified dial with stop. —Special covers and knobs. —With ground screw.
L4006B	circulator	100 to 240 [38 to 116]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj.	horizontal	makes	—TRADELINE model available. —Insulation depth 1-1/2 or 3 in. [38.1 or 76.2 mm]. —NPT brass spud 3/4 in. —Screw in front of case on dial suitable for Powerpile control. —Factory-set stop at 240 F [116 C].
L4006C	high or low limit	65 to 200 [18 to 93]	3-1/2 [1.9] fixed	horizontal direct immersion	breaks	—TRADELINE model available. —Less cover. —Capillary 10 in. [254.0 mm]. —NPT brass spud 3/4 in.
L4006E[b]	high limit	110 to 290 [43 to 143]	manual reset	horizontal or vertical	breaks	—TRADELINE model available. —Insulation depth 1-1/2 or 3 in. [38.1 or 76.2 mm]. —NPT brass spud 1/2 in. —Factory-set stop at 250 F [121 C]. —Capillary 8 in. [203.0 mm].
L4007A	high or low limit	100 to 240 [38 to 116]	2 or 5 [1.1 or 2.8] fixed, 5 to 30 [2.8 to 17] adj.	horizontal or vertical	breaks	—Insulation depth 1-1/2 or 3 in. [38.1 or 76.2 mm].
L4007B	circulator	100 to 240 [38 to 116]	5 [2.8] fixed or 5 to 30 [2.8 to 17] adj.	vertical	makes	—Celsius scale markings.
L4008A	high or low limit	100 to 240 [38 to 116] or 110 to 290 [43 to 143]	5 [2.8] fixed, 5 to 30 [2.8 to 16.7] adj.	remote bulb direct immersion	breaks	—Remote capillary 5 ft 6 in. [1.7 m], 8 ft 6 in. [2.6 m] or 10 ft [3.0 m]. —Factory-set scale stop at 120, 170, or 200 F [49, 77, or 93 C]. —Celsius scale markings. —Front cover screw.
L4008B	circulator	100 to 240 [38 to 116]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj.	remote bulb direct immersion	makes	—Capillary 5 ft. 6 in. [1.7 m].
L4008E[b]	high limit	40 to 80 [4 to 82] or 110 to 290 [43 to 143]	manual reset	remote bulb	breaks	—Factory-set scale stop at 140, 200, or 250 F [60, 93, or 121 C]. —Capillary 5 ft. 6 in. or 20 ft. [1.7 m or 6.1 m].

[a]Copper well or fitting is supplied with all models except remote bulb type. When ordering, specify boiler tapping size 1/2 or 3/4 in. NPT and insulation depth.

[b]Manual reset (trip-free)—switch breaks circuit and locks out when controlled medium reaches set point. Controlled temperature must drop 20 F [11.1 C] below set point before contacts can be manually reset.

TABLE II—L6006, L6007, L6008 AQUASTAT CONTROLLERS WITH SPDT SWITCHING
(breaks R-B and makes R-W on temperature rise at set point)

MODEL	APPLICATION	RANGE F[C]	MIDSCALE DIFFERENTIAL F[C]	INSERTION[a]	AVAILABLE OPTIONS
L6006A	circulator and low limit or high limit	100 to 240 [38 to 116] or 100 to 290 [38 to 143]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj.	horizontal	—SUPER TRADELINE model available. —Modified dial with stop. —NPT brass spud 1/2 in. or 3/4 in. —3-3/8 in. [85.7 mm] insertion. —Less well. —Adapter for horizontal or vertical mount. —Insulation depth 1-1/2 or 3 in. [38.1 or 76.2 mm].
L6006B	circulator and low limit or high limit	100 to 240 [38 to 116]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj. or 30 [16.7] fixed	horizontal	—Direct immersion. —Insulation depth 1-1/2 in. [38.1 mm]. —3/4 in. brass compression fitting.
L6006C	circulator, low limit, and high limit	65 to 200 [18 to 93]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj.	horizontal or vertical surface mounted	—TRADELINE model available. —Strap-on, surface mount.
L6007A	circulator and low limit or high limit	40 to 180 [4 to 82]	fixed	horizontal or vertical	—Insulation depth 1-1/2 or 3 in. [38.1 or 76.2 mm].
L6008A	circulator and low limit cooling	100 to 240 [38 to 116] or -30 to 70 [-35 to 21]	5 [2.8] fixed or 5 to 30 [2.8 to 16.7] adj.	remote bulb	—TRADELINE models available. —Modified dial with stop. —Capillary 5-1/2 ft [1.7 m].
L6008G	2-stage Aquastat to cycle 2-stage gas valve	130 to 230 [54 to 110]	3-1/2 [1.9] fixed	remote bulb	—Capillary 6 ft. [1.8 m]. —Adjustable interstage.
L6008H (max. temp. of element 405 F [207 C])	low fire Aquastat	150 to 200 [66 to 93]	15 [8.3] fixed	remote bulb	—Capillary 33 in. [0.8 m].

[a]Copper well or fitting is supplied with all models except remote bulb type. When ordering, specify boiler tapping size 1/2 or 3/4 in. NPT and insulation depth.

MOUNTING IMMERSION WELL AND DIRECT IMMERSION MODELS (L4006A,B,C,E; L4007A,B; L6006A,B; L6007A)

INSTALLING IMMERSION WELL MODELS (L4006A,B,E; L4007A,B; L6006A; L6007A)

On existing installation, shut off the power, remove the old control. If the old immersion well appears suitable, and if the adapter clamp on the Aquastat controller fits the old well spud, this well need not be replaced.

1. If the system is filled, drain system to a point below the boiler tapping.
2. Remove plug (or old well) from boiler tapping.
3. Install the immersion well included with the controller. If boiler tapping is greater than 1/2 in., a reduction fitting must be used to adapt the boiler opening to the 1/2 in. threads that are standard with the well or fitting. Fittings with 3/4 in. threads are also available.
4. Fill the system. Make sure that the well is screwed in tightly enough to prevent leakage. Do NOT tighten after controller is secured to well, applying force to case.
5. Loosen screw (at top of case, above scale setting), and remove cover. Loosen two screws that secure adapter clamp (Fig. 6).
6. Insert the sensing element into the immersion well.
7. Fasten the case of the Aquastat controller to the well with the adapter clamp. Make certain that the clamp is properly positioned over the groove of the well spud. Also, be sure the flange at the opening of the well fits snugly into the opening of the case. The sensing element bulb *must* bottom in the well.

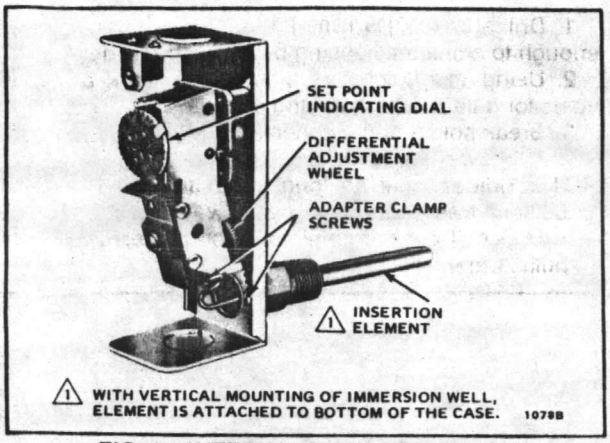


FIG. 6—INTERNAL VIEW OF L6006A.

INSTALLING DIRECT IMMERSION MODELS (L4006C, L6006B)

Models which provide for direct immersion of the sensing element into the boiler include a capsule compression fitting assembly instead of an immersion well. Install fitting in boiler tapping as follows:

1. Be sure sealing washer is in place as shown in Fig. 7. Make sure that spud of capsule compression fitting is screwed in tightly enough to prevent leaking.
2. Insert immersion bulb (sensing element) through capsule compression fitting. Adjust the adapter clamp so that it fits over the groove at the opening of the capsule compression fitting.
3. Tighten adapter clamp screws so that Aquastat controller is firmly attached to capsule compression fitting.

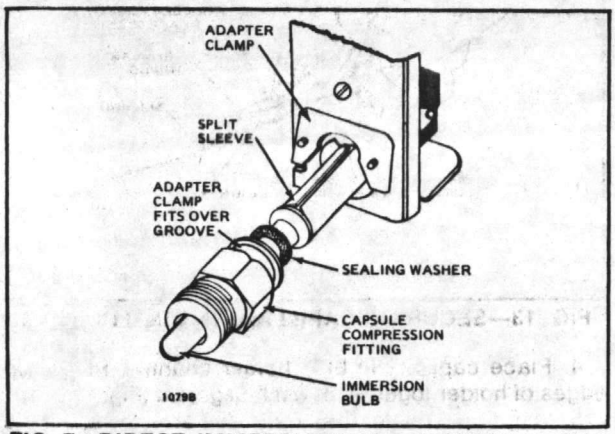


FIG. 7—DIRECT IMMERSION MODEL WITH FITTING PARTIALLY REMOVED.

MOUNTING REMOTE BULB MODELS (L4008A,B,E; L6008A,G,H)

The remote temperature-sensing bulb can either be installed in an immersion well (Fig. 8) that extends into the boiler or tank, or it can be directly immersed in the liquid. For installations not using a well, secure the remote bulb with a bulb compression fitting (Fig. 9), or capillary compression fitting (Fig. 10).

Well, bulb compression fitting or capillary compression fitting must be ordered separately. See Accessories and Parts list. Sizes available: 1/2 in., 3/4 in. NPT spud. Well, if used, must fit sensing bulb snugly for good thermal response. Insert bulb until it rests against bottom of well, then hold it there while tightening the tubing clamp (Fig. 8).

The boiler manufacturer generally provides a tapping for the insertion of the Aquastat controller's sensing element. This tapping should be located at a point where typical water temperature can be measured. The bulb or protecting immersion well must never be located close to a hot or cold water inlet or a steam coil.

If the system is filled, drain system to a point below the boiler tapping, or wherever the sensing bulb is to be installed.

The bulb can also be installed in the supply line of an indirect water heater, in the direct water heater itself, or in the feed riser, about 6 in. [152.4 mm] above the boiler. If the riser is valved, the bulb can be installed between the boiler and the valve.

NOTE: Avoid making sharp bends or kinks in the capillary. Bends should be no sharper than 1 in. [25.4 mm] radius.

NOTE: Some models have an adjustable length to 3 in. [76 mm]. In these models, extra tubing inside the case may be pulled out, if needed.

After installing, carefully coil excess capillary at the bottom of the controller case.

IMMERSION WELL MOUNTING

1. Screw the well into the boiler, tank, or pipe tapping.
2. Insert bulb in well, pushing tubing until bulb bottoms in well.
3. Attach retainer clamp to end of well spud. Loosen draw nut and spread jaws of clamp with screwdriver if necessary.
4. With retainer clamp attached to well spud (be sure jaws of clamp hook over ridge at end of spud, as shown at points "A"), adjust tubing to fit through retainer clamp groove, as shown at point "B."
5. Tighten draw nut so that retainer clamp is firmly attached to well spud and tubing is held securely in place.

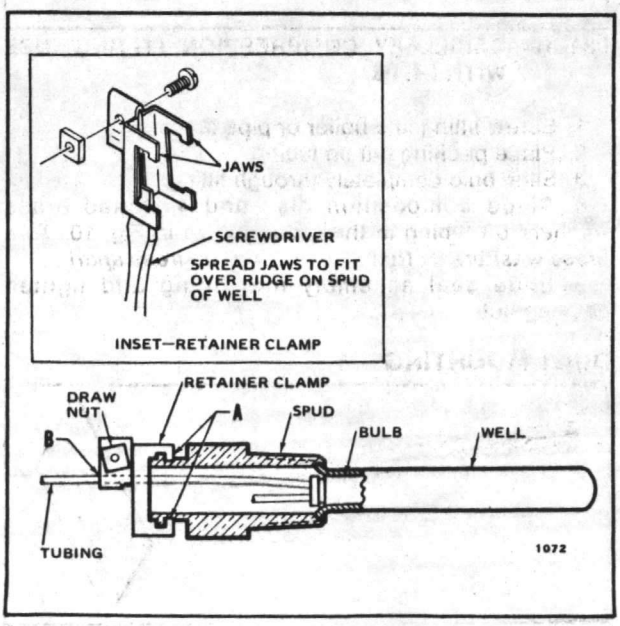


FIG. 8—IMMERSION WELL FITTING.

MOUNTING WITH BULB COMPRESSION FITTING

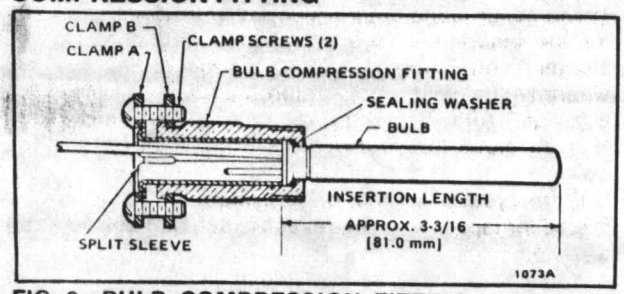


FIG. 9—BULB COMPRESSION FITTING. USE WITH L4008A,B; L6008A.

1. Screw the fitting into boiler or pipe tapping.
2. Slide sealing washer onto bulb.
3. Insert bulb into fitting until bulb bottoms.
4. Slide split sleeve into fitting.
5. Place clamps A and B on assembly so that sleeve is drawn into fitting when screws are tightened.

NOTE: Make sure that nub on clamp A engages space between sleeve and clamp.

6. Tighten clamp screws evenly.

MOUNTING WITH CAPILLARY COMPRESSION FITTING

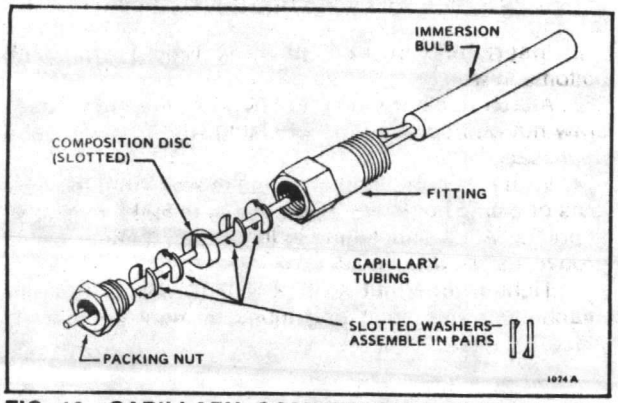


FIG. 10—CAPILLARY COMPRESSION FITTING. USE WITH L4008.

1. Screw fitting into boiler or pipe tapping.
2. Place packing nut on tubing.
3. Slide bulb completely through fitting.
4. Place composition disc and 4 slotted brass washers on tubing in the order shown in Fig. 10. *Turn brass washers so that slots are 180 degrees apart.*
5. Slide seal assembly into fitting and tighten packing nut.

DUCT MOUNTING

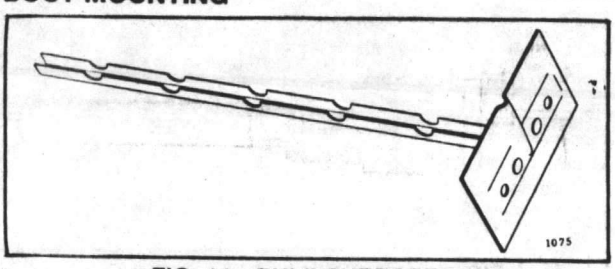


FIG. 11—BULB SUPPORT.

1. Drill a 3/4 in. [19.1 mm] hole in the duct wall large enough to admit the sensing bulb into the holder.
2. Using the holder as a template, mark and drill holes for bulb holder mounting screws.
3. Break holder to desired length (Fig. 12).

NOTE: Holder must be long enough to hold sensing bulb in freely circulating air away from duct wall. Neatly coil excess capillary at controller case or at bulb holder.

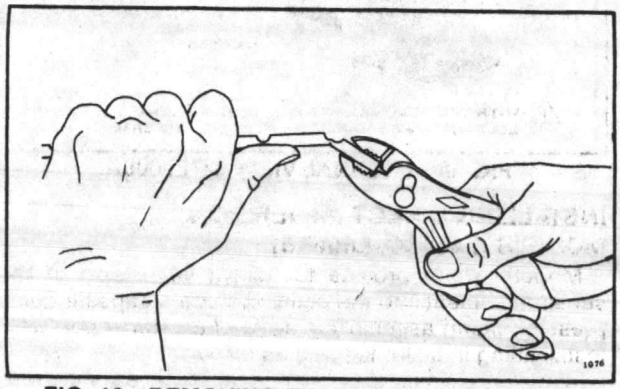


FIG. 12—REMOVING EXCESS BULB SUPPORT.

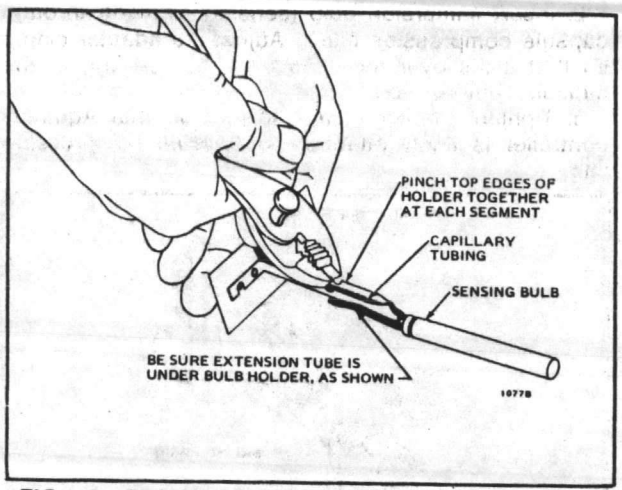


FIG. 13—SECURING CAPILLARY IN BULB HOLDER.

4. Place capillary in bulb holder channel. Pinch top edges of holder together at each segment (Fig. 13).
5. Insert bulb holder into controlled area through hole prepared in step 1.
6. Fasten bulb holder to duct wall with screws furnished.

MOUNTING REMOTE BULB MODELS FOR OUTDOOR AIR SENSING

These models have a 5 ft [1.5 m] capillary. This capillary establishes the maximum distance between the case and the outdoor mounting.

The bulb should be installed on the outside of the building in the shield provided (Fig. 14) where it will be exposed to representative air temperature, but not to direct sunlight. It should be mounted high enough so that accumulated snow, leaves, or other debris cannot obstruct circulation of air around it, and where children cannot reach it. Avoid vents from the building.

Install the case at the indoor location selected, fastening the screws through holes in back of the case. Bring the bulb and tubing out through a 3/4 in. [19.1 mm] hole in the outside wall. In uncoiling the tubing, carefully avoid sharp bends or kinks. Excess tubing should be left coiled near the case. Do not make sharp bends near the case or bulb.

Slip the bulb through the supports in the shield. Pinch the split supporting clip until it holds the bulb firmly in position. If the seal-off tube protrudes from under the shield, it may be bent under as shown in Fig. 14.

Hold the shield over the mounting position and form a small-radius bend in the tubing. Place the split plug around the tubing and move the shield into mounting location as a unit. Push the split plug into the hole until it is wedged securely in place. Fasten the shield in place on the wall with the screws provided.

NOTE: If the tubing is properly shaped and the split plug installed as directed, the shield will cover the split plug, and the hole in the wall will be hidden from sight.

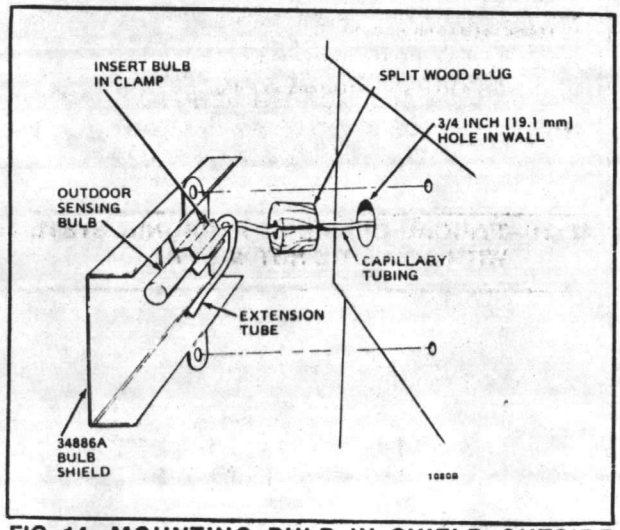


FIG. 14—MOUNTING BULB IN SHIELD OUTSIDE BUILDING.

MOUNTING THE L6008A REMOTE BULB CONTROLLER

Mounting with Guard Bracket

Mount the bulb in the guard bracket as shown in Fig. 15. Locate the bulb and bracket combination in freely circulating air in the controlled area. With screws provided, fasten the bracket in place.

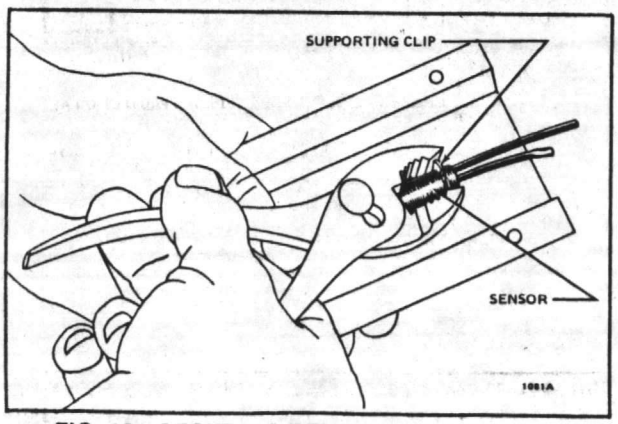


FIG. 15—SECURING REMOTE BULB IN CLIP.

Mounting on Suction Line

1. In cooling units with more than one suction line, sensing bulb should be placed on the common line.
2. Make certain the bulb is at least 2 ft [0.6 m] from the point at which the suction line leaves the cooler. This will prevent the outside temperature from being transmitted to the remote bulb through the copper tubing of the suction line.
3. Place the remote sensing bulb on the side of the horizontal suction line between the coil and trap (not on the trap).
4. Attach the sensing bulb to the suction line with clips or straps (Fig. 16).
5. Coil the excess length of capillary tubing near the L6008A case.

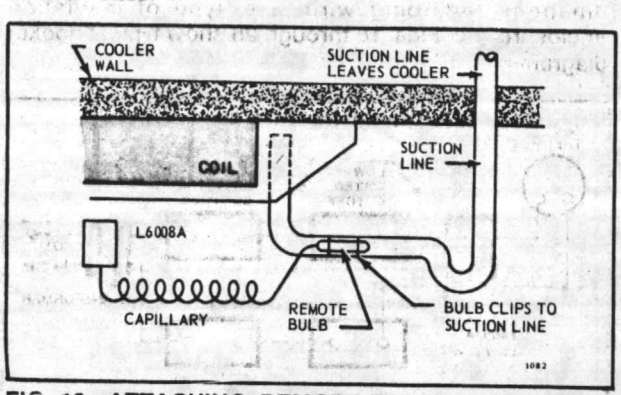


FIG. 16—ATTACHING REMOTE BULB TO HORIZONTAL SUCTION LINE.

MOUNTING SURFACE MOUNT MODEL (L6006C)

The L6006C is designed for surface mounting on piping or tanks. Mount the L6006C directly on tank surface using the adjustable mounting bracket as shown in Fig. 17. The

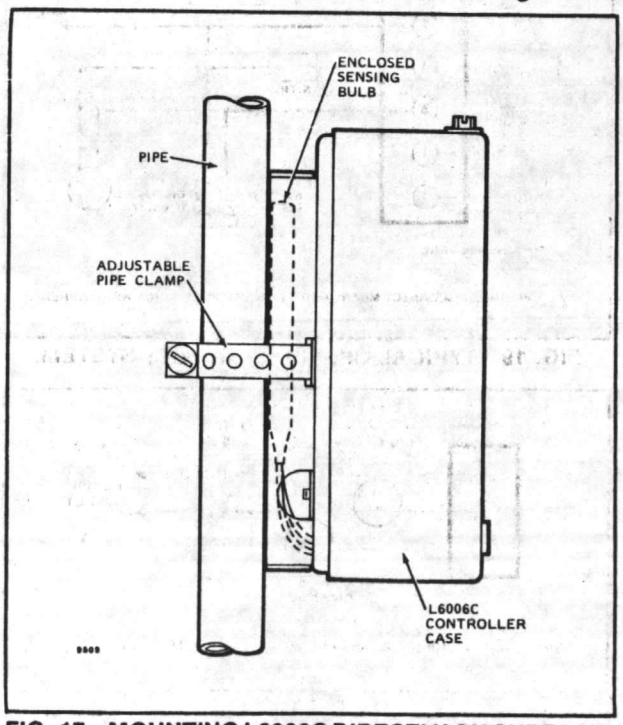


FIG. 17—MOUNTING L6006C DIRECTLY ON SURFACE.

control can be mounted in any position. (If mounting L6006C on pipe, see NOTE below.) Turn on power.

NOTE: When mounting the L6006C on piping, the pipe should be 1 in. [25.4 mm] diameter or larger for accurate temperature sensing. Remove any insulation from pipe. Thoroughly scrape off all scale, rust, or paint. Mount controller using adjustable bracket furnished.

WIRING

Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.

All wiring must comply with local codes and ordinances regarding wire size, type of insulation, enclosure, etc. Figs. 18 through 26 show typical hookup diagrams.

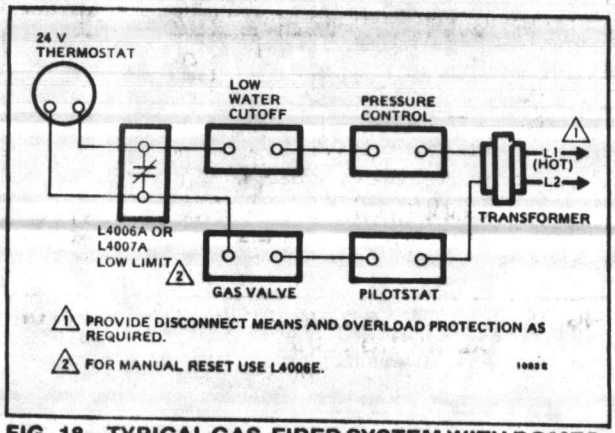


FIG. 18—TYPICAL GAS-FIRED SYSTEM WITH DOMESTIC HOT WATER.

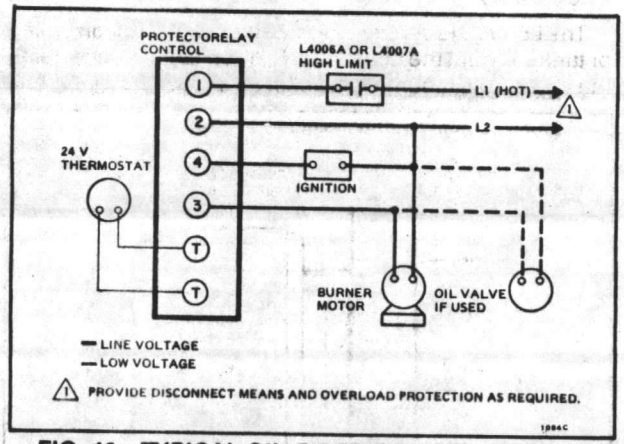


FIG. 19—TYPICAL OIL-FIRED GRAVITY SYSTEM.

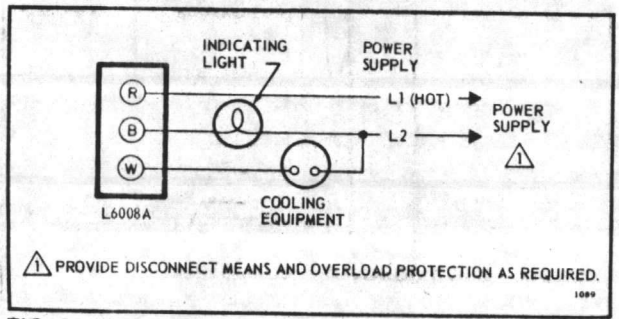


FIG. 20—L6008A USED TO CONTROL COOLING EQUIPMENT AND INDICATING LIGHT.

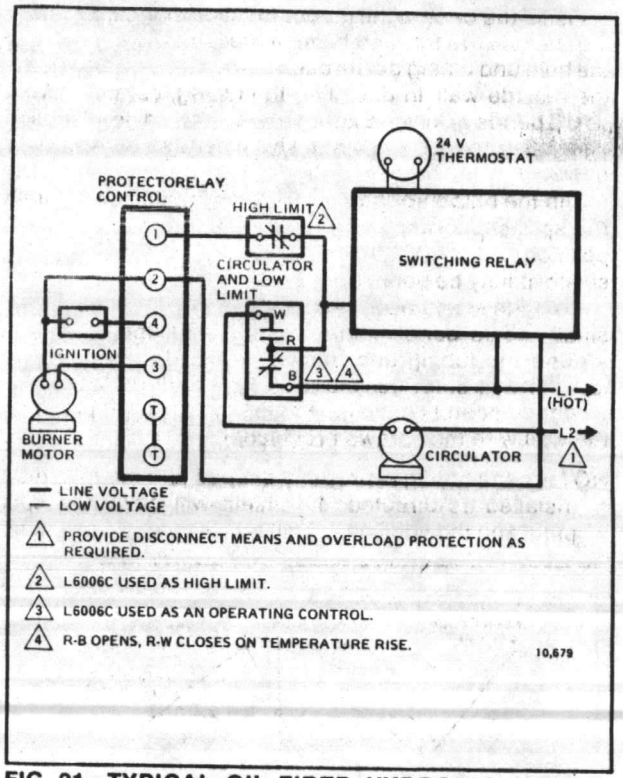


FIG. 21—TYPICAL OIL-FIRED HYDRONIC SYSTEM WITH DOMESTIC HOT WATER.

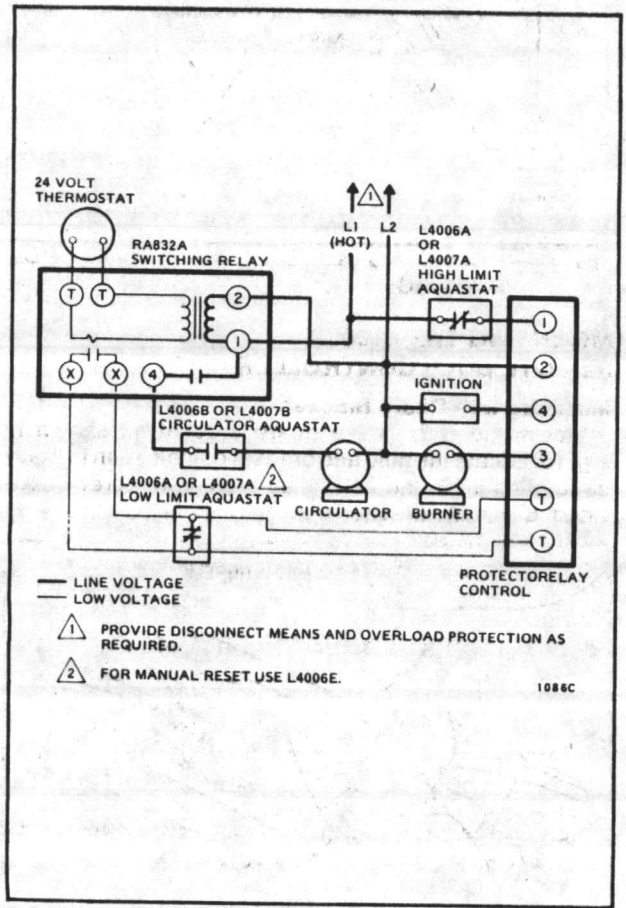


FIG. 22—TYPICAL OIL-FIRED HYDRONIC HEATING SYSTEM THAT PROVIDES YEAR-ROUND DOMESTIC HOT WATER, USING RA832A.

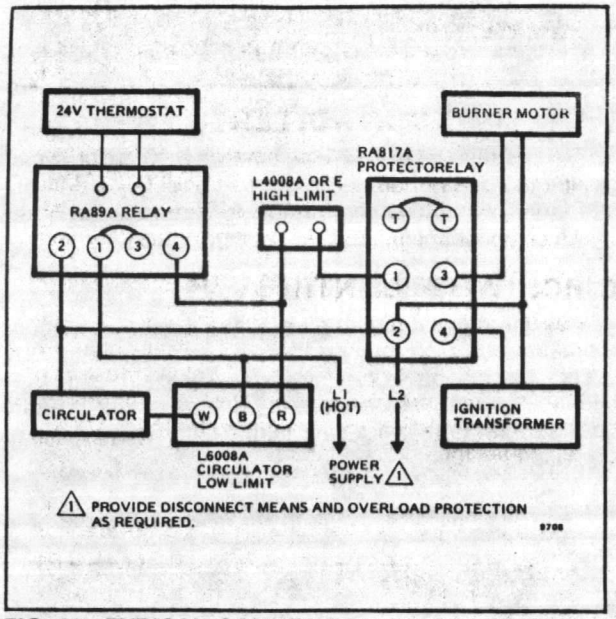


FIG. 23—TYPICAL CONNECTION DIAGRAM FOR AN OIL-FIRED, HYDRONIC HEATING SYSTEM THAT PROVIDES YEAR-ROUND DOMESTIC HOT WATER, USING RA817A.

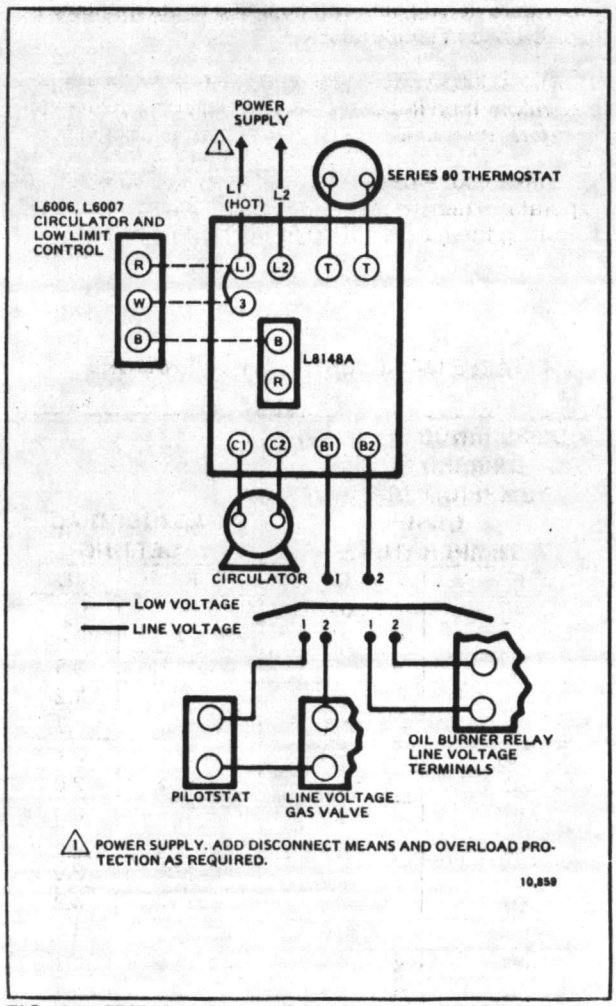


FIG. 24—TYPICAL WIRING HOOKUP, USING L6006 OR L6007 WITH L8148A.

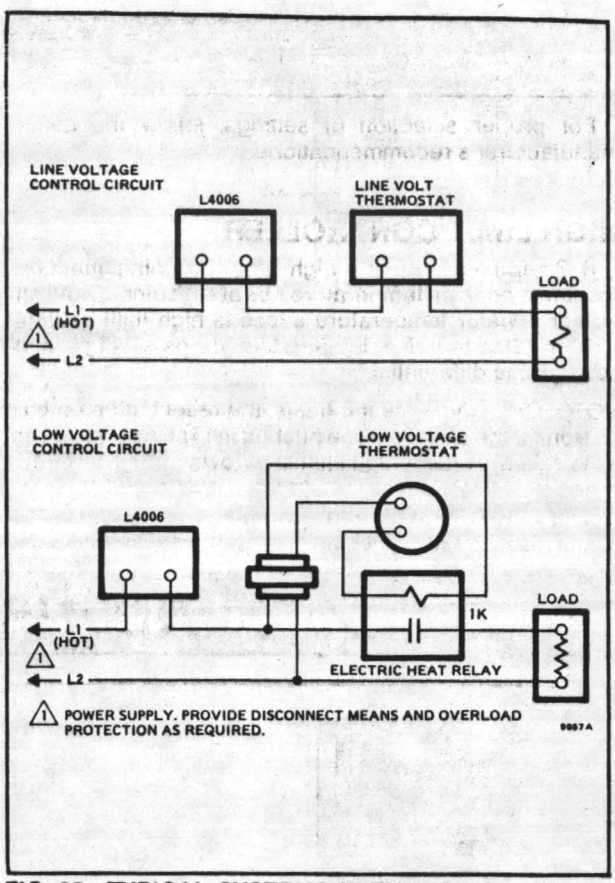


FIG. 25—TYPICAL SYSTEMS WITH 120 VOLT ELECTRIC HEAT PRIMARIES.

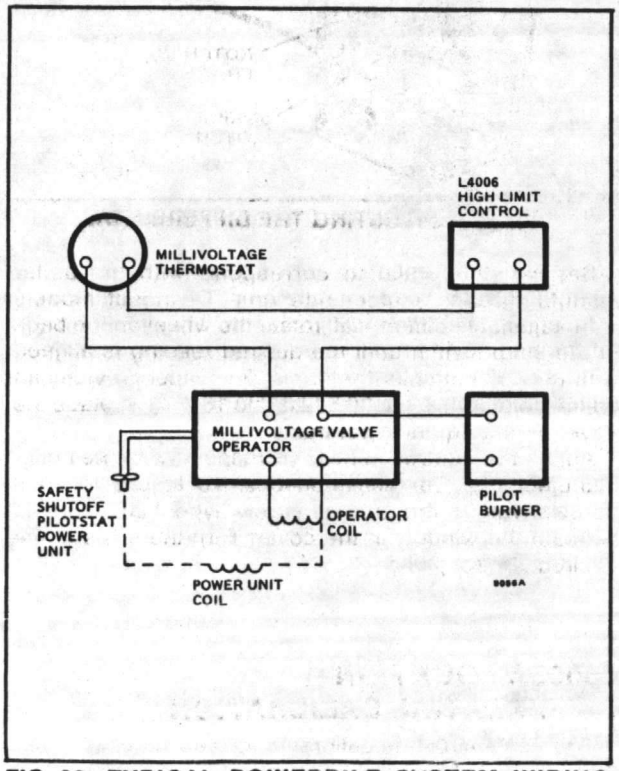


FIG. 26—TYPICAL POWERPILE SYSTEM WIRING DIAGRAM.

OPERATION

For proper selection of settings, follow the boiler manufacturer's recommendations.

HIGH LIMIT CONTROLLER

R-B terminals provide high limit switching function (contacts open on temperature rise at set point). Shuts off burner if water temperature exceeds high limit setting. Burner restarts when temperature drops to high limit setting, less differential.

NOTE: On manual reset models, the reset button on the front of the case must be pushed in to allow the burner to operate after a high limit shutdown.

LOW LIMIT CONTROLLER

R-B terminals provide low limit switching function (contacts open on temperature rise at set point). Maintains minimum boiler temperature for domestic hot water. Turns on boiler at temperature setting, minus differential.

CIRCULATOR CONTROLLER

R-W terminals provide circulation control function (contacts close on temperature rise at set point). Prevents circulation of water that is below the desired heating temperature. Breaks circulator circuit on temperature drop below setting minus differential, remakes on rise to setting.

ADJUSTMENTS

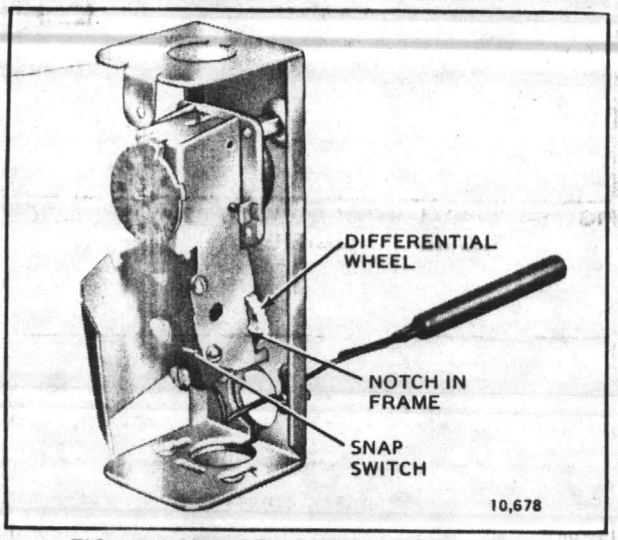


FIG. 27—ADJUSTING THE DIFFERENTIAL.

Set the differential to correspond with the boiler manufacturer's recommendations. To adjust models with adjustable differential, rotate the wheel on the back of the snap switch until the desired reading is aligned with the "V" notch in the frame. The wheel provides an adjustment from 5 F to 30 F [2.8 C to 16.7 C]. Replace the cover on the Aquastat controller.

Adjust the control point to correspond with the boiler manufacturer's recommendations. To adjust, insert a screwdriver in the slotted screw type head located beneath the window in the cover. Turn the scale to the desired control point.

L6008A LOCATION DIFFERENTIAL CALIBRATION

The L6008A1093 is calibrated for applications where the bulb and controller case are located in the same control space.

If the bulb and controller case are located in separate rooms, and if the temperature in the 2 rooms is different, an adjustment is required. The dial setting (control space temperature setting) must be adjusted to compensate for the difference in temperature.

1. If the L6008A case is located in a room with a higher temperature than indicated on the dial setting, raise the dial setting the number of degrees listed in Table III.

2. If the L6008A case is located in a room with a lower temperature than indicated on the dial setting, lower the dial setting the number of degrees listed in Table III.

TABLE III—ADJUSTING TEMPERATURE

DIFFERENCE BETWEEN DESIRED ROOM TEMPERATURE AND CASE TEMPERATURE		ADJUST DIAL SETTING	
F	C	F	C
0	0	—	0
5	2.8	3/4	0.45
10	5.6	1-1/2	0.9
15	8.3	2	1.2
20	11.1	2-3/4	1.7
25	13.9	3-1/2	2.1
30	16.7	4-1/4	2.6
35	19.5	5	3.0
40	22.2	5-3/4	3.5
45	25.0	6-1/2	3.9
50	27.8	7	4.2
55	30.6	8	4.8
60	33.4	8-1/2	5.1
70	38.9	10	6.0
80	44.5	11-1/2	6.9

EXAMPLE: In the example shown in Fig. 28, the L6008A case is located in a room with a lower temperature than the controlled space. Therefore, the controlled space setting (dial setting) must be adjusted to compensate for the temperature difference of 35 F [19.5 C] between the 2 rooms. Table III indicates that the dial setting should be lowered 5 F [3.0 C] to compensate for the 35 F [19.5 C] temperature difference.

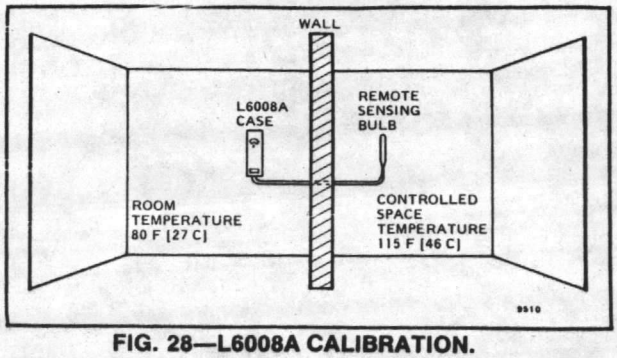


FIG. 28—L6008A CALIBRATION.

CHECKOUT

Check to make certain that the Aquastat controller has been installed and adjusted properly. Put the system into operation and observe the action of the device through several cycles to make certain it provides proper control of the system as described under OPERATION. Further adjustments can then be made to meet more exact comfort requirements.

Honeywell Inc.
1885 Douglas Drive N.
Golden Valley, MN 55422-4386

International Sales Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

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M-78

SOHIO CARBORUNDUM

MATERIAL SAFETY DATA SHEET

Sohio Emergency Phone (Toll-Free)
In Ohio: 800-362-8059
Outside Ohio: 800-321-8642
CHEMTREC Assist: 800-424-9300
Other Product Safety Info.: 216-575-8024

MANUFACTURER: Sohio Engineered Materials Company - Fibers Division
ADDRESS: P.O. Box 808, Niagara Falls, New York 14302

PRODUCT IDENTIFICATION

TRADE NAME: FIBERFRAX® ROPE

CAS NUMBER: NA
SYNONYM(S): Ceramic Fiber; Refractory Fiber; MMVF
CHEMICAL FAMILY: Vitreous Aluminosilicate Fibers
MOLECULAR FORMULA: NA
MOLECULAR WEIGHT: NA
SOHIO PRODUCT CODE: NA HIERARCHY: NA
MSDS NUMBER: BL3

PRODUCT HAZARD SUMMARY

HEALTH — WARNING!
MAY BE HARMFUL IF INHALED
MAY BE IRRITATING TO THE SKIN, EYES AND RESPIRATORY TRACT
POSSIBLE CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS

FIRE — NON-COMBUSTIBLE

REACTIVITY — STABLE

PRODUCT HEALTH HAZARD INFORMATION

ROUTE OF EXPOSURE — EFFECTS OF OVEREXPOSURE

INGESTION:
May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

SKIN:
SLIGHTLY TO MODERATELY IRRITATING. May cause irritation and inflammation due to mechanical reaction to sharp, broken ends of fibers.

EYE:
SLIGHTLY TO MODERATELY IRRITATING. Abrasive action may cause damage to the outer surface of the eye.

INHALATION:

May cause respiratory tract irritation. Pre-existing medical conditions may be aggravated by exposure: specifically, bronchial, hyper-reactivity and chronic bronchial or lung disease.

SPECIAL TOXIC EFFECTS:

Currently, there are no known chronic health effects in humans from long-term exposure to ceramic fibers.

In animal studies, refractory ceramic fibers injected into the peritoneal (abdominal) cavity have caused acute abdominal hemorrhage in hamsters but not in rats. Such injections have also produced tumors in life-time rat studies. In fact, similar results have been observed with numerous other fibrous materials. In such experiments, this abnormally sensitive injection technique is a non-physiological method of exposure, bypassing both normal pulmonary protective and clearance mechanisms.

Recently published inhalation studies have provided contradictory results. One study, which used rats as the experimental animal, reported lung damage consisting of alveolar proteinosis and interstitial fibrosis, whereas, another study using a different strain of rat, showed no similar effects.

Similarly, the pulmonary tumor-causing potential of refractory ceramic fibers in animals when inhaled is unclear. Two studies suggest a low-order potential in inducing pulmonary tumors in animals, while two other studies suggest ceramic fibers are not tumorigenic in animals.

Further animal and human health studies are planned. Pending the results of these studies, strict adherence to recommended safe work practices described elsewhere in this data sheet is advised.

FIRST AID

INGESTION:

Do not induce vomiting. Get medical attention if irritation persists.

SKIN CONTACT:

Wash area of contact thoroughly with soap and water. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful. Get medical attention if irritation persists.

EYE CONTACT:

Flush immediately with large amounts of water. Eye lids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

INHALATION:

Remove affected person from source of exposure. Get medical attention.

ND = No Data
NA = Not Applicable

PERSONAL PROTECTION INFORMATION

The following personal protective guidelines should be followed, especially where engineering controls (e.g. mechanical dust collection and other means of exhaust ventilation) are not technically feasible or do not reduce airborne fiber concentrations to below 2 fibers/cc.

EYE PROTECTION:

Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye baths readily available where eye contact can occur.

SKIN PROTECTION:

Wear gloves, hats and full body clothing to prevent skin contact. Use separate lockers for work clothes to prevent fiber transfer to street clothes. Avoid taking unwashed work clothes home. Wash work clothes separately from other clothing. Rinse washing machine thoroughly after use. If clothing is to be laundered by someone else, inform launderer of proper procedures.

RESPIRATORY PROTECTION:

Use NIOSH or MSHA approved equipment when airborne exposure limits are exceeded. NIOSH/MSHA approved breathing equipment may be required for non-routine and emergency use. Ventilation may be used to control or reduce airborne concentrations. Acceptable respirators recommended for given airborne ceramic fiber concentrations are:

Concentration	Respirator Type
2.0 - 5.0 f/cc	3M 8710 or equivalent.
5.0 - 50.0 f/cc	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
> 50.0 f/cc	MSA 01-00-06 full face piece type C supplied-air or equivalent. OSHA approved air source required.

Pending the results of long-term health effects studies, engineering control of airborne fibers to the lowest levels attainable is advised.

PHYSICAL PROPERTIES

BOILING POINT, C (F): NA
MELTING POINT, C (F): ND
VAPOR PRESSURE, mm Hg: NA
VAPOR DENSITY (AIR=1): NA
SOLUBILITY IN WATER, %: NA

APPEARANCE/ODOR: ND

SPECIFIC GRAVITY: ND
% VOLATILE: ND
EVAPORATION RATE (BUTYL ACETATE=1): NA
VISCOSITY, SUS: NA
POUR POINT: NA
pH: NA

FIRE AND EXPLOSION DATA

FLASH POINT, C (F): None
AUTOIGNITION TEMPERATURE, C (F): None

ND = No Data
NA = Not Applicable

FLAMMABILITY LIMITS IN AIR (% BY VOL.): LOWER: NA UPPER: NA
BASIC FIREFIGHTING PROCEDURES: Use extinguishing agent suitable for type of surrounding fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: NA

REACTIVITY DATA

STABILITY/INCOMPATIBILITY:
Stable under normal conditions of use. Incompatible with hydrofluoric acid and concentrated alkali.

HAZARDOUS REACTIONS/DECOMPOSITION PRODUCTS:
NA

ENVIRONMENTAL INFORMATION

SPILL OR RELEASE TO THE ENVIRONMENT:
Where possible, use vacuum suction to clean up spilled material. Use dust suppressant where sweeping is necessary. Avoid clean up procedures that may result in water pollution. Personal safety and exposure recommendations described elsewhere in this data sheet apply to exposure during clean up of spilled material.

WASTE DISPOSAL:
This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however it could be hazardous if it is considered toxic, corrosive, ignitable, or reactive according to Federal definitions (40 CFR 261). Additionally, it could be designated as hazardous according to state regulations. This substance could also become a hazardous waste if it is mixed with or comes in contact with a hazardous waste. If such contact or mixing may have occurred, check 40 CFR 261 to determine whether it is a hazardous waste. If it is a hazardous waste, regulations at 40 CFR 262, 263, and 264 apply.

The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, state, and local regulations.

ADDITIONAL ENVIRONMENTAL REGULATORY INFORMATION:
There may be specific regulations at the local, regional or state level that pertain to this material.

SPECIAL PRECAUTIONS/SUPPLEMENTAL INFORMATION

HANDLING/STORAGE:
Carbon monoxide, carbon dioxide, oxides of nitrogen, reactive hydrocarbons and a small amount of formaldehyde may accompany binder burnoff during first heat. Use adequate ventilation or other precautions to eliminate vapors resulting from binder burnoff. Exposure to burnoff fumes may cause respiratory tract irritation, bronchial hyper-reactivity and asthmatic response.

Product which has been in service at elevated temperatures (greater than 1600 F) may undergo partial conversion to cristobalite, a form of crystalline silica which can cause severe respiratory disease--"Pneumoconiosis". The amount of cristobalite present will depend on the temperature and length in service.

The permissable exposure limit (PEL) for mineral dusts containing cristobalite is determined by one half the value calculated from the mass formula, $(10\ mg/M^3)/(\%\ SiO_2 + 2)$, i.e. 18% cristobalite; $1/2(10)/(18+2) = 0.25\ mg/M^3$ (OSHA 1978). Particular care should be taken when working with "used" material to minimize generation of dust. When removing and handling ceramic fiber used in high temperature applications, special caution should be taken to avoid unnecessary cutting and tearing of the used material to minimize generation of airborne dust. Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded, especially in confined areas with inadequate ventilation or other areas. Acceptable respirators recommended for given airborne cristobalite concentrations are:

Concentration	Respirator Type
Up to 10 times PEL	3M 8710 or equivalent.
10 to 100 times PEL	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
> 100 times PEL	MSA 01-00-06 full face piece type C supplied-air or equivalent. OSHA approved air source required.

TRANSPORTATION REQUIREMENTS

D.O.T. HAZARD CLASS (49 CFR 172.101): NA
D.O.T. PROPER SHIPPING NAME (49 CFR 172.101): NA
D.O.T. LABELS REQUIRED (49 CFR 172.101): NA
D.O.T. PLACARDS REQUIRED: NA
BILL OF LADING DESCRIPTION: ND
UN/NA CODE: NA

INGREDIENT/HEALTH HAZARD INFORMATION

COMPONENT	CAS NO.	%	EXPOSURE LIMITS - REFERENCE
Aluminosilicate (vitreous)	NA	75-85	2 fibers/cc TWA (SOHIO)*; 10 fibers/cc CL (SOHIO)*
Organic carrier fiber	NA	15-25	NA

ND = No Data
NA = Not Applicable

COMPONENT	CAS NO.	%	EXPOSURE LIMITS - REFERENCE
Remaining components not determined hazardous and/or hazardous components present at less than 1.0% (0.1% for carcinogens).	Mixture	Trace	NA

*Pending the results of chronic health effects studies, airborne exposures should be controlled at or below the SOHIO recommended exposure limits listed above.

REVISION DATE: 9/20/85
REPLACES SHEET DATED:

COMPLETED BY: G. R. Krautter
APPROVED BY: RWMast

ND = No Data
NA = Not Applicable

FO-44271

Mercury Switches
Contain Mercury Thallium Amalgam

CAUTION!

Amalgam May Be Released Upon Breakage
Clean-up Broken Parts And Residue Immediately

Dispose of in accordance with Local, State,
and Federal Regulations
Inhaled vapors can cause headache, abdominal pain,
difficulty breathing, inflammation of gums and mouth,
tremors, kidney failure, death.
Skin contact may cause irritation, absorption.

MICRO SWITCH
A DIVISION OF HONEYWELL INC. • 11 WEST SPRING STREET • FREEPORT, ILLINOIS 61032

Mercury Switches
Contain Metallic Mercury

CAUTION!

Mercury May Be Released Upon Breakage
Clean-up Broken Parts And Residue Immediately

Dispose of in accordance with Local, State,
and Federal Regulations
Inhaled vapors can cause headache, cough chest pain,
difficulty breathing, inflammation of gums and mouth,
tremors, death.
Skin contact may cause irritation, absorption.

MICRO SWITCH
A DIVISION OF HONEYWELL INC. • 11 WEST SPRING STREET • FREEPORT, ILLINOIS 61032

)-44272

MATERIAL SAFETY DATA SHEET

MICRO SWITCH
A DIVISION OF HONEYWELL INC.

CORP ID # IL50-002 DIV. ID # MS002

I. MATERIAL IDENTIFICATION

MATERIAL NAME:
Glass Enclosed Mercury Thallium Switch

MANUFACTURER:
MICRO SWITCH, 11 W. Spring St., Freeport, Illinois 61032

TELEPHONE NUMBER
(815)235-5500

SYNONYMS:

MATERIAL USE:
Glass Enclosed Mercury Thallium Switch

APPEARANCE AND ODOR
Silvery, heavy, liquid, metals

II. HAZARDOUS INGREDIENTS

MATERIAL	CAS #	%	TLV (UNITS)
Mercury *	007 439 976	91.5/wt	0.05 mg/m^3+ 0.10 mg/m^3++
Thallium * (skin)	007 440 280	8.5/wt	0.10 mg/m^3**

* This amalgam will be exposed upon breakage.

\+ ACGIH current Threshold Limit Value (TLV).

++ OSHA current Permissable Exposure Limit (PEL)

** OSHA and ACGIH have same exposure limit.

III. HEALTH HAZARD INFORMATION

EFFECTS OF EXCESSIVE EXPOSURE

Weakness, fatigue, loss of weight, loss of appetite, insomnia, loss of hair, gastrointestinal disturbances, tremor, gingivitis. Mercury and Thallium can be absorbed through the skin.

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:
Flush with running water for 15 minutes.

SKIN CONTACT:
Remove contaminated clothing. Wash affected areas with soap & water.

INHALATION: Remove to fresh air. Restore and/or support breathing as needed. Administer oxygen for chemical pneumonitis. Seek medical attention.

INGESTION:
Seek medical attention.

IV. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION

Full face piece gas mask equipped with high efficiency filters plus canister containing iodine - impregnated charcoal 1 mg/m^3-5 mg/m^3. Full face positive pressure self-contained breathing apparatus above 5 mg/m^3.

PROTECTIVE GLOVES

Rubber gloves while cleaning up broken switch.

OTHER PROTECTIVE EQUIPMENT

Avoid eye contact by use of safety glasses when cleaning up broken switch.

N.D. – NOT DETERMINED N.A. – NOT APPLICABLE

IV. SPECIAL PROTECTION INFORMATION (CONT.)

VENTILATION	General or local exhaust adequate to meet TLV.

V. SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS	Switches must be cushioned from physical damage.
D.O.T. CLASS	Poison B UN 2024

VI. SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	If a switch is broken, notify Safety Personnel. Provide adequate ventilation. Clean up spills promptly. A suction bottle with capillary tube can be used for small amounts. Prevent skin contact. Collect all parts of broken switch in sealed container.
WASTE DISPOSAL METHOD	Small quantities should be sealed in polyethylene bags and buried in Class I landfill. Do not discharge mercury-thallium amalgam down drain. Dispose of in accordance with local, state, and federal regulations.

VII. REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID	
UNSTABLE	STABLE		
	X		Breakage
INCOMPATIBILITY (MATERIALS TO AVOID)		Acetylenes, Ammonia, Alkali metals, Chlorine dioxide, Methyl azide	
HAZARDOUS DECOMPOSITION PRODUCTS		Inorganic mercury vapor	

VIII. FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARDS	Non-flammable
PRECAUTIONS	Move containers from fire area if you can do it without risk.
SPECIAL FIRE FIGHTING PROCEDURES	Self-contained breathing apparatus should be used if metal is exposed to heat.
EXTINGUISHING MEDIA	Select media for surrounding fire.

NFPA RATING

H - 3	F - 0	R - 0	W

FLAMMABLE LIMITS/% IN AIR

LEL: N.A.	UEL: N.A.

IX. PHYSICAL DATA

BOILING POINT 760mm Hg: 675 °F (357 °C)	**SOLUBILITY IN WATER** Negligible
VAPOR PRESSURE AT 68 °F: 0.0011 mm Hg	**VOLATILES:** N.A. % BY VOLUME
SPECIFIC GRAVITY (H_2o = 1): 13.38	**EVAPORATION RATE** (= 1): N.D.
VAPOR DENSITY (AIR = 1): Depends on concentration	**FLASH POINT** Non-flammable

INFORMATION SOURCE

The information contained herein is based upon current available scientific information and manufacturers data. The descriptions contained herein represent the majority of uses for this product. Abuse or unforeseen circumstances are not addressed. Information may be developed from time to time which may render the conclusions of this report obsolete. MICRO SWITCH makes no warranties to its customers, agents, employees, or contractors as to the applicability of this information to the users intended purpose or for the consequences for its use or misuse.

☒ NEW ☐ REVISION

APPROVED BY	DATE
E. Stewart	11/5/85

OIL SYSTEMS MATERIAL

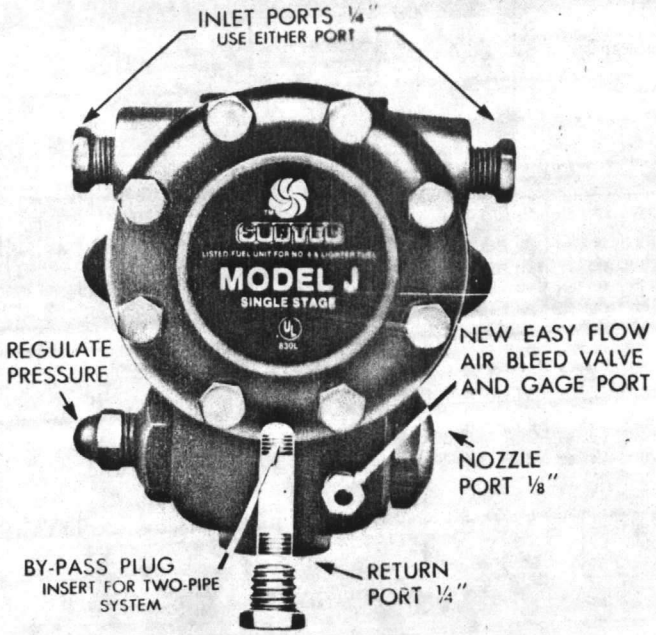
AD2564

IMPORTANT . . INSTALLATION INFORMATION

SUNTEC

SUNTEC ROTA-ROLL® FUEL UNITS

MODEL J SINGLE STAGE AND MODEL H TWO STAGE



ONE-PIPE SYSTEM (Inlet line only)

Fuel units are shipped without by-pass plug installed. Verify that no one has installed the by-pass plug. For line lengths under 50 feet use 3/8" O.D. copper tubing. For line lengths 50 to 100 feet use 1/2" O.D. copper tubing. "J" and "H" models are not recommended for lift above two feet, max 2" Hg inlet vacuum, except for the J2–F (Fig. 2).

TWO-PIPE SYSTEM (Inlet and Return line)

Remove internal by-pass plug from plastic bag and insert as shown in illustration. Tighten securely. For recommended line sizes refer to charts on reverse side. Maximum operating vacuum at fuel unit for the "J" model is 10" Hg. The Model "H" should not be used where inlet vacuum exceeds 20" of Hg at 1725 and 15" of Hg at 3450 rpm.

ALL SYSTEMS — General Information

1. Oil lines should consist of not smaller than 1/2" O.D. copper tubing. See line size and installation data.
2. Oil lines must be absolutely air tight. Check all connections and joints. Note: Teflon tape should not be used on fittings.
3. During initial start-up or if the oil supply runs dry, prime the fuel unit with lubricating oil.
4. Return line and inlet pressures must not exceed 10 psi. Higher pressures may cause the seal to leak.

AIR BLEED PROCEDURE WITH NEW EASY FLOW AIR BLEED VALVE

One-Pipe System

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

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

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

Two-Pipe Systems

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

MOUNTING POSITION

Model "J" may be mounted in any position.

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

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

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

ADDITIONAL INSTALLATION INFORMATION

Piping of fuel lines for oil fired
WATER HEATER . . . . . Form No. 1335

Suntec Boost Pump –
SIMPLIFIED CIRCUIT . . . . Form No. 450012

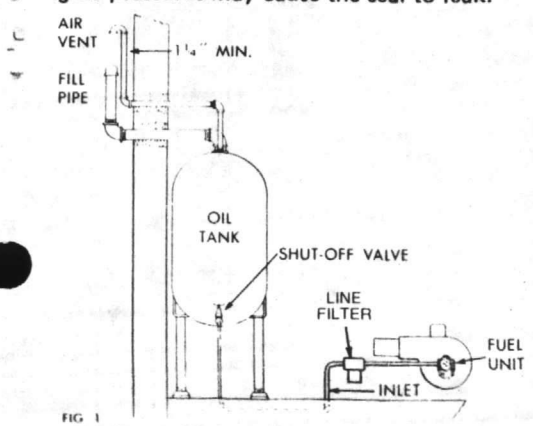


FIG. 1

ONE PIPE SYSTEMS

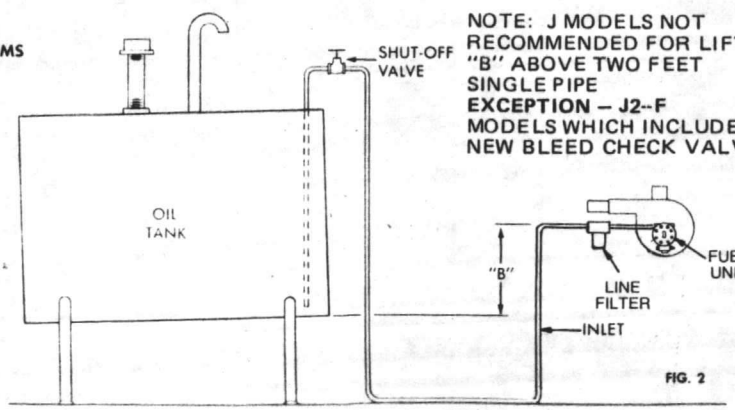


FIG. 2

NOTE: J MODELS NOT RECOMMENDED FOR LIFT "B" ABOVE TWO FEET SINGLE PIPE
EXCEPTION – J2–F MODELS WHICH INCLUDE THE NEW BLEED CHECK VALVE.

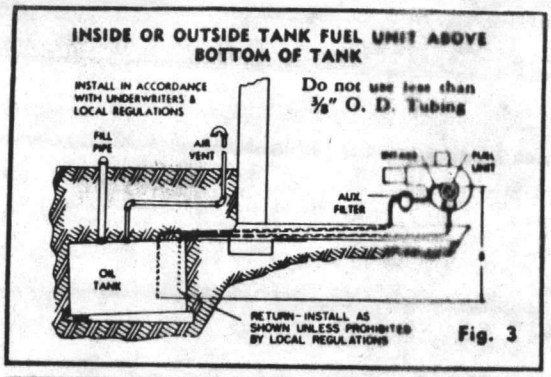


Fig. 3

TWO PIPE INSTALLATION

MAXIMUM ALLOWABLE LENGTH OF TOTAL INTAKE OR RETURN LINE IN FEET. (CALCULATED FOR FUEL OIL, VISCOSITY 57SSU)

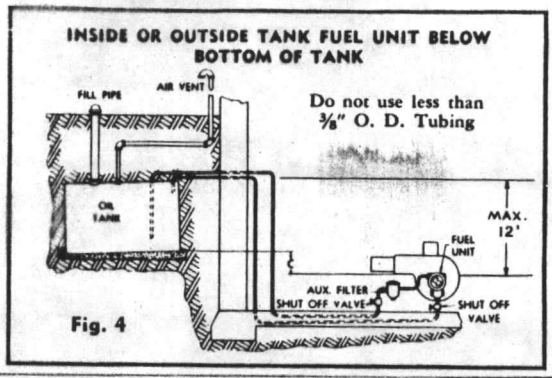


Fig. 4

LIFT CONDITION (FIG. 3)

Lift "B" Fig. 3	⅜" O. D. Tubing (1725 RPM)										½" O. D. Tubing (1725 RPM)											½" O. D. Tubing (3450 RPM)															
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	65′	65′	53′	42′	31′	75′	77′	75′	63′	55′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	73′	100′	100′	100′	100′	100′	99′	77′	59′	100′	100′	100′	100′	100′	100′	94′	81′	69′
1′	60′	60′	49′	38′	29′	72′	74′	72′	61′	53′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	71′	100′	100′	100′	100′	100′	91′	72′	55′	93′	93′	93′	93′	93′	89′	77′	65′
2′	55′	55′	45′	35′	27′	69′	71′	70′	58′	51′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	68′	100′	100′	100′	100′	100′	84′	66′	50′	88′	88′	88′	88′	88′	85′	73′	62′
3′	50′	50′	41′	32′	24′	67′	69′	67′	56′	49′	100′	100′	100′	100′	96′	100′	100′	100′	100′	100′	65′	93′	93′	93′	93′	93′	77′	60′	46′	83′	83′	83′	83′	83′	80′	69′	58′
4′	45′	45′	37′	29′	22′	64′	66′	64′	53′	47′	100′	100′	100′	100′	87′	100′	100′	100′	100′	100′	63′	84′	84′	84′	84′	84′	69′	54′	41′	78′	78′	78′	78′	78′	75′	64′	55′
5′	40′	40′	33′	26′	20′	61′	63′	61′	51′	45′	100′	100′	100′	100′	78′	100′	100′	100′	100′	100′	96′	60′	75′	75′	75′	75′	75′	62′	48′	37′	73′	73′	73′	73′	73′	70′	60′	51′
6′	36′	36′	29′	23′	17′	58′	60′	58′	49′	43′	100′	100′	100′	90′	68′	100′	100′	100′	100′	100′	92′	57′	66′	66′	66′	66′	66′	54′	42′	32′	69′	69′	69′	69′	69′	66′	56′	48′
7′	31′	31′	25′	20′	15′	55′	57′	55′	46′	41′	100′	100′	99′	78′	59′	100′	100′	100′	100′	100′	87′	54′	57′	57′	57′	57′	57′	47′	37′	28′	64′	64′	64′	64′	64′	61′	52′	44′
8′	26′	26′	21′	17′	13′	52′	54′	53′	44′	39′	100′	100′	83′	66′	50′	100′	100′	100′	100′	100′	83′	51′	48′	48′	48′	48′	48′	40′	31′	24′	59′	59′	59′	59′	59′	56′	48′	41′
9′	21′	21′	17′	14′	—	50′	51′	50′	42′	37′	83′	83′	68′	53′	40′	100′	100′	100′	100′	100′	79′	49′	39′	39′	39′	39′	39′	32′	25′	19′	54′	54′	54′	54′	54′	52′	44′	38′
10′	16′	16′	13′	—	—	47′	48′	47′	39′	35′	64′	64′	52′	41′	31′	100′	100′	100′	100′	100′	74′	46′	30′	30′	30′	30′	30′	25′	19′	15′	49′	49′	49′	49′	49′	47′	40′	34′
11′	—	—	—	—	—	44′	45′	44′	37′	33′	—	—	—	—	—	100′	100′	100′	100′	100′	70′	43′	—	—	—	—	—	—	—	—	44′	44′	44′	44′	44′	42′	36′	31′
12′	—	—	—	—	—	41′	42′	41′	35′	31′	—	—	—	—	—	100′	100′	100′	100′	100′	65′	40′	—	—	—	—	—	—	—	—	39′	39′	39′	39′	39′	37′	32′	27′
13′	—	—	—	—	—	38′	39′	38′	32′	28′	—	—	—	—	—	100′	100′	100′	100′	100′	61′	37′	—	—	—	—	—	—	—	—	34′	34′	34′	34′	34′	33′	28′	24′
14′	—	—	—	—	—	35′	37′	36′	30′	26′	—	—	—	—	—	100′	100′	100′	100′	99′	56′	34′	—	—	—	—	—	—	—	—	29′	29′	29′	29′	29′	28′	24′	20′
15′	—	—	—	—	—	33′	34′	33′	28′	24′	—	—	—	—	—	100′	100′	100′	100′	91′	52′	32′	—	—	—	—	—	—	—	—	24′	24′	24′	24′	24′	23′	20′	17′

LIFT CONDITION (FIG. 3)

Lift "B" Fig. 3	⅜" O. D. Tubing (3450 RPM)														
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
1′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
2′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
3′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
4′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
5′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′	100′
6′	100′	100′	100′	100′	100′	100′	100′	90′	100′	100′	100′	100′	100′	100′	100′	100′
7′	100′	100′	100′	100′	100′	100′	100′	78′	100′	100′	100′	100′	100′	100′	100′	100′
8′	100′	100′	100′	100′	100′	100′	85′	65′	100′	100′	100′	100′	100′	100′	100′	100′
9′	100′	100′	100′	100′	100′	90′	69′	53′	100′	100′	100′	100′	100′	100′	100′	100′
10′	83′	83′	83′	83′	83′	69′	53′	41′	100′	100′	100′	100′	100′	100′	100′	95′
11′	—	—	—	—	—	—	—	—	100′	100′	100′	100′	100′	100′	100′	86′
12′	—	—	—	—	—	—	—	—	100′	100′	100′	100′	100′	100′	90′	76′
13′	—	—	—	—	—	—	—	—	95′	95′	95′	95′	95′	91′	78′	67′
14′	—	—	—	—	—	—	—	—	82′	82′	82′	82′	82′	78′	67′	57′
15′	—	—	—	—	—	—	—	—	68′	68′	68′	68′	68′	65′	56′	48′

GRAVITY CONDITION (FIG. 4)

Distance "C" Fig. 4	⅜" O. D. Tubing (1725 RPM)											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0′	64′	64′	53′	41′	31′	75′	75′	70′	60′	51′	30′	20′
1′	69′	69′	57′	45′	34′	78′	78′	72′	62′	52′	31′	21′
2′	74′	74′	61′	48′	36′	80′	80′	75′	64′	54′	32′	22′

Distance "C" Fig. 4	⅜" O. D. Tubing (3450 RPM)															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	31′	31′	31′	31′	31′	25′	19′	15′	25′	25′	25′	25′	25′	23′	20′	17′
1′	33′	33′	33′	33′	33′	27′	21′	16′	26′	26′	26′	26′	26′	25′	22′	18′
2′	35′	35′	35′	35′	35′	29′	23′	17′	27′	28′	28′	28′	29′	26′	23′	19′

Distance "C" Fig. 4	½" O. D. Tubing (3450 RPM)															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0′	100′	100′	100′	100′	100′	99′	77′	59′	100′	100′	100′	100′	100′	94′	81′	69′
1′	100′	100′	100′	100′	100′	100′	83′	63′	100′	100′	100′	100′	100′	99′	85′	72′
2′	100′	100′	100′	100′	100′	100′	89′	68′	100′	100′	100′	100′	100′	100′	89′	76′

PUMP USAGE IDENTIFICATION

J PUMP

Model	Max. Nozzle Capacity (GPH) At Rated Pressure 1725 RPM	3450 RPM	Rated Pressure (PSI)
JA2B	0	7	100
JB2B	0	10	100
JJ2B	0	3	100
J2B	3	16	100
J2BF	3	16	100
J3B	7	20	100
J3B-B	0	14	200
J3P-B	0	14	200
J4P	10	30	100
J5B	16	40	100
J5P	16	40	100
J6B-B	15	50	200
J6B	20	55	100
J6B-C	7	40	300
J6K	20	55	100

EXAMPLE

J3 B A B 100

- 100 — MOUNTING
- B — PRESS. RATING (NO LETTER—100PSI)
- A — ROTATION
- B — STRAINER TYPE
- J3 — MODEL

Strainer Type	UL Strainer Rating (GPH) * #2 Fuel Oil
B	7
P	Unlimited

H PUMP

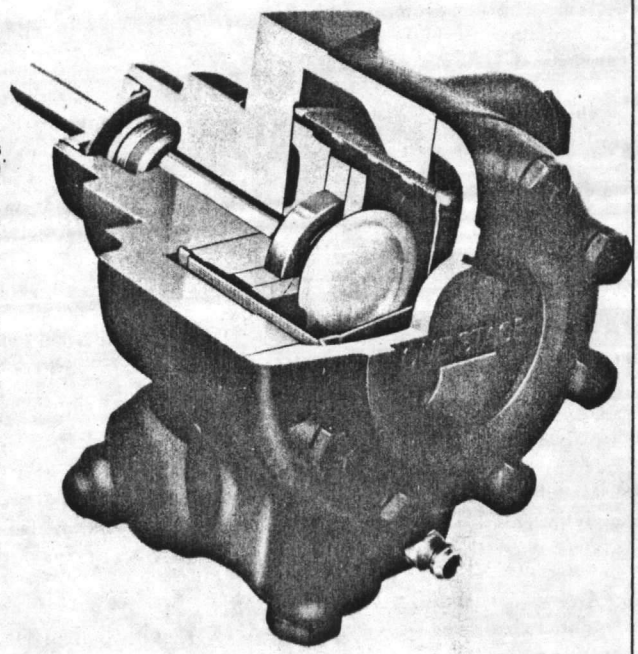
Model	Max. Nozzle Capacity (GPH) At Rated Pressure 1725 RPM	3450 RPM	Rated Pressure (PSI)
HA2B	0	7	100
HA2P	0	7	100
HH2B	0	3	100
H2B	3	16	100
H2P	3	16	100
H3B-B	0	14	200
H3B	7	20	100
H3B-C	0	7	300
H3P	7	20	100
H3P-B	0	14	200
H3P N-C	0	14	300
H4P-C	0	16	300
H4P	10	30	100
H4P N-C	1.5	20	300
H5P	16	40	100
H6B-C	7	40	300
H6P	20	55	100
H6P-C	7	40	300
H6P N-C	10	45	300
H7P-B	30	80	200
H7P	40	No	100
H8P	80	No	100
H8P N-C	55	No	300

* Max. Firing Rate Not to Exceed Max. Nozzle Capacity or Strainer Rating Whichever is Less. A Greater Firing Rate Requires a Suitable External Strainer.

SIMPLIFIED FIELD SERVICE

FOR "J" AND "H" FUEL UNITS

MODEL "J" Single-stage ROTA-ROLL PUMP-MEMBERS



Model J is recommended for single-pipe, gravity feed installations or for two-pipe installations under low-lift conditions up to 10 inches of vacuum. It may be mounted in *any* position.

Model J2XX(F) with Check Valve in piston provides fast purging and fast cutoff with single-pipe Lift. Check Valve keeps air from re-entering the strainer chamber while bleeding with Easy Flow Air Bleed Valve.

Flow of oil through the unit is shown in drawing below. Oil entering the unit, passes through the strainer, becomes trapped between teeth of the Rota-Roll gears and is pumped under pressure to the valve. Pressure forces the piston away from the nozzle cutoff seat, and oil then flows out the nozzle port. Oil in excess of nozzle capacity is bypassed through the valve, back to the strainer chamber in a single-pipe system, or in a two-pipe system is returned to the tank. When the pump motor shuts off, pressure is reduced on the head of the piston. The piston then snaps back, firmly closing the nozzle port opening.

A bleed opening in the piston (Fig. 1) or check valve (Fig. 2) provides for automatic air purging on a two-pipe system, and accelerates piston travel on shutdown, thereby giving fast cutoff.

AIR BLEED PROCEDURE WITH NEW EASY FLOW AIR BLEED VALVE*

One-Pipe System

Start burner: Loosen Easy Flow Air Bleed Valve CCW just ¼ turn for fast purging (Fig. 1) (Fig. 2).

For clean bleed in restricted spaces, an easily attached hose can be used to direct bleed oil into a container. A ¼" I.D. hose can be slipped directly over end of valve.

BLEED UNIT FOR 15 SECONDS AFTER THE LAST AIR BUBBLE IS SEEN.

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

J2XX(F) assembly (Fig. 2) may be used with Single-pipe or two pipe installations.

Two-Pipe Systems

Air bleeding is automatic. Opening Easy Flow Air Bleed Valve will allow oil to be pulled up faster if desired. By-passed oil or air cannot reenter unit and returns to tank through return line providing return line is run to the bottom of the tank.

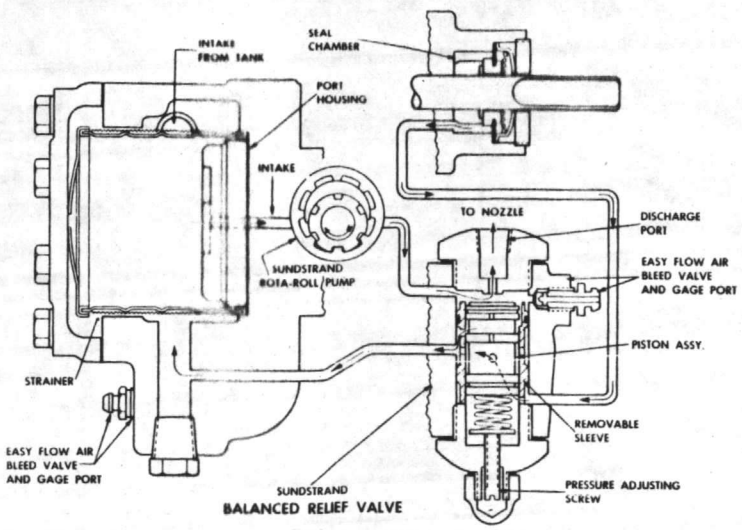


Fig. 1

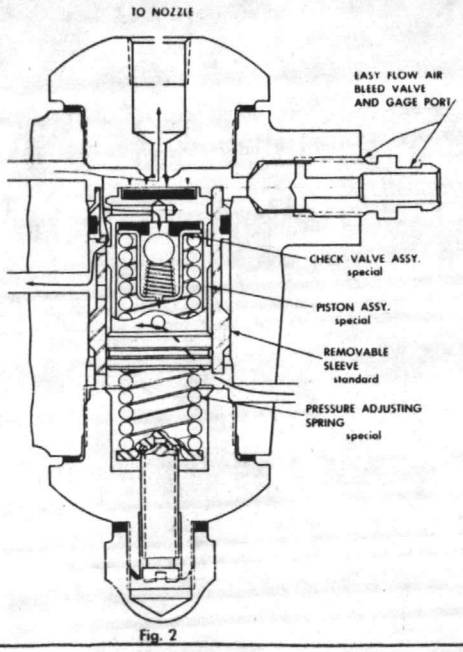


Fig. 2

new models H-4 and H-5 two-stage 2 Rota-Roll Pump-members

This new fast priming fuel unit has been designed to give the ultimate in 2 stage performance when mounted in *any* of the three recommended mounting positions. An exclusive circuit makes it ideal for long line high lift installations.

When starting dry *both sets* of gears draw on the suction line. Air pumped by both the first and second stage gears then is discharged into the return line. Extremely fast priming therefore occurs.

Once prime is established, the first stage continues to discharge to tank. The second stage then builds pressure causing the regulating valve to bypass excess oil back into the strainer chamber. Consequently, flow through the suction and return lines is greatly reduced, and friction losses are minimized, thus permitting use of longer or smaller diameter lines.

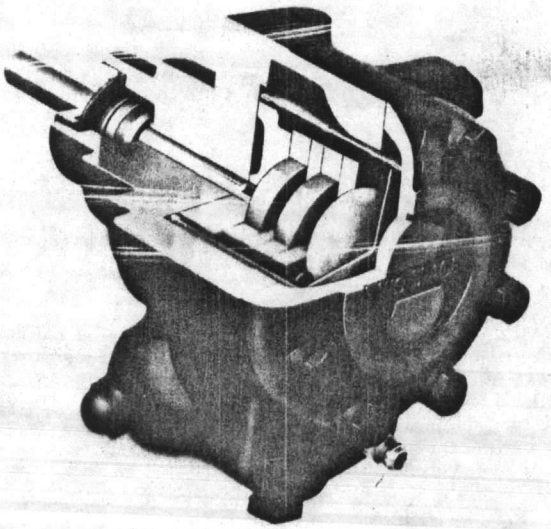
Furthermore, because the first stage has an inlet above that of the second stage, any air drawn into the unit after priming is immediately picked up by the first stage and discharged to tank. Also, the second stage can only draw in solid air-free oil. Thus, there is no air in the oil delivered to the nozzle, and sharp cutoff is assured.

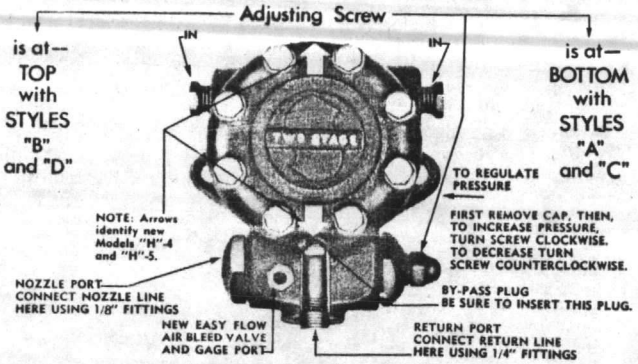
Valve action is similar to that in Model J. Oil flow is as indicated in the drawing below.

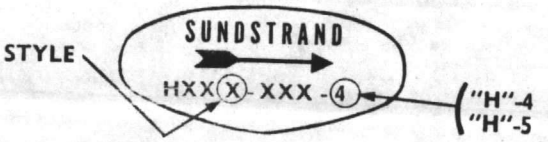
Model H is recommended for two-pipe, high-lift installations under vacuums to 20 inches. It may also be used on single-pipe gravity feed installations, but then functions as a single-stage unit.

All Model H units described herein are designed to be mounted with the valve horizontal — at either the top or bottom. They may also be mounted with the valve vertical providing the adjusting screw is at the top with styles B and D, or at the bottom with Styles A and C. Flexibility of mounting position and interchangeability with single-stage models are therefore afforded.

NOTE: Earlier "H" models having a designation ending in —1, —2, and —3, were only intended for mounting with the valve underneath.







Seal Chamber connected to Strainer Chamber in all H7 and H8XX-XXX-5 Models. (Fig. 4).

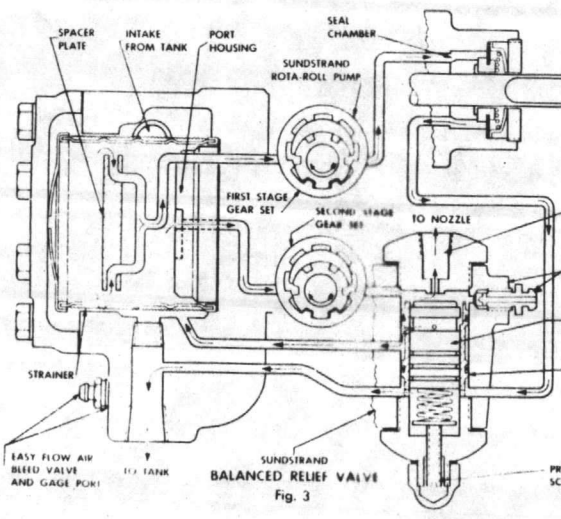


Fig. 3

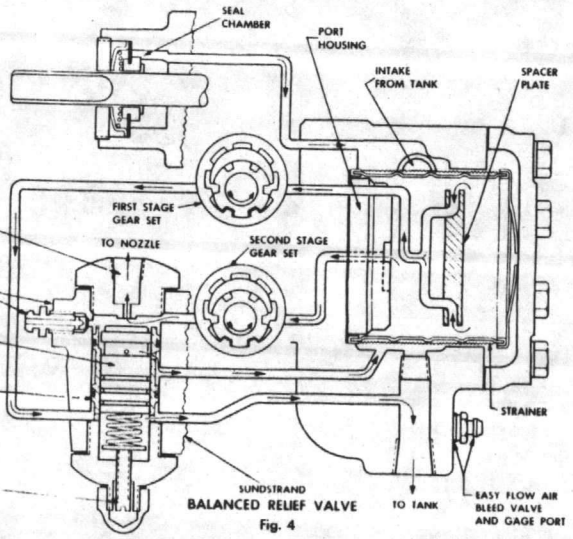


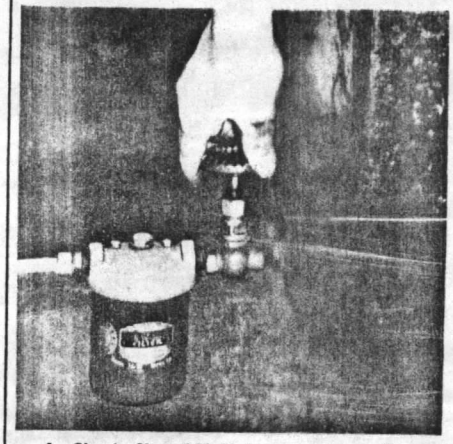
Fig. 4

SCHEMATIC FUEL OIL CIRCUITS

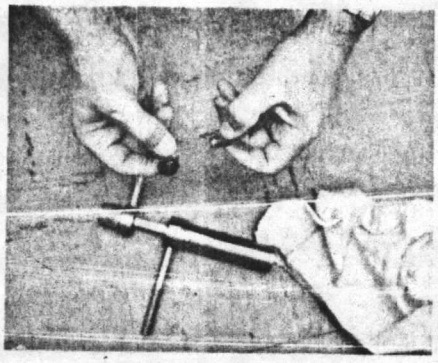
Fig. 3 All Models H1, 2, 3, 4, 5 and 6 Dash — ④

Fig. 4 All Models H7 and H8 Dash — ⑤

ROUTINE PERFORMANCE CHECKS



1. Check Shut-Off Valve and Line Filter. Replace or clean cartridge in line filter if dirty. Be sure to open shut-off valve.

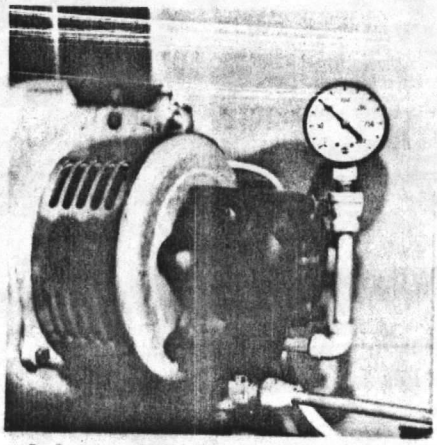


2. Check Nozzle Assembly. Replace the nozzle according to manufacturer's recommendations when needed.

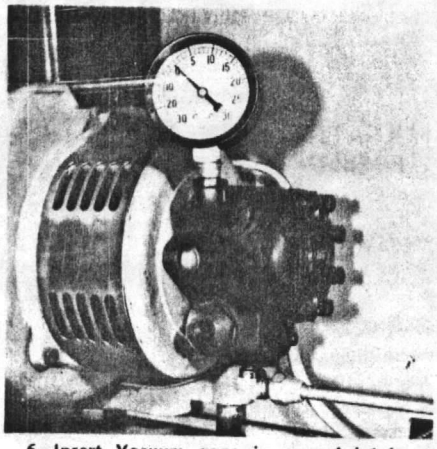
Important:
Use proper designed tools for removal of nozzle from firing head.

3. Check Strainer. Clean strainer using clean fuel oil or kerosene. Install new cover gasket. Replace strainer if necessary.

4. Check Connections. Tighten all connections and fittings in the intake line and unused intake port plugs.



5. Pressure Setting. Insert pressure gage in gage port. Normal pressure setting should be at 100 PSI. Check manufacturer's pressure setting recommendation on each installation being serviced.



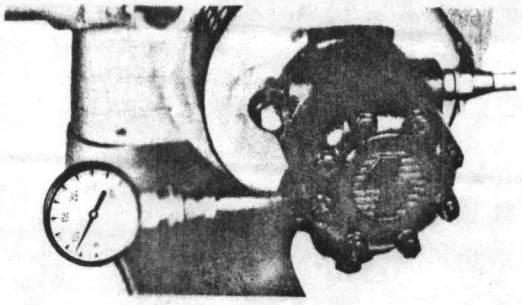
6. Insert Vacuum gage in unused intake port. Check for abnormally high intake vacuum.

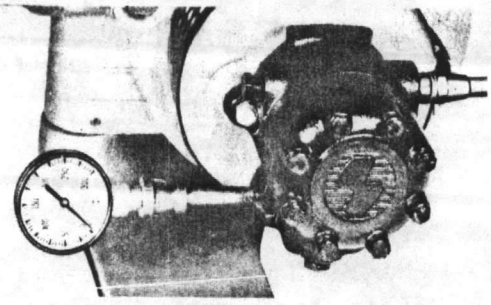
TROUBLE SHOOTING

	cause	remedy
NO OIL FLOW AT NOZZLE	Oil level below intake line in supply tank	*Fill tank with oil.*
	Clogged strainer or filter	*Remove and clean strainer. Repack filter element.*
	Clogged nozzle	*Replace nozzle.*
	Air leak in intake line	*Tighten all fittings in intake line. Tighten unused intake port plug. Tighten in-line valve stem packing gland. Check filter cover and gasket.*
	Restricted intake line (High vacuum reading)	*Replace any kinked tubing and check any valves in intake line. Check Form 440041 for line sizes.*
	A two pipe system that becomes airbound	*Check and insert by-pass plug.*
	A single-pipe system that becomes airbound (Model J unit only)	*Loosen gage port plug or easy flow valve and drain oil until foam is gone in bleed hose.*
	Slipping or broken coupling	*Tighten or replace coupling.*
	Rotation of motor and fuel unit is not the same as indicated by arrow on pad at top of unit	*Install fuel unit with correct rotation. See Form No. 450016.*
	Frozen pump shaft	*Return unit to approved service station or Sundstrand factory for repair. Check for water and dirt in tank.*

	cause	remedy
OIL LEAK	Loose plugs or fittings	*Dope with good quality thread sealer.*
	Leak at pressure adjusting end cap nut	*Fibre washer may have been left out after adjustment of valve spring. Replace the washer.*
	Blown seal (single pipe system)	*Check to see if by-pass plug has been left in unit. Replace fuel unit.*
	Blown seal (two pipe system)	*Check for kinked tubing or other obstructions in return line. Replace fuel unit.*
	Seal Leaking	*Replace fuel unit.*
NOISY OPERATION	Bad coupling alignment	*Loosen fuel unit mounting screws slightly and shift fuel unit in different positions until noise is eliminated. Retighten mounting screws.*
	Air in inlet line	*Check all connections.*
	Tank hum on two-pipe system and inside tank	*Install return line hum eliminator, in return line.*
PULSATING PRESSURE	Partially clogged strainer or filter	*Remove and clean strainer. Replace filter element.*
	Air leak in intake line	*Tighten all fittings and valve packing in intake line.*
	Air leaking around cover	*Be sure strainer cover screws are tightened securely.*
LOW OIL PRESSURE	Defective gage	*Check gage against master gage, or other gage.*
	Nozzle capacity is greater than fuel unit capacity	*Replace fuel unit with unit of correct capacity. See Form No. 400226, for GPH, P.S.I. and R.P.M.*

IMPROPER NOZZLE CUT-OFF





To determine the cause of improper cut-off, insert a pressure gage in the nozzle port of the fuel unit. After a minute of operation shut burner down. If the pressure drops and stabilizes above 0 P.S.I., the fuel unit is operating properly and air is the cause of improper cut-off. If, however, the pressure drops to 0 P.S.I., fuel unit should be replaced.

Filter leaks	*Check face of cover and gasket for damage.*
Strainer cover loose	*Tighten 8 screws on cover.*
Air pocket between cut-off valve and nozzle	*Run burner, stopping and starting unit, until smoke and after-fire disappears.*
Air leak in intake line	*Tighten intake fittings and packing nut on shut-off valve. Tighten unused intake port plug.*
Partially clogged nozzle strainer	*Clean strainer or change nozzle.*

GENERAL CONTROLS DIVISION
801 Allen Ave., Glendale, California 91201

S311 WITH DUEL INLET ALUMINUM BODY FUEL OIL SHUTOFF VALVE

INSTALLATION, SERVICE AND PARTS LIST

SDI/SDP S311-7-1
Effective 7-82
Supersedes 12-81

DESCRIPTION

S311 Series are 2-way, normally closed direct acting solenoid valves. Positive shutoff is assured by using synthetic seating materials and spring loaded plunger. They are designed to control fuel oil to domestic high pressure atomizing oil burners using No. 1, No. 2 and No. 4 and other comparable fuel oils.

CS3 solenoid coil is rated at 8 watts. Class "A" moisture resistant type "M" encapsulated coils are standard. Class "F" encapsulated, moisture and fungus resistant coil is also available.

OPERATION

Valves are Normally Closed types which open when energized and close when de-energized.

SPECIFICATIONS

Maximum Operating Pressure — psi: See nameplate
Minimum Flow Media Temperature is 35°F ambient

OPERATING TEMPERATURES

FLUID MEDIA	COIL CLASS	MAXIMUM TEMPERATURE °F		SEAT MATERIAL
		FLUID	AMBIENT	
OIL	M (105C)	185	77	BUNA
	F (155C)	200	150	

For other applications, consult factory.

INSTALLATION

Check valve specification to make sure of proper application.

CAUTION

1. **This oil burner valve should be installed only by a trained and experienced service person.**
2. **Valve has dual inlet. USE PIPE PLUG TO PLUG OFF INLET NOT USED. Torque pipe plug (15) 6 to 8 foot-pounds. Check for leakage. Improper installation of pipe plug to valve body may result in a hazardous oil leak.**
3. **Valve with "W" (Rainproof conduit)* in 5th digit position of valve catalog number must be mounted on horizontal pipe line with solenoid in an upright position.**

1. Clean all lines of foreign matter before valve is installed. If sediment is a problem, install fine mesh strainer having adequate capacity ahead of valve.

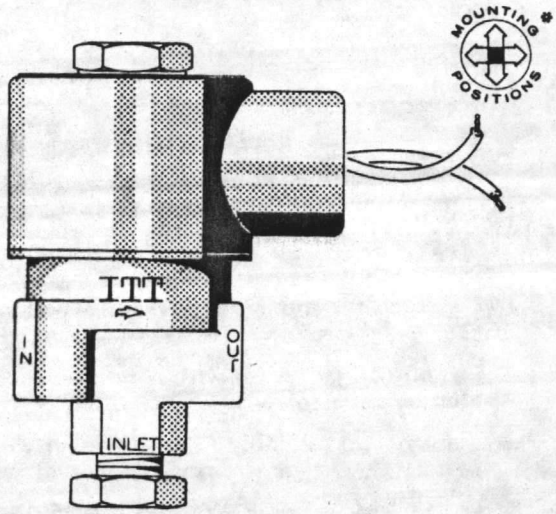


Fig. 1. Typical S311 with Type "7" Body

2. Mount valve in any position*. For angle flow, remove plug from bottom "INLET" and install in horizontal connection marked "IN".
3. Apply thread seal sparingly to male threads only. Use wrench on body flat. Do not use solenoid assembly as lever to turn valve. Provide clearance for solenoid removal.
4. Wiring must be in accordance with applicable codes. Check nameplate for proper voltage. Loosen hex nut to rotate coil jacket. Tighten nut. Wire valve in parallel with burner motor.

MAINTENANCE

⚠ WARNING ⚠

Disassembly, reassembly or internal adjustment without factory test may result in serious personal injury or property damage due to fire or explosion. If control does not operate properly after following INSTALLATION and SERVICE instructions, complete control must be replaced by a trained and experienced service-person.

CLEANING

Cleaning fluid must be compatible with all valve components.

NOTE

IT IS RECOMMENDED S311 SERIES VALVES BE CLEANED ON A ROUTINE BASIS BY QUALIFIED SERVICE PERSONNEL. VALVES SHOULD BE CLEANED WHERE FLOW MEDIA OR SERVICE CONDITIONS MAY DETERMINE LIFE OF VALVE. APPLY CORRECT VOLTAGE. IF EXCESSIVE LEAKAGE OCCURS OR OPERATION IS SLUGGISH, UNIT MUST BE CLEANED.

DISASSEMBLY AND REASSEMBLY (See Fig. 2)

⚠ WARNING ⚠

Turn off electrical power supply to solenoid before disconnecting coil lead wires.

1. Unscrew hex nut (1) and remove with lockwasher (2), nameplate (3).
2. Lift off coil jacket (4) with bottom washers (5) from plunger tube (6).
3. Remove coil assembly (7) and washer (8) from coil jacket (4). Do not disarrange solenoid assembly.
4. Use ITTGC solenoid wrench No. 63591A to remove base nut (9) from valve body (10). Do not nick, dent or damage plunger tube (6) or valve seating surfaces.
5. Carefully hold plunger tube (6) in position when removing base nut (9) from body (10) to prevent loss of internal parts.
6. Lift off plunger tube (6) and remove base nut (9), "O" ring (11), spring (12) and plunger assembly 13) and square seal (14).
7. Check "O" ring (11), seating surfaces (Ref.) in plunger assembly and in body (10), plunger spring (12) and square seal (14) for damage or wear.

Reassemble in reverse order.

NOTE

TIGHTEN BASE NUT (9), 18 to 24 INCH POUNDS.

COIL REPLACEMENT

It is not necessary to remove valve from pipeline. Follow steps 1, 2 and 3 under VALVE DISASSEMBLY. Disassemble solenoid, taking care to note the exact order of placement and quantity of parts.

NOTE

ONE OF THE WASHERS (5) HAS "X" MARKING ON ONE SIDE. THE SIDE MARKED "X" MUST BE PLACED NEXT TO COIL.

Incorrect reassembly can cause coil burnout. At all times take care not to nick, dent or damage plunger tube.

PARTS LIST

This parts list covers replaceable coil part numbers and universal kit for S311 Series Model "A" STANDARD valve. See tables for details. Before ordering parts/kit, check serial number on the nameplate. New serializing system is used, e.g., 7926A. The fifth alpha digit will be "A" on all Model "A" valves.

When ordering parts/kit, specify catalog number, serial number and parts name. If your valve catalog number is not listed, obtain complete catalog number, serial number and consult factory.

See Fig. 2 for exploded view of typical S311 with TYPE "7" body Model "A".

UNIVERSAL KIT

The Universal Kit contains an "O" ring, plunger spring, plunger assembly and square seal.

COIL CLASS CHART

CAT. DIGITS	VOLTAGE	AVAILABLE WITH COIL CLASS	
		F	M
01	24v-60Hz	X	X
02	120v-60Hz		X
02	120v-60Hz & 110v-50Hz	X	
03	208v-60Hz	X	X
04	240v-60Hz		X
04	240v-60Hz & 220v-50Hz	X	
08	110v-50Hz		X
09	220v-50Hz		X
24	24v-50Hz	X	X
54	240v-50Hz	X	X

KIT CHART

STANDARD

5th Digit	9th Digit	12th & 13 Digit	Universal Kit	Voltage Type
A, B, D, E F, L, M, N P, Q, R, S T, U, V or W	V	C5 or C9	S109127A	AC

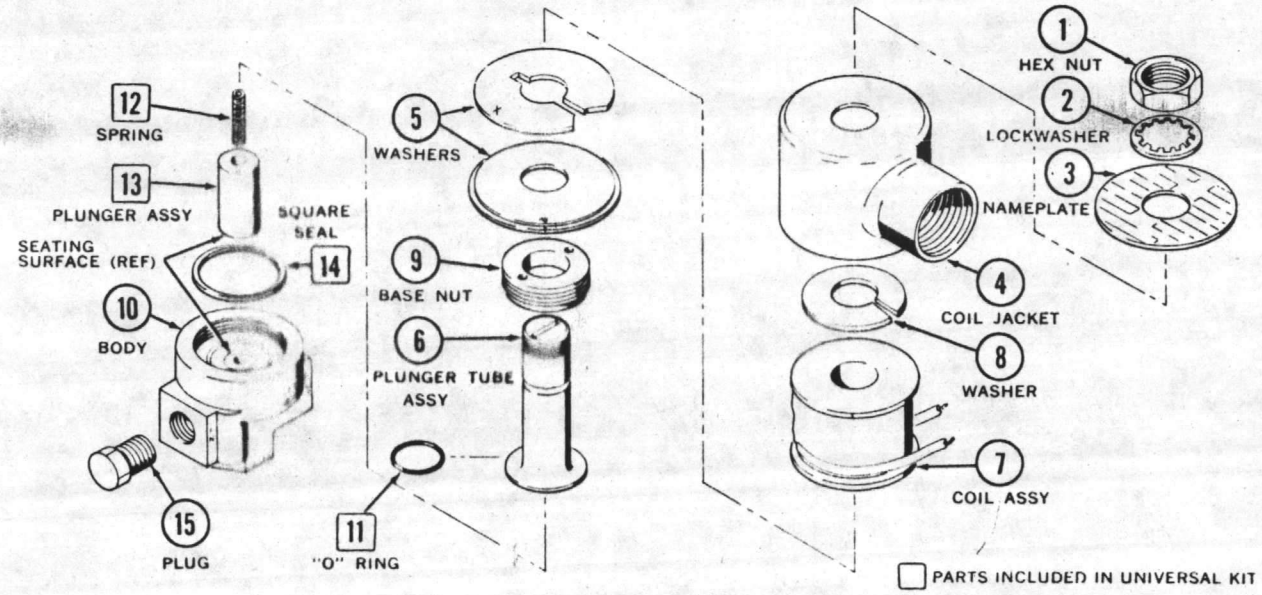


Fig. 2. Exploded View of Typical S311 with Type "7" Body, Model "A" Valve, N.C.

COIL CHART

IDENTIFYING CATALOG DIGITS①	COIL CLASS	WATTS	ELECTRICAL CONNECTION	COIL PART NUMBER ② ③
S31 ___A	A*	8		CS3AM___ ___A24*
S31 ___F	F			CS3AF ___ ___A24
S31 ___H	H		24" Leads	CS3AH___ ___A24
S31 __RA	A*			CS3AM___ ___B*
S31 __RM	M		Quick	CS3AM___ ___B
S31 __RF	F		Connect	CS3AF ___ ___B
S31 __VF	F		Terminals	CS3AF ___ ___B

① Sixth digit of catalog number represents coil class as shown.
② Seventh and eighth digits of catalog number represent voltage shown in coil class chart. These digits must be transferred into the coil part number.
③ Recommended spare parts.

NOTE:
*Type "A" coil is replaced by Type "M" molded coil.
For coil part numbers (CS3AA___ ___A24 use CS3AM___ ___A24)
(CS3AA___ ___B use CS3AM___ ___B)

TROUBLE SHOOTING

Guide to Insure Proper Operation

1. FAILURE OF VALVE TO OPEN: Check voltage at solenoid lead connections by energizing solenoid. A click sound indicates that solenoid is operating. If no click sound is heard, the current is probably not reaching the solenoid. Check for loose lead wire connections, broken lead wires/open circuit, solenoid coil for coil burnout. Tighten leadwire connections or replace coil if required. Buzzing or chattering can be caused by low voltage or dirt or chips between top of plunger and tube head. If low voltage is the problem, increase voltage. Valve will operate at 85% of rated voltage at the operating pressure shown on nameplate. Clean plunger and interior of tube and base assembly if required to stop buzzing and chattering and achieve a full open position.

2. FAILURE OF VALVE TO CLOSE: Check condition of synthetic seat insert and seating surface. Check for damaged spring, dirt between seat insert and seating surface. Disassemble valve and clean all parts to insure shutoff or replace damaged or worn out parts.

EXAMPLE CATALOG NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13
S	3	1	1	A	F	0	2	V	7	A	C	9
				HOUSING	COIL CLASS	VOLTAGE		SEAT SQ. SEAL & "O" RING MATERIAL			ORIFICE SIZE	

Gordon-Piatt Energy Group PARTS STOCKING REPRESENTATIVES

Parts for Gordon-Piatt Energy Group products can be obtained from the following authorized parts stocking representatives.

ALABAMA

DOWDY & ASSOCIATES, INC.
149 W. VALLEY AVENUE
BIRMINGHAM, AL 35209
205-942-4766

ALASKA

PROCTOR SALES, INC.
5401 CORDOVA ST., #303
ANCHORAGE, AK 99502
907-562-2608

ARKANSAS

WOODBURY-BEACH CO.
803 S. VAN BUREN ST.
LITTLE ROCK, AR 72204
501-663-9421

CALIFORNIA

L. O. SCHUELKE CO., INC.
1015 TERMINAL WAY
SAN CARLOS, CA 94070
415-591-7392
TELEX 34-8358

L. O. SCHUELKE CO., INC.
14971 CHESTNUT ST.
SUITE B
WESTMINSTER, CA 92683-5236
714-895-1411

COLORADO

ENGINEERED PRODUCTS CO.
P. O. BOX 9087
DENVER, CO 80209
303-777-4471
TELEX 45-768

CONNECTICUT

CONNECTICUT THERMAL, INC.
4695 MAIN ST.
P. O. BOX 6384
BRIDGEPORT, CT 06606
203-374-7568
TELEX 131-436

INDUSTRIAL COMBUSTION, INC.
P. O. BOX 628
BLOOMFIELD, CT 06002-0628
203-242-2719

DELAWARE

POWER & COMBUSTION, INC.
7909 PHILADELPHIA ROAD
BALTIMORE, MD 21237
301-866-4900

FLORIDA

INDUSTRIAL ENGINEERING CO.
P. O. BOX 7030A
ORLANDO, FL 32854
305-293-9212

GEORGIA

MCKINNEY & ASSOCIATES, INC.
535-A MOROSGO DR., N.E.
ATLANTA, GA 30324
404-261-4175

ILLINOIS

BARR MECHANICAL SALES, INC.
4726 W. LAWRENCE AVE.
CHICAGO, IL 60630
312-283-7818

BURDEN-COOPER, INC.
6610 NO. 2ND ST.
ROCKFORD, IL 61111
815-633-6555

DONELSON CORPORATION
312 BRYAN STREET
PEORIA, IL 61603
309-674-8068
TELEX 40-4305

INDIANA

CICI ENGINEERING SALES & SERVICE INC.
2110 NO. GRAND AVENUE
EVANSVILLE, IN 47711
812-424-2584

DYE PLUMBING & HEATING
P. O. BOX 96
712 MADISON
LA PORTE, IN 46350
219-362-6251

POORMANS HTG. & A/C SERVICE
1417 MARTIN ST.
FT. WAYNE, IN 46802
219-422-3534

INDIANA (CONT'D)

A. B. YOUNG CO., INC.
P. O. BOX 30068
INDIANAPOLIS, IN 46230
711 EAST 65TH STREET
INDIANAPOLIS, IN 46220
317-255-5416

IOWA

C. H. MCGUINESS COMPANY
505 S. W. 7TH ST.
DES MOINES, IA 50309
515-243-0280

KANSAS

WICHITA BURNER CO., INC.
P. O. BOX 11046
WICHITA, KS 67202
316-264-6816

KENTUCKY

BROCK-MCVEY COMPANY
MIDLAND AVE. EXTENSION
P. O. BOX 321
LEXINGTON, KY 40584
606-255-1412

MAINE

ATKINSON & LAWRENCE, INC.
P. O. BOX 667
NATICK, MA 01760-0667
617-653-6422
401-421-1063 (RHODE ISLAND NUMBER)

MARYLAND

POWER & COMBUSTION, INC.
7909 PHILADELPHIA ROAD
BALTIMORE, MD 21237
301-866-4900

SUPERIOR EQUIPMENT & SERVICE CO.
405 EAST DIAMOND AVENUE
GAITHERSBURG, MD 20877
301-258-8484

MASSACHUSETTS

ATKINSON & LAWRENCE, INC.
P. O. BOX 667
NATICK, MA 01760-0667
617-653-6422
401-421-1063 (RHODE ISLAND NUMBER)

MICHIGAN

F. W. STARRETT CO., INC.
21590 GREENFIELD RD., SUITE #206
OAK PARK, MI 48237
313-967-1710

MINNESOTA

BSC MECHANICAL CONTRACTORS
2119 LYNDALE AVE., SOUTH
MINNEAPOLIS, MN 55405-3091
612-871-5515

PALEN-KIMBALL COMPANY
550 VANDALIA ST.
ST. PAUL, MN 55114
612-646-2800

MISSOURI

DEBCO EQUIPMENT CO.
6973 OLIVE BLVD.
ST. LOUIS, MO 63130
314-727-4674
TELEX 44-824

NEBRASKA

B. G. PETERSON COMPANY
2966 HARNEY STREET
OMAHA, NE 68131-3584
402-344-4311

NEW HAMPSHIRE

ATKINSON & LAWRENCE, INC.
P. O. BOX 667
NATICK, MA 01760-0667
617-653-6422
401-421-1063 (RHODE ISLAND NUMBER)

NEW JERSEY

METCO CONTRACTING INC.
99 FANNY ROAD
BOONTON, N. J. 07005
99 FANNY ROAD
PARSIPPANY, N. J. 07054
201-489-0704

NEW MEXICO

BARNHART-TAYLOR ENGR. CO., INC.
2501 ALAMO, S. E.
ALBUQUERQUE, N. M. 87106
505-243-2219

NEW YORK

BUCKPITT & COMPANY, INC.
P. O. BOX 292
ROCHESTER, N. Y. 14601
88 UNIVERSITY AVENUE
ROCHESTER, N. Y. 14605
716-454-7474

BUCKPITT & COMPANY, INC.
2974 GENESEE STREET
BUFFALO, N. Y. 14225
716-891-9117

HASKO UTILITIES CO., INC.
555 WEST 59TH STREET
NEW YORK, NEW YORK 10019
248 WEST 60TH STREET
NEW YORK, N. Y. 10023
212-765-7141

NEW YORK (CONT'D)

J & B FUEL BURNING EQUIPMENT, INC.
202 MARCELLUS STREET
SYRACUSE, N. Y. 13204
315-422-0661

P & R HEATING & COOLING CORP.
109 FREEMANS BRIDGE ROAD
SCOTIA, N. Y. 12302
518-382-8071

WESTCHESTER THERMAL, INC.
160 SUMMERFIELD STREET
SCARSDALE, N. Y. 10583
914-472-3660
TELEX 131-436

NORTH CAROLINA

W. C. ROUSE & SON
P. O. BOX 10272
GREENSBORO, N. C. 27404
919-299-3035

NORTH DAKOTA

NORTHWEST IRON FIREMAN, INC.
P. O. BOX 1068
FARGO, N. D. 58107
701-237-4096

OHIO

CONSOLIDATED EQUIPMENT COMPANY
1333 EAST 3RD STREET
DAYTON, OH 45403
513-228-8395

KEVIN MCGOVERN & ASSOCIATES, INC.
P. O. BOX 12500
COLUMBUS, OH 43212
614-481-8121

THE P. M. EQUIPMENT CO., INC.
6123 HIGHLAND ROAD
CLEVELAND, OH 44143
216-449-3070

STEELMAN-CINCINNATI, INC.
4007 BACK BUXTON ROAD
AMELIA, OH 45102
513-753-9276

OKLAHOMA

FEDERAL CORPORATION
P. O. BOX 26408
OKLAHOMA CITY, OK 73126
405-239-7301

OREGON

BERT FARNES COMPANY
9920 S. W. TIGARD STREET
PORTLAND, OR 97223
503-639-1557
TELEX 15-1121

PENNSYLVANIA

COMBUSTION SYSTEMS, INC.
565 LINCOLN AVE., REAR
PITTSBURGH, PA 15202
412-761-0330

THE KEELER CO., INC.
318 HENDEL STREET
SHILLINGTON, PA 19607
215-775-1505

SNYDER SPECIALTY SUPPLY CORP.
P. O. BOX 162
UPPER DARBY, PA 19082-0162
215-528-5286

RHODE ISLAND

ATKINSON & LAWRENCE, INC.
64 SUMMER STREET, P.O. BOX 667
NATICK, MA 01760-0667
401-421-1063 (RHODE ISLAND NUMBER)

SOUTH DAKOTA

GIRTON-ADAMS COMPANY
735 SO. 2ND AVE. - 57104
P. O. BOX 897 - 57101
SIOUX FALLS, S. D.
605-336-3070

TENNESSEE

O'BRIEN ENGINEERING CO.
585 SOUTH COOPER
MEMPHIS, TN 38104-5398
901-274-9011

BEN O'NEAL CO., INC.
P. O. BOX 5
CHATTANOOGA, TN 37401
615-624-3359

TEXAS

HOLMAN BOILER WORKS INC.
1956 SINGLETON BLVD.
DALLAS, TX 75212
214-637-0020

HOLMAN BOILER WORKS INC.
3921 AGNES
CORPUS CHRISTI, TX 78405
512-884-0411

BARNHART-TAYLOR ENGR. CO., INC.
1602-A EAST YANDELL DR.
EL PASO, TX 79902
915-533-1231

VERMONT

VERMONT BOILER SPECIALISTS, INC.
216 BATTERY STREET
BURLINGTON, VT 05401
802-658-1632

VIRGINIA

E. MCLAUCHLAN & SONS, INC.
2000 EAST GRACE STREET
RICHMOND, VA 23223
804-266-3566

WASHINGTON

PROCTOR SALES, INC.
P. O. BOX 5887
LYNNWOOD, WA 98046-0914
20715 50TH AVE., WEST
LYNNWOOD, WA 98046-0914
206-774-1441
TELEX 152-376

WISCONSIN

MCCOTTER & HANSEN, INC.
1200 WEST SIERRA LANE
MEQUON, WI 53092
414-241-3190

MCCOTTER & HANSEN, INC.
1401 W. WISCONSIN AVE. - 54911
P. O. BOX 1542 - 54913
APPLETON, WI
414-241-3190

TRI-STATE BOILER COMPANY
106 CAMERON STREET
LACROSSE, WI 54601
608-784-3839

WISCONSIN MECHANICAL COMPANY
ROUTE 9 - BOX 426
CHIPPEWA FALLS, WI 54729
715-723-2211

TAB PLACEMENT HERE

DESCRIPTION:

3

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Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Submittal

NOLAND

Plumb
Heatin
Electric
Air Cor
Refrige
Industr
Machir

Job REPLACE BOILERS
BLDGS.LCH-401&4022,CG-1
& A5502
N-62470-85-B-6439
CAMP LEJEUNE,N.C. & NEW RIVER

Prepared For KINSTON PLBG. & HTG.

Architect

Engineer

Date 11/18/86

☑ APPROVED
☐ APPROVED AS NOTED
☐ NOT APPROVED
☐ REVISE & SUBMIT
KINSTON PLUMBING & HEATING C
BY E L DATE 11-25-

For any additional information please contact:

Noland Representative LARRY ELMORE Phone 523-6171

CONTRACTOR'S SUBMITTAL TRANSMITTAL

LANTDIV NORFOLK 4-4355/3 (Rev 11-80)

CONTRACT NO	TRANSMITTAL NO	DATE
N62470-85-C-6439	6439-08	11/26/86

FROM CONTRACTOR: Kinston Plumbing & Heating Co., Inc.

TO: OICC

PROJECT TITLE AND LOCATION: Replace Boilers, Bldgs LCH-4014, LCH-4022, AS-3502 & CG-1 MCBCL & MCASNR

CONTRACTOR USE ONLY

*List only one specification division per form

List only one of the following categories on each transmittal form, and indicate which is being submitted

☐ Contractor Approved XXXXX ☐ OICC Approval ☐ Deviation/Substitution for OICC Approval

REVIEWER USE ONLY

**ACTION CODES
A-Approved
D-Disapproved
AN-Approved as noted
RA-Receipt acknowledged
C-Comments
H-Resubmit

ITEM NO.	PROJ. SPEC. SECT. & PARA. and/or PROJ. DWG. NO. *	ITEM IDENTIFICATION (Type, size, model no., Mfg. name, dwg. or brochure number)	NO. OF COPIES	ACTION CODES **	REVIEWER'S INITIALS CODE AND DATE
1	15802.2.1.8	Valves	6	A	KW 403 12 11 86
2	15803.2.6	Pressure Gauge & Air Cock	6	A	
3	15802.2.1.10	Thermometer	6	A	
4	15055.2.1	Backflow Preventer & Certification	6	A	
5	15803.1.2.1.3	Valve Certifications	6	A	

CONTRACTOR'S COMMENTS

All items included in Noland Co. brochure - six copies of brochure submitted

COPY OF TRANSMITTAL AND SUBMITTALS TO ROICC

CONTRACTOR REPRESENTATIVE (Signature) JC Kermon

DATE RECEIVED BY REVIEWER | FROM (Reviewer) | TO

☒ Submittals are returned with action indicated. Approval of an item does not include approval of any deviation from the contract requirements unless the contractor calls attention to and supports the deviation.

☐ Submittals are forwarded to LANTDIV with A-E recommendations indicated in REVIEWER USE ONLY Section and in comments below on **ONE COPY** of the transmittal form.

REVIEWER'S COMMENTS

RECEIVED

DEC 15 1986

Kinston Plumbing and Heating

COPIES TO
ROICC (2)
LANTDIV (1)
A-E (1)

DATE 12/12/86

SIGNATURE P.F. King for LT Jenkins

☆ U.S. GPO:1986-527-003/11170 Region 3-11

Class 125
Bronze Gate

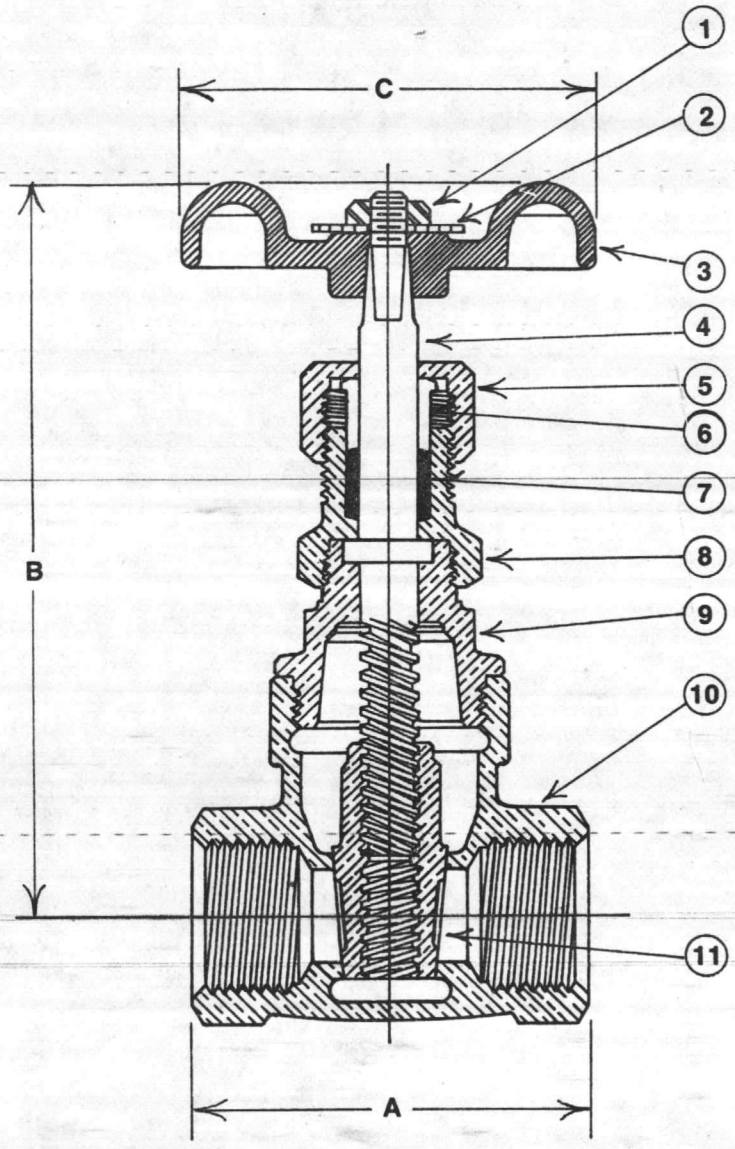
HAMMOND IB645

Class 125 Bronze Gate Valve
Screwed Bonnet Non-Rising Stem
Solid Wedge Disc
Threaded Ends

2-85

RATING

125 PSI Steam To 406°F
200 PSI Non-Shock
Cold Water, Oil or Gas
Federal Specification
WW-V-54 Type I, Class A
MSS SP-80



DIMENSIONS IN INCHES

SIZE	A	B	C
1/4	1-9/16	3-11/16	2
3/8	1-11/16	3-11/16	2
1/2	1-31/32	3-13/16	2
3/4	2-3/16	4-15/32	2-3/8
1	2-7/16	5-1/32	2-3/4

SIZE	A	B	C
1-1/4	2-25/32	5-5/8	3
1-1/2	2-29/32	6-1/4	3-1/2
2	3-5/32	7-1/4	4
2-1/2	4-1/16	9-3/4	4-3/4
3	4-3/4	11-3/4	5-1/4

MATERIAL SPECIFICATIONS

1	Handwheel Nut	Steel	
2	Identification Plate	Aluminum	
3	Handwheel	Malleable Iron	ASTM A-47 (32510)
4	Stem	Cast Bronze	ASTM B-62
5	Packing Nut ¼"-1" 1¼"-3"	Brass Rod Cast Bronze	ASTM B-16 ASTM B-584 Alloy 844
6	Gland Follower	Sintered Brass	ASTM B-282, Type I

7	Packing Ring	Teflon - Asbestos	
8	Stuffing Box ¼"-1¼" 1½"-2" 2½"-3"	Brass Rod Cast Bronze Cast Bronze	ASTM B-16 ASTM B-584 Alloy 844 ASTM B-62
9	Bonnet	Cast Bronze	ASTM B-62
10	Body	Cast Bronze	ASTM B-62
11	Disc	Cast Bronze	ASTM B-62

HAMMOND VALVE CORP.
1844 Summer Street
Hammond, Indiana 46320
(219) 931-3200

Class 125
Bronze Globe

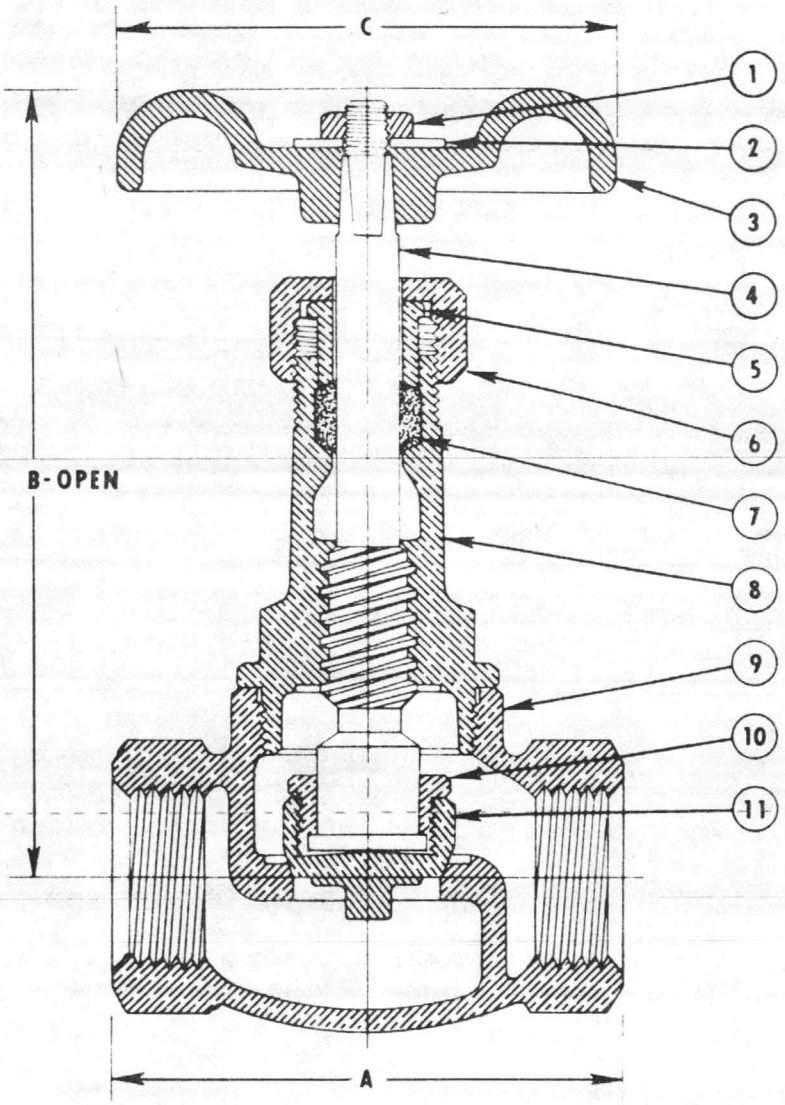
HAMMOND IB440

Class 125 Bronze Globe Valve
Screwed Bonnet—Bronze Disc
Threaded Ends

2-85

RATING

125 PSI Steam to 406ºF
200 PSI Non-Shock
Cold Water, Oil or Gas
Federal Specification
WW-V-51, Type I, Class A
MSS SP-80



DIMENSIONS IN INCHES

SIZE	A	B	C
*1/8	1-29/32	3-5/8	2
*1/4	1-15/16	3-5/8	2
*3/8	2-3/32	3-5/8	2
*1/2	2-13/32	4-1/8	2-3/8
3/4	2-29/32	4-7/8	2-3/4
1	3-1/4	5-9/16	3

SIZE	A	B	C
1-1/4	3-3/4	6-3/8	3-1/2
1-1/2	4-1/4	6-27/32	4
2	5	7-3/4	4-3/4
2-1/2	6	9-1/32	5-1/4
3	7	10-11/32	6

*DISC AND STEM INTEGRAL IN THESE SIZES

MATERIAL SPECIFICATIONS

1	Handwheel Nut		Steel	
2	Identification Plate		Aluminum	
3	Handwheel		Malleable Iron	ASTM A-47 (32510)
4	Stem	1/8"-3/4"	Cast Bronze	ASTM B-62
		1"-3"	Cast Bronze	ASTM B-61
5	Gland Follower		Sintered Brass	ASTM B-282, Type I

6	Packing Nut	1/8"-1"	Brass Rod	ASTM B-16
		1¼"-3"	Cast Bronze	ASTM B-584 Alloy 844
7	Packing Ring		Teflon Asbestos	
8	Bonnet		Cast Bronze	ASTM B-62
9	Body		Cast Bronze	ASTM B-62
10	Locknut	¾"-2"	Brass Rod	ASTM B-16
		2½"-3"	Cast Bronze	ASTM B-61
11	Disc	¾"-3"	Cast Bronze	ASTM B-62

HAMMOND VALVE CORP.
1844 Summer Street
Hammond, Indiana 46320
(219) 931-3200

Class 125
Bronze Swing Check

HAMMOND
IB904

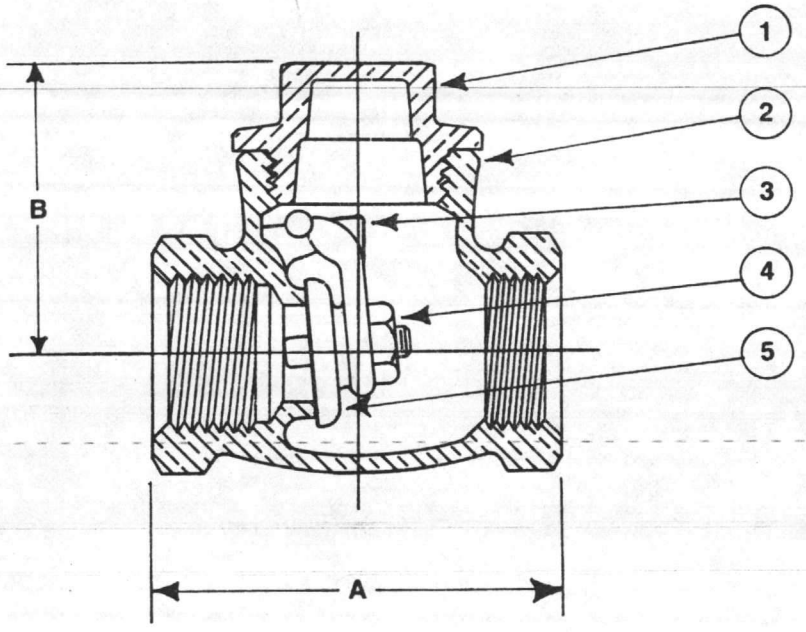
Class 125 Bronze Swing Check Valve
With Bronze Disc
Threaded Ends

2-85

RATING

125 PSI Steam To 406°F
200 PSI Non-Shock
Cold Water, Oil or Gas
Federal Specification
WW-V-51 Type IV, Class A
MSS SP-80

Warning - Do not use for reciprocating air compressor service.



DIMENSIONS IN INCHES

SIZE	A	B
1/4	1-7/8	1-13/32
3/8	1-7/8	1-13/32
1/2	2-1/8	1-17/32
3/4	2-1/2	1-3/4
1	3	2-1/32

SIZE	A	B
1-1/4	3-7/16	2-3/16
1-1/2	3-13/16	2-1/2
2	4-7/16	2-7/8

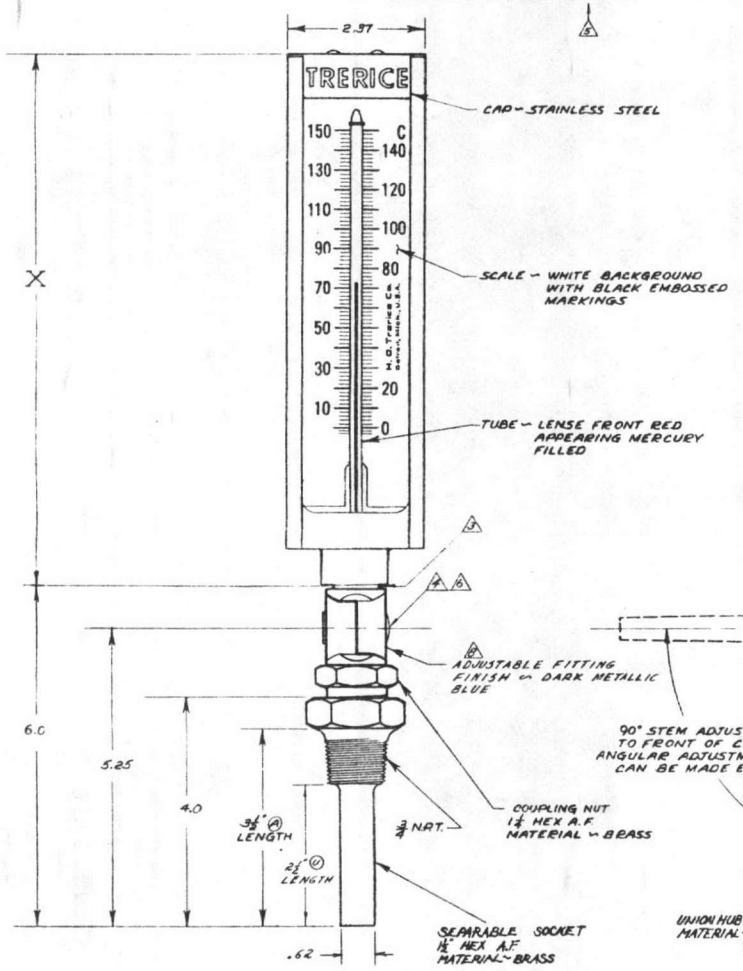
MATERIAL SPECIFICATIONS

1	Bonnet	Cast Bronze	ASTM B-584 Alloy 844
2	Body	Cast Bronze	ASTM B-62
3	Hinge	Cast Bronze	ASTM B-584 Alloy 844
4	Disc Nut	Brass Rod	ASTM B-16

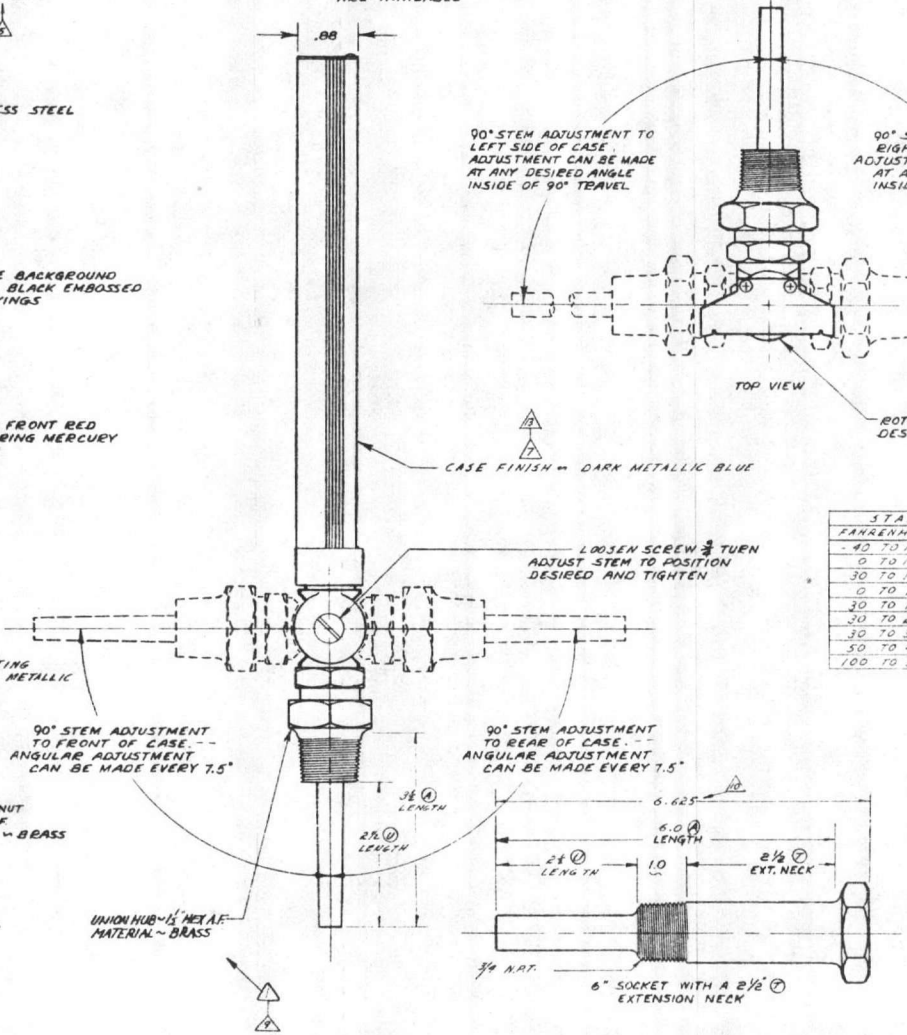
5	Disc	¼''-¾'' 1''-2''	Brass Rod Cast Bronze	ASTM B-16 ASTM B-62

HAMMOND VALVE CORP.
1844 Summer Street
Hammond, Indiana 46320
(219) 931-3200

DIMENSION X		
7" SIZE	9" SIZE	12" SIZE
8 29/32	10 29/32	13 29/32



NOTE ~ ALL STEM DIMENSIONS ARE FOR STANDARD 3½ (A) LENGTH STEMS WITH LONGER (A) LENGTHS ARE AVAILABLE



STANDARD RANGES	
FAHRENHEIT	CELSIUS
-40 TO 110°	-40 TO 40°
0 TO 100°	-18 TO 38°
30 TO 130°	0 TO 55°
0 TO 160°	-18 TO 70°
30 TO 180°	0 TO 82°
30 TO 240°	0 TO 115°
30 TO 300°	0 TO 150°
50 TO 400°	10 TO 205°
100 TO 550°	40 TO 290°

DATE	NO.	REVISION RECORD	BY	CK
8-27-74	K	LIST STD. RANGES		
8-28-74	M	ADD NOTE		
8-28-81	L	REVISE FOR LIGHT FORM		
7-24-74	K	ADDED (T) LENGTH		
7-24-74	J	ADDED (D) LENGTH		
1-24-74	H	ADDED 6-8 CT. DIAL		
6-3-74	G	REVISE LUGHT PLATE		
7-17-73	F	ADDED (MIDDLE AND REAR)		
7-30-73	E	ADDED (A) AND (D) LENGTH		
7-30-73	D	ADDED 12" SIZE		
4-25-73	C	ADDED "A"		
8-27-72	B	ADDED THUMB SCREW		
8-31-69	A	REMOVE CASE LOCK NUT		
1-3-69	-	ADDED R½ 30 TO 130°F		
10-9-67	-	ADDED NOTE		

H. D. Trerice Co.
Detroit, Mich., U.S.A.

NAME TEERICE 109, 209 & 209 SERIES ADJUSTABLE ANGLE 7°, 9° & 12° ALUM CASE INDUSTRIAL THERM.

DRAWN [illegible] APPD. [illegible]
DATE 4-12-67 SCALE FULL

NO. 127-462

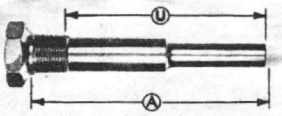
TOLERANCE: 2 PLACE DECIMALS ± .010, 3 PLACE DECIMALS ± .005, ANGLES ± 1° UNLESS OTHERWISE SPECIFIED — DO NOT SCALE

NOTE
ALL DIMENSIONS ARE NOMINAL AND MAY VARY ± .12

Trerice

INDUSTRIAL THERMOMETERS ACCESSORIES AND SPECIAL FEATURES

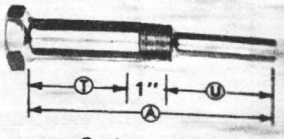
SOCKETS OF STANDARD AND SPECIAL MATERIAL FOR TRERICE INDUSTRIAL THERMOMETERS



Socket without Extension Neck

The table below lists the catalog numbers for separable sockets with and without extension necks to fit any TRERICE Industrial Thermometer and also lists special materials in which the sockets can be furnished.

CAP and CHAIN can be furnished with any of the sockets listed below when specified. See price sheet for extra charge.



Socket with Extension Neck

SEPARABLE SOCKETS

For use on Industrial Thermometers. Pages 4 thru 11.

*Socket Ⓐ Length	Socket Ⓤ Insertion Length	Ext. Neck Ⓣ Length	N.P.T.	MATERIAL							
				Brass		Steel		Stainless Steel Type 304		Stainless Steel Type 316	
				Cat. No.	E.D.P. No.	Cat. No.	E.D.P. No.	Cat. No.	E.D.P. No.	Cat. No.	E.D.P. No.
3½"	2½"	None	¾"	3-4F2	A105	3-4F3	A112	3-4F5	A119	3-4F6	A126
6"	5"	None	¾"	3-4J2	A106	3-4J3	A113	3-4J5	A120	3-4J6	A127
6"	2½"	2½"	¾"	3-4JD2	A107	3-4JD3	A114	3-4JD5	A121	3-4JD6	A128
8"	7"	None	¾"	3-4L2	A108	3-4L3	A115	3-4L5	A122	3-4L6	A129
8"	4½"	2½"	¾"	3-4LD2	A109	3-4LD3	A116	3-4LD5	A123	3-4LD6	A130
12"	11"	None	1"	3-5R2	A110	3-5R3	A117	3-5R5	A124	3-5R6	A131
12"	8½"	2½"	1"	3-5RD2	A111	3-5RD3	A118	3-5RD5	A125	3-5RD6	A132

*For each additional 6" or fraction Ⓐ length in brass or steel see price sheet. If stainless steel is required, prices on application. Extension necks other than 2½" Ⓣ length can be supplied. Prices on application.

SANITARY FITTINGS

SANITARY FITTINGS FOR FOOD AND DAIRY INDUSTRIES

TRERICE Thermometers can be furnished with sanitary fittings such as 3-A and I.A.M.D. types when desired. Consult factory for prices, specifying thermometer and complete information on type of fitting required.

SCALES

SPECIAL SCALES FOR 7", 9" AND 12" CASE THERMOMETERS ARE AVAILABLE AS FOLLOWS:

Any standard range may be furnished with black background and white figures and graduations. For extra charge see price sheet.

Combination Fahrenheit and Celsius Ranges are available.

Combination Temperature and Pressure Ranges, price on application.

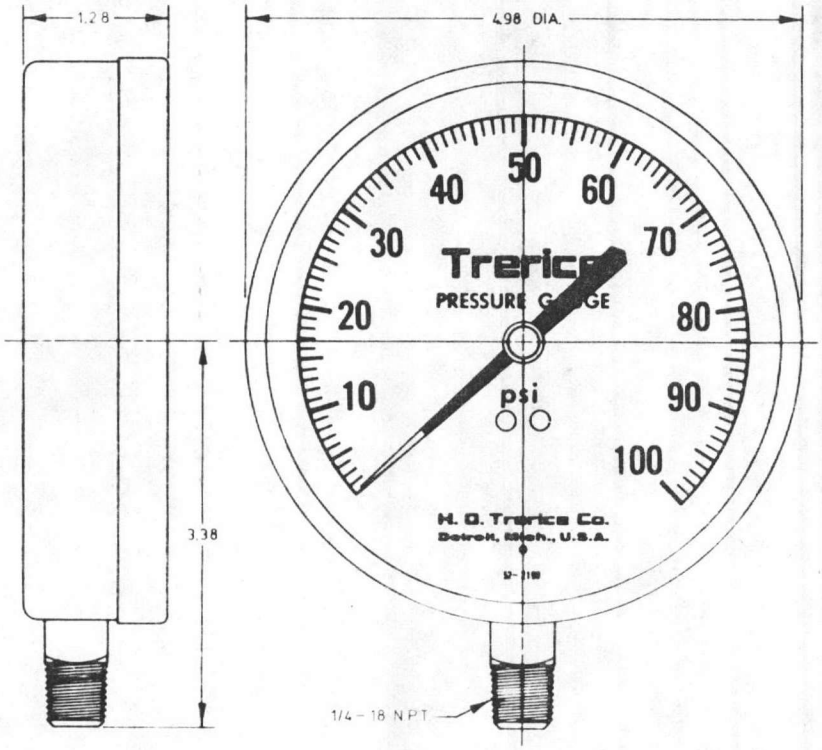
Special Ranges between the limits of −40 and 1000°F. or equivalent centigrade are available. See page no. 10.

STANDARD RANGES

ENGLISH RANGES (STOCKED IN U.S.A.)	
30" VAC. TO 0 P.S.I.	0 TO 60 P.S.I.
30" VAC. TO 15 P.S.I.	0 TO 100 P.S.I.
30" VAC. TO 30 P.S.I.	0 TO 160 P.S.I.
30" VAC. TO 60 P.S.I.	0 TO 200 P.S.I.
30" VAC. TO 100 P.S.I.	0 TO 300 P.S.I.
30" VAC. TO 150 P.S.I.	0 TO 400 P.S.I.
30" VAC. TO 300 P.S.I.	0 TO 600 P.S.I.
0 TO 15 P.S.I.	0 TO 800 P.S.I.
0 TO 30 P.S.I.	0 TO 1000 P.S.I.

METRIC RANGES (SPECIAL ORDER)	
-100 TO 0 KPa	0 TO 400 KPa
-100 TO 100 KPa	0 TO 700 KPa
-100 TO 200 KPa	0 TO 1200 KPa
-100 TO 400 KPa	0 TO 1500 KPa
-100 TO 600 KPa	0 TO 2000 KPa
-100 TO 1000 KPa	0 TO 3000 KPa
-100 TO 2000 KPa	0 TO 4000 KPa
0 TO 100 KPa	0 TO 6000 KPa
0 TO 200 KPa	0 TO 7000 KPa

DUAL SCALES (STOCKED IN CANADA)		
30" VAC. TO 0 P.S.I. -100 TO 0 KPa	30" VAC. TO 300 P.S.I. -100 TO 2000 KPa	0 TO 200 P.S.I. 0 TO 1500 KPa
30" VAC. TO 15 P.S.I. -100 TO 100 KPa	0 TO 15 P.S.I. 0 TO 100 KPa	0 TO 300 P.S.I. 0 TO 2000 KPa
30" VAC. TO 30 P.S.I. -100 TO 200 KPa	0 TO 30 P.S.I. 0 TO 200 KPa	0 TO 400 P.S.I. 0 TO 3000 KPa
30" VAC. TO 60 P.S.I. -100 TO 400 KPa	0 TO 60 P.S.I. 0 TO 400 KPa	0 TO 600 P.S.I. 0 TO 4000 KPa
30" VAC. TO 100 P.S.I. -100 TO 600 KPa	0 TO 100 P.S.I. 0 TO 700 KPa	0 TO 800 P.S.I. 0 TO 6000 KPa
30" VAC. TO 150 P.S.I. -100 TO 1000 KPa	0 TO 160 P.S.I. 0 TO 1200 KPa	0 TO 1000 P.S.I. 0 TO 7000 KPa



SPECIFICATIONS

CASE: BLACK FINISHED CAST ALUMINUM

RING: STAINLESS STEEL

WINDOW: GLASS

DIAL: WHITE WITH BLACK FIGURES AND GRADUATIONS

POINTER: BLACK FINISHED, FLOURESCENT RED TIP, ADJUSTABLE

MOVEMENT: BRASS

BOURDON TUBE: PHOSPHOR BRONZE

SOCKET: BRASS, 1/4 - 18 N.P.T.

ACCURACY:
1% OF FULL SCALE OVER MIDDLE 1/2 OF SPAN
2% OVER FIRST AND LAST 1/4 OF SPAN
△6 ANSI B40.1 GRADE A

DATE	NO.	REVISION RECORD	BY	CK.	AP.
7-11-83	6	Added ANSI Grade	BJJ	RL	
2-8-83	5	Redrawn - Revised	BJJ	RL	RAA

H. O. Trerice Co.
Detroit, Mich., U.S.A.

NAME
*600C PRESSURE GAUGE

DWN. BJJ	CK. HOT	APVD. RAA	NO. 127-580
DATE 1-9-75	SCALE 1"=1"		

TOLERANCE 2 Place Decimals ± .010 3 Place Decimals ± .005 Angles ± 1° Unless Otherwise Specified — DO NOT SCALE

CONBRACO®

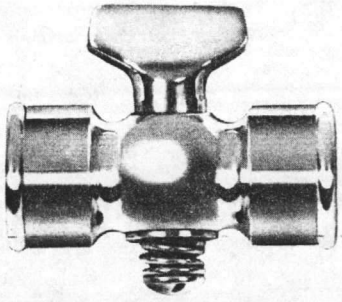
AIR COCKS

41 SERIES

- TESTED AT 100 LBS. AIR PRESSURE – STANDARD – SPRING BOTTOM, 5/32" PORT.
- THESE AIR COCKS CAN BE FURNISHED WITH SOLID BOTTOM FOR PRESSURES UP TO 250 P.S.I.

KEY

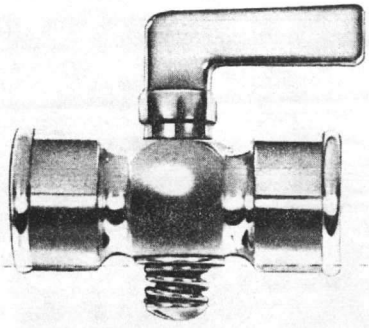
FOR ALL AIR COCKS TYPE	FINISH			
	SATIN BRASS	POLISHED BRASS	SATIN CHROME	POLISHED CHROME
Standard	01	05	17	21
Nut Bottom	04	08	20	24



DOUBLE FEMALE - HEAVY PATTERN TEE HANDLE

NO.	SIZE-INCHES	WT./100
41-102-	¼	28.1 lbs.

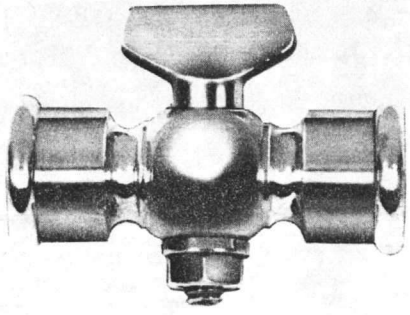
STANDARD AND NUT BOTTOM AVAILABLE.



DOUBLE FEMALE - HEAVY PATTERN LEVER HANDLE

NO.	SIZE-INCHES	WT./100
41-103-	¼	25.7 lbs.

STANDARD AND NUT BOTTOM AVAILABLE.

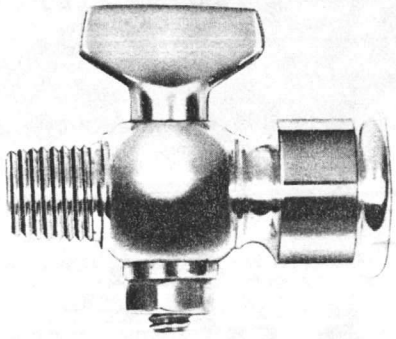


DOUBLE FEMALE EXTRA HEAVY PATTERN TEE HANDLE SOLID BOTTOM ONLY 150# S.W.P. – 300# W.O.G.

NO.	SIZE-INCHES	WT./100
41-200-	⅛	33.6 lbs.
41-202-	¼	31.7 lbs.

DOUBLE FEMALE – HEXAGON SHOULDER

41-222-	¼	33.3 lbs.



¼ NPT MALE x ¼ NPT FEMALE TEE HANDLE - HEAVY PATTERN SOLID BOTTOM ONLY 150# S.W.P. - 300# W.O.G.

NO.	SIZE-INCHES	WT./100
41-250-	¼	24.5 lbs.

TAB PLACEMENT HERE

DESCRIPTION:

4

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HEAT TRANSFER SALES, INC.

901-G NORWALK ST.
GREENSBORO, N.C. 27407
PHONE 919-294-3838

SUBMITTAL NO. S1360-6393

03-03-03

DATE: NOVEMBER 20, 1986

JOB: REPLACE BOILERS LCH-4014, LCH-4022, AS3502 & CG-1 CAMP LEJEUNE, NC.C

CONTRACTOR:

KINSTON P & H
BOX 637
KINSTON, N.C. 28501

ENGINEER: NAVAL ENGINEERING

THIS ORDER IS BEING HELD FOR APPROVAL AND WILL NOT BE RELEASED UNTIL APPROVED.

BLDG. LCH-4022

H.W. AIR CONTROL SYSTEM
1-30 GALLON ASME EXPANSION TANK
1-439 TANK FITTING
1-440 TANK DRAINER
1-434 2" AIR SEPARATOR
1-335 3/4" BRONZE PRV

H.W. PUMP
~~1-TACO 1612C 1 1/2" OIL LUBRICATED SLEEVE BEARING INLINE PUMP. 33 GPM @ 30 FT. HD. 1/2 HP 208/3/60 1750 RPM O.D.P. MOTOR. 5 3/4" DIAMETER BRONZE IMPELLER.~~ Existing

1-HERSEY-BEECO FRP-11 3/4" REDUCED PRESSURE ZONE BACKFLOW PREVENTER.

BLDG. CG-1

H.W. AIR CONTROL SYSTEM
1-60 GALLON ASME EXPANSION TANK
1-439 TANK FITTING
1-440 TANK DRAINER
1-434 2" AIR SEPARATOR
1-335 3/4" BRONZE PRV

☐ APPROVED
☑ APPROVED AS NOTED
☐ NOT APPROVED
☐ REVISE & SUBMIT
KINSTON PLUMBING & HEATING CO.
BY FL DATE 11-25-86

H.W. PUMP
1-TACO 1634C 2" OIL LUBRICATED SLEEVE BEARING INLINE PUMP. 66 GPM @30 FT. HD. 1 HP 230/3/60 1750 RPM O.D.P. MOTOR. 6.15" DIAMETER BRONZE IMPELLER.

1-HERSEY-BEECO FRP-11 3/4" REDUCED PRESSURE ZONE BACKFLOW PREVENTER.

(10) SET OF SUBMITTAL DATA FOR YOUR APPROVAL.

Submittal Data Information "PS" Expansion Tanks

401-007

SUPERSEDES: SD400-1.3

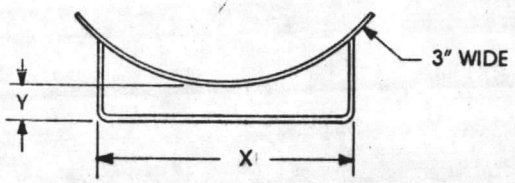
Job: Replace Boilers LCH-4014 & 4022, AS3502 & CG-1, Camp Lejeune, NC

ITEM	LOCATION	MODEL	QUANTITY	GALLONS
		PS030	1	30 Gal.
		PS060	1	60 Gal.

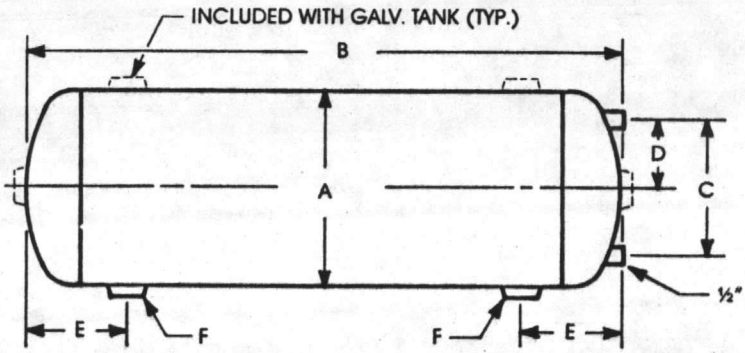
(OPTIONAL) SADDLES

(For Horizontal Installation)

FIG. 1



Tank Dia.	X	Y	Weight In Lbs. Per Pair
14	8	2	8
16	8	2 1/8	8
20	14 5/8	1 1/16	14
24	14 5/8	1 3/4	13
30	14	2 1/2	12 1/2
36	15 1/2	2 7/16	13 1/2



SIZES & DIMENSIONS

Model No.	Capacity Gal.	A	B	C	D	E	F	Approx. Wt. Lbs.	
								Painted	Galv.
PS015	15	14	25 7/8	10	5	7	1½	49	59
PS030	30	14	49 1/4	10	5	7	1½	88	96
PS040	40	14	64 7/8	10	5	7	1½	114	124
PS060	60	16	74 1/4	12	6	7½	1½	118	132
PS080	80	20	64 1/8	16	8	9	2	160	175
PS100	100	20	79 1/4	16	8	9	2	196	215
PS120	120	24	67	20	10	10	2	213	233
PS135	135	24	74 3/4	20	10	10	2	235	255
PS180	180	30	64 7/8	22	11	12	2	363	286
PS220	220	30	79 1/8	22	11	12	2	433	460
PS240	240	30	85 3/4	22	11	12	2	466	496
PS300	300	36	76 1/2	28	14	13 3/8	2	676	706
PS400	400	36	99 3/4	28	14	13 3/8	2	858	899
PS500	500	36	126 5/8	28	14	13 3/8	2	1069	1120

SPECIFICATIONS

- Manufactured in Accordance with ASME Section VIII.
- Max. Working Pressure — 125 PSIG.
- Max. Operating Temperature — 375°F.

Quality Through Design — COMPARE.

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TACO, (Canada) Ltd., 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 (416) 625-2160 Telex: 06-961179

NUMBER **SD 100-2.5**	SUBMITTAL DATA Effective: July 1, 1981 Supersedes: SD 100-2.5 dated 4/81

Plant ID 001-311

TACO-TROL TANK FITTINGS

PURPOSE

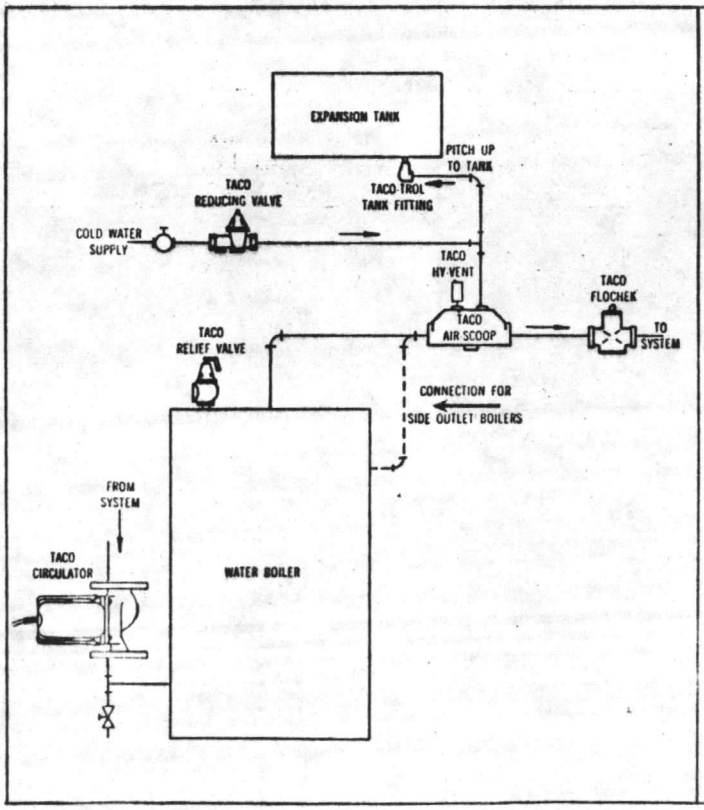
Designed to control the flow of air into the expansion tank while preventing free interchange of water between the expansion tank and the system.

HOW IT WORKS

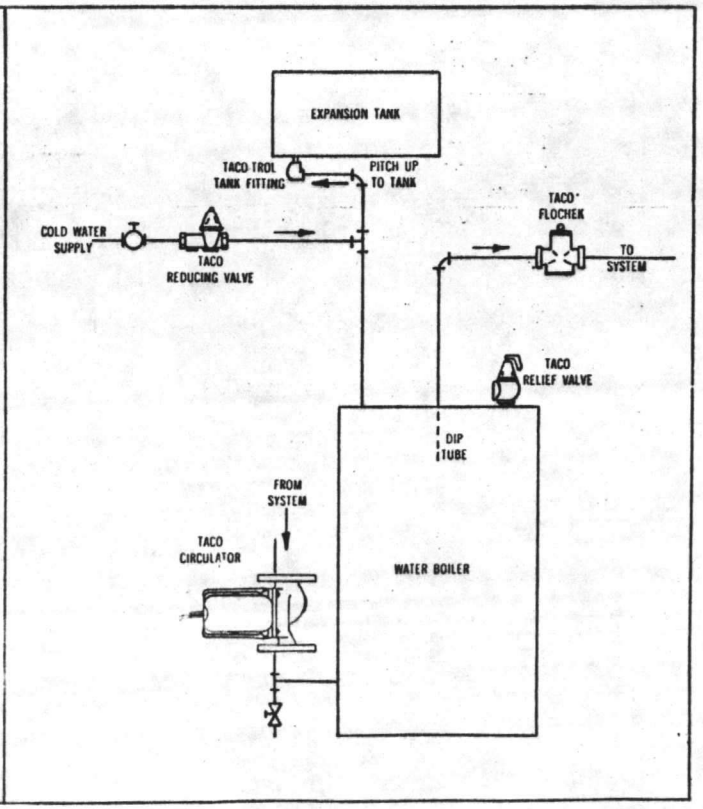
As air enters the fitting, it is directed thru the outer tube to the tank. As the water in the tank cools during an off cycle period of the firing device, water will tend to flow back toward the boiler or system. Because a restriction is built into the fitting, gravity circulation between boiler and tank is virtually eliminated. An inner tube and manual vent are also provided to permit air to escape from the tank during the initial filling and venting of the system.

HOW USED

The Taco-Trol Tank Fitting is screwed directly into the expansion tank and may be piped to an Air-Scoop (air separator or purger) or directly to the boiler if a "dip tube" is used (See Sketch).



INSTALLATION WITH AIR-SCOOP & HI-VENT



INSTALLATION WITH DIP TUBE

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Printed in U.S.A.

Taco (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario Telephone: (416) 625-2160 Telex: 06-961179

INSTALLATION AND FILLING PROCEDURE

INSTALLATION

1– Cut tubes to correct length per dimension table below.

2– Insert Tank Fitting into bottom of expansion tank, using close nipple supplied.

3– Connect Fitting to Air-Scoop Tank Connection or Boiler Dip Tube with ½" (15 mm) pipe: If vertical line is some distance from Fitting, pitch horizontal Line up to Fitting approximately 1/8" (5 mm) per foot (305 mm) of pipe length.

FILLING PROCEDURE

A– Open air vent screw on Taco-Trol Tank Fitting. Close all system vents and fill system. As soon as water flows freely from vent screw opening in Tank Fitting, close the screw tightly.

DO NOT RE-OPEN THIS VENT SCREW EXCEPT TO DRAIN TANK

B– Open system vents and vent all high points.

C– Adjust Pressure Reducing Valve (if required) to provide positive pressure at highest point in system.

D– After system is filled, start circulator. Circulate cold water for several minutes to dislodge air bubbles from system.

E– Stop circulator. Fire Boiler to High Limit shut-off temperature. After firing stops, wait a few minutes, then re-start circulator to permit separated air to enter expansion tank or leave system thru Taco Air-Scoop.

F– Stop circulator and re-vent system high points. Reset all controls for automatic operation. System is now ready for normal operation.

If it is necessary to drain expansion tank for any reason, open air vent screw in Taco-Trol Tank Fitting and open Boiler drain to drain tank.

SIZE & SPECIFICATIONS

Prod. No.	Size Connections		Maximum Working Pressure	Approx. Wht. Lbs.
	Boiler or Air-Scoop	Expansion Tank		
439	3/4" (20 mm)	1/2" (15 mm)	125 PSI (862kPa)	1 (.5 kg)
438	1" (25 mm)	1" (25 mm)	125 PSI (862kPa)	2.2 (1 kg)

CUT-OFF TABLE

For expansion tanks smaller than 24" in diameter cut off both tubes as follows:–

	Tank Diameter	Cut Off Both Tubes
439	24" (610 mm)	None
	20" (508 mm)	2-1/8" (54 mm)
	16" (406 mm)	4-1/4" (108 mm)
	14" (356 mm)	5-5/16" (135 mm)
	12" (305 mm)	6-3/8" (162 mm)

For expansion tanks larger than 24" thru 36" in diameter cut off both tubes as follows:–

	Tank Diameter	Cut Off Both Tubes
438	36" (915 mm)	None
	30" (762 mm)	3-3/16" (80 mm)
	24" (610 mm)	6-3/8" (160 mm)

NOTE: Inner tube must always be 1" (25 mm) longer than outer tube

Taco	SUBMITTAL DATA SHEET	Customer: Kinston P & H Box 637 Kinston, NC 28501 Job: Replace Boilers LCH-4014 & 4022 AS30502 & CG-1 Camp Lejeune, NC
NUMBER SD 100-2.6	Effective: November 15, 1982 Supersedes: SD100-2.6 dated 4/30/81	

TANK DRAINER

PURPOSE

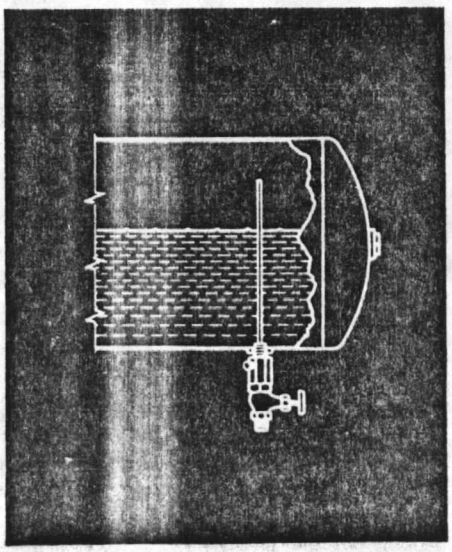
Designed for fast draining of water from water-logged Expansion Tanks.

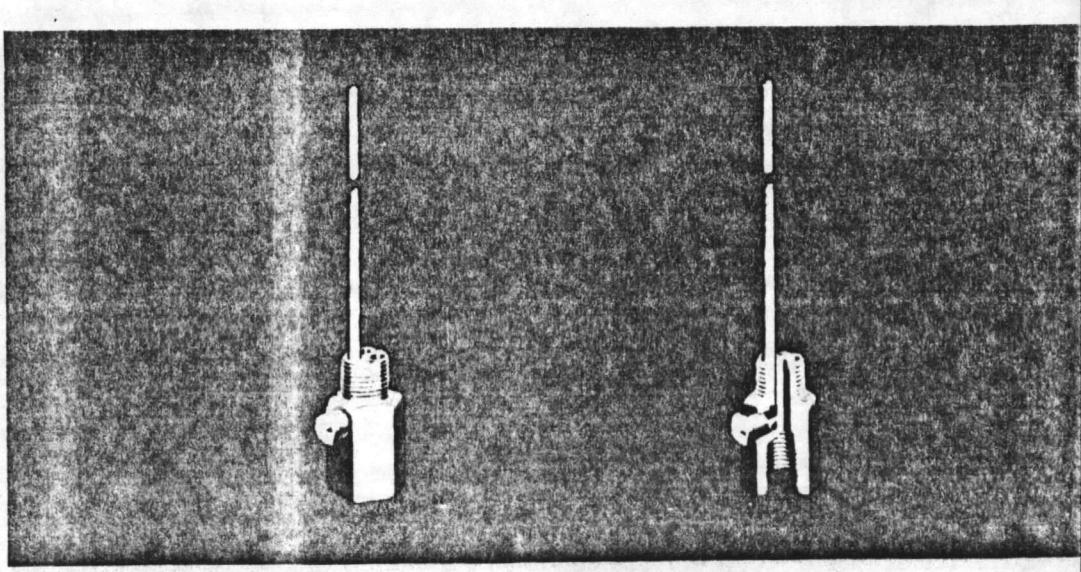
FEATURES

- Low Cost
- Quick Air Charging
- Easily installed
- All brass body
- 11" (280 mm) long copper tube
- Air charging plug on side, preventing water from soaking installer
- Adaptable to any style drain valve
- Individually boxed for full protection

OPERATION

Removing the plug on side of Tank Drainer permits air to enter into top of Expansion Tank, breaking the vacuum for fast and full flow draining of the Expansion Tank and/or the Heating System.





* DIMENSIONS

PRODUCT NO.	CONN. SIZE	APPROX. SHIPPING WEIGHT				DIAMETER		LENGTH	
		EACH		12 PCS.					
		Lb.	Kg.	Lb.	Kg.	In.	mm	In.	mm
440	1/2" N.P.T.	.6	.3	8	3.6	1 - 1/8	29	13	330

*CHANGE

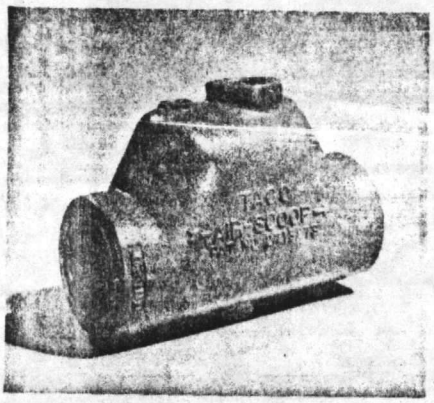
Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

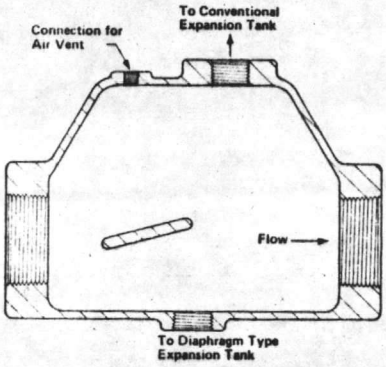
NUMBER **SD 100-2.4**	Effective: January 1, 1984 Supersedes: SD 100-2.4 dated 3/1/83

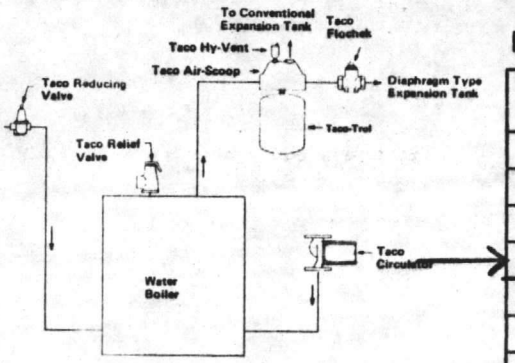
SUBMITTAL DATA SHEET

Taco-Trol Air Elimination & Expansion Controls

AIR-SCOOP (air separator)







Purpose

The Taco Air-Scoop (air separator) is specifically designed to provide a noiseless, air-free Hydronic heating, cooling or combination system, by efficiently separating out the air from the water in any of these systems.

Features

- **One piece cast iron construction**
- **Engineered baffle to separate air from water**
- **Never requires any servicing**

Operation

Air being lighter than water it travels along the upper portion of a horizontal pipe in low velocity hydronic systems.

As the air and water enter the Air-Scoop (air separator) their velocity decreases, permitting the air bubbles to be scooped up by the baffle and directed to the top of the chamber.

The air reaching the top of the air scoop is either immediately vented through the Hy-Vent or it moves into the conventional expansion tank, if used.

Should the air completely fill the Expansion Tank and back down into the Air-Scoop (air separator) the excess will be removed by the Air Valve without disturbing the operation of the system.

Rating

Maximum operating temperature 275F. (135C)
Maximum working pressure . . . . . 125 PSI (862 kPa)

Dimensions

Prod. No.	Size	A		B		C		D	E	F	Weight	
		in	mm	in	mm	in	mm				lb.	Kg.
431	1"	6	152	4½	114	3	76	¾" NPT	½" NPT	⅛" NPT	4	1.8
432	1¼"											
433	1½"	8	203	6	152	4	102	1"			7	3.2
434	2"											
435	2½"	10	254	8	203	5½	140				15	6.8
436	3"							1¼" NPT			14	6.4
437	4"*	16 5/16	414	11 5/8	295	7 1/8	181	1½" NPT		¼" NPT	52	23.6

*This size has 125 lb. flanged ends.

Flow

Where noise is a consideration a maximum velocity in the pipe of 4 ft./sec. (1.2m/sec.) is recommended.

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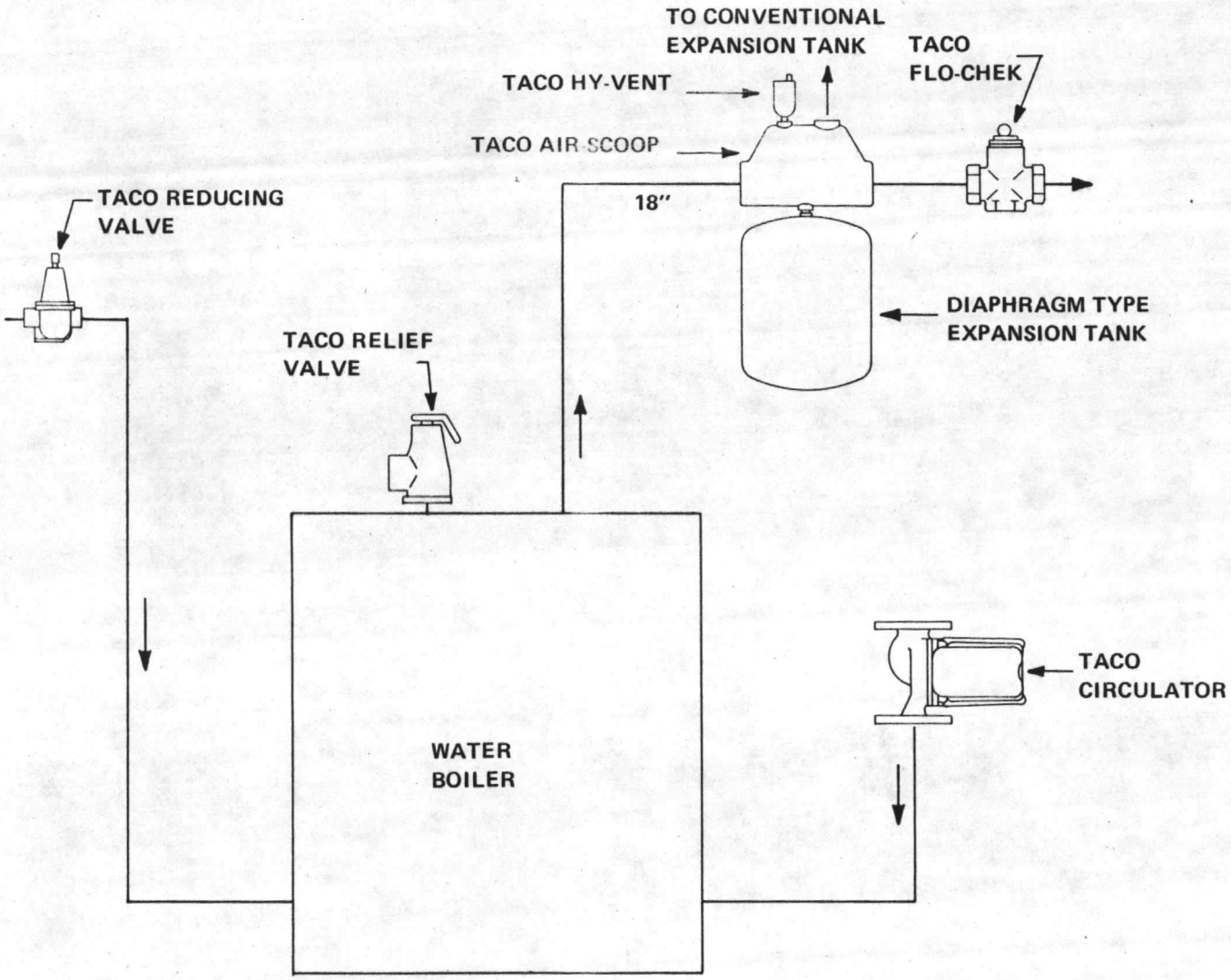
Litho in U.S.A.
Taco (Canada) Limited 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone: 416-625-2160 Telex: 06-961179

NUMBER **IS100-2.4A**	INSTRUCTION SHEET Effective: October 1, 1983 Supersedes: IS100-2.4A dated 4/1/83

Plant I.D. No. 001-914

AIR SCOOP MODEL NOS. 431-5, 432-5



INSTRUCTIONS

Locate the Taco Air Scoop in the horizontal supply line. The tapped connection at the bottom of the Air Scoop is provided for connecting a Taco-Trol Expansion Tank.

The 1/8" tapped connection at the top of the Air Scoop is provided for installing a Taco Hy-Vent. The second tapped hole is provided for a pipe connection from an overhead plain steel expansion tank if one is used.

After the system is filled and purged or vented at high points, the Air Scoop will automatically separate any remaining air from the water pumped through it. The air is then automatically vented to the atmosphere or passes into an overhead expansion tank providing a quiet, air-free system.

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F102-039

Submittal Data Information
Pressure Reducing Valves, Dual Controls and Pressure Relief Valve

101-005

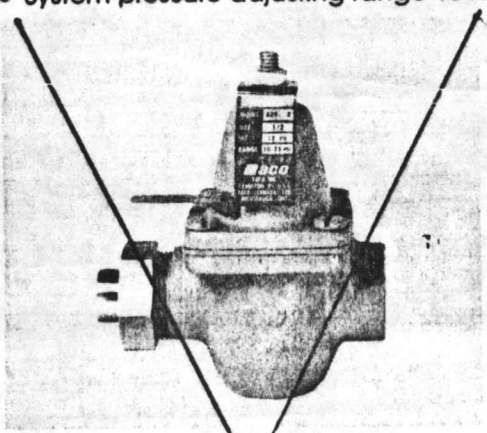
Numbers: 329, 329T, 335, 334, 334T and 333 SUPERSEDES: SD100-2.2

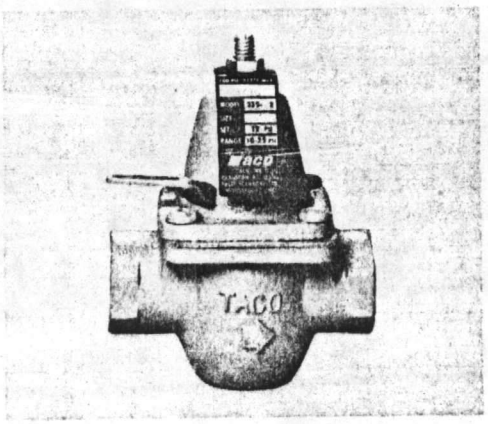
Job: Replace Boilers LCH-4014 & 4022, A53502 & CG-1, Camp Lejeune

PRESSURE REDUCING VALVES — 329 AND 335

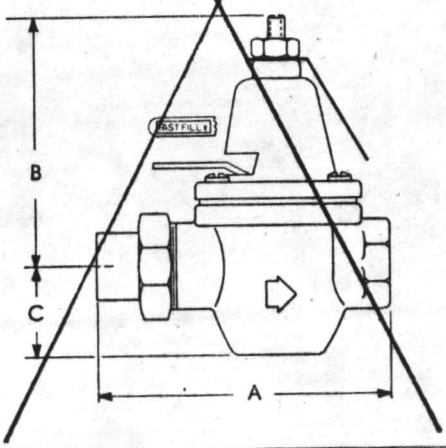
PURPOSE: To automatically feed water to a hot water heating system whenever pressure in the system drops below the pressure setting of the valve

FEATURES:
- Fast fill rate on all models
- Pressure setting adjustment separated from fast fill lever for easy, fast adjustment
- Built-in check to prevent emptying system if incoming pressure fails
- System pressure adjusting range 10 to 25 PSI

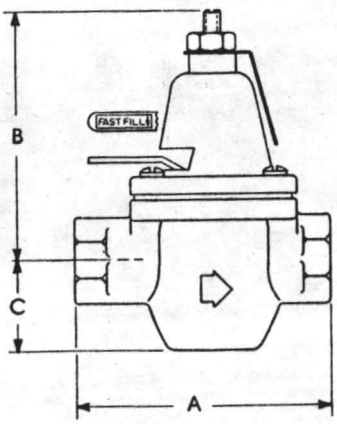




329, 329T



335



PRODUCT NO.	CONSTRUCTION MATERIAL	SIZE & TYPE CONNECTION	MAXIMUM SUPPLY SIDE PRESSURE	MAXIMUM TEMPERATURE	DIMENSIONS, INCHES			SHIPPING WT./LB.	
					A	B	C	EA.	CTN.
329	CAST IRON	½" (15MM) NPT & SWEAT	200 PSI (1380 KPA)	212°F (100°C)	4¼ (108MM)	3¾ (95MM)	1⅜ (35MM)	2.4 (1.1 KG)	30 (14 KG)
329T	CAST IRON	½" (15MM) NPT			4⅜ (111MM)	3¾ (95MM)	1⅜ (35MM)		
335	BRONZE	¾" (20MM) NPT			3¾ (95MM)	3¾ (95MM)	1⅜ (35MM)		

Quality Through Design — COMPARE.

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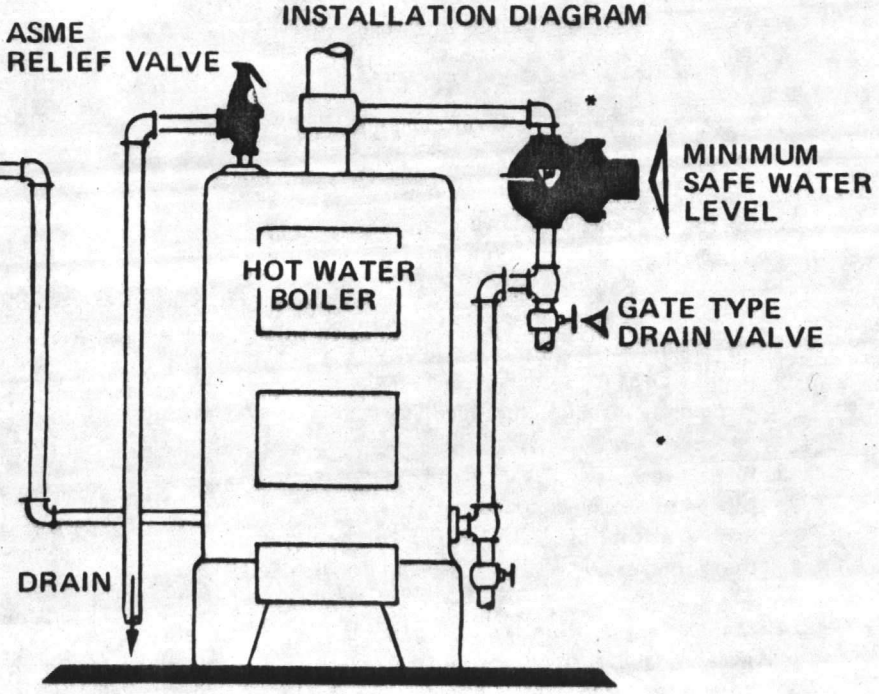
TACO, (Canada) Ltd., 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 (416) 625-2160 Telex: 06-961179

INSTRUCTION SHEET	
NUMBER **IS-100-2.2A**	Effective: May 1, 1983 Supersedes: IS100-2.2A dated 8/1/81

TACO REDUCING VALVE PRESSURE REGULATORS

INSTRUCTIONS FOR INSTALLING

INSTALLATION DIAGRAM



DUAL CONTROL SERVICE

The installation of a separate Feed Water Pressure Regulator and an ASME Pressure Relief Valve provides the dual service accomplished by a dual control Hot Water Heating Regulator (see reverse side) and, in addition conforms to the ASME requirements for low pressure heating boilers. (Many state and local regulations are based on ASME boiler codes.) Where local or state codes are in effect, installations must be in compliance.

*The use of a low water cut-off is strongly recommended for protection against a low water level condition in the boiler which could result from continuous firing should controls become inoperative or a break occur in the return piping.

FEED WATER PRESSURE REGULATORS

These regulators must be installed in the cold water supply line to the boiler and in a horizontal position. When piping is ready to receive the regulator, flush out the supply pipe to clear it of chips scale, dirt, etc. before installing regulator. Install regulator with the supply line connected to the inlet. Install a shut-off valve ahead of the regulator. Regulator is set to feed water at approximately 15 lbs. pressure. To readjust regulator, follow instruction No. 7 on reverse side of this sheet. These regulators have a strainer screen which should be removed and cleaned at least twice a year.

SERIES WITH FAST FILL AND PURGE LEVER

These valves are equipped with a unique and simple "fast fill and purge lever" . . . which permits rapid filling of the system . . . and sustained flow for air purging.

This advanced design incorporates a removable "push" rod which is actuated by the position of the "purge lever." When the lever is raised to the vertical position, it presses the "push" rod down which manually forces the valve wide open for maximum flow. Returning the lever to its normal position releases tension on the rod permitting the valve to maintain normal pressure in the system automatically.

*LOW WATER CUT-OFF

Install a low water cut-off so that the raised line cast on float chamber body is on a level with the top of the boiler. Top of switch box should be reasonably level. Piping to the top and bottom float chamber connections should conform to that shown on installation diagram. Keep the float chamber clean by periodically opening the valve below the float chamber to flush out mud and sediment. Do this at least once each month.

IMPORTANT:

When water main pressure exceeds 100 lbs. or is variable, a domestic service type water pressure reducing valve should also be installed in addition to this feed valve regulator. This reduces the pressure for accurate, longer life feed valve performance, as well as providing quiet, economical service pressure to the domestic fixtures.

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TACO HOT WATER
HEATING DUAL CONTROLS

INSTRUCTIONS FOR INSTALLING

1. These TACO DUAL CONTROLS must be installed in the cold water supply line to the boiler and in a horizontal position above the top of the boiler as shown on diagram.

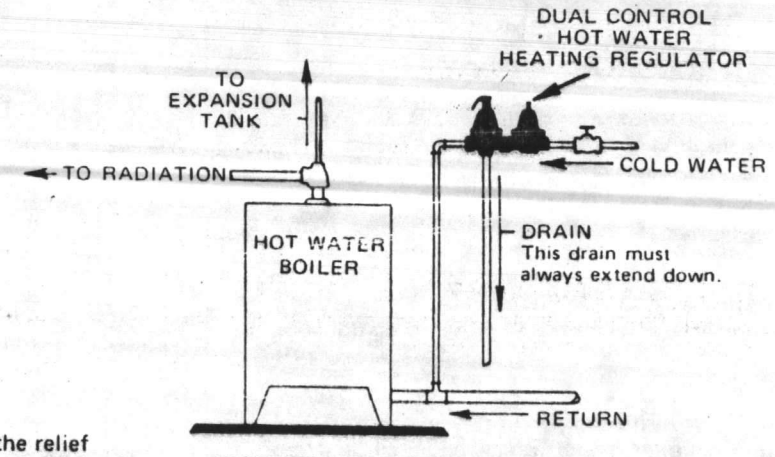
2. When the piping is ready to receive the Regulator, flush out the supply pipe to clear it of chips, scale, dirt, etc. before installing the Regulator.

3. Install the "Regulator" with the supply line connected to the inlet. Install a shut-off valve ahead of the Regulator.

4. Connect a pipe from the "DRAIN" tapping in the relief valve to above some convenient open drain such as a floor drain or set tubs. Always obey local regulations.

   Do not install a valve of any kind in this line. This drain must always pitch down from the regulator. No portion of the drain line should be above the regulator. Drain pipe must not be smaller than the drain tapping provided. The relief valve is non-adjustable and set to relieve at 30 lbs.

INSTALLATION DIAGRAM



IMPORTANT
Please Note Footnote at Bottom of Reverse Side of This Sheet

5. To fill the system, open the shut-off valve ahead of the Regulator. This valve must always be kept open when the system is in operation. Water will flow into the system until it is full and under pressure.

6. The pressure reducing valve of the Regulator is set to deliver water to the boiler at approximately 15 lbs. pressure. This pressure is sufficient for a 3-story building.

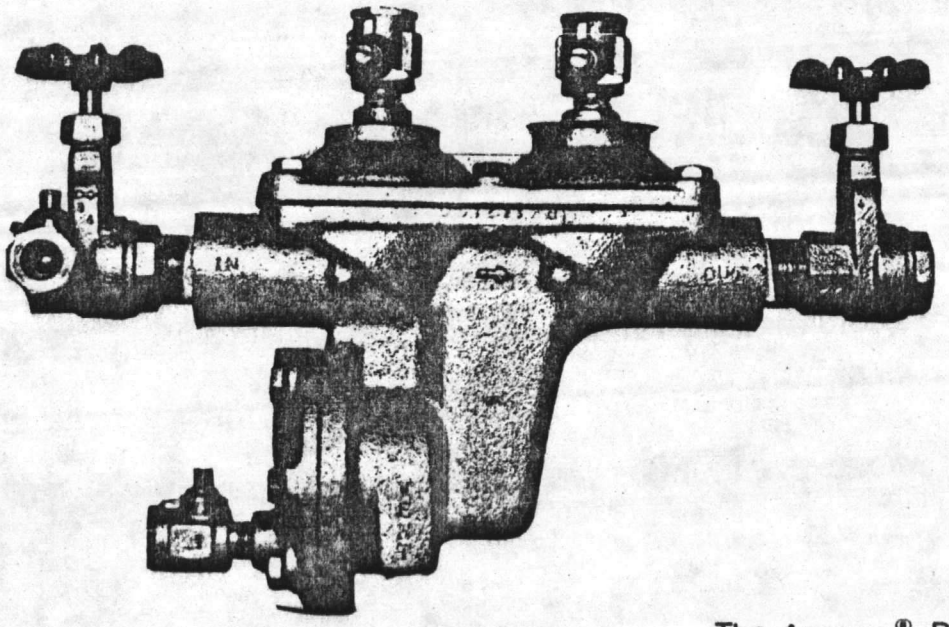
7. To reset the reducing valve for higher pressure (when the pressure is not sufficient to lift the water to highest radiation), calculate the number of feet from the regulator to the top of highest radiation. Multiply this by .43 and add 3 lbs. This will give the pressure needed to raise the water to the highest radiator and keep it under pressure – loosen lock nut. Turn adjusting screw clockwise slowly until the gauge indicates the pressure calculated. Then lock adjustment.

8. The regulator screen should be cleaned at beginning of each heating season.

9. The air cushion tank sometimes becomes filled with water (waterlogged). This is usually indicated by dripping of the relief valve when the burner is running. To recharge with air, close gate valve between tank and system and open gate valve in drain pipe. Allow tank to completely drain (this requires from 10 to 15 minutes), then close drain valve and open valve between tank and system.

Aergap® REDUCED PRESSURE BACKFLOW PREVENTERS by BEECO®

Model FRP-II ¾" - 2" WITH FULL USC, CSA, AND ASSE #1013 APPROVAL



DESCRIPTION

The Beeco® Model FRP-II backflow preventer is an economical, easily repaired in line, reduced pressure device. Both check valves are spring loaded poppet type valve assemblies. The relief valve is a diaphragm actuated, spring loaded, double seat valve assembly. Spring and seats can be removed and replaced using low cost replacement kits.

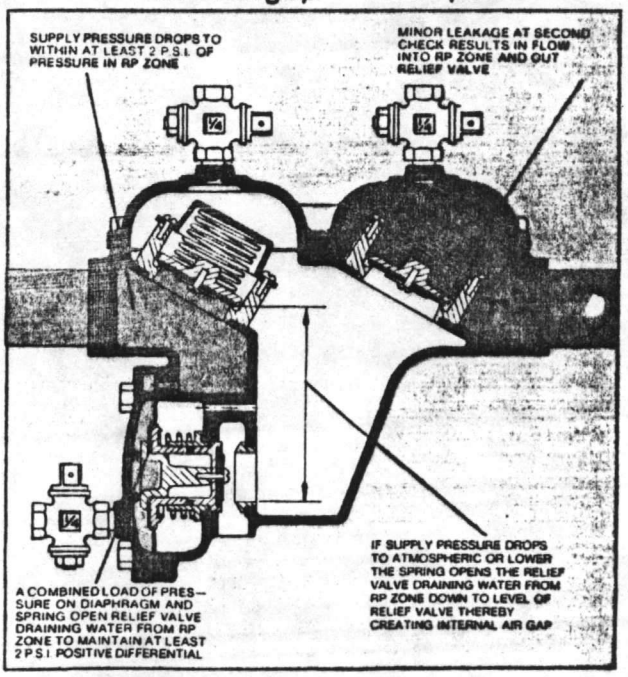
All parts are made from corrosion resistant materials.

The compact design places the sensing diaphragm and passage within the unit housing to eliminate danger of malfunction due to damage from handling or vandalism.

The Model FRP-II features the *Aergap*® principle which provides the highest level of protection against backsiphonage by creating an internal air gap whenever supply pressure is reduced to atmospheric or lower under the normal operation of the device.

An Air Gap Drain Funnel is available for installation with the FRP-II.

The *Aergap*® Principle



OPERATION

NORMAL:

The check valves remain closed until there is a demand for water. In opening and crossing the first check valve, water is reduced in pressure. The relief valve remains in a closed position because of the differential between the supply pressure and the reduced pressure within the zone. The second check valve remains open as water flows through the device in the normal direction.

BACKPRESSURE:

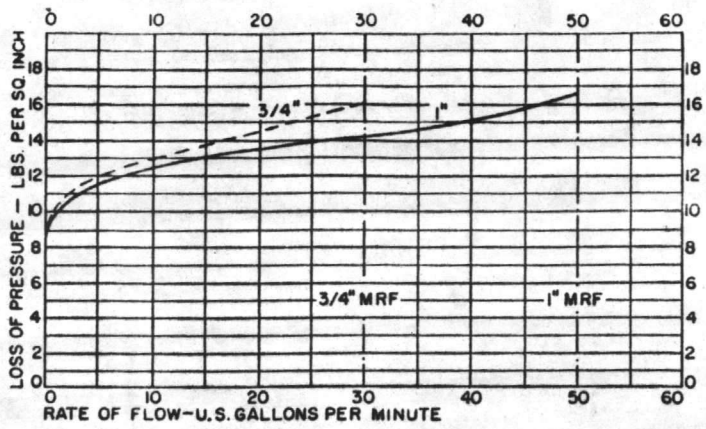
In the event pressure increases downstream of the device, tending to reverse the direction of the flow, both check valves are closed to prevent backflow.

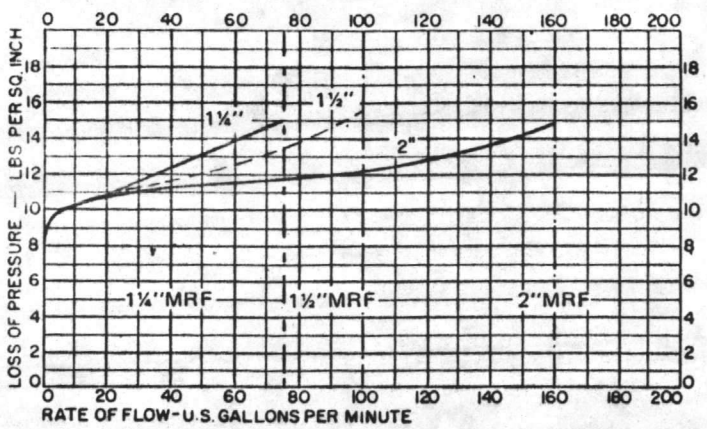
If the second check valve is prevented from closing tightly, minor leakage back into the zone increases the zone pressure to within a few pounds of the supply pressure, the relief valve opens, and water is discharged to the atmosphere.

If supply pressure drops, the relief valve opens automatically and drains water to atmosphere to reduce pressure in the zone below that of the supply pressure.

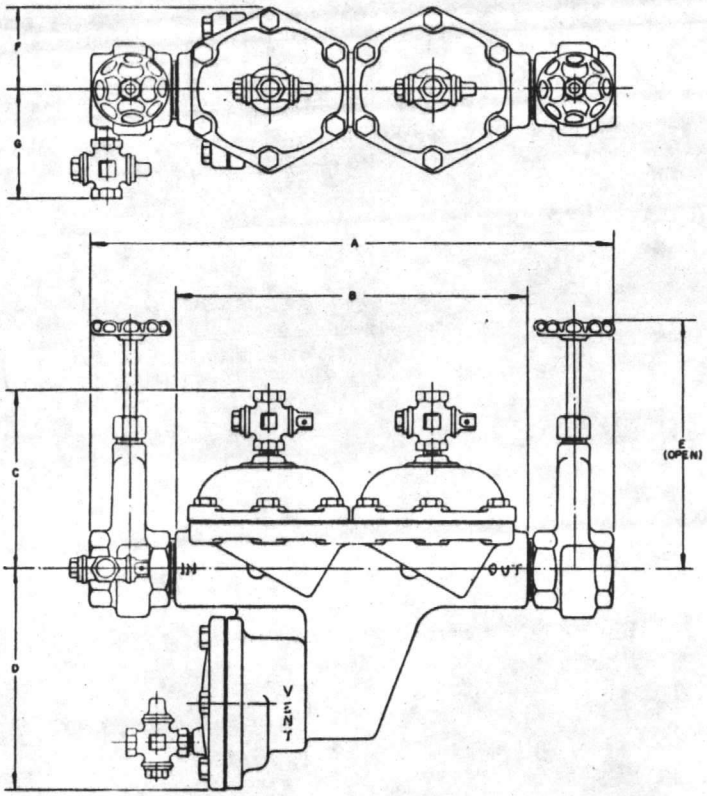
BACKSIPHONAGE:

If the supply pressure drops to atmosphere or lower, the relief valve will remain fully open, providing an internal air gap between the first check valve and the water level in the RP zone.





THE ABOVE FLOW CHARTS REFLECT PRESSURE LOSS WITH GATE VALVES



Dimensions and Weights					
Size	3/4"	1"	1-1/4"	1-1/2"	2"
A	13-1/8"	13-5/8"	18"	17-1/2"	20-1/4"
B	8"	8"	12"	11"	12-3/8"
C	3-5/8"	3-5/8"	5"	5"	5-3/4"
D	4-15/16"	4-15/16"	6-13/16"	6-13/16"	7/1/16"
E (Open)	4-1/16"	5"	5-1/2"	6"	7-1/4"
F	1-9/16"	1-9/16"	2-13/16"	2-13/16"	2-7/8"
G	3-1/2"	3-1/2"	3-3/4"	3-3/4"	3-3/4"
Size Test Cocks	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT
Net Wgt. L/Valves	9-1/2 lbs.	10-1/2 lbs.	25 lbs.	24-1/2 lbs.	32-1/2 lbs.
Net Wgt. W/NRS Valves	12-1/4 lbs.	14 lbs.	29-3/4 lbs.	34-3/4 lbs.	42-1/4 lbs.
Gross Wgt. L/Valves	11-1/4 lbs.	12-1/4 lbs.	27-3/4 lbs.	27-1/4 lbs.	35-3/4 lbs.
Gross Wgt. W/NRS Valves	14-1/2 lbs.	16-1/4 lbs.	33-1/4 lbs.	38-1/4 lbs.	45-3/4 lbs.

SPECIFICATIONS

Body	Bronze
Check Valve Enclosures	Glass Filled Noryl
Valve Disc	Silicone Rubber
Diaphragm	Buna N and Nylon
"O" Ring	Buna N
Springs	Stainless Steel
Screws	Stainless Steel
Maximum Working Pressure	150 psi
Hydrostatic Test Pressure	300 psi
Temperature Range	33°—210°F
Gasket	Cork Rubber

SAMPLE SPECIFICATION:

Backflow Preventers shall be of the reduced pressure type with two independently operating check valves and shall be designed for installation in a normal horizontal flow attitude. An independent relief valve shall be located between the two check valves.

The backflow preventer shall include an integral sensing system that will automatically open the relief valve whenever the differential pressure between the inlet supply and the reduced pressure zone drops to at least 2PSI. The relief valve shall remain open until a positive pressure differential of 2PSI is re-established. The sensing passage shall be located within the unit housing to protect against accidental damage or crimping. In order to assure maximum size passageway, snubber or other restrictive elements shall not be used.

In the event that pressure upstream of the first check valve drops to atmosphere or below, the construction of the unit shall be such that in the normal operation of the device the level of water in the zone between the two check valves shall be lowered to create within the unit an air gap greater than one times the diameter of the inlet pipe.

Construction of the unit shall also be such that any minor leakage at the second check valve will result in a visible flow from the relief valve even if the first check valve is totally disabled.

All backflow preventers shall meet with the approval of U.S.C. Cross Connection Control Lab / U.S. Army Corps of Engineers / U.S. Navy / AMPS / Southern Building Code Congress / AWWA / ASSE / CSA B64.4.

SALES OFFICES

SOUTHEAST — 2131 Kingston Court, S.E., Suite 102, Marietta, GA 30067 (404) 952-4424
NEW ENGLAND — 250 Elm St., Dedham, MA 02026-9115 (617) 326-9400
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Water Meter & Controls Group
250 Elm Street, Dedham, MA
02026-9115 U.S.A.

Printed in U.S.A. 5M 4/85 TD

Hersey
PRODUCTS INC.

INSTALLATION MAINTENANCE, AND TEST INSTRUCTIONS

BEECO® *Aergap*™
MODELS FRP I AND FRP II
REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER
FRP I, ¾", 1"
FRP II, ¾", 1", 1¼", 1½", 2"

MODEL FDC
BACKFLOW PREVENTER

GENERAL INFORMATION

Beeco® Aergap™ Model FRP Reduced Pressure Principle Backflow Preventers and Model FDC Double Check Valve Assemblies are designed and manufactured to give long, troublefree service in safeguarding public and private water systems from pollution or contamination caused by cross-connections. However, to insure proper operation, each device should be tested at least annually (or as prescribed by authorities having jurisdiction), and after each repair operation.

Rubber parts, which include valve discs, relief valve diaphragms and small o-rings should be replaced at least every five years or as prescribed by authorities having jurisdiction (see replacement valve kits).

Special test kits and repair tools are required to repair and test these devices. Model FRP and FDC repair tools and test kits are listed in this manual. Test kits and tools are available from your nearest Hersey sales office or Beeco distributor.

If service by the manufacturer is preferred, factory-trained field service engineers are available. Contact your nearest Hersey sales office or Beeco distributor for details.

PARTS ORDERING INSTRUCTIONS

Please state name of part, part number and quantity required. If applicable, also state model, size and serial number of device for which parts are intended. Order parts from nearest Hersey sales office listed on back cover, or from your Beeco distributor. Minimum order: $20.00 net. For parts prices, see Parts Price List, available from your Hersey sales office or Beeco distributor.

PARTS TERMS

Net 30 days, F.O.B. SELLER'S factory or warehouse, with full freight allowed on shipments of $500.00 or more. Parcel post, truck or UPS shipments under $500.00 are prepaid and the cost of shipment included on our invoice.

Parts returns for credit are not accepted without our prior consent, and limited to parts ordered within one year of the requested return. If your order was correctly filled, a handling charge of 30% of the net invoice total is made for returned merchandise. Parts returned must be shipped prepaid.

TAXES

PURCHASER shall pay any and all taxes, imposed by any government jurisdiction upon the sale of goods hereunder.

PARTS LISTS ACCURACY

Each entry has been carefully checked for accuracy. However, should any question arise regarding the proper description, part number, quantity or list price of any item or items listed in this parts catalog, Hersey Products Inc. reserves the right to determine the applicable description, part number, quantity or list price.

WARRANTY

Beeco Backflow Preventer replacement parts, test kits and maintenance tools are warranted to be free from defects in material and workmanship for a period of one year from date of shipment from HERSEY'S factory or warehouse. Parts or assemblies deemed defective during this period are to be returned for examination, transportation prepaid, to HERSEY'S factory, 250 Elm Street, Dedham, Massachusetts 02026, Attention: Quality Assurance Department (Notification of shipment should be sent attention: Service Manager. Please obtain Returned Goods Authorization forms from your Hersey Sales Office or Beeco distributor prior to shipment, as one copy is to be used as a packing slip). If examination of the parts or assemblies indicates that a defect exists, HERSEY PRODUCTS INC. reserves the right to repair or replace such parts or assemblies at HERSEY's option.

EXCEPT AS PREVIOUSLY PROVIDED, HERSEY PRODUCTS ARE SOLD ON AN "AS IS" BASIS. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE GOODS IS WITH THE BUYER. SHOULD THE GOODS PROVE DEFECTIVE FOLLOWING THEIR PURCHASE, THE BUYER AND NOT HERSEY, OR ANY DISTRIBUTOR OR RETAILER OF HERSEY PRODUCTS ASSUMES THE ENTIRE COST OF ALL NECESSARY SERVICING OR REPAIR. UNDER NO CIRCUMSTANCES WILL HERSEY BE LIABLE FOR DAMAGES OF ANY KIND, DIRECT OR INDIRECT, CONSEQUENTIAL, SPECIAL OR OTHERWISE RESULTING FROM FAULTY INSTALLATION, IMPROPER APPLICATION OR MALFUNCTIONING OF ITS EQUIPMENT. HERSEY SHALL NOT BE RESPONSIBLE FOR ANY COMMERCIAL LOSS SUSTAINED BY ANY PARTY AS A CONSEQUENCE OF ANY DEFECT IN THE MATERIAL OR WORKMANSHIP OF ITS PRODUCTS.

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¾"-2" BEECO MODEL FRP REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

¾"-2" HERSEY MODEL FDC DOUBLE CHECK VALVE ASSEMBLY

¾"-2" BEECO MODEL FRP I / FRP II REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

Model FRP Section I — Description and Operation

DESCRIPTION (see Fig. 1)

The BEECO Reduced Pressure Principle Backflow Preventer operates on the principle that water will not flow from a zone of lower pressure to one of higher pressure. It provides protection against backflow caused by both backpressure and backsiphonage.

The device consists of two spring-loaded check valves (A and B) and a spring-loaded, diaphragm-actuated differential pressure relief valve (C) located in the zone between the check valves.

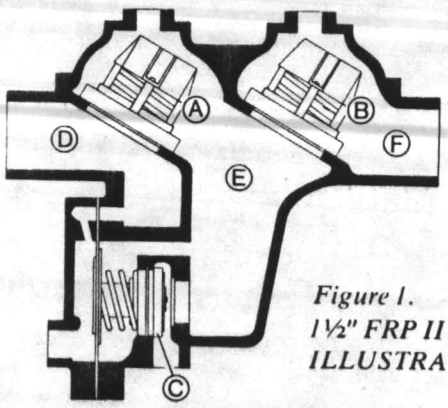


Figure 1.
1½" FRP II DEVICE ILLUSTRATED

NORMAL OPERATION

The first check valve (A) causes all water passing through it to be automatically reduced in pressure by approximately 5-8 psi.

The second check valve (B) is lightly springloaded and forms the "double check" feature of the device. It acts to prevent unnecessary drainage of the domestic system in case a backflow condition occurs.

The relief valve (C) is spring-loaded to remain open, and diaphragm actuated to close by means of differential pressure.

To illustrate the operation, assume water, having a supply pressure of 60 psi, is flowing in a normal direction through the device. If all valves beyond area F are closed, creating a static condition, the water pressure in area D will be 60 psi and water pressure between the check valves (E) will be 52 psi.

The inlet pressure of 60 psi is transmitted through a drilled passageway to the *underside* of the diaphragm of the relief valve (C). This valve is springloaded to remain in an open position until the differential pressure amounts to approximately 4 psi across the relief valve.

During normal operation, therefore, the 8 psi differential pressure produced by the first check valve (A) exceeds the spring-loading of the relief valve (C) and causes the relief valve (C) to remain closed.

BACKFLOW

There are two conditions that tend to produce backflow:

Backsiphonage — where the pressure in the drinking water system becomes less than atmospheric due to a vacuum or partial vacuum in that system.

Backpressure — where the pressure in the nonpotable system exceeds that in the drinking water system.

BACKSIPHONAGE

As the supply pressure drops in area D, it also drops in the area below the diaphragm of the relief valve (C). When the pressure differential across the diaphragm decreases to approximately 4 psi, the relief valve (C) will start to open. This happens because the spring above the diaphragm of the relief valve (C), which is trying to force the valve open, is designed to compress with a differential pressure of 8 psi. When that differential is decreased to 4 psi, the spring will extend and cause the relief valve (C) to start to open.

This spring-loaded relief valve is designed to eliminate intermittent discharges and "spitting" with normal minor fluctuations in the line pressure.

As the supply pressure continues to drop, the relief valve (C) automatically opens to drain and, regardless of the pressure on the supply side, approximately 4 psi less pressure will be maintained between the check valves (zone E) until zone pressure reaches atmospheric.

BACKPRESSURE

Assume that pressure at the discharge side (F) increases to 80 psi, while the supply pressure (D) remains at 60 psi:

1. *If the second check valve (B) does not leak,* water under higher pressure in area F will not enter the area between the check valves (zone E), and the pressure in this zone will remain at 52 psi. Under these conditions, the relief valve (C) will remain closed since the 8 psi differential pressure is still being maintained between the supply pressure (area D) and the area of reduced pressure between the check valves (zone E).

2. *If the second check valve (B) does leak,* water under high pressure (area F) will flow into zone E. If the pressure in this zone increases to approximately 56 psi — still 4 psi *lower* than the supply pressure (area D) — the relief valve will start to open and discharge this reversely flowing water to atmosphere, maintaining the pressure in zone E approximately 4 psi lower than supply pressure. The relief valve will automatically continue to drain as long as this backflow condition exists and as long as the second check valve (B) is leaking.

If for any reason the first check valve (A) should leak during a shutoff beyond area F, the water under higher pressure in area D will leak into zone E. This will cause the relief valve to open as previously described and, again, provide visual indication at the drain outlet.

In the unlikely event that the relief valve diaphragm should rupture, an unbalanced condition between area D and zone E will occur, and the relief valve will immediately discharge to atmosphere.

FRP SECTION II — INSTALLATION

A. GENERAL INSTALLATION INSTRUCTIONS

1. Before installing the device, pipelines should be thoroughly flushed to remove foreign material.
2. If not already provided, shut off valves should be installed at each end of the device so that it can be tested and maintained. A ¼" test cock must be mounted on the inlet side of the inlet shutoff valve.
3. Devices must be installed in a *horizontal* position above the ground or floor level.
4. Devices should be installed in an accessible location with ample clearance to facilitate testing and repairs. (See Fig. 2)
5. In no case should the relief valve discharge be solidly piped into a sump, sewer, drainage ditch, etc.

B. WARM CLIMATE OUTDOOR INSTALLATION (See Fig. 2)

1. Reduced pressure backflow preventers should be installed only where there is adequate drainage and no danger of freezing. At no time should they be placed where any part of the unit could be submerged in standing water. The recommended installation is above ground. A concrete slab under the unit is sometimes desirable.
2. Normally, any discharge from the relief valve is spilled onto the ground. Drainage may be piped away from the location, in which case, an air gap must be used between the relief valve port and the drain line. (See Fig. 4)

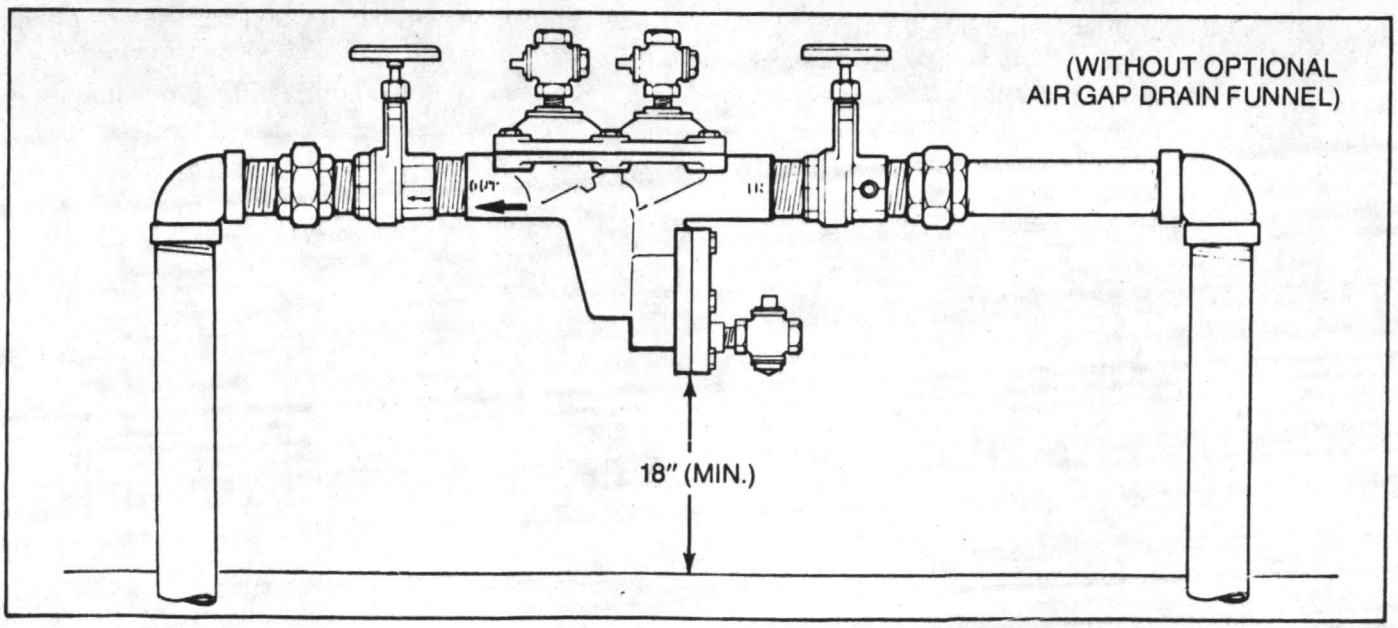


Figure 2. WARM CLIMATE OUTDOOR INSTALLATION

C. COLD CLIMATE OUTDOOR INSTALLATION

In remote locations or where installation cannot be made in a heated building, a separate insulated structure should be built around the backflow preventer and adjacent piping. In extremely cold areas, some form of heat should be provided within the structure. Strip heaters or light bulbs may be sufficient for this purpose.

D. COLD CLIMATE INDOOR INSTALLATION (See Fig. 3)

In climates where freezing conditions are likely, or where it is impractical to install the backflow preventer above ground, the installation should be made at an easily accessible location inside a heated building.

The unit should be placed above the floor at a distance great enough to allow clearance for repair work. If the backflow preventer is positioned against a wall, care should be taken to be sure that the four test cocks are easily accessible. Proper drainage should be provided for the relief valve. An air gap must be used between the relief valve outlet and the drain line if drainage is to be piped away.

E. MODIFIED PIT INSTALLATION (See Fig. 5)

In the event installation must be made in a pit, only the modified pit type installation may be used. The relief valve drain should be piped to the outside of the pit and discharged no less than 12" above the grade line.

F. BATTERY (PARALLEL) INSTALLATION (See Fig. 6)

Where it is essential to provide uninterrupted water service, installation of two model FRP devices in a battery (parallel) setting is recommended. This avoids interruptions to water service when maintenance or testing is required. One device can be shut off while the other is left in operation. This installation also provides higher flow capacity than provided by one backflow preventer.

G. CORRECTION OF DISCHARGE

1. After installation, *with flow through the device,* continual discharge from the relief valve opening usually indicates that there is foreign material holding the relief valve open. To remove foreign material, flush relief valve as follows:
   a. Close inlet shutoff valve.
   b. Open test cock No. 2. Relief valve should fully open and discharge.
   c. Close test cock No. 2.
   d. Open inlet shutoff valve.

   If relief valve continues to leak, repeat procedure. If flushing does not stop discharge, with flow through the device, close shutoff valves, remove and clean the relief valve.*
2. After installation, *with no flow through the device* (inlet shutoff valve open, outlet shutoff valve closed) continual discharge from the relief valve indicates a leaking first check valve, probably caused by foreign material under the seat. If flushing (substantial flow through the device) will not clear the device, close shutoff valves, remove and clean the first check valve.*
3. Occasional "spitting" or momentary discharge from the relief valve can be expected, if line pressure drops suddenly, due to operation of flushometers, quick opening valves, or similar devices and valves.

*See Disassembly and Cleaning Procedures.

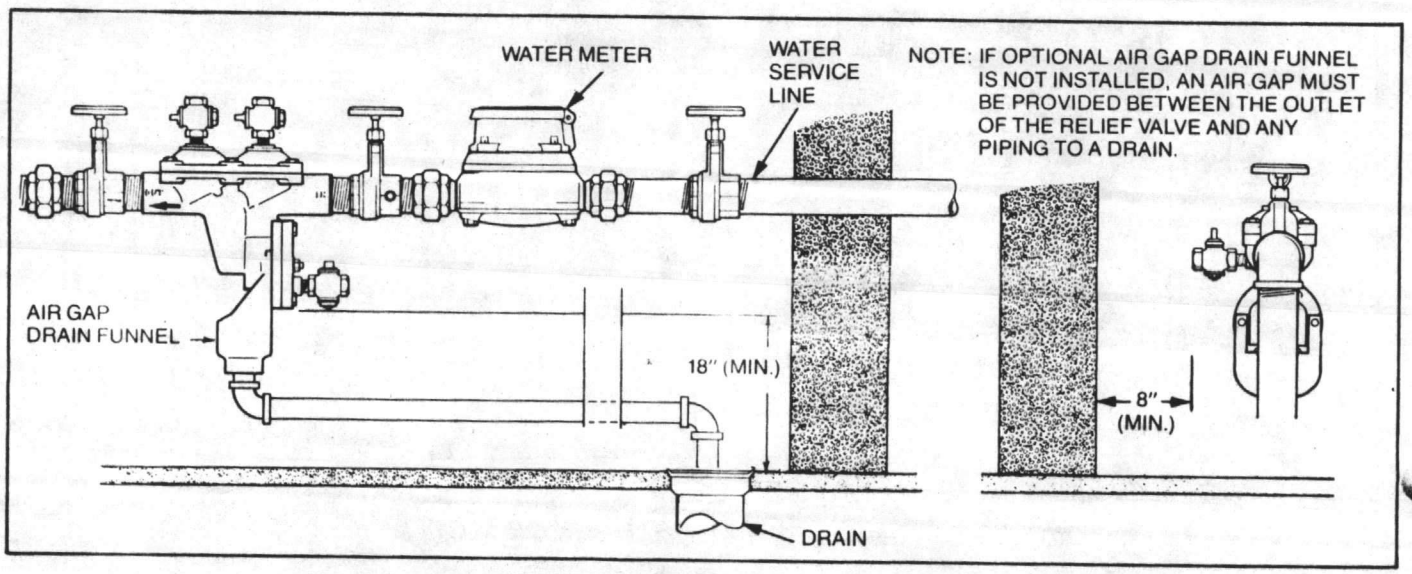


Figure 3. COLD WEATHER INDOOR INSTALLATION

MODEL FRP RELIEF VALVE AIR GAP DRAIN FITTING

GENERAL

This fitting has been designed to permit direct connection of the relief valve drain piping to the backflow preventer. It provides an air gap below the outlet of the relief valve; and includes an internally-threaded opening at its base.

Two sizes are provided: one for installation on ¾" and 1" devices; and the second for installation on 1¼", 1½" and 2" devices. The internal thread size is 1" - 11½ NPT on both fittings. Both fittings are available as kits which include the fitting and two connection bolts and nuts (see FRP Parts List, pages 10 and 12).

INSTALLATION (see Fig. 3)

Remove the two relief valve cover bolts that are in line with the notches on the fitting. Discard them.

Hold the fitting in position against the flange on the bottom case *opposite* the cover. Insert bolts into the holes on the flange and tighten firmly, using an open-end wrench. Install nuts.

Thread piping to fitting, using commercially-available pipe sealant.

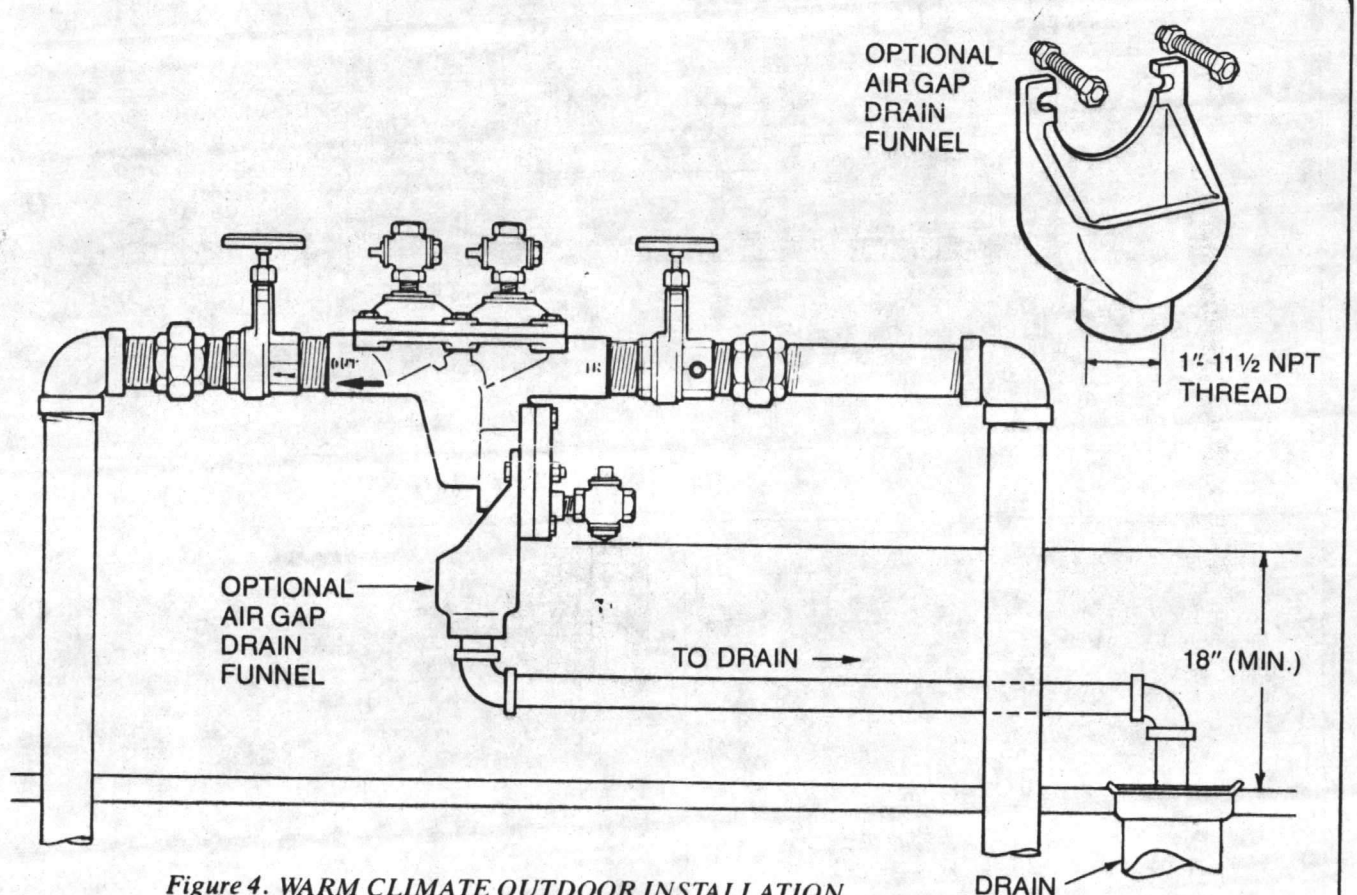


Figure 4. WARM CLIMATE OUTDOOR INSTALLATION (WITH OPTIONAL AIRGAP DRAIN FUNNEL)

FRP SECTION III — MAINTENANCE

A. DISASSEMBLY

1. Remove top case bolts and lift off top case(s).
2. Loosen check valve mounting screws and lift off check valve assemblies, with screws attached. (See Fig. 7, 14A, 14B, 15).
3. Remove relief valve housing bolts and relief valve housing, or relief valve cover (See Fig. 7, 14A, 14B, 15).
4. Remove relief valve assembly from housing by grasping diaphragm and lifting assembly up (FRPI) or pull out horizontally (FRPII).
5. Inspect relief valve seat for damage caused by foreign material. If it requires replacement, order repair kit (see page 10, 12).
6. To remove seat, insert wrench and turn counterclockwise. (See Fig. 9A, 9B).

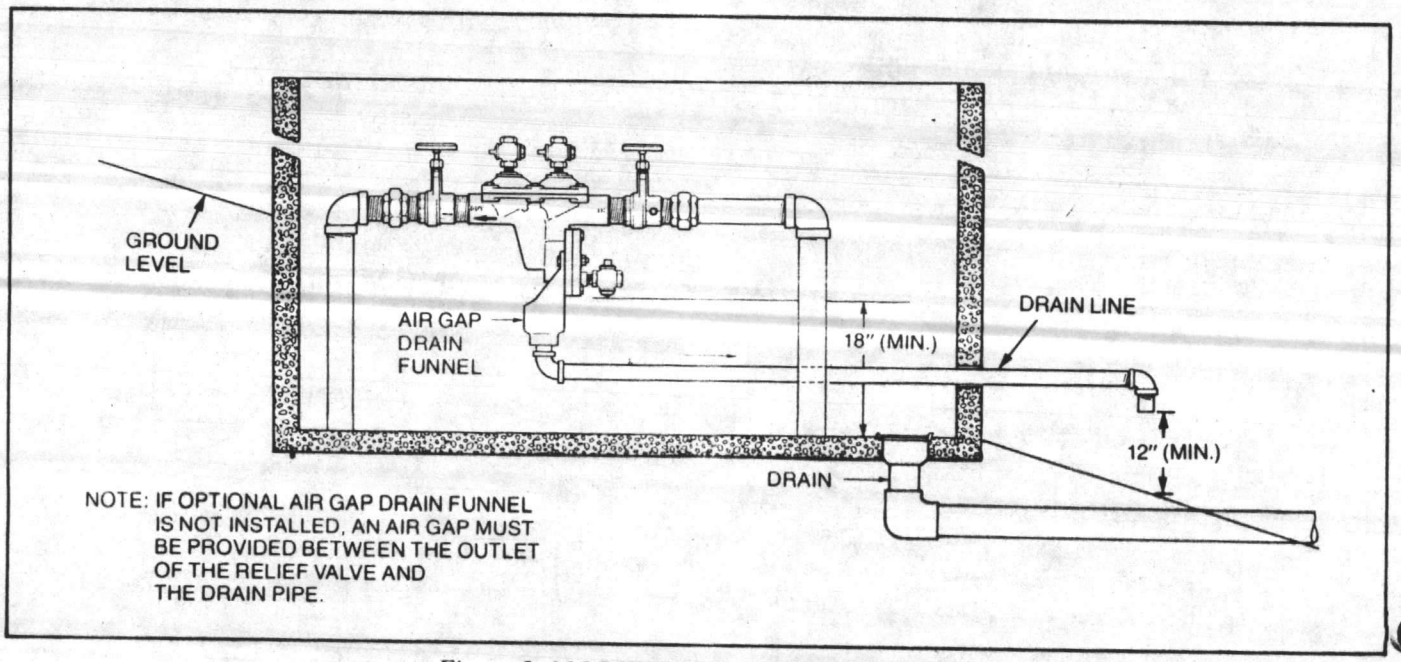


Figure 5. MODIFIED PIT INSTALLATION

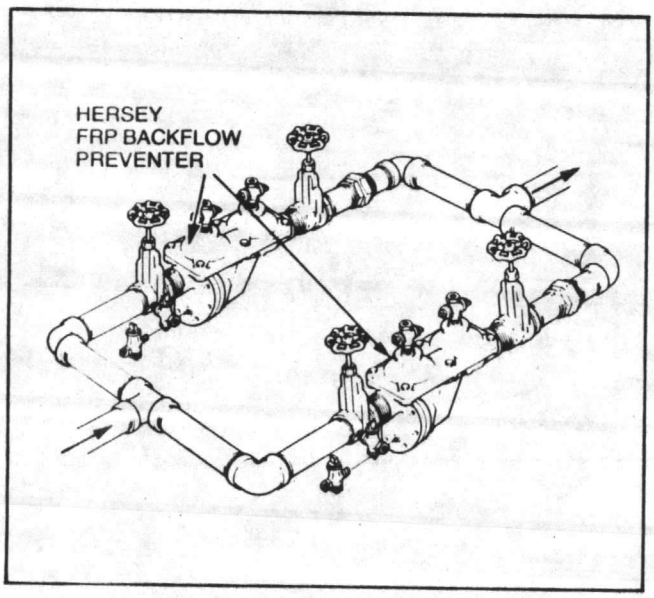


Figure 6. BATTERY (PARALLEL) INSTALLATION

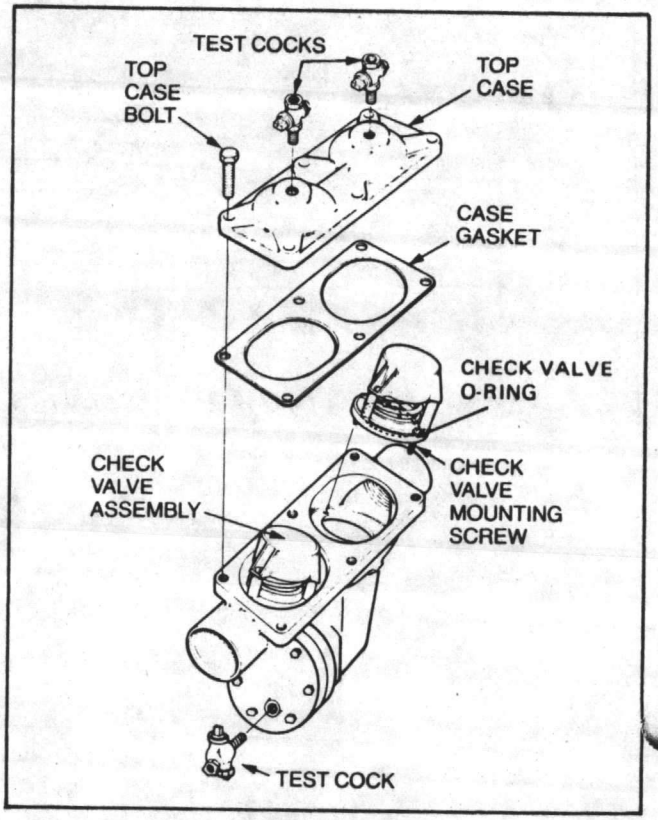


Figure 7. 3/4" AND 1" CHECK VALVE ASSEMBLIES

B. CLEANING

1. Check Valves

a. If dirt in the lines has accumulated on first check valve seat, causing leakage when there is no flow through the device, remove check valve as outlined in Paragraph A.

b. Open ¾" and 1" first check valves as follows:

1. Press thumb against disc to compress spring.
2. Insert flat-sided wooden pencil between seat and disc to hold valve open (see Fig. 10).

c. Open 1¼", 1½" and 2" first check valves as follows:

1. Remove the check valve disc screw, but leave washer in place.
2. Attach the spring compression tool (see Fig. 11) with 4 machine screws and wing nuts provided, using the mounting screw holes in the check valve seat ring.
3. Engage the pilot on the end of the jacking screw in the valve screw hole.
4. Turn jacking screw clockwise to open valve.

d. To open second check valves, all sizes, press thumb against disc to compress spring.

e. Clean valve seats and discs with a clean non-abrasive cloth. DO NOT USE SOLVENTS ON THE PLASTIC SEAT!

f. Re-assemble check valves to body of device. (On 1¼", 1½" and 2" sizes first remove spring compression tool and replace disc screw.)

g. If cleaning does not stop leaking replace the check valve assembly.

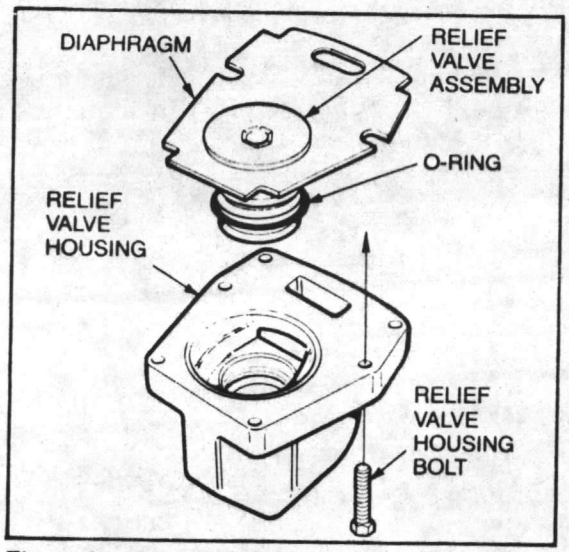


Figure 8A. RELIEF VALVE ASSEMBLY FRP-I

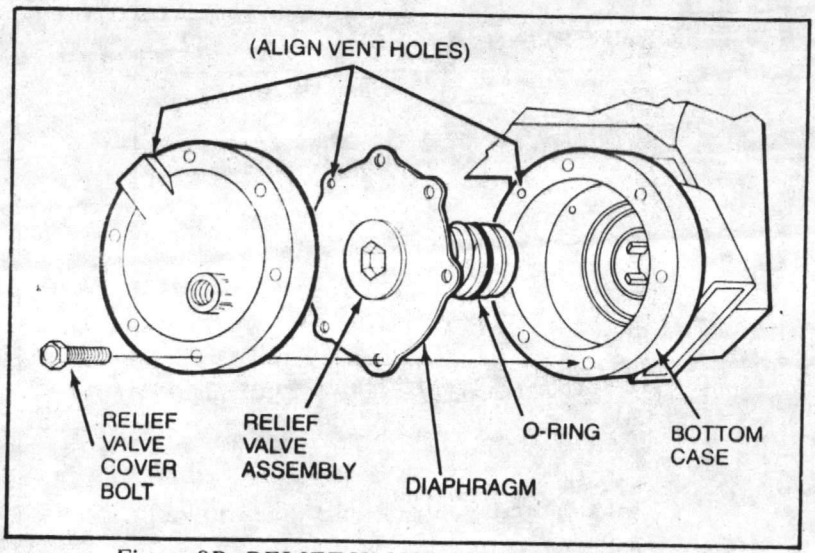


Figure 8B. RELIEF VALVE ASSEMBLY FRP-II (1-1/2" ILLUSTRATED)

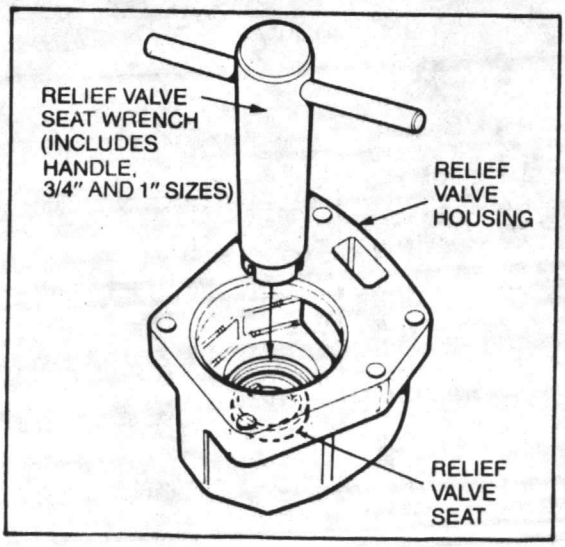


Figure 9A. RELIEF VALVE SEAT REPLACEMENT FRP-I

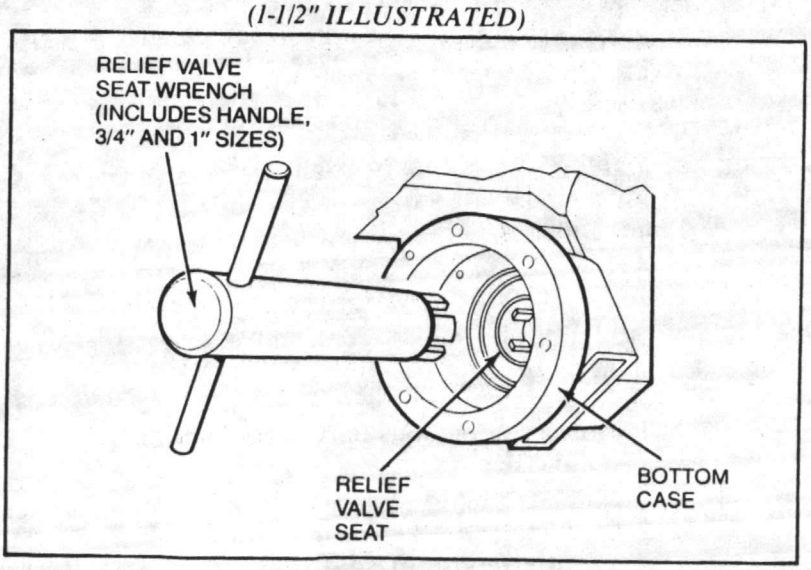


Figure 9B. RELIEF VALVE SEAT REPLACEMENT FRP-II

C. REPAIRS

Foreign matter in the supply line may cause wear or damage to components of the check and relief valve assemblies. To simplify repair procedures, complete valve assemblies, rather than individual parts, are provided at modest prices.

Kits are available for the first check, second check and relief valve assemblies, and also including all three valves. Case gaskets, o-ring seals and mounting screws (first and second valve kits) are included. See description on pages 10 and 12.

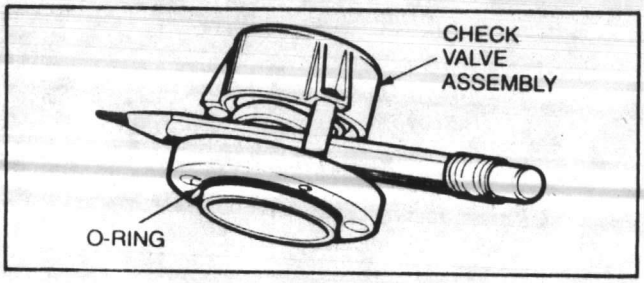


Figure 10. CLEANING 3/4" AND 1" CHECK VALVE

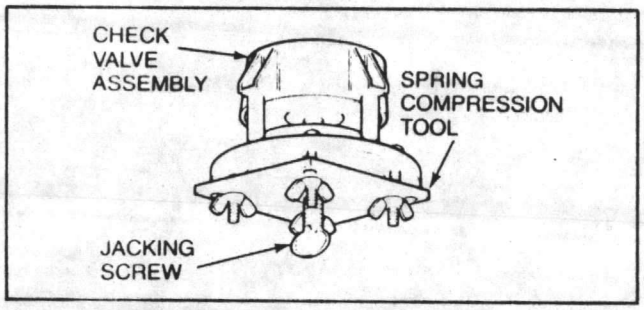


Figure 11. CLEANING 1¼", 1½" AND 2" CHECK VALVE

D. REASSEMBLY

1. Check valves
   a. Make sure o-ring is in place as shown in Figure 7.
   b. Place mounting screws in holes in check valve assembly as shown in Fig. 7, and position valve in body. The ¾" and 1" valves have 2" screws; the 1¼", 1½" and 2" valves have 4 screws.
   c. Tighten screws until resistance is felt. Do not overtighten screws.
2. Relief Valve
   a. Make sure o-ring is in place as shown in Fig. 8.
   b. If seat has been removed, apply Loctite adhesive sealant to threads of replacement seat (remove any residue from bottom case or housing threads before installing seat.)
   c. Install seat, using special wrench. Turn clockwise until resistance is felt. To avoid distortion of seat do not overtighten.

NOTE: Do not get any sealant on seating area of seat. Remove any present before installing relief valve assembly.

   d. Push relieve valve into position in housing or bottom case, seating o-ring in recess.
   e. Align diaphragm plate parallel to flange on housing or bottom case. Diaphragm holes must align with holes in flange. (See Figs. 8A and 8B.) On 1¼", 1½" and 2" sizes, the diaphragm plate extends inside the outer surface of the flange.
   f. Test relief valve operation by pushing assembly in with thumbs to compress spring. Assembly should spring back when pressure is released.
   g. Reassemble housing or cover to bottom case.

NOTE: On the FRPII, the vent holes in the cover, diaphragm and flange must be aligned. The vent hole in the cover is inside the boss opposite the test cock.

NOTE: Tighten all bolts finger-tight before using wrench. Tighten opposite bolts in sequence to avoid cocking the assembly.

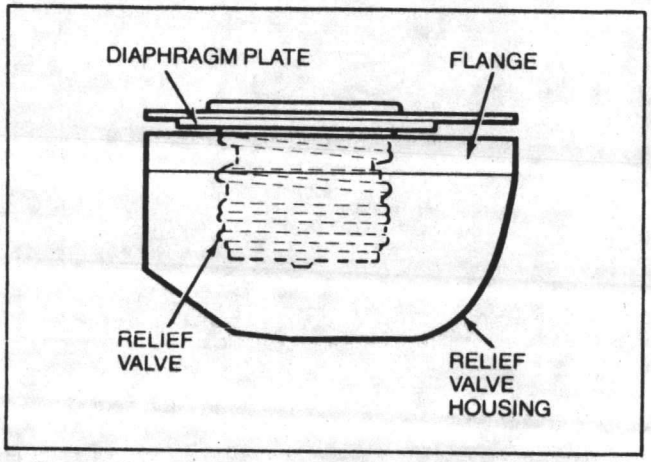


Figure 12A. REPLACING RELIEF VALVE FRP-I

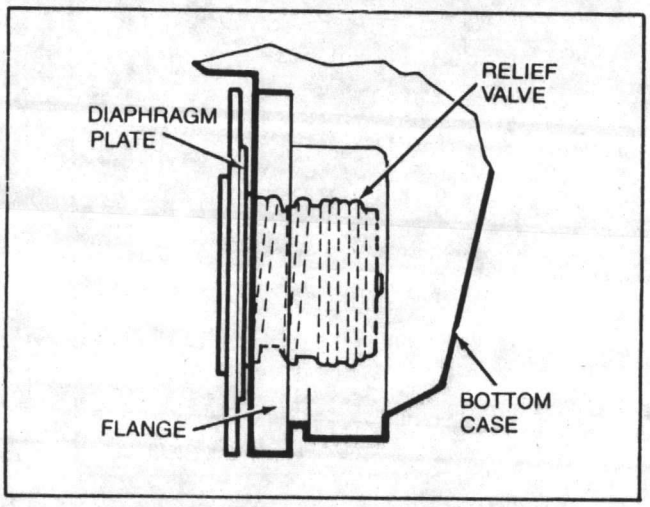


Figure 12B. REPLACING RELIEF VALVE FRP-II

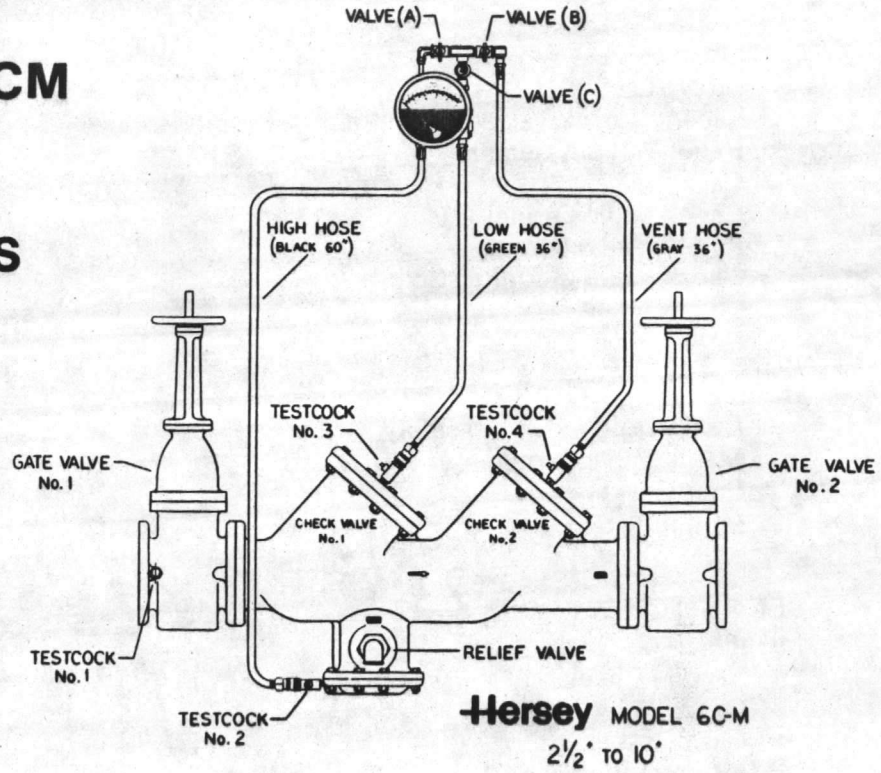
DIFFERENTIAL PRESSURE GAUGE TEST METHOD
BEECO TEST KIT PART NUMBER 98415

MODEL FRP II and 6CM

REDUCED PRESSURE BACKFLOW PREVENTERS

ASSEMBLY OF TEST KIT TO BACKFLOW PREVENTER

1. Close valves (A), (B) and (C) on test kit.
2. Connect HIGH pressure hose (black) to testcock No. 2 on the device.
3. Connect LOW pressure hose (green) to testcock No. 3.
4. Close gate valve No. 2.
5. Open testcocks No. 2 and No. 3.
6. Open vent valve (B).
7. Open high pressure (A) and low pressure (C) valves until all air is expelled.
8. Close (A), (B) and (C) valves.
9. Connect VENT hose (gray) to testcock No. 4 on the device.



TEST PROCEDURES

A. To determine the static pressure drop across the first check valve. Requirement: the first check valve shall maintain a static pressure drop of at least 5 PSI.
   1. Testcocks No. 2 and No. 3 must be open.
   2. Crack open gate valve No. 2 to re-establish pressure conditions in the device.
   3. Close gate valve No. 2 and note the differential pressure on the gauge. A reading of 5-8 PSI is normal.

B. To test the second check valve for tightness against reverse flow. Requirement: the second check valve must be tight against reverse flows under all pressure differentials.
   1. Slowly open HIGH valve (A) and VENT valve (B). Keep LOW valve (C) closed.
   2. Open testcock No. 4
   3. The differential pressure reading on the gauge will drop slightly and then remain steady. If the gauge reading continues to drop (until the relief valve discharges), it indicates that the second check valve is leaking.

C. To test gate valve No. 2 for tightness. After passing Test B, continue the test by closing testcock No. 2. The indicated pressure will decrease slightly. If the pressure differential continues to decrease (approaching zero), the No. 2 gate valve is reported to be leaking.

   NOTE: If gate valve No. 2 is leaking, the Test A is invalid. An indication of leakage in Test B could be either check valve No. 1 or check valve No. 2. If no indication of leakage in Test B, then both check valves are tight.

D. To test operation of the differential pressure relief valve. Requirement: the differential press relief valve must operate to maintain the zone between the two check valves at least 2 PSI less than the supply pressure.
   1. Valves (A), (B) and (C), and testcock No. 4 must be closed. Testcocks No. 2 and No. 3 must be open.
   2. Open HIGH valve (A).
   3. Very slowly open LOW valve (C) until the differential gauge needle starts to drop. Note the pressure reading when the relief valve starts to discharge. This gauge reading must be at least 2 PSI.

   NOTE: If during test C, gate valve No. 2 is shown to be leaking, also open VENT valve (B) and testcock No. 4 during step #2 of Test D. This extra step uses supply pressure to seat check valve No. 2 and allows testing of the relief valve.

TEST CONCLUSION

1. Close all testcocks.
2. Disconnect VENT hose from testcock No. 4
3. Open valves (A), (B) and (C) to drain water pressure from the test gauge.
4. Remove hoses from testcocks No. 2 and No. 3 and drain remaining water in the gauge to prevent freezing.

FRP SECTION V — ¾" AND 1" REPLACEMENT PARTS (SEE FIGS. 14A AND 14B)

	Part No. ¾"-1"
COMPLETE VALVE KIT — FRP I	65554
FRP II	65627

Includes:
- First Check Valve Assembly
- Second Check Valve Assembly
- Relief Valve Assembly
- Case Gasket
- Check Valve O-rings (2)
- Relieve Valve O-ring
- Check Valve Mounting Screws (4)

FIRST CHECK VALVE KIT 65555

Includes:
- First Check Valve Assembly
- Check Valve O-ring
- Case Gasket
- Mounting Screws (2)

SECOND CHECK VALVE KIT 65556

Includes:
- Second Check Valve Assembly
- Check Valve o-ring
- Case Gasket
- Mounting Screws (2)

RELIEF VALVE KIT — FRP I	65557
FRP II	65628

Includes:
- Relief Valve
- O-ring Seal

RELIEF VALVE AIR GAP FITTING KIT 65639

RELIEF VALVE SEAT INSTALLATION KIT 65524

Includes:
- Relief Valve Seat
- Relief Valve Seat Wrench
- Relieve Valve Adhesive/Sealant

DIFFERENTIAL PRESSURE GAUGE TEST KIT 98415

OTHER PARTS:

Relief valve cover-FRP II	65624
Relief valve housing w/seat Ring-FRP I	N/A
Top case	65531
Bottom case-FRP II ¾"	65623
Bottom case-FRP II 1"	65622
Bottom case-FRP I	N/A
Case bolts -FRP I	90026 (12)
Case bolts-FRP II	90026 (12)
Test cocks	96339 (3)
Check valve mounting screws	98116 (4)
Case gasket	65534

(Figures in parentheses after part number indicate number of parts required, if more than one.)

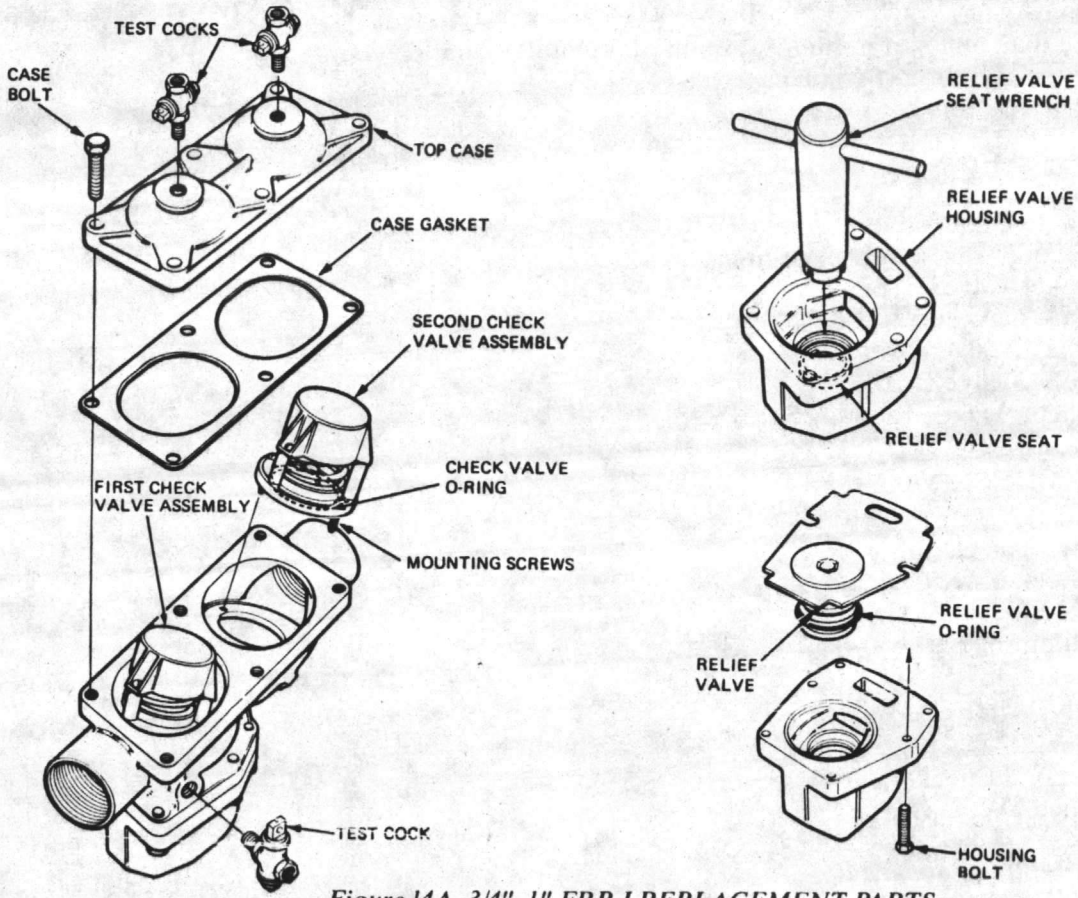


Figure 14A. 3/4"–1" FRP-I REPLACEMENT PARTS

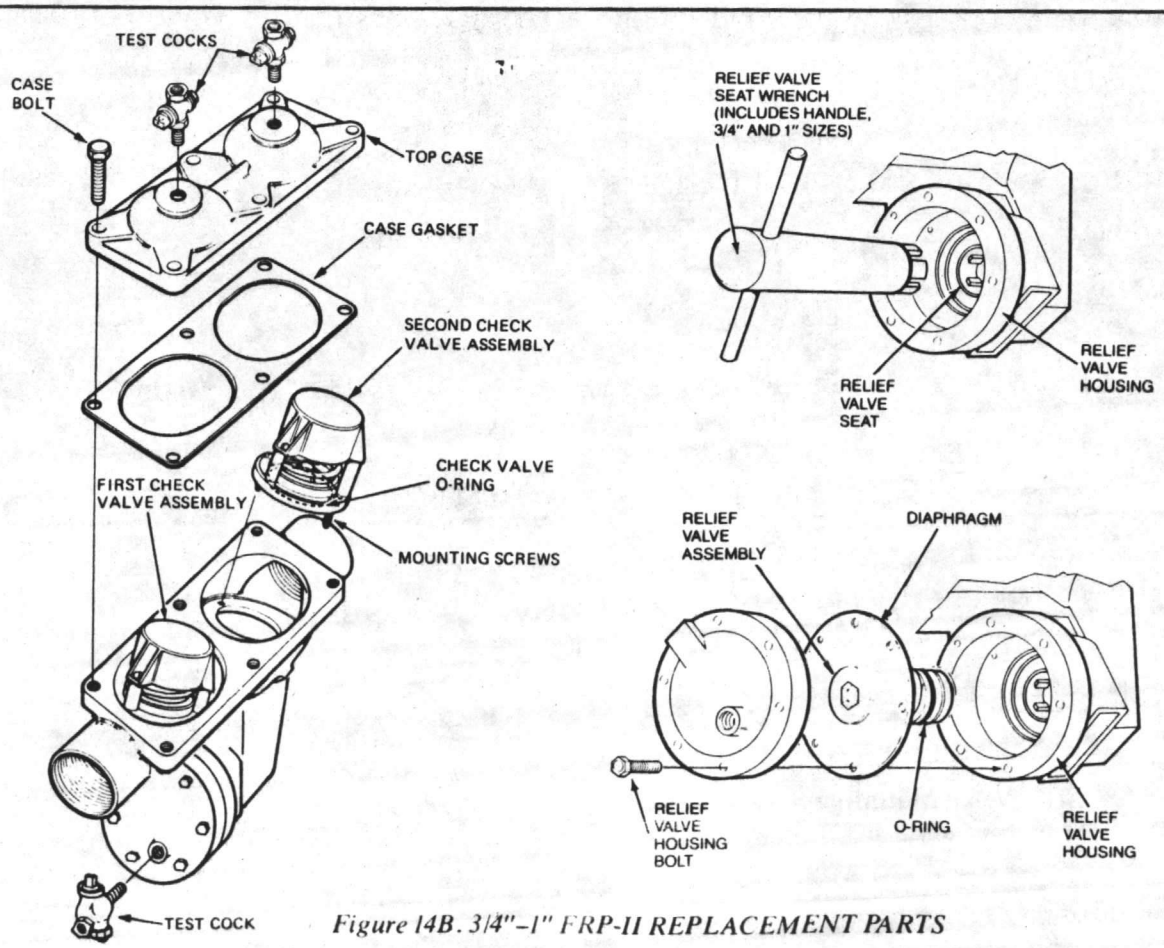


Figure 14B. 3/4"–1" FRP-II REPLACEMENT PARTS

FRP SECTION VI-1¼", 1½" and 2" FRP-II REPLACEMENT PARTS (SEE FIG. 15)

If more than one part per unit is required, quantity is indicated in parentheses after part number.

	Part No. 1¼", 1½"	Part No. 2"
COMPLETE VALVE KIT Includes: First Check Valve Assembly Second Check Valve Assembly Relief Valve Assembly Case Gaskets (2) Check Valve O-rings (2) Relief Valve O-ring Check Valve Mounting Screws (8)	65525	65543
FIRST CHECK VALVE KIT Includes: First Check Valve Assembly Check Valve O-ring Case Gasket Mounting Screws (4)	65526	65544
SECOND CHECK VALVE KIT Includes: Second Check Valve Assembly Check Valve O-ring Case Gasket Mounting Screws (4)	65527	65545
RELIEF VALVE KIT Includes: Relief Valve O-Ring Seal	65546	65546
RELIEF VALVE SEAT INSTALLATION KIT Includes: Relief Valve Seat Relief Valve Seat Wrench Relief Valve Adhesive/Sealant	65548	65548
DIFFERENTIAL PRESSURE GAUGE TEST KIT	**98415**	**98415**
RELIEF VALVE AIR GAP FITTING KIT	65640	65640

OTHER PARTS	Part No. 1¼", 1½"	Part No. 2"
Relief Valve Cover	65632	65632
Top Case	65560(2)	65578(2)
Bottom Case	65631	65636
Case Bolts	90028(18)	90028(22)
Test Cocks	96339(3)	96339(3)
Check Valve Spring Compression Tool	65572	65572
Check Valve Mounting Screws	98174(8)	98174(8)
1½" x 1¼" Reducing Bushing (1¼" only)	67016(2)	———
Case Gasket	65568(2)	65595(2)

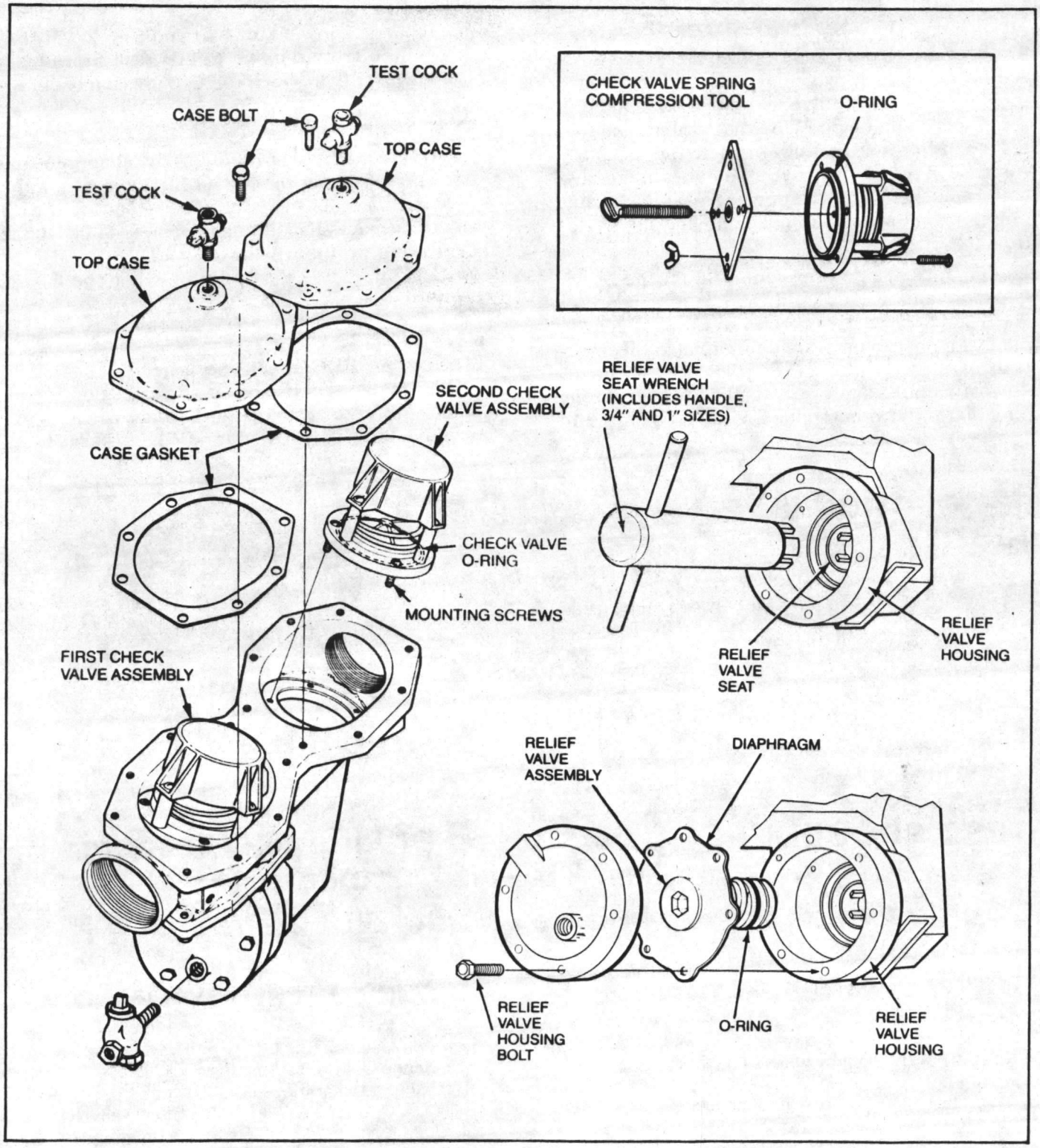


Figure 15. 1¼", 1½" AND 2" FRP II REPLACEMENT PARTS

FDC-SECTION I — Description, Operation and Installation-Model FDC Double Check Valve Assemblies

DESCRIPTION AND OPERATION

The Hersey Model FDC Double Check Valve Assembly consists of two independent spring-loaded poppet-type check valve assemblies, mounted in series in a common body. Two gate valves and four test cocks for field testing complete the assembly. For ease of repair, the valve assemblies are removable from the top of the device, making possible in-line maintenance without removing the device from its setting.

Under normal operating conditions, the check valves remain closed until there is a demand for water. Each of the two check valves is designed to open at a one psi pressure differential in the direction of flow. In the event pressure increases downstream of the device, tending to reverse the direction of flow, both check valves are closed to prevent backflow. If the second check valve is prevented from closing tightly, the first check valve will still provide protection from a backflow condition.

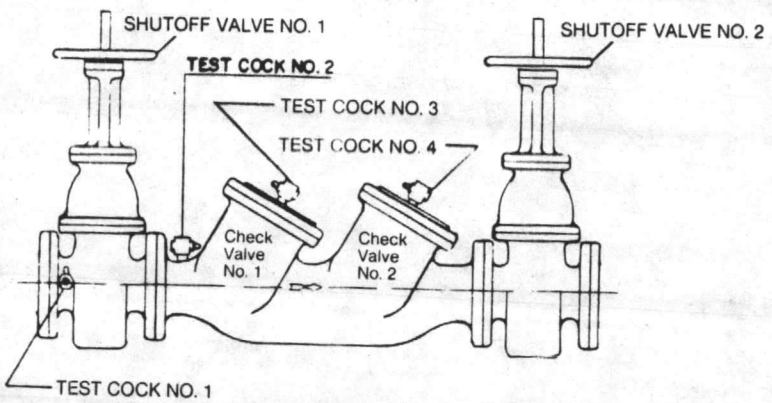
INSTALLATION

The same instructions apply to installation of the Model FDC as for the Model FRP, except that no provision for discharge of water from the device has to be made. In addition to being installed in the horizontal position, the Model FDC may also be installed in the vertical position when the flow is upward. See pages 3–5.

MAINTENANCE

The Model FDC should be tested annually, and valves replaced at least every 5 years. For further details, refer to cleaning, repair and assembly procedures for Model FRP check valves, pages 6–8.

FDC SECTION II TESTS



TEST PROCEDURE - Using Beeco Differential Pressure Test Kit Part Number 98415

Double Check Valves - Hersey Model No. 2 and FDC

TESTING OF CHECK VALVE NO. 1

1. Close No. 1 and No. 2 gate valves.
2. Open testcocks Nos. 2, 3 and 4. Confirm that gate valve No. 1 is holding tight by observing that the discharge of water from testcock No. 2 stops.
3. Attach test kit VENT hose (gray) to testcock No. 1, LOW hose (green) to testcock No. 2, and HIGH hose (black) to testcock No. 3. Open valves (A) and (B). Close valve (C).
4. Close testcock No. 4
5. Open testcock No. 1. The needle on the gauge will indicate a pressure in excess of 15 PSI.
6. Slowly open valve (C) until the gauge reads approximately 10 PSI. Close valve (C). The gauge reading will not change if check valve No 1 is holding tight. If No. 1 check valve is leaking the gauge reading, will drop to 0.

TESTING OF CHECK VALVE NO. 2

1. Close testcock No. 1.
2. Open testcock No. 4.
3. Change LOW hose from testcock No. 2 to testcock No. 3. Change HIGH hose from testcock No. 3 to testcock No. 4. Open valves (A) and (B). Close valve (C).
4. Open testcock No. 1. The needle on the gauge will indicate a pressure in excess of 15 PSI.
5. Slowly open valve (C) until the gauge reads approximately 10 PSI. Close valve (C). The gauge reading will not change if check valve No. 2 is holding tight. If check valve No. 2 is leaking, the gauge will drop to 0.

NOTE: Minor leakage in gate valve No. 2 will not affect the test results of check valve No. 2. However, a leaking gate valve No. 1 will cause a good check valve No. 1 to fail the test.

TEST PROCEDURES — HERSEY NO. 2 DOUBLE CHECK VALVE ASSEMBLY ALTERNATIVE TWO-GAUGE METHOD

(SEE FIGURE 16)

QTY. DESCRIPTION

2 - Pressure gauges, of good quality - 2" dial or larger, 0-150 psi range.
3 - 6-ft. lengths rubber hose with ¼" watertight screw couplings. (¼" i.d. welding hose is suggested).
2 - ¼" level handle brass gauge cocks, double female.
2 - ¼" standard brass tees
2 - ¼" brass close nipples
6 - ¼" I.P. thread to welding hose thread brass couplings (sometimes called regulator outfit fittings).
⅜" plywood board for mounting gauges.

TEST NO. 1

Purpose:

To test No. 1 check valve for tightness against reverse flow.

Requirement:

Valve must be tight against reverse flow under all pressure differentials.

Steps.

1. Close shutoff valve No. 2.
2. Install pressure gauges and control cocks (closed) at test cocks No. 2 and No. 3.
3. Open test cocks No. 2 and 3. Close No. 1 shutoff valve.
4. Drain *slowly* from control cock at test cock No. 2 until gauge at test cock No. 2 reads 1 psi less than gauge at test cock No. 3. Close control cock. If both gauges hold the established differential pressure for at least one minute, the check shall be noted in the report as "Closed Tight".

   If the check valve leaks, both gauges will drop simultaneously while water is being drained from control cock at test cock No. 2 in the attempt to establish the one-pound differential. Confirm by the following procedure:

   a. Open shutoff valve No. 1 and re-establish pressure in the device.
   b. Install bypass hose between No. 1 and No. 3 test cocks, thus feeding line pressure downstream of check valve.
   c. Close shutoff valve No. 1 Drain slowly from control cock at test cock No. 2 until gauge at test cock No. 2 reads 1 psi less than gauge at test cock No. 3. If water runs continuously from control cock, the check shall be noted as "Leaked".

TEST NO. 2

Purpose:

To test No. 2 check valve for tightness against reverse flow.

Requirement:

Valve must be tight against reverse flow under all pressure differentials.

Steps:

1. Open No. 1 shutoff valve and re-establish pressure in the device.
2. Install pressure gauges and control cocks at test cocks No. 3 and No. 4.
3. Open test cocks No. 3 and No. 4. Close No. 1 shutoff valve.
4. Drain *slowly* from control cock at test cock No. 3 until gauge at test cock No. 3 reads 1 psi less than gauge at test cock No. 4. Close control cock. If both gauges hold the established differential for at least one minute, the check shall be noted as "Closed Tight." If the check valve leaks, both gauges will drop simultaneously while water is being drained from control cock at test cock No. 3 in the attempt to establish the one-pound differential. Confirm by the following procedure:

   a. Open No. 1 shutoff valve and re-establish pressure in the device.
   b. Install bypass hose between No. 1 and No. 4 test cocks, thus feeding line pressure downstream of check valve.
   c. Close No. 1 shutoff valve. Drain slowly from control cock at test cock No. 3 until gauge at test cock No. 3 reads 1 psi less than gauge at test cock No. 4. If water runs continuously from control cock, the check shall be noted as "Leaked".
   d. Remove all equipment and return shut-off valves to original setting.

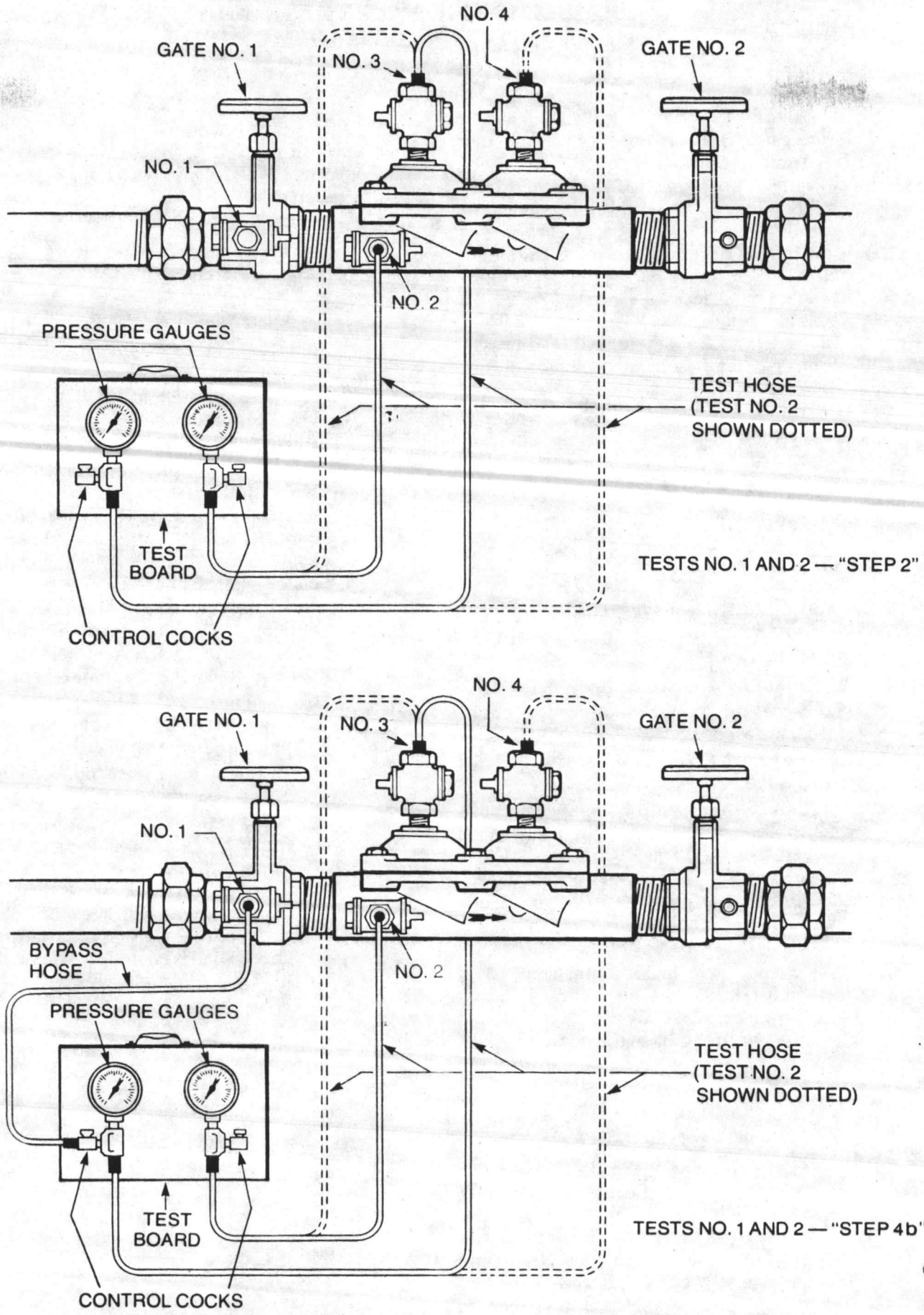


Figure 16. PRESSURE GAUGES INSTALLED ON FDC DOUBLE CHECK VALVE ASSEMBLY

FDC Section III-Replacement Parts

A. ¾" - 1" MODEL FDC DOUBLE CHECK VALVE ASSEMBLY

Description	Part No.
Check Valve Kit	65556 (2)
Bottom Case (¾")	65528
Bottom Case (1")	65601
Top Case	65531
Case Gasket	65534
Test Cocks	96339 (3)
Check Valve Mounting Screws	98116 (4)
Case Bolts	90026 (6)

B. 1½" - 2" MODEL FDC DOUBLE CHECK VALVE ASSEMBLY

Description	Part No.	
	1½"	2"
Check Valve Kit	65527 (2)	65545 (2)
Bottom Case	65559	65574
Top Case	65560 (2)	65578 (2)
Case Gasket	65568 (2)	65595 (2)
Test Cocks	96339 (3)	96339 (3)
Check Valve Mounting Screws	98174 (8)	98174(8)
Case Bolts	90028 (12)	90028 (16)

PARTS, TEST KITS AND TOOLS MAY BE ORDERED FROM THE FOLLOWING HERSEY SALES OFFICES:

2131 Kingston Court, S.E., Suite 102
Marietta, GA 30067
(404) 952-4424

1025 Criss Circle
Elk Grove Village, IL 60007
(312) 439-7700

7240 East Slauson Ave.
Los Angeles, CA 90040
(213) 722-6870

250 Elm Street
Dedham, MA 02026-9115
(617) 326-9400

320 Braen Avenue
Wyckoff, NJ 07481
(201) 445-0373

Hersey Products Inc. manufactures Disc, Compound, Detector, and Turbine Water Meters; Detector Checks; Reduced Pressure and Double Check Valve Assembly Backflow Preventers; Remote Reading Systems and Recycling Control Registers and Devices.

Hersey PRODUCTS INC. Water Meters & Controls Group
250 Elm Street, Dedham, MA 02026-9115 (617) 326-9400 Telex 92-4352

Printed in U.S.A.

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Taco Submittal Data Information 1600 Series Pumps

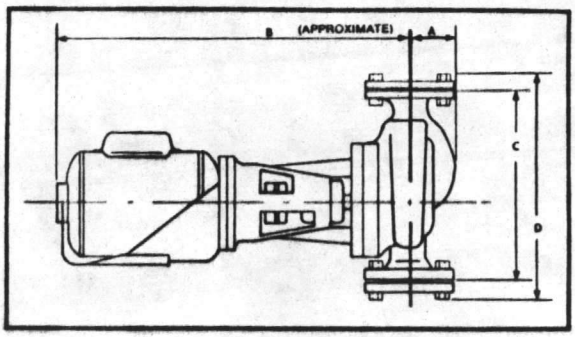
301-005

MODEL 1634

SUPERSEDES: SD300-1.5

Job: Replace Boilers LCH-4014&4022, AS3502 & CG-1, Camp Lejeune, NC

ITEM NO.	MODEL NO.	IMPELLER DIA.	G.P.M.	HEAD IN FT.	H.P.	ELECTRICAL CHARACTERISTICS
	1634C	6.15"	66 GPM	30 FT	1 HP	230/3/60

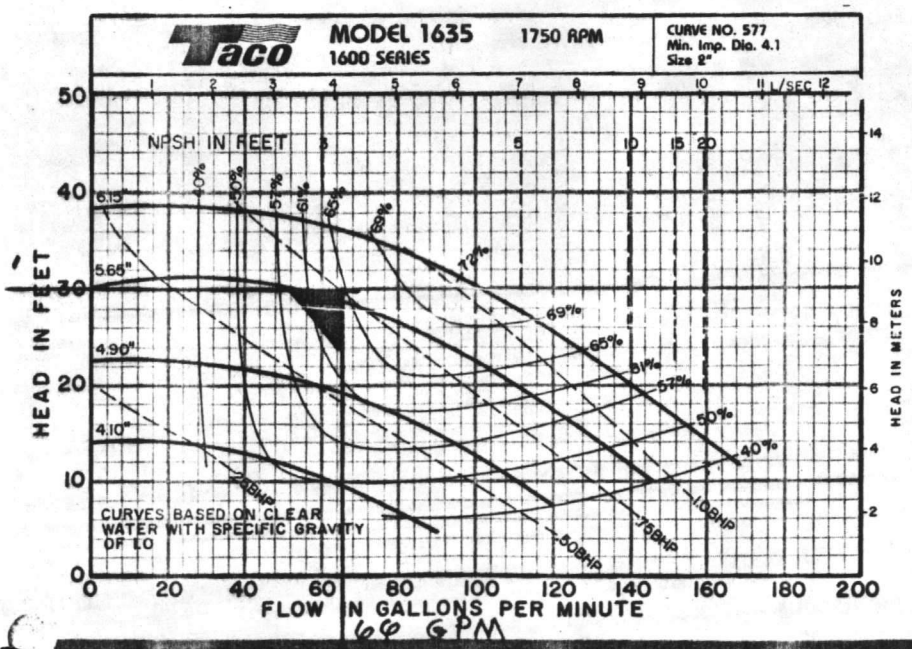


SIZES & DIMENSIONS:

(APPROXIMATE)

MODEL	Flange Size	H.P. (W)	A	B	C	D
1634	2	½ (373)* ¾ (560)* 1 (746)* 1½ (1119)*	3½ (89)*	18 (457)* 18½ (469)* 19 (483)* 21 (533)*	13½ (343)*	16⅛ (410)*

*Millimeters



SPECIFICATIONS:

MOTORS
1750 RPM, Three Phase 200V or 230/460V 60C Sleeve Bearing Motors.
Also available in Single Phase with overload protection except 3 HP (2238W).

BODY
Cast Iron with flanged in-line connections. Companion flanges are included.

IMPELLER
Cast Bronze, Closed, Dynamically Balanced.

DRIVE COUPLING
Non-Metallic/Vibration Dampening

SHAFT
Alloy Steel with Cupro-Nickel Sleeve.

FRAME
Sleeve Bearing, Disc Type, Oil lubricated. REMOVABLE BEARING CARTRIDGE FITS ALL MODELS. Dip Stick to measure oil level.

MECHANICAL SEAL
2 Piece Standard—250°F (121°C) Operating Temp.
Hi-Temp—Extra Cost—300°F (149°C) Operating Temp.

WORKING PRESSURE
175 PSI (1207kPa) . . . in accordance with ASA B16.1
NOTE: Flanges are tapped for gauges

Quality Through Design — COMPARE.

TACO, INC. 1160 Cranston St., Cranston, RI 02920 (401) 942-8000 Telex: 92-7627
TACO (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario, Canada Telex: 06-961179

Taco

REPLACEMENT PARTS

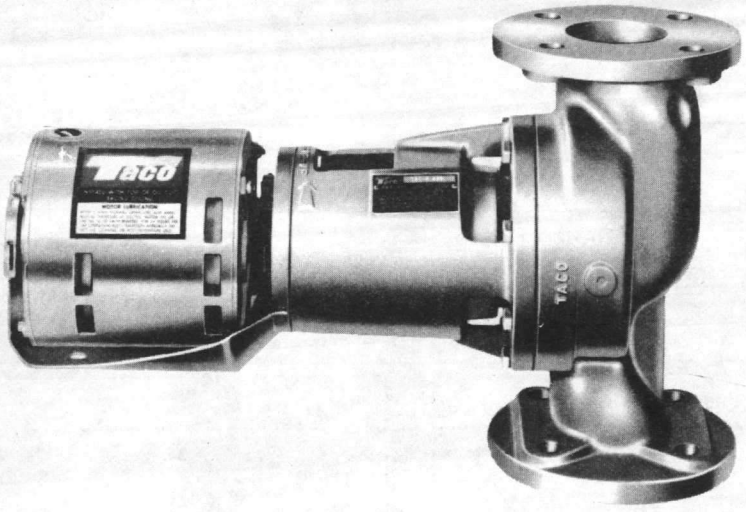
NUMBER
304-001

Effective: December 1, 1985
Supersedes: PL300-1
dated: 12/1/84

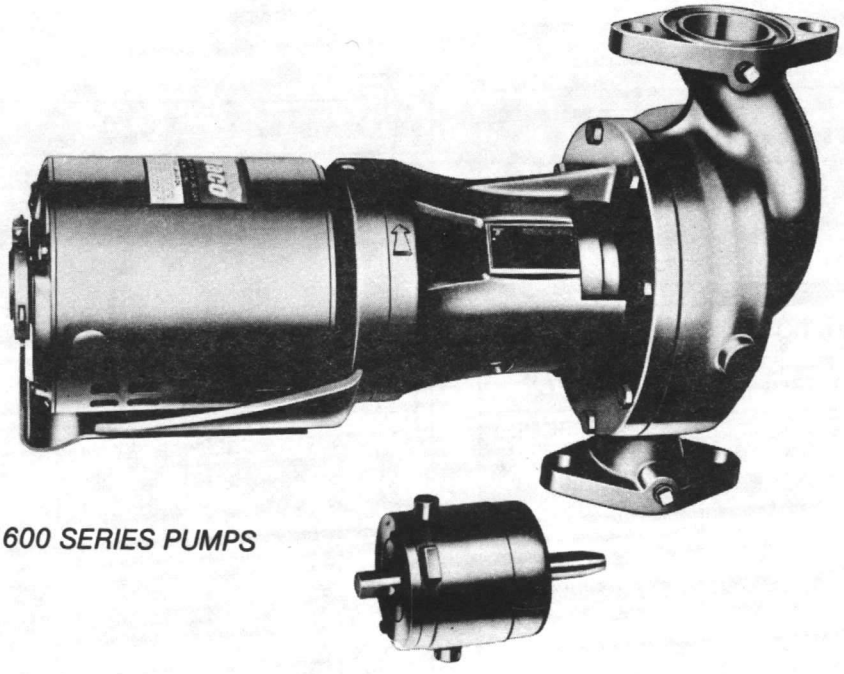
121 THRU 138 PUMPS
1600 SERIES PUMPS

IMPORTANT: When ordering, always specify part number, part name, and complete model number of pump.

CARTRIDGE DESIGN PUMPS



121 – 138 SERIES PUMPS



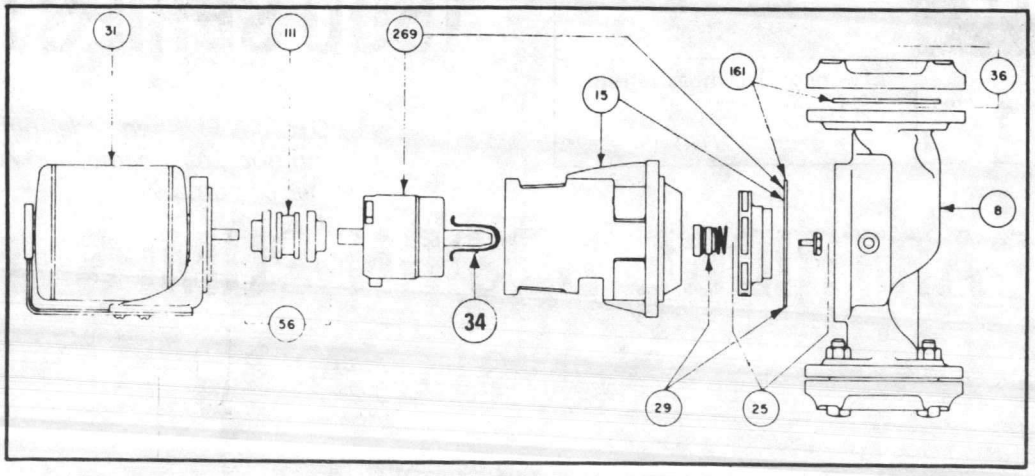
1600 SERIES PUMPS

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

Litho in U.S.A.

Form No. F304-001 Taco (Canada) Limited 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone: 416-625-2160 Telex: 06-961179

REPLACEMENT PARTS FOR (–9) AND SERIAL NUMBER CARTRIDGE DESIGN PUMPS



SERIAL NUMBER CODE

1600 - 4.25 C 1 N 1 N

- N — FLANGE TYPE
- 1 — MOTOR FRAME SIZE
- N — WATER SEAL
- 1 — BRACKET DESIGN
- C — MATERIAL OF CONSTRUCTION

MATERIAL OF CONSTRUCTION	
X O O O O	
A	CAST IRON PUMP AND IMPELLER (3)
B	ALL BRONZE PUMP AND IMPELLER
C	CAST IRON PUMP AND BRONZE IMPELLER

BRACKET DESIGN	
O X O O O	
1	ALL CURRENT STYLE PUMPS

WATER SEAL TYPE, ITEM # 29	
O O X O O	
N	1600 – 170RP NI – RESIST
H	1600 – 170HRP TUNGSTEN CARBIDE
E	1600 – 170ERP CERAMIC

MOTOR FRAME SIZE*		
O O O X O		
1	48 FRAME	(1/4, 1/3, 1/2 HP)
2	56 FRAME	(3/4, 1 HP)
3	56 FRAME	(1 1/2, & 2 HP)
4	56 FRAME	(3 HP)

* Refer to standard motors only. See nameplate for other motors.

FLANGE TYPE	
O O O O X	
N	NPT (STANDARD)
D	DIN (EXPORT)

ITEM # 8 REPLACEMENT BODY		
PUMP MOD. NO.	CAST IRON	BRONZE
121	121 – 018RP	121 – 018BRP
122	"	"
131, 32, 33 & 38[1]	133 – 150RP	133 – 150BRP
1600, 10, 11[1]	1610 – 001RP	1610 – 001BRP
1602, 1604[2]	N/A	N/A
1612, 14, 15	1614 – 001RP	1614 – 001BRP
1616, 18, 19	1618 – 004RP	1618 – 004BRP
1620, 22, 24	1634 – 001RP	1634 – 001BRP
1630. 1632	"	"
1634, 1635	"	"
1636, 1638	1640 –002RP	1640 – 002BRP
1640, 1641	"	"

ITEM # 36 REPLACEMENT FLANGE SET		
PUMP MOD. NO.	CAST IRON	BRONZE
121	1600 – 033RP	1600 – 033BRP
122	1600 – 034RP	1600 – 034BRP
131, 32, 33, & 38[1]	"	"
1600, 10, 11[1]	1600 – 031RP	1600 – 031BRP
1602, 1604[2]	"	"
1612, 14, 15	"	"
1616, 18, 19	1600 –032RP	1600 – 032BRP
1620, 22, 24	"	"
1630, 1632	"	"
1634, 1635	"	"
1636, 1638	1600 – 174RP	1600 – 174BRP
1640, 1641	"	"

Note (1) When replacing Item #8 body on 131, 132, 133, 138 and 1600C – 1& –9, you must also order current style impeller.
Note (2) Body for the 1602 & 1604 are no longer available. Consult factory.
Note (3) 121 thru 138 only.

ITEM # 15 REPLACEMENT BRACKET					ITEM # 161 GASKET KIT
PUMP MOD. NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
	CAST IRON	BRONZE	CAST IRON	BRONZE	
121, 122	1600 – 155RP	1600 – 156RP	NA	NA	1600 –050RP
1600, 10, 11	"	"	"	"	"
1602, 1604	1600 – 175RP	1600 – 176BRP	"	"	"
1612, 20, 30	"	"	"	"	"
131, 132	"	"	"	"	"
1615*	–	–	–	–	"
133, 138	NA	N/A	1604 – 023RP	1604 – 024RP	"
1614, 22, 24	"	"	1604 – 023RP	1604 – 024RP	"
1632, 34	"	"	1604 – 023RP	1604 – 024RP	"
1635*	–	–	–		1600 – 050RP
1616, 36	"	"	1604 – 025RP	1604 – 026RP	1618 – 006RP
1619*	–	–	–	–	"
1638, 40, 41	"	"	1604 – 025RP	1604 – 026RP	"

* Select bracket, per motor frame size code in serial number.

ITEM #25 REPLACEMENT IMPELLER ASSEMBLY								
PUMP NO.	(-9) PUMPS	CURRENT	DIA. -9	DIA. CUR.	PUMP NO.	(-9) PUMPS	CURRENT	DIA. -9 CUR.
121, 122	121 – 142BRP	121 – 142BRP	4.30	4.30	1618	1618 – 001BRP	N/A	7.900
131	131 – 075BRP	1630 – 023BRP	4.80	4.40	1619*	N/A	1619 – 001BRP	
132	132 – 063BRP	1630 – 022BRP	5.20	4.90	1620	1620 – 022BRP	N/A	5.100
133	133 – 075BRP	1632 – 022BRP	5.75	5.65	1622	1622 – 020BRP	N/A	5.850
138	138 – 037BRP	1634 – 023BRP	6.25	6.15	1624	1624 – 040BRP	N/A	6.500
1600	1600 – 179BRP	1610 – 020BRP	4.75	4.50	1630	1630 – 022BRP	1630 – 022BRP	4.900
1602	1602 – 025BRP	N/A	5.500		1632	1632 – 022BRP	1632 – 022BRP	5.650
1604	1604 – 028BRP	N/A	6.200		1634	1634 – 023BRP	1634 – 023BRP	6.150
1610	1610 – 019BRP	1610 – 019BRP	4.750		1635*	N/A	1635 – 001BRP	–
1611*	N/A	1611 – 001BRP	–		1636	1636 – 001BRP	1636 – 001BRP	6.400
1612	1612 – 019BRP	1612 –019BRP	5.750		1638	1638 – 001BRP	1638 – 001BRP	6.900
1614	1614 – 018BRP	1614 – 018BRP	6.350		1640*	1640 – 001BRP	N/A	7.900
1615*	N/A	1615 – 001BRP	–		1641*	N/A	1641 – 001BRP	–
1616	1616 – 002BRP	1616 – 002BRP	7.100					

*When ordering, please advise diameter of impeller.

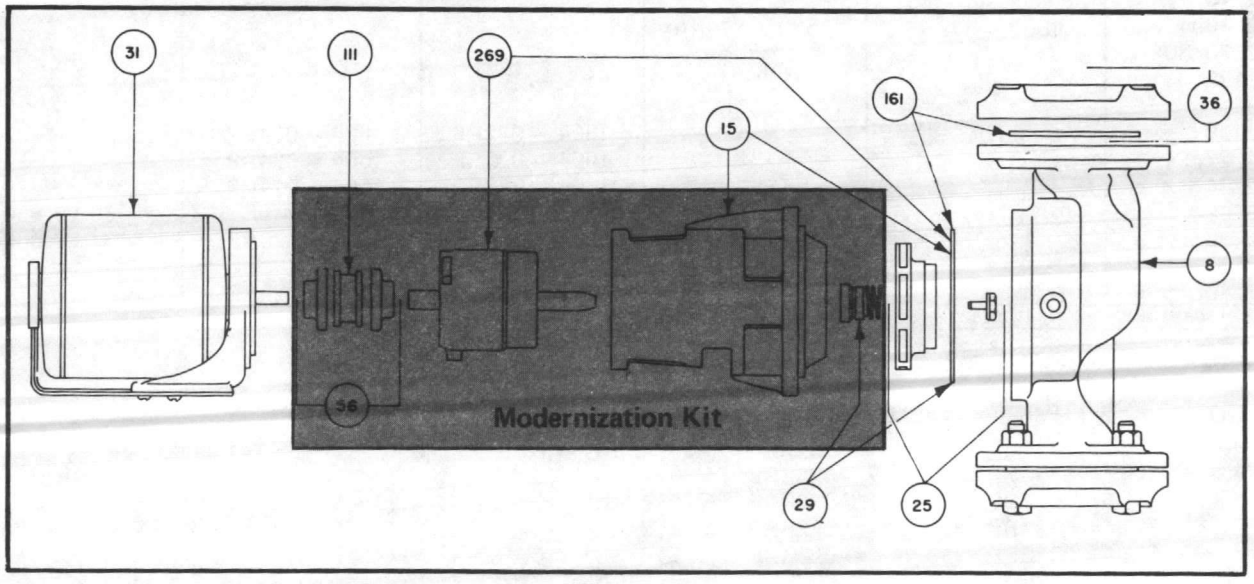
ITEM # 31 REPLACEMENT MOTOR ASSEMBLY*				
HP	115/60/1	115/230/60/1	200/60/3	230/460/60/3
1/4	121 – 151RP	N/A	121 – 148RP	121 – 137RP
1/3	131 – 143RP	N/A	131 – 115RP	131 – 137RP
1/2	N/A	132 – 096RP	132 – 066RP	132 – 097RP
3/4	N/A	133 – 119RP	133 – 140RP	133 – 134RP
1	N/A	138 – 119RP	138 – 148RP	138 – 142RP
1½	N/A	1636 – 013RP	1636 – 019RP	1636 – 010RP
2	N/A	1638 – 012RP	1638 – 015RP	1638 – 010RP
3	N/A	N/A	1640 – 013RP	1640 – 010RP

* When ordering other than standard, refer to nameplate, then consult factory.

ITEM # 34 SHAFT SLEEVE	1600 – 205	All –9 and Serial Number Pumps.
ITEM # 56 COUPLER	1624 – 053RP	All Inline Pumps ¼ thru 2 HP.
ITEM # 56 COUPLER	1624 – 041RP	All Inline Pumps 3 HP.
ITEM # 111 RUBBER INSERT	1624 – 004RP	All 4J Couplers.
ITEM # 111 RUBBER INSERT	1624 – 020RP	All 3J Couplers.
ITEM # 111 RUBBER INSERT	900 – 512	All 5J Couplers.
ITEM # 269 CARTRIDGE ASSY.	1600 – 160RP	All -9 and Serial Number Pumps.

REPLACEMENT PARTS FOR OLD STYLE PUMPS AND CIRCULATORS *

*121+122-3-7; 131, 132+133-3-6; 138-1+2; 1600, 1602, 1604, 1610, 1612, 1614, 1620, 1622, 1624, 1630, 1632, 1634-1+-C1.



ITEM # 8	BODY	Same as –9 and Serial Number Pumps.
ITEM # 25	IMPELLER AND SHAFT ASSEMBLY	No longer available . Must purchase Item #74 Modernization Kit listed below, Plus –9 IMPELLER
ITEM # 29	SEAL KIT	Part No. 1600 – 055RP
ITEM # 31	MOTOR ASSEMBLY [1]	Same as –9 and Serial Number Pumps.
ITEM # 36	FLANGE SET	Same as –9 and Serial Number Pumps.
ITEM # 56	COUPLER	Same as –9 and Serial Number Pumps.
ITEM # 111	RUBBER INSERT	Same as –9 and Serial Number Pumps.
ITEM # 161	GASKET KIT	Same as –9 and Serial Number Pumps.

ITEM # 74 MODERNIZATION KIT*

PUMP NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
	CAST IRON	BRONZE	CAST IRON	BRONZE	
121, 122	121 – 154RP	122 – 002RP	N/A	N/A	
131, 132 [2]	131 – 144RP	132 – 145RP	133 – 147RP	138 – 153RP	
133, 138	N/A	N/A	"	"	
1600, 1610	121 – 154RP	122 – 022RP	N/A	N/A	
1602, 1604 [2]	131 – 144RP	132 – 145RP	133 – 147RP	133 – 147RP	
1612, 1620 [2]	"	"	133 – 147RP	138 – 153RP	
1630 [2]	"	"	"	"	
1614, 1622	N/A	N/A	"	"	
1624, 1632	N/A	N/A	"	"	
1634	N/A	N/A	"	"	

Note (1) When replacing 1/3 or 1/2 HP 56 Frame (old) motor with a new 48 Frame motor, adapter kit # 1600 – 194RP must be ordered.

Note (2) Select modernization kit per motor frame size. Select impellers per selection chart on previous page, under –9 column

*Change