

POCKET GUIDE for TROUBLESHOOTING Gas Products



**F P I FIREPLACE PRODUCTS
INTERNATIONAL LTD.**

To be used by F.P.I. trained service technicians only.



Table of Contents

Tools and Instruments 3

Problem

A Pilot not igniting after repeated depressions of Piezo 4-5
B Pilot not staying lit 6
C Main Burner not igniting with switch in "ON" position and pilot on. 7
D Main Burner shuts down "at will". 8-9
E Pilot on but cannot re-ignite main burner. 8-9
F Carbon on glass and/or logs 10
G Propane Usage Calculation 11

Drawings

Fig. TS1 Pilot Assembly 12
Fig. TS2 Testing For Pilot Gas Flow 13
Fig. TS3 Gas Valve "ON" & "OFF" positions 14
Fig. TS3A Purging Air from the Supply Line 15
Fig. TS4 Pilot Adjustment 16
Fig. TS5 Thermopile Voltage Check 17
Fig. TS5A Thermopile 18
Fig. TS6 Safety Circuit Jumper Wire Test 19
Fig. TS7 Standing Pilot Ignition Wiring Diagram 20
Fig. TS8 Continuity Testing of Electrical Circuits 21
Fig. TS9 Electromagnet Power Unit (EPU) Testing 22
Fig. TS10 Adjusting Gas Pressure 23
Fig. TS11 Switch Jumper Wire Test 24
Fig. TS12 Switch Wire Jumper Test 25
Fig. TS13 Valve Operating Head Test (Robertshaw & S.I.T. valve) 26
Fig. TS13A Valve Operating Head Test (Robertshaw Quick Drop-out valve) 27
Fig. TS14 High Limit Switch Testing 28
Fig. TS15 Flue Gas Spillage Test - Inserts 29
Fig. TS15A Flue Gas Spillage Test - Freestanding 29
Fig. TS16 Air Shutter adjustment 30

Table 1 Masonry Chimney Liner Dimensions with Circular Equivalents 31
Table 2 Vent Tables 32
Table 3 NG & LP - Gases (Btu per hour at Sea Level) 33
Table 4 Number Drill Sizes 34
Table 5 Max. Capacity of Pipe in Thousands of Btu per Hour for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of 0.3 Inch Water Column 35
Table 6 Max. Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of 0.3 Inch Water Column 36
Table 7 Max. Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour of Undiluted Liquefied Petroleum Gases (11 Inches Water Column Inlet Pressure) 37

Conversion Table 38-40



Tools & Instruments

Listed below are the proper hand tools and test equipment required by the service technician to properly service or troubleshoot gas appliances.

Suggested List of Hand Tools

- 1) Open-end wrenches: 3/8", 7/16", 1/2", 5/8", 9/16"
- 2) Adjustable end wrenches: 8" and 10"
- 3) 5/8 inch nut driver
- 4) Straight screwdrivers (including small 1/8" blade for pilot adjustment; also stubby straight)
- 5) Phillips screwdrivers #1 and #2 (stubby Phillips)
- 6) 1/4" Hex nut driver
- 7) 3/16" Hex key or set (T-handle needed in some cases)
- 8) Wire-cutting pliers
- 9) Crimping pliers
- 10) Wire-stripping pliers
- 11) Needle nose pliers
- 12) Pipe wrenches: 8" - 14"
- 13) Tin snips
- 14) Flashlight
- 15) Numbered drill index
- 16) Tubing cutter
- 17) Flaring tool
- 18) Soft-bristled toothbrush
- 19) Soft 1" paint brush
- 20) Electric drill: 1/4" or 3/8"

Suggested List of Testing Equipment

- 1) Multi-meter (must measure millivolts)
- 2) Manometer
- 3) Gas sniffer or leak detection fluid
- 4) 2 to 4, 12" - 16" Jumper wires
- 5) "Flame Stick" lighting wand

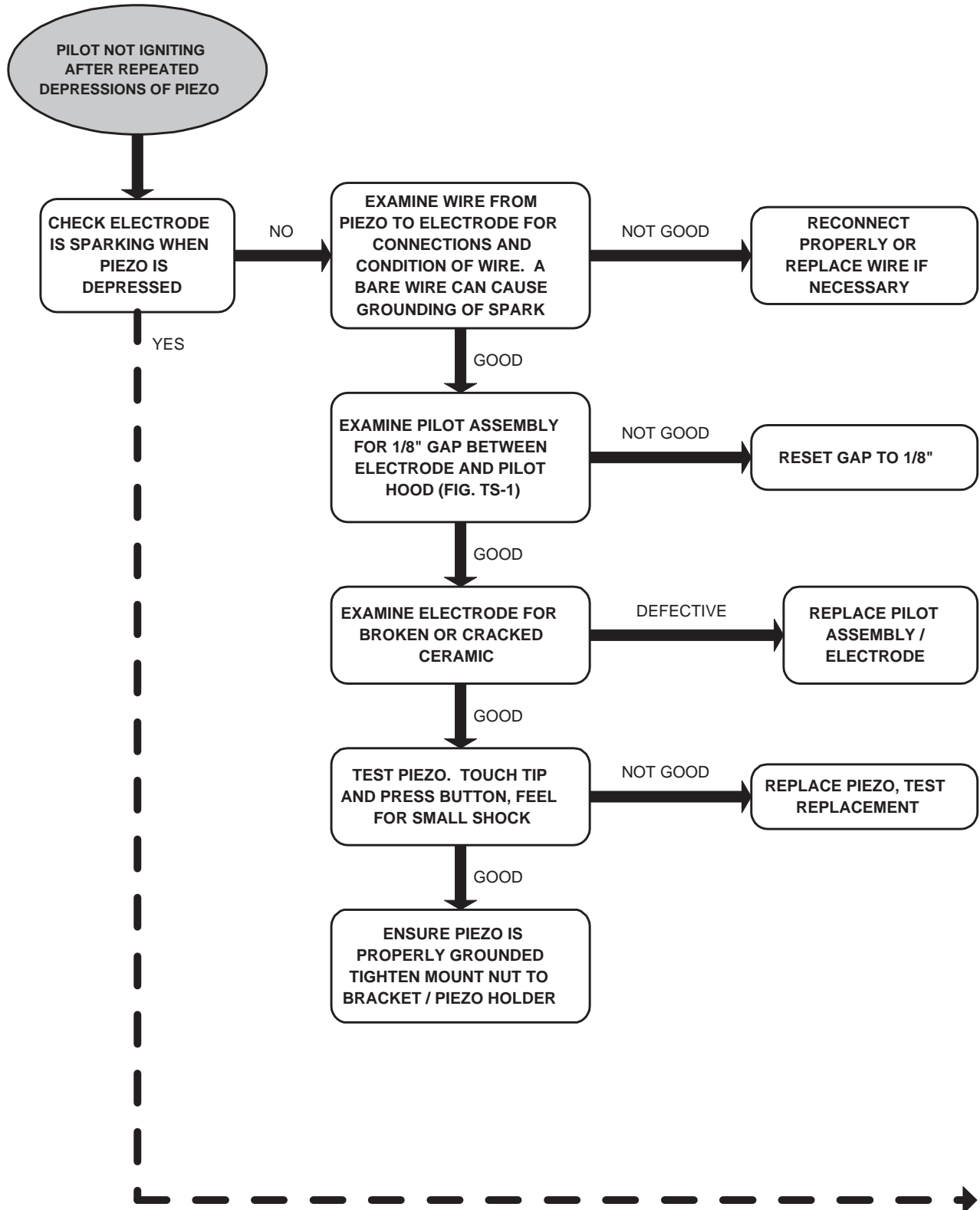
Miscellaneous

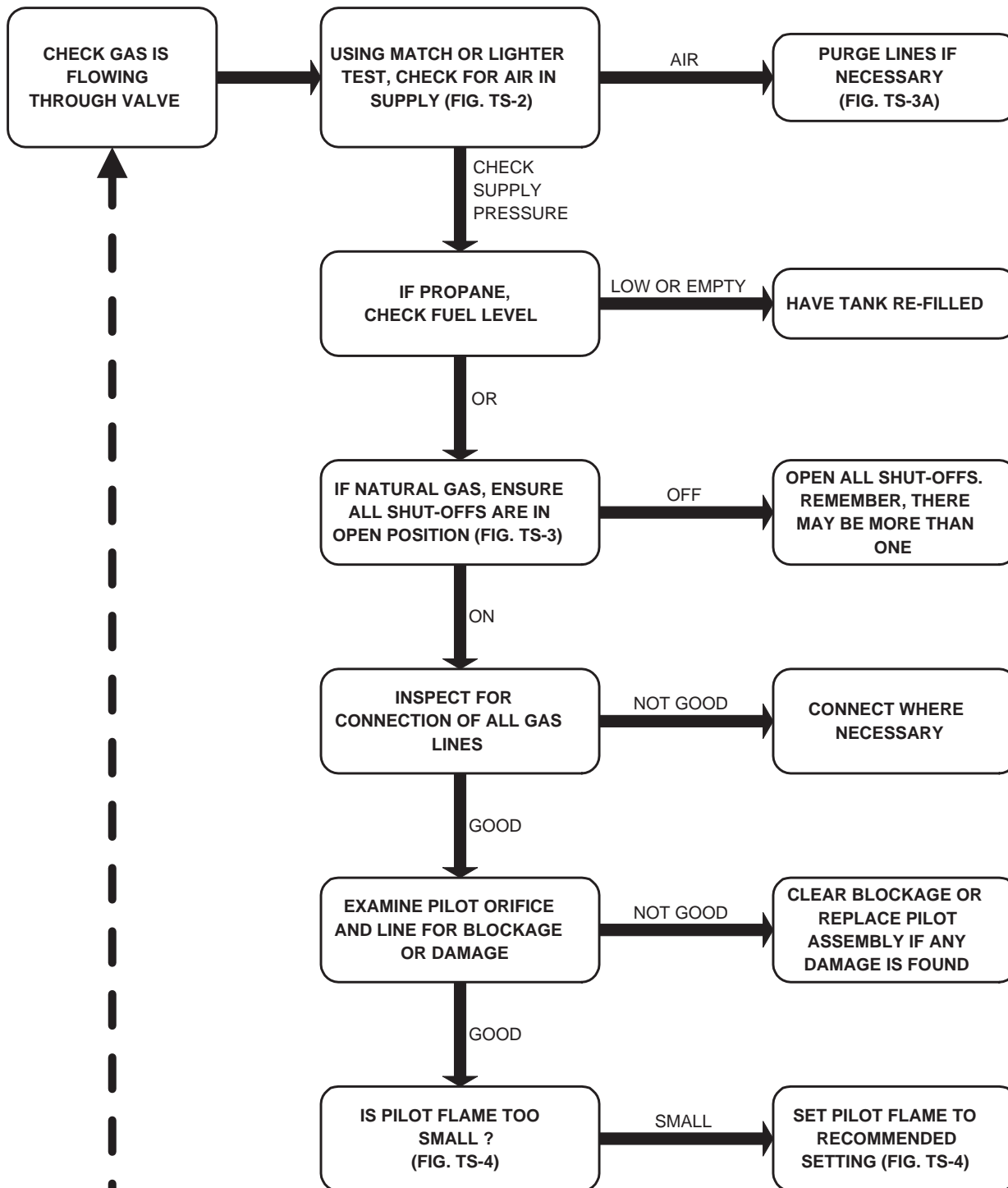
- 1) Pipe joint compound
- 2) Smoke match
- 3) Drop cloth (for floor in front of unit)
- 4) Glass cleaner/towels

All tools and test equipment should be properly stored and maintained.



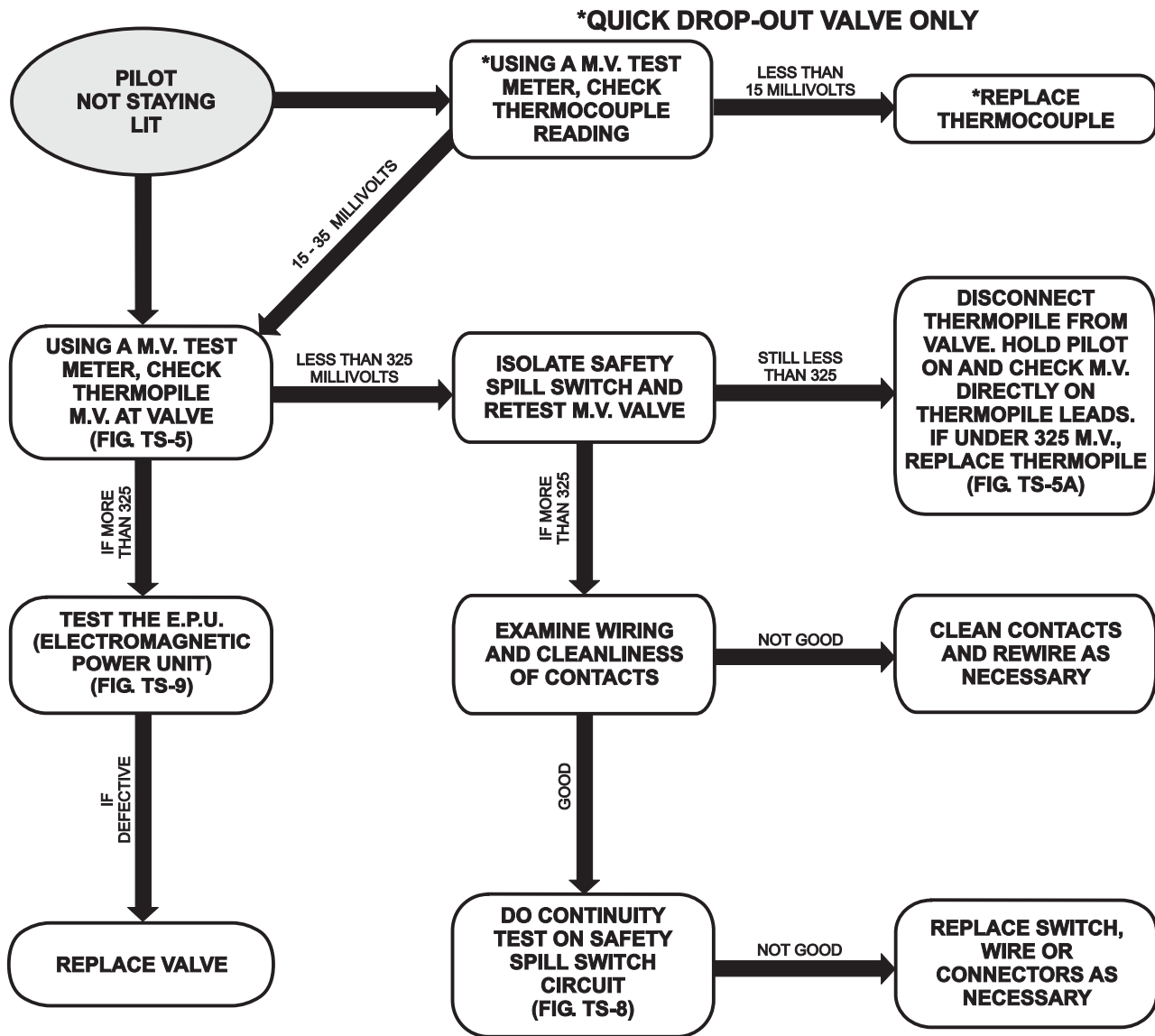
PROBLEM "A"







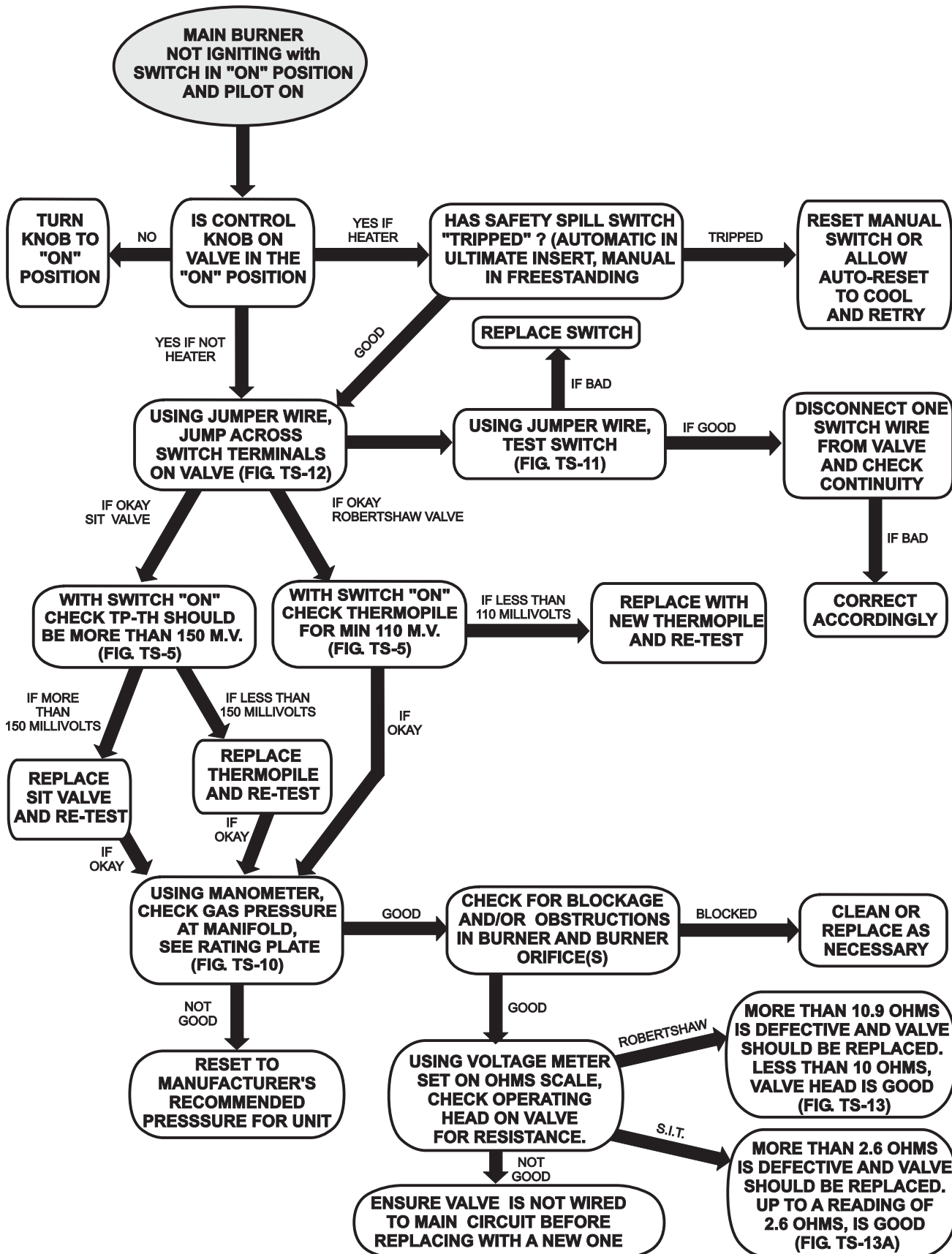
PROBLEM "B"

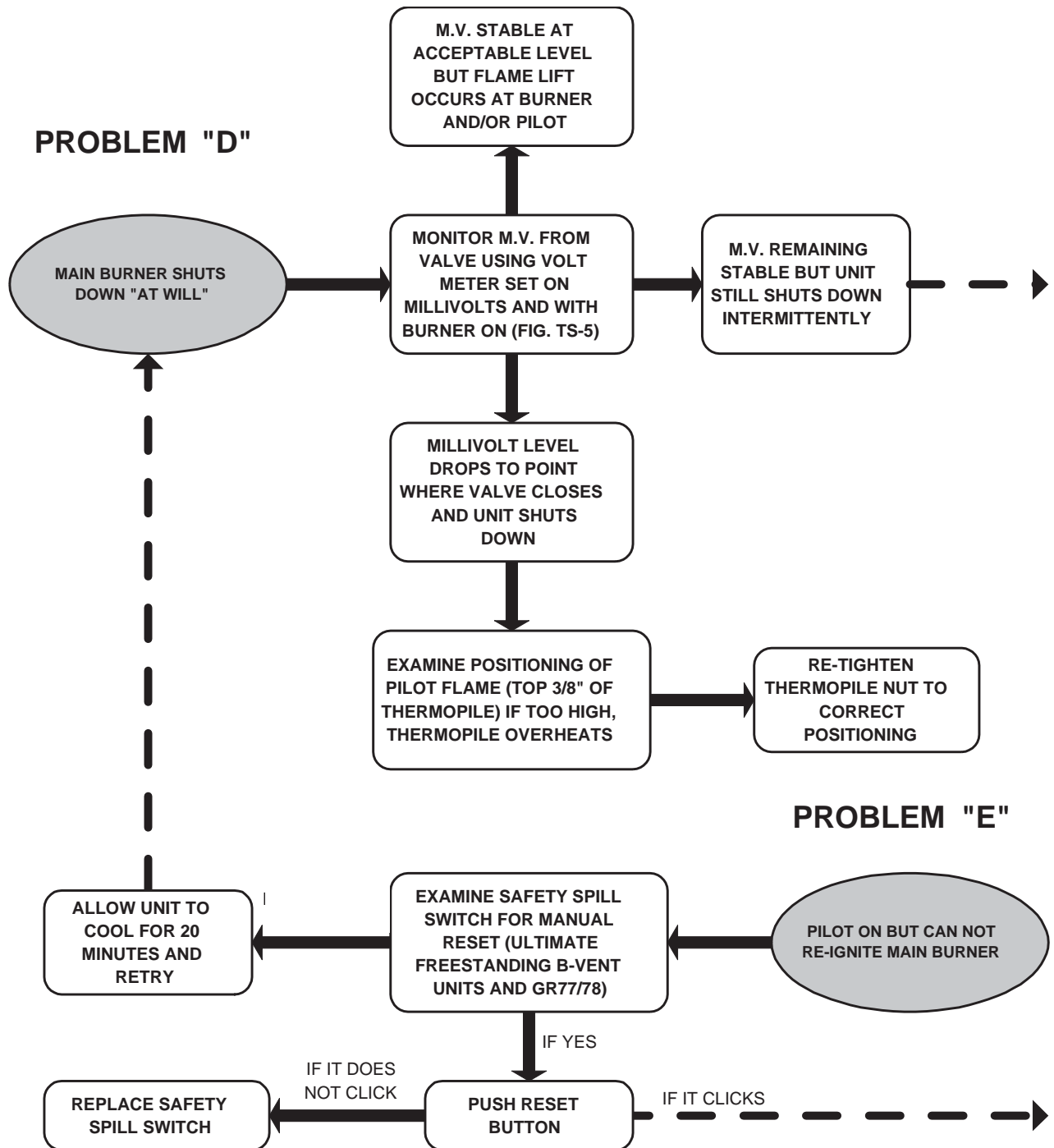


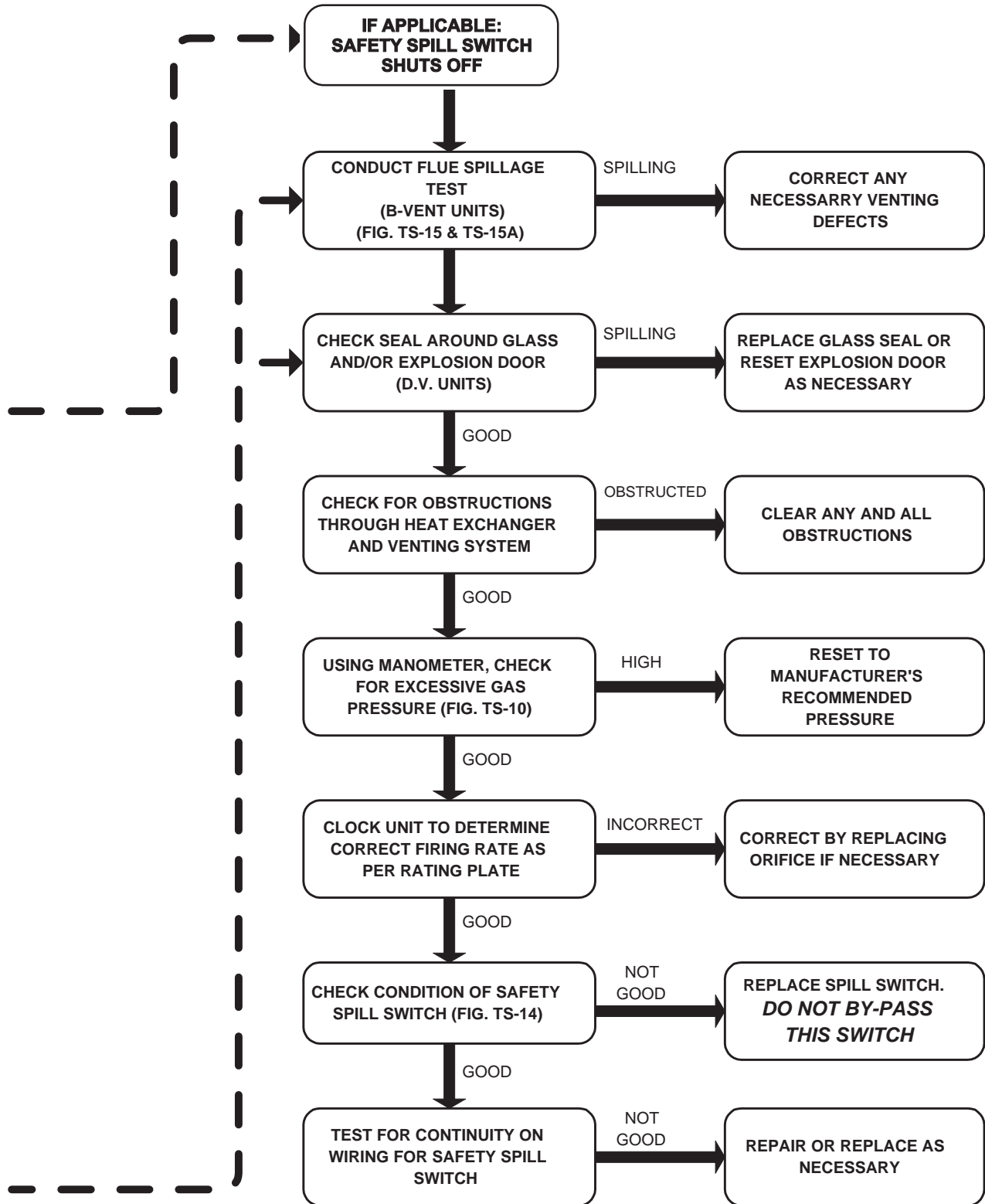
NOTE: On a quick drop-out valve the pilot is operated by the thermocouple only. The thermopile operates the main valve.



PROBLEM "C"

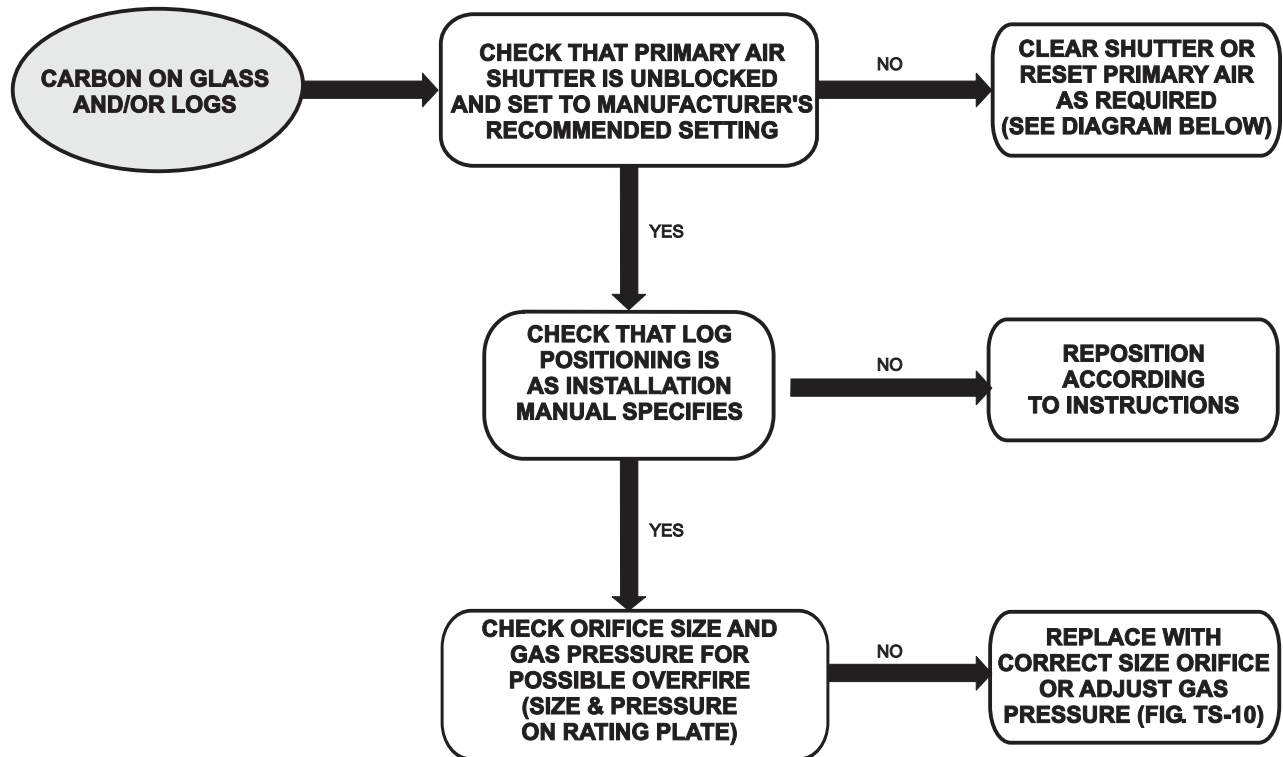




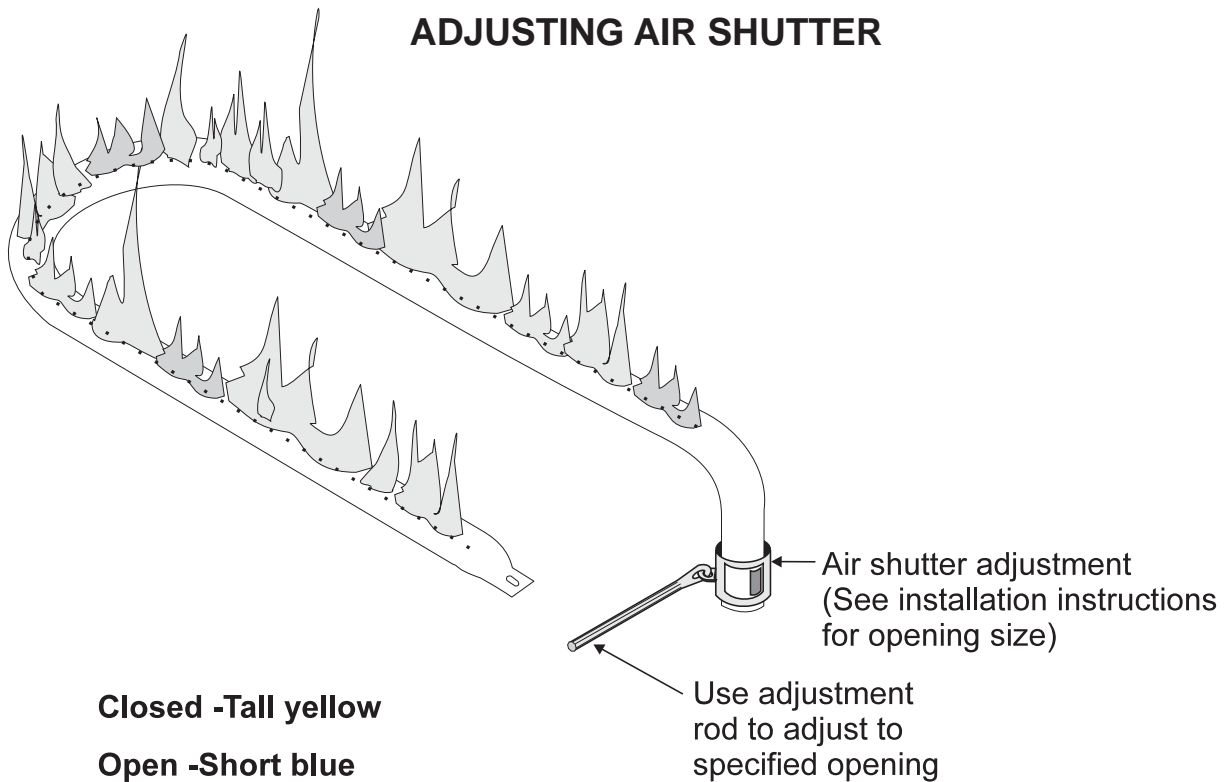




PROBLEM "F"



ADJUSTING AIR SHUTTER





**PROBLEM "G"
(EXAMPLE ONLY)**

**PROPANE
USAGE
CALCULATION**

**Calculate the cost of using
Propane as shown below:**

**Btu per liter = 24,245
Liters per imperial gallon = 4.53
Liters per U.S. gallon = 3.78
1 x 100 lb bottle = 89 liters or 23.54 U.S. gallons
91,690 Btu per U.S. gallon of propane**

Example:

**Using a unit with a rating of 41,000 Btu/h
41,000 Btu per hour x 10 = 410,000 Btu per 10 hours**

(CDN)
$$\frac{410,000}{24,245 \text{ Btu per liter}} = 16.91 \text{ liters}$$

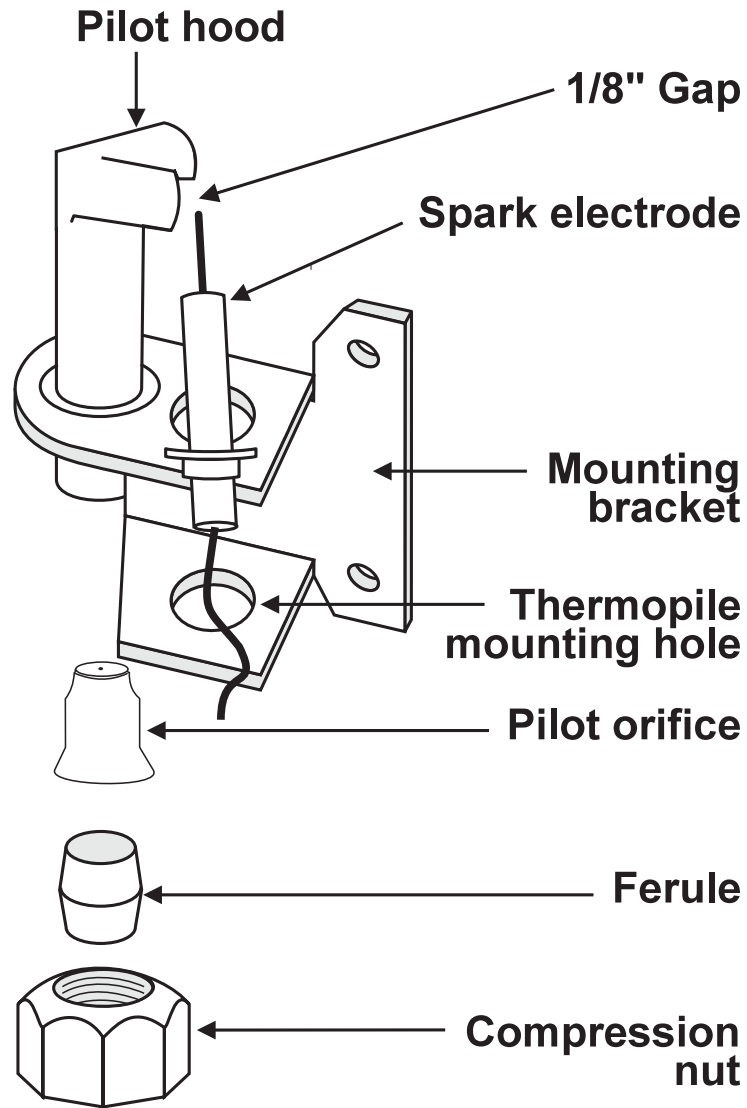
**At 40 cents per liter and 10 hours max. burning / day:
Cost is 16.91 liters x 40 cents = \$6.76 /day**

(US)
$$\frac{410,000}{91690 \text{ Btu per Gallon}} = 4.47 \text{ Gallons}$$

**At 90 cents per U.S. Gallon and 10 hours max. burning / day:
Cost is 4.47 Gallons x 90 cents = \$4.02 /day**

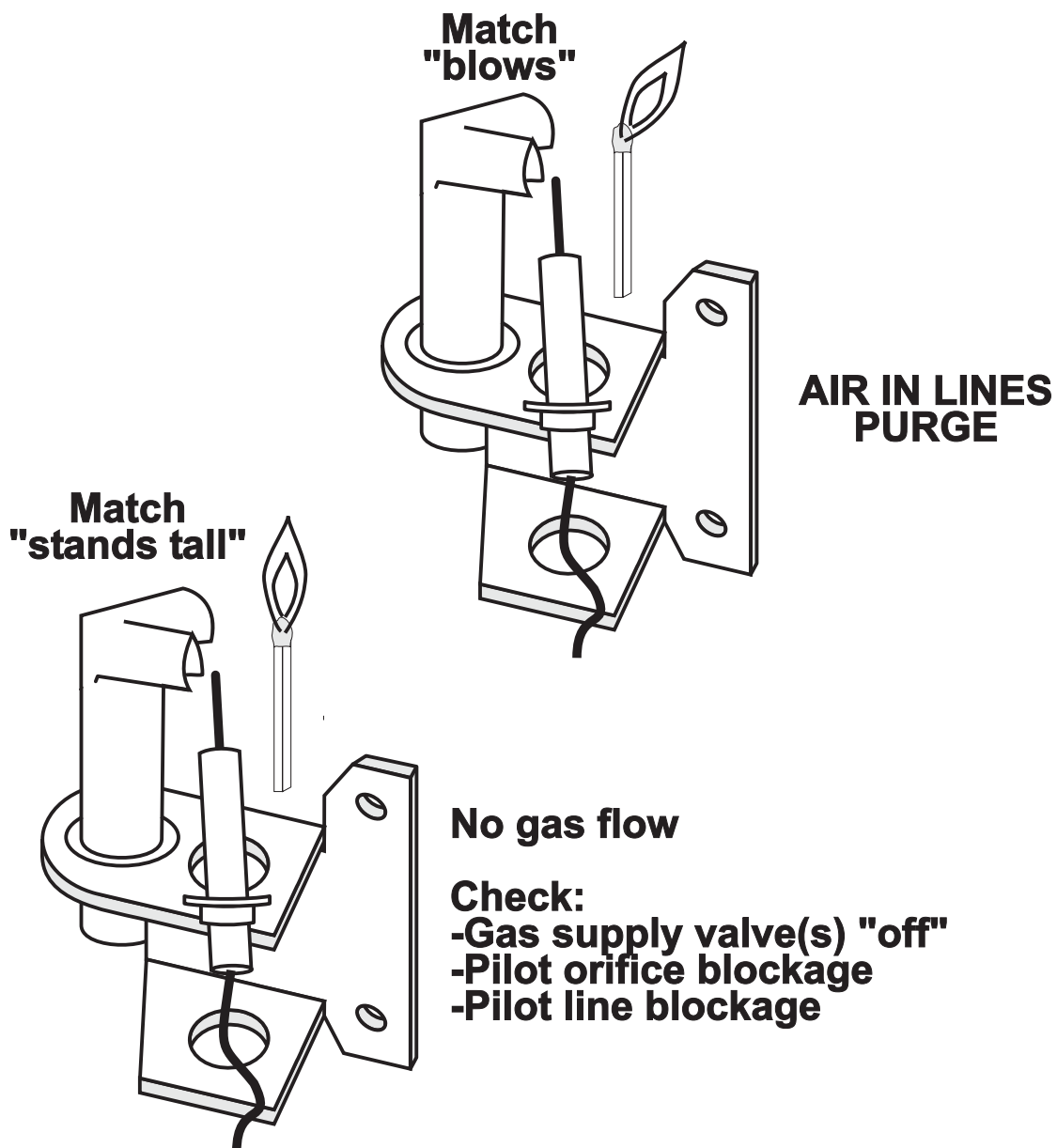


**PILOT ASSEMBLY
TS-1**



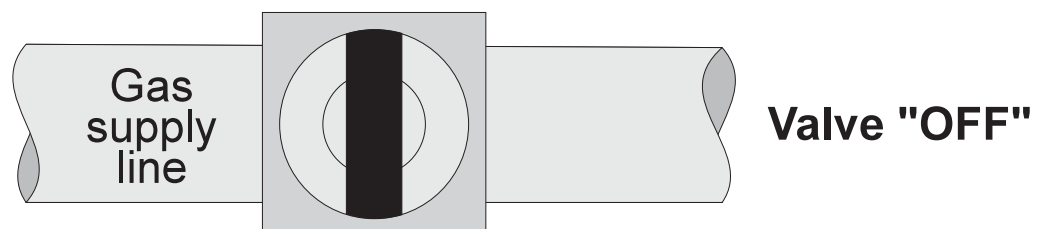
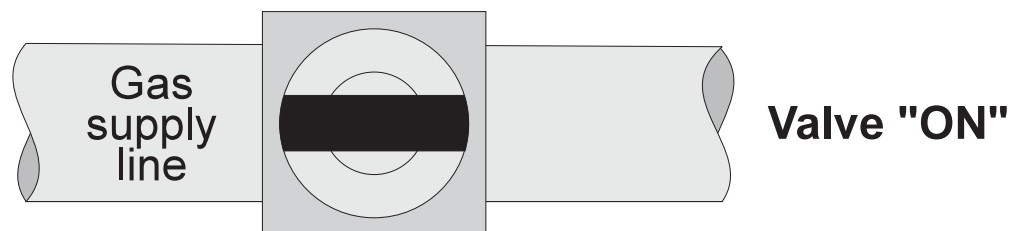
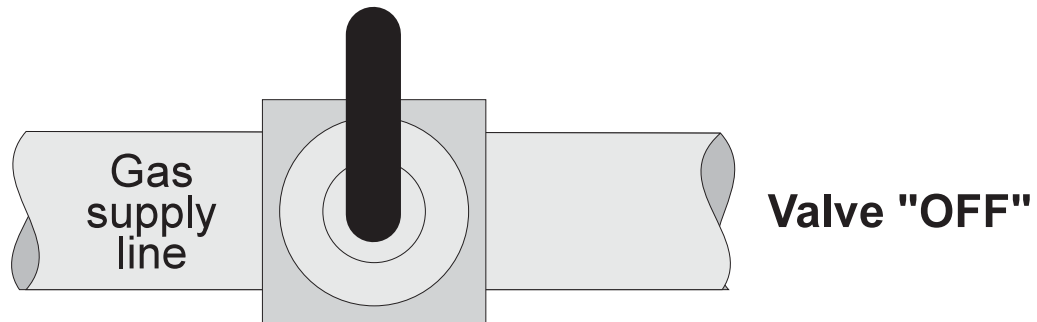
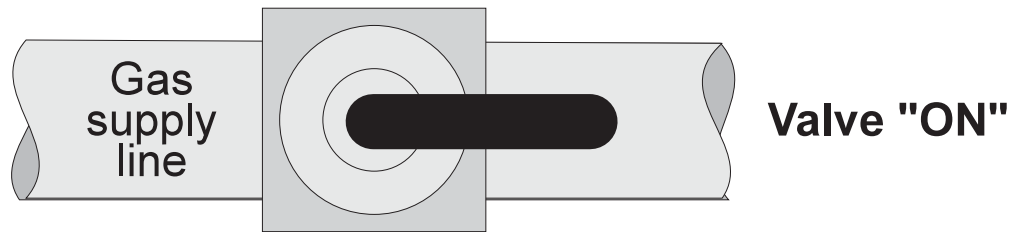
**TESTING FOR PILOT GAS FLOW
TS-2**

**Light a match then allow gas flow to pilot
DO NOT LIGHT A MATCH IF YOU SMELL GAS**



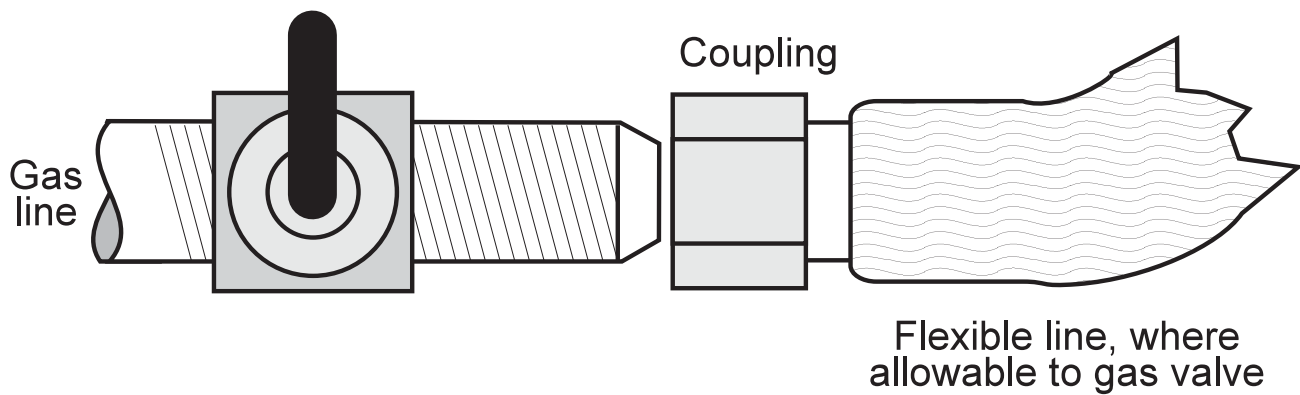


**GAS VALVE "ON" AND
"OFF" POSITION
TS-3**



**PURGING AIR FROM THE
SUPPLY LINE
TS-3A**

1. Loosen coupling at supply line
2. Turn gas supply line valve on
3. When gas flows turn supply valve off
4. Connect coupling, wait 5 min. before lighting, check for gas leaks





PILOT ADJUSTMENT TS-4

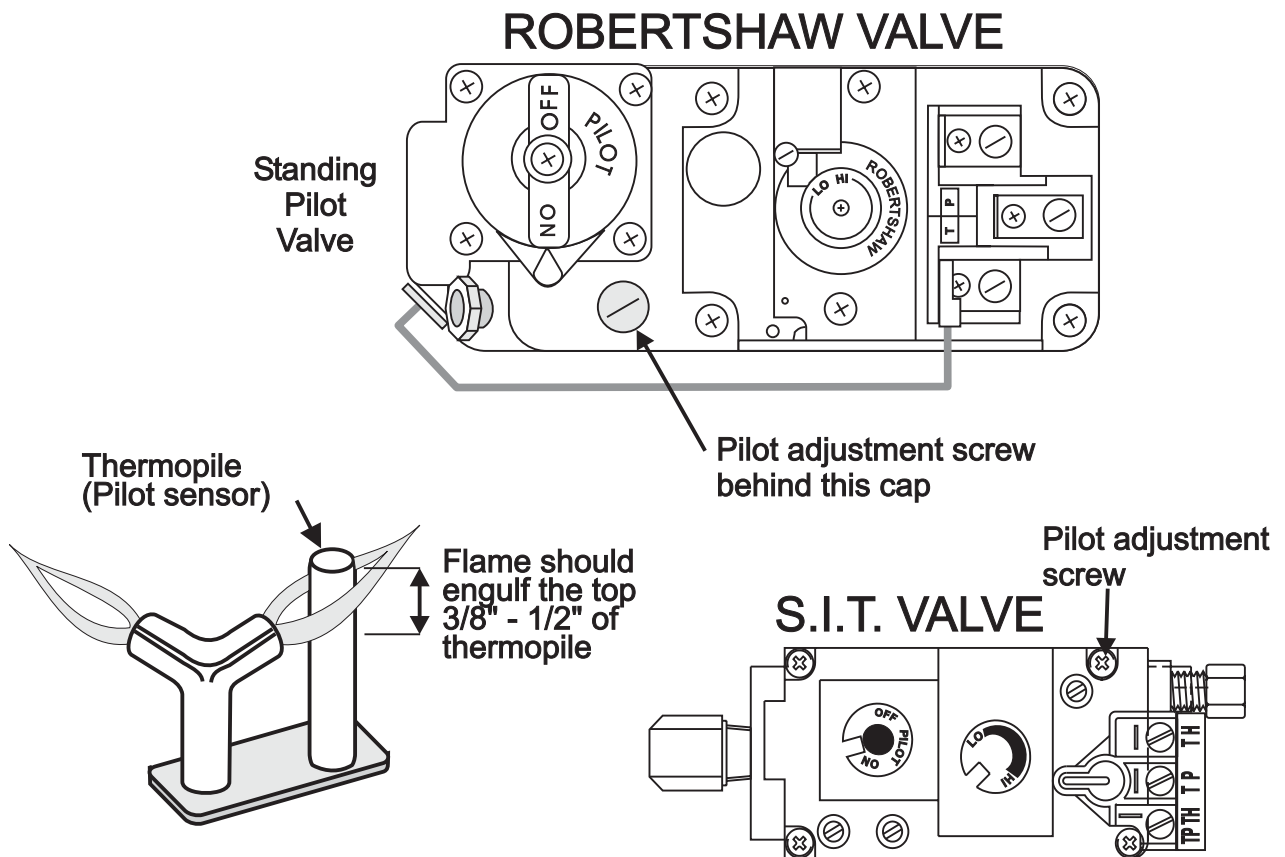
Adjusting a pilot:

1. Remove the protective cap screw
2. Turn the pilot adjustment screw

Clockwise -reduces the pilot flame

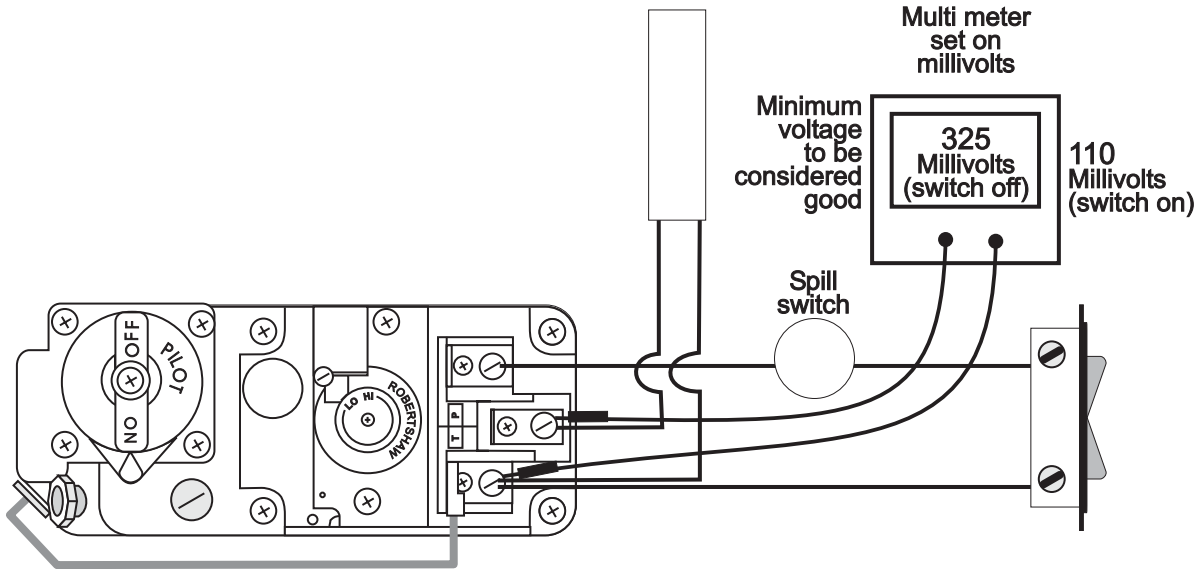
Counterclockwise -increases the pilot flame

Note: The pilot flame should be a steady blue flame which has contact with the upper 3/8" of the thermopile or thermosensor

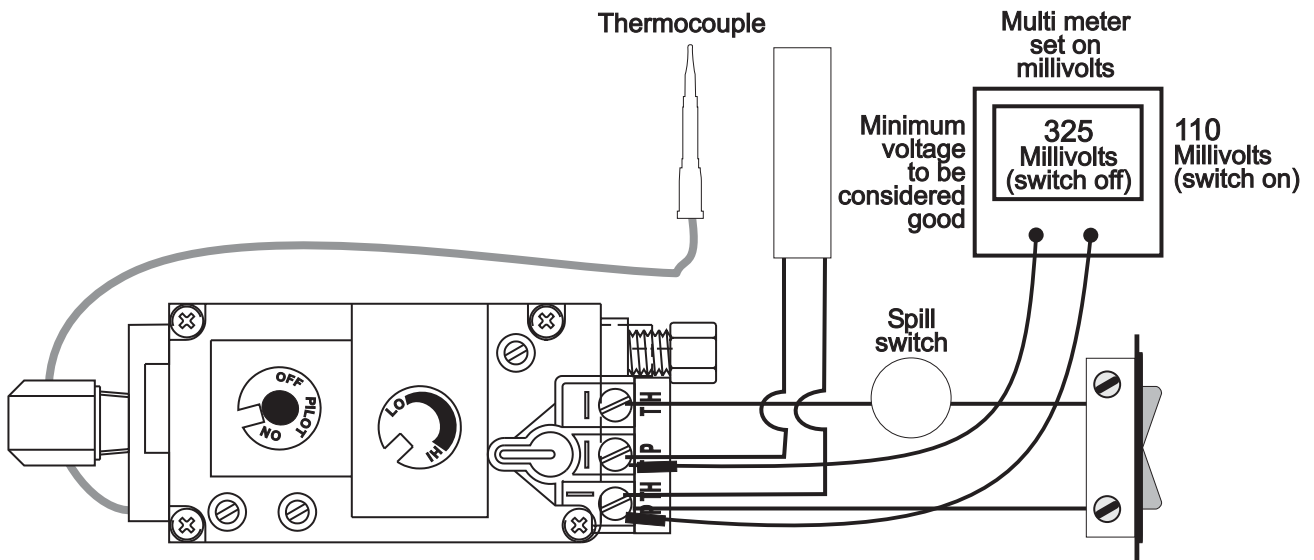


Note: Only adjust pilot if thermopile is producing less than 435 Millivolts

THERMOPILE VOLTAGE CHECK TS-5



ROBERTSHAW VALVE

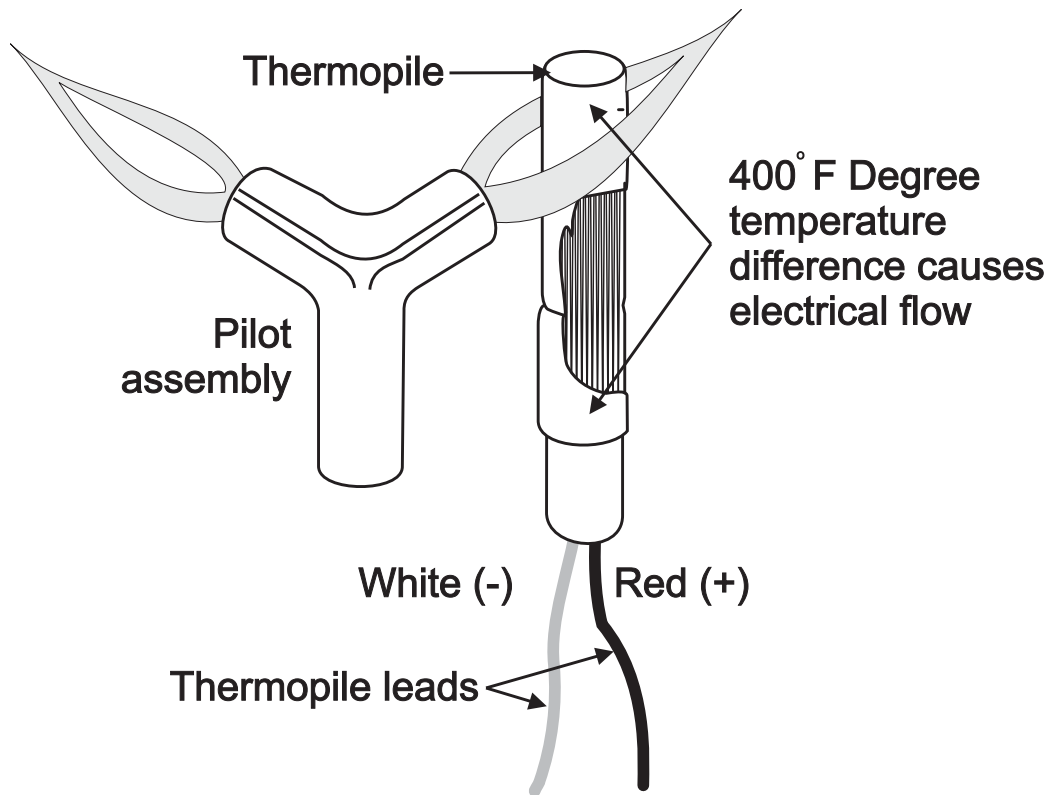


S.I.T. VALVE

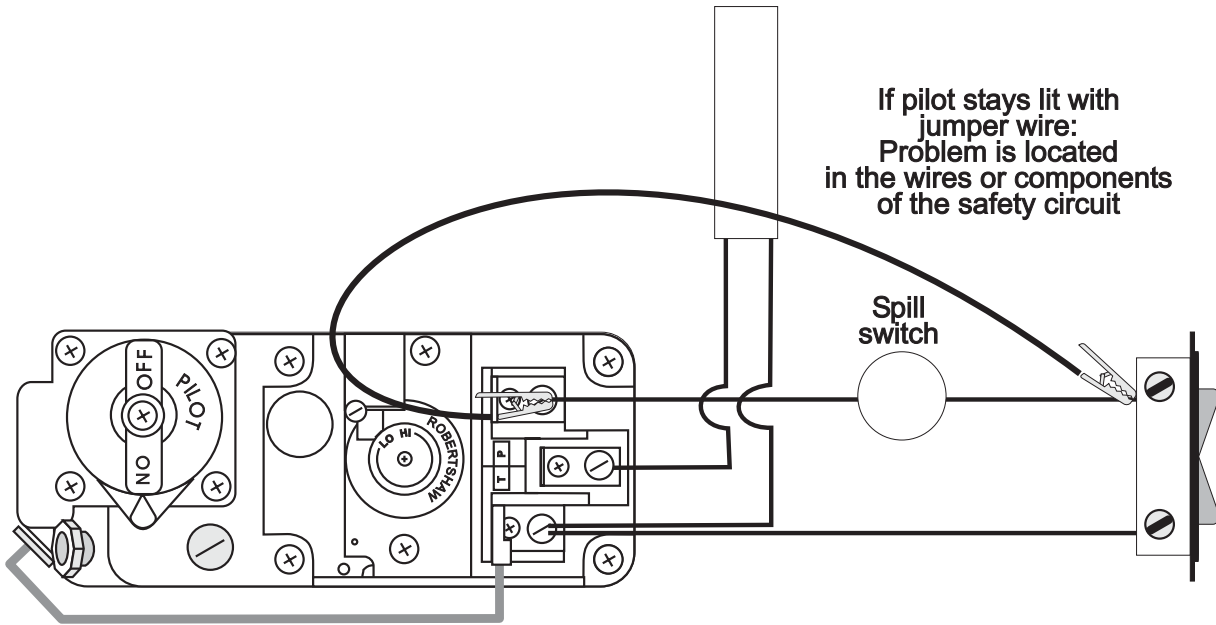


THERMOPILE VOLTAGE CHECK TS-5A

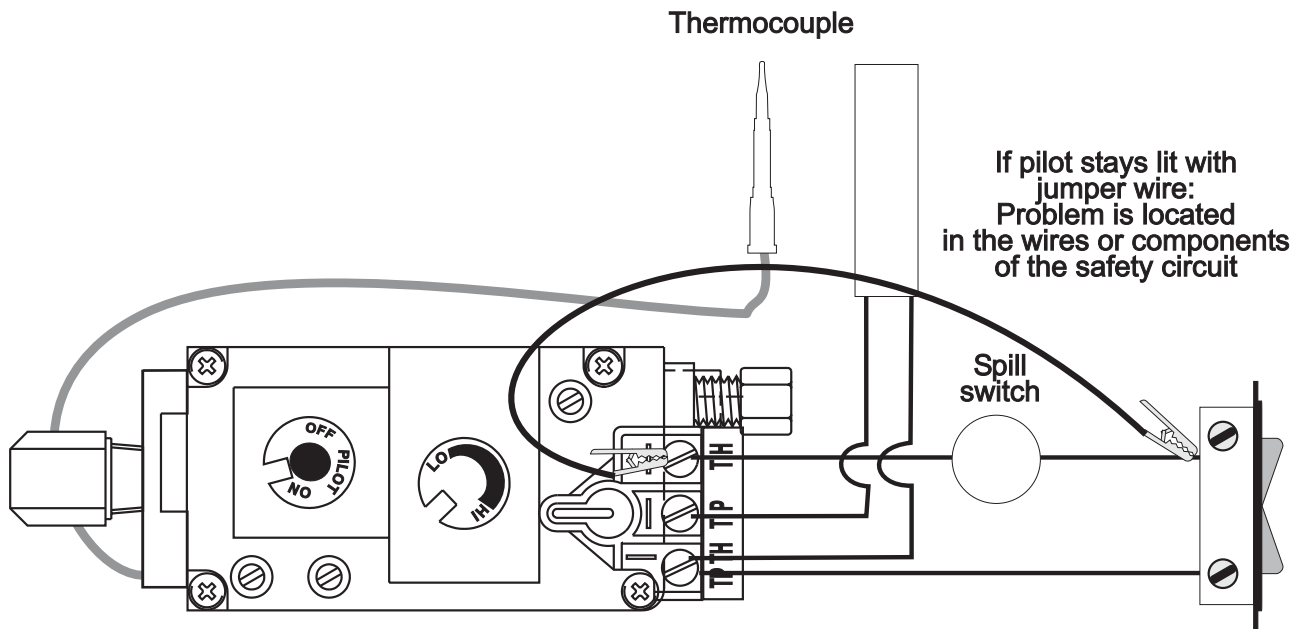
500-600 Millivolts
Min. 325 Millivolts -no load



**SAFETY CIRCUIT
JUMPER WIRE TEST
TS-6**



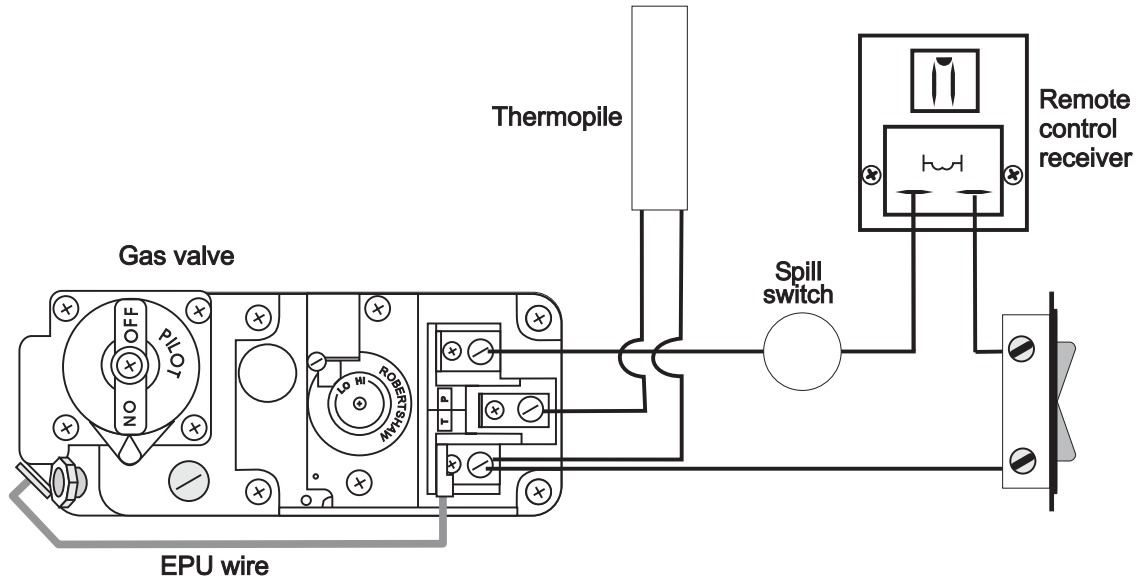
ROBERTSHAW VALVE



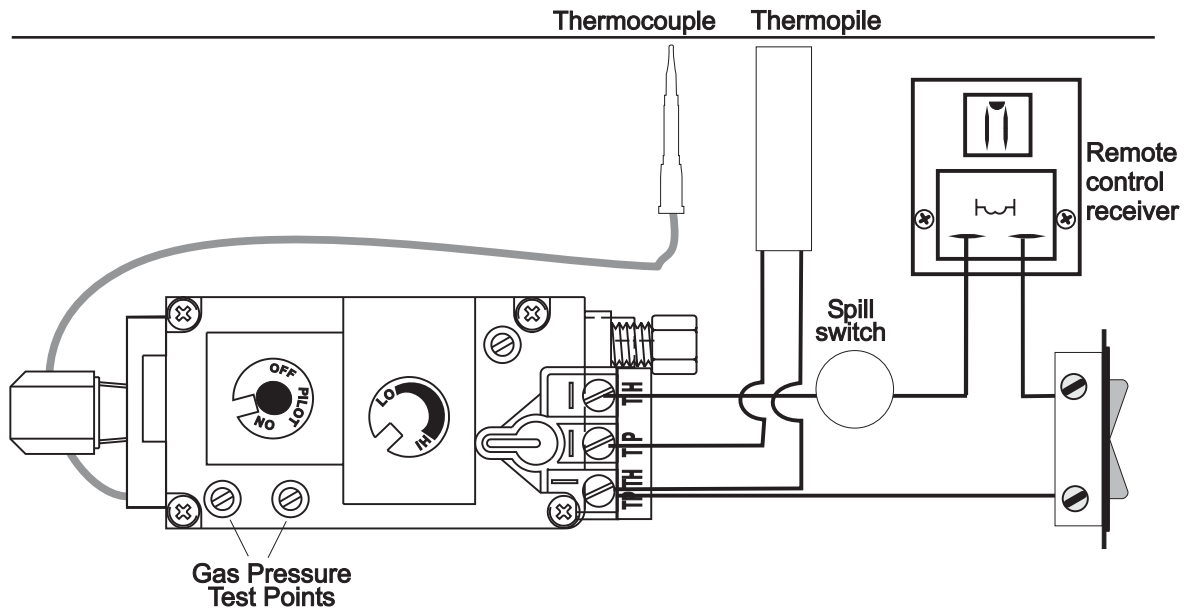
S.I.T. VALVE



**STANDING PILOT IGNITION WIRING
DIAGRAM (SHOWS REMOTE
CONTROL CONNECTION)
TS-7**

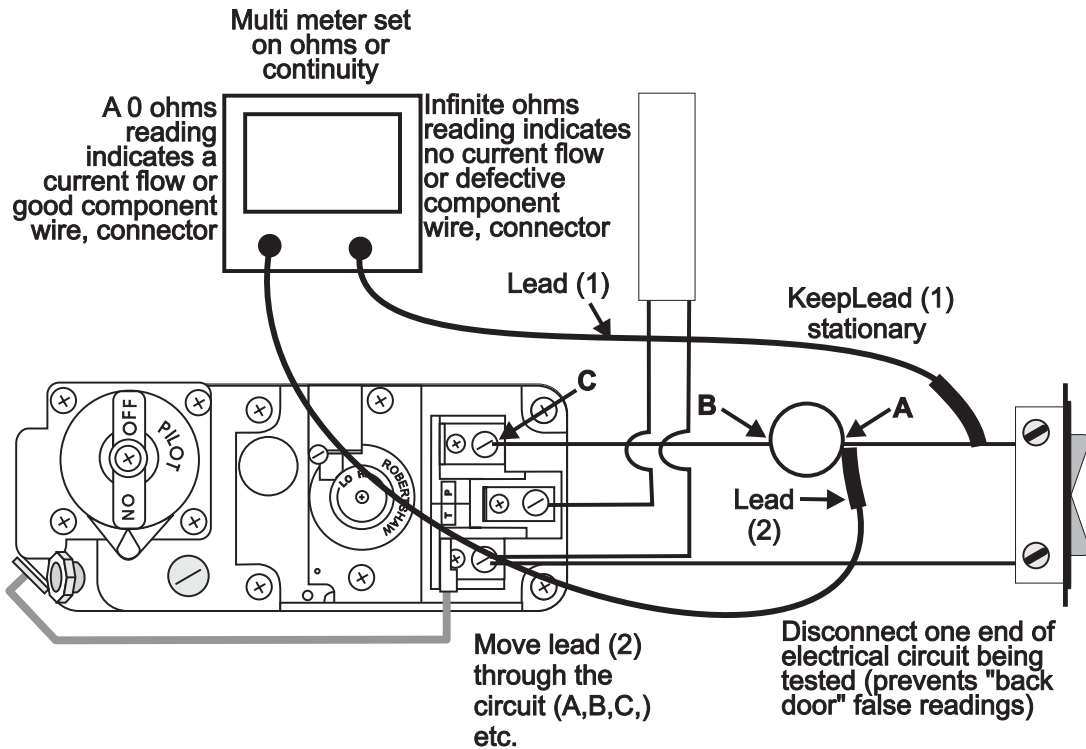


ROBERTSHAW VALVE

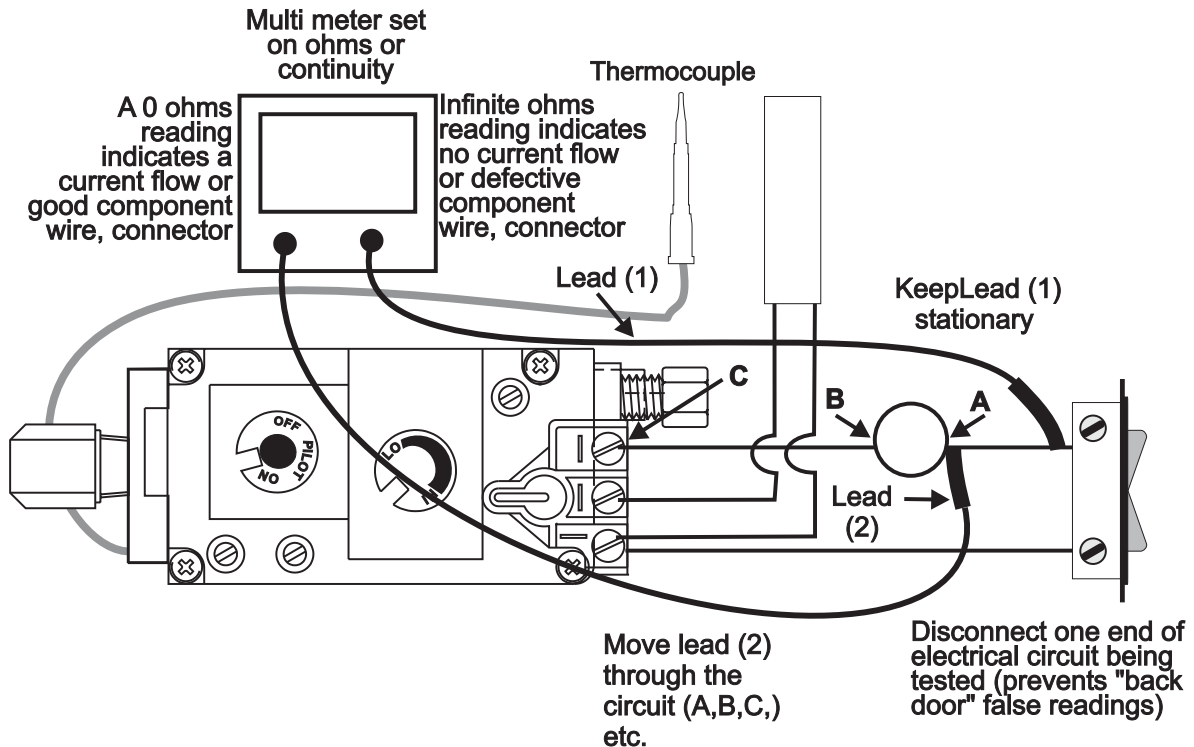


S.I.T. VALVE

CONTINUITY TESTING OF ELECTRICAL CIRCUITS TS-8



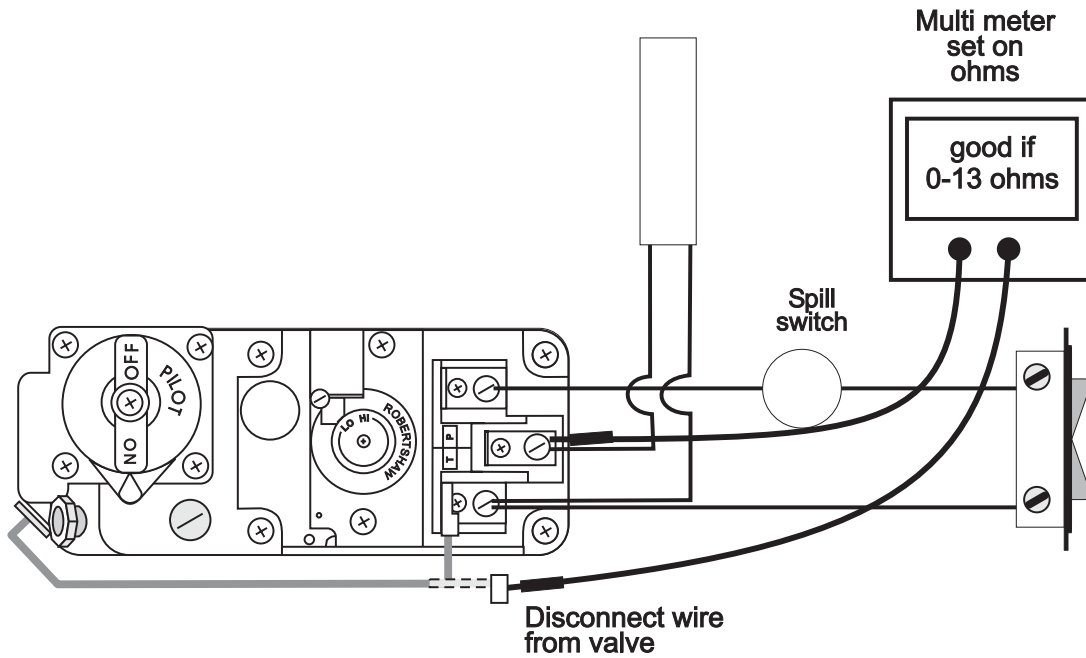
ROBERTSHAW VALVE



S.I.T. VALVE

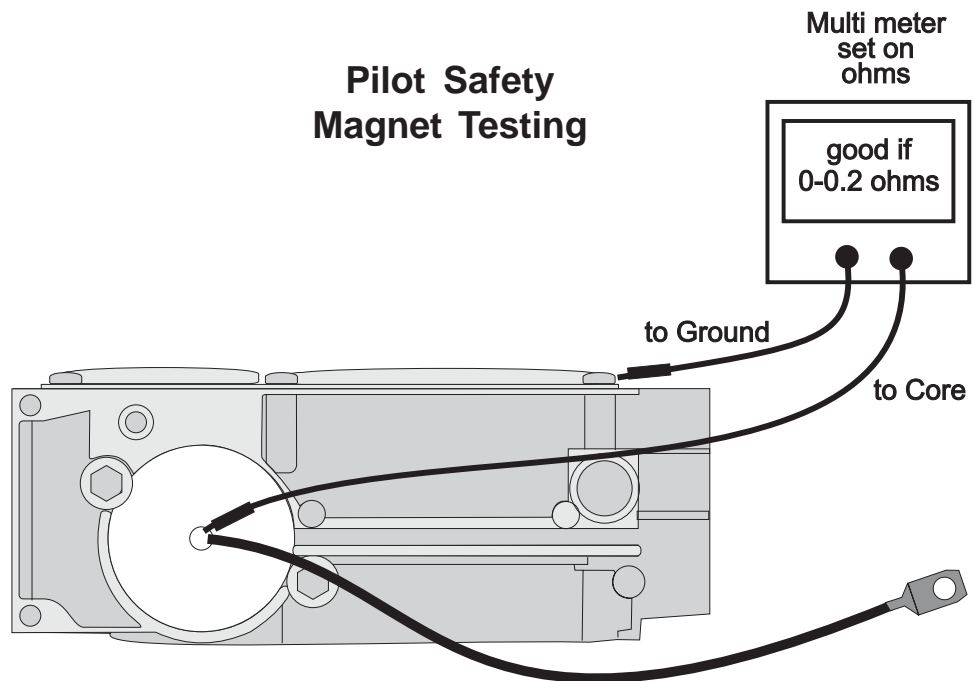


ELECTROMAGNET POWER UNIT (EPU) TESTING TS-9



ROBERTSHAW VALVE

Pilot Safety Magnet Testing

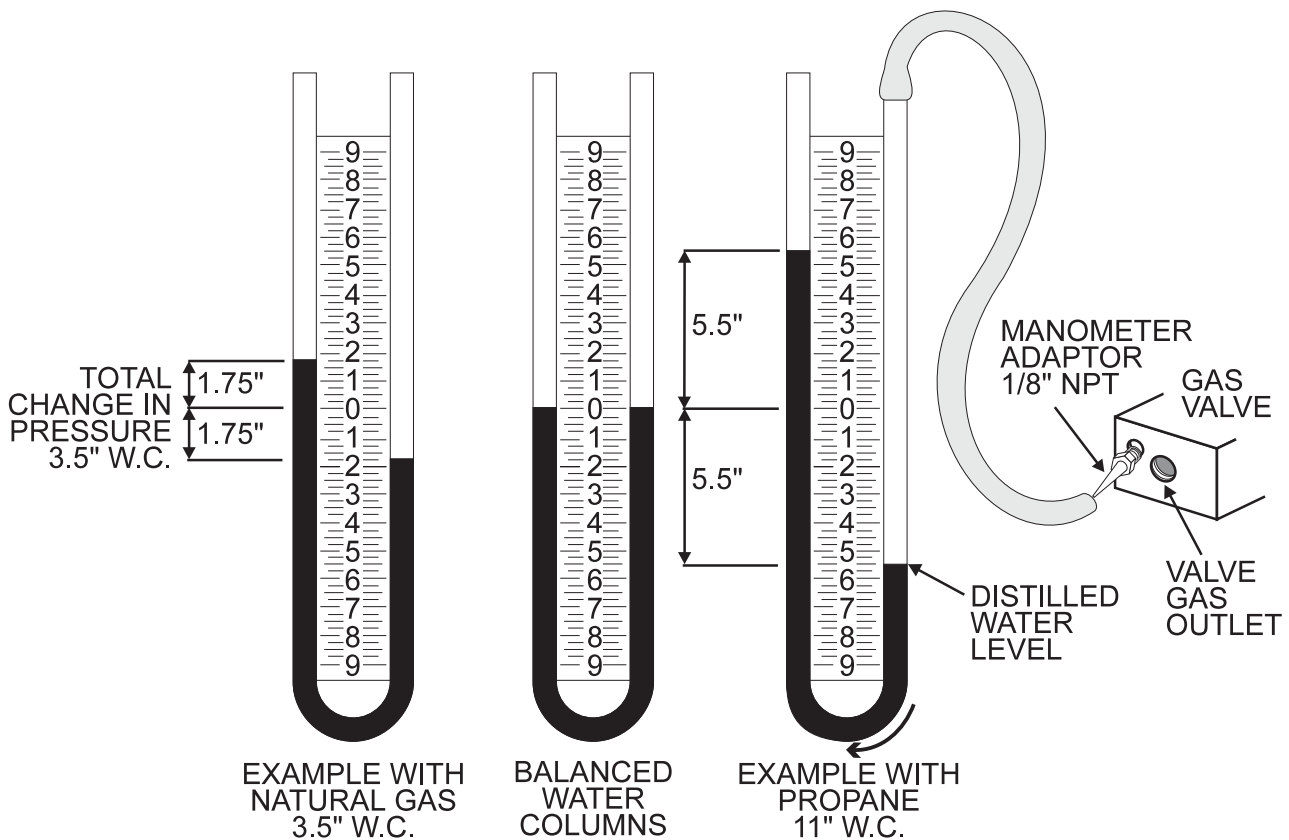
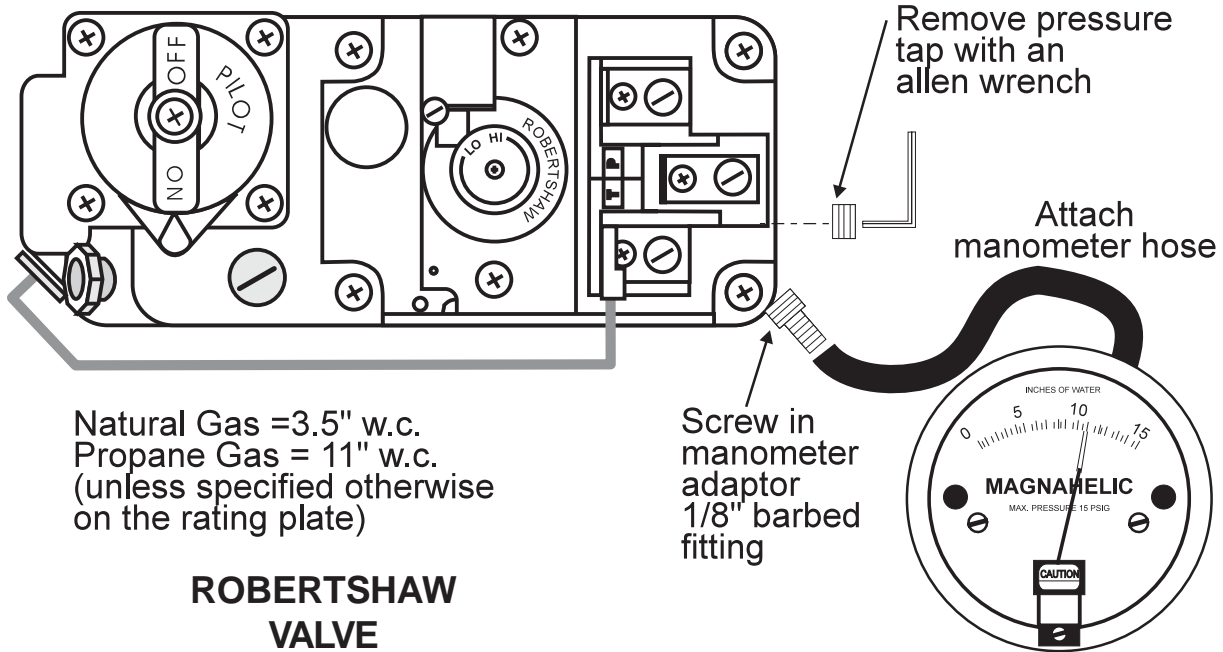


S.I.T. VALVE (View from rear)



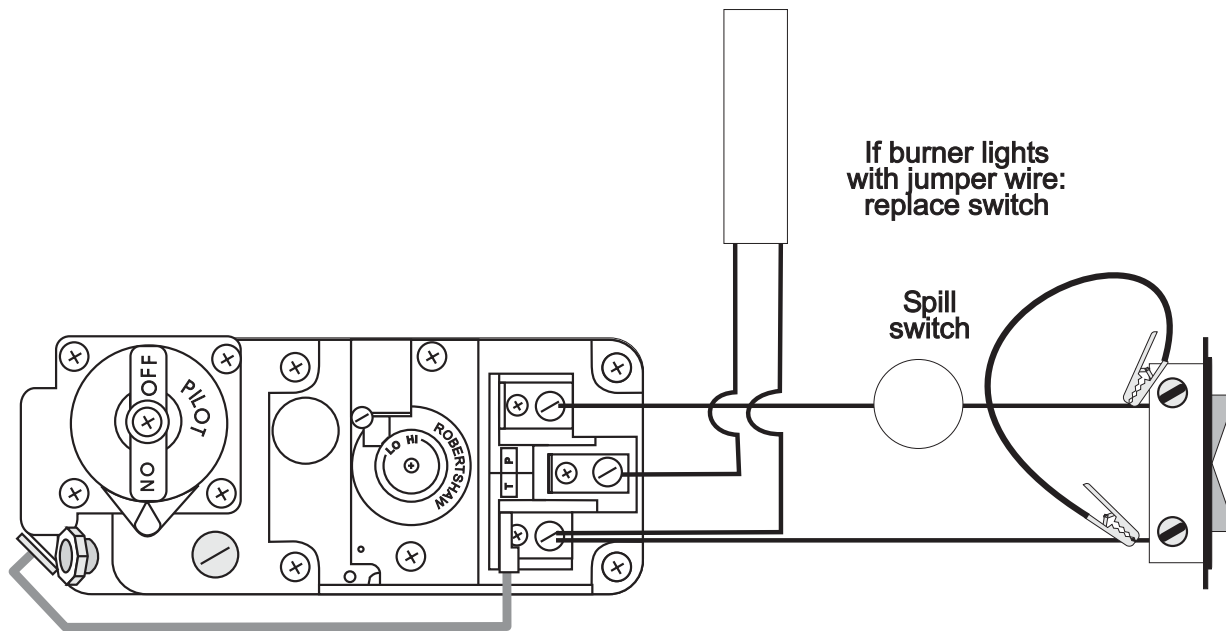
CHECKING GAS PRESSURE TS-10

Light gas appliance,
note gas pressure reading
and adjust as necessary

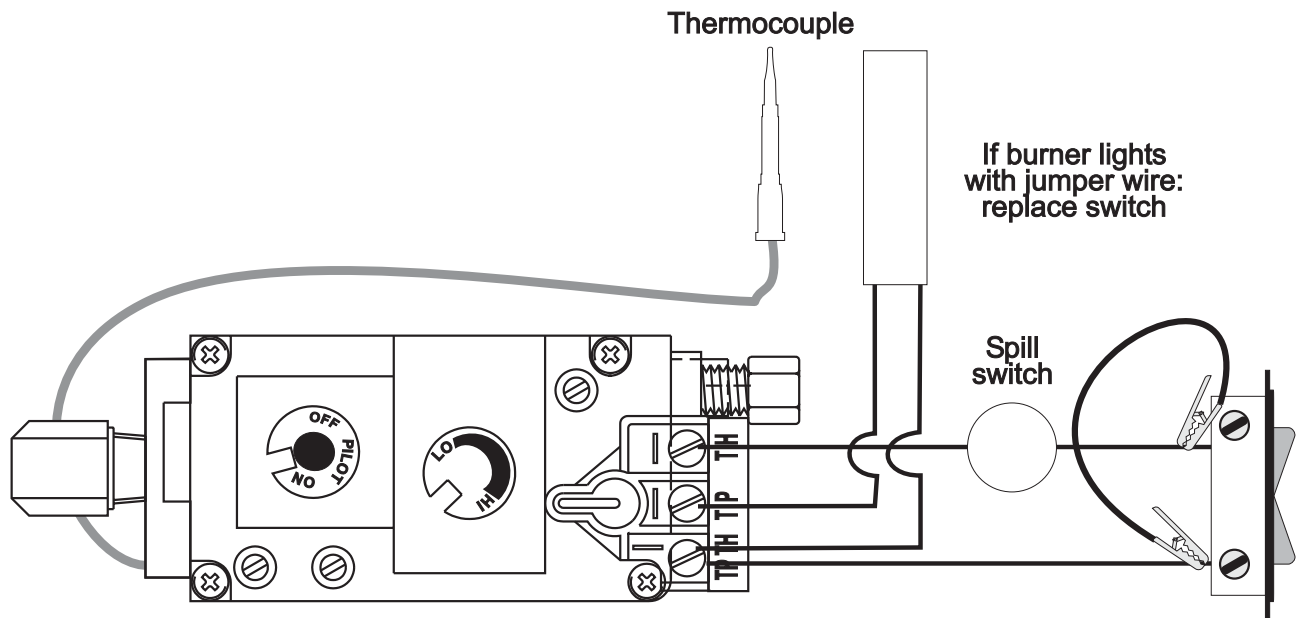




SWITCH JUMPER WIRE TEST TS-11

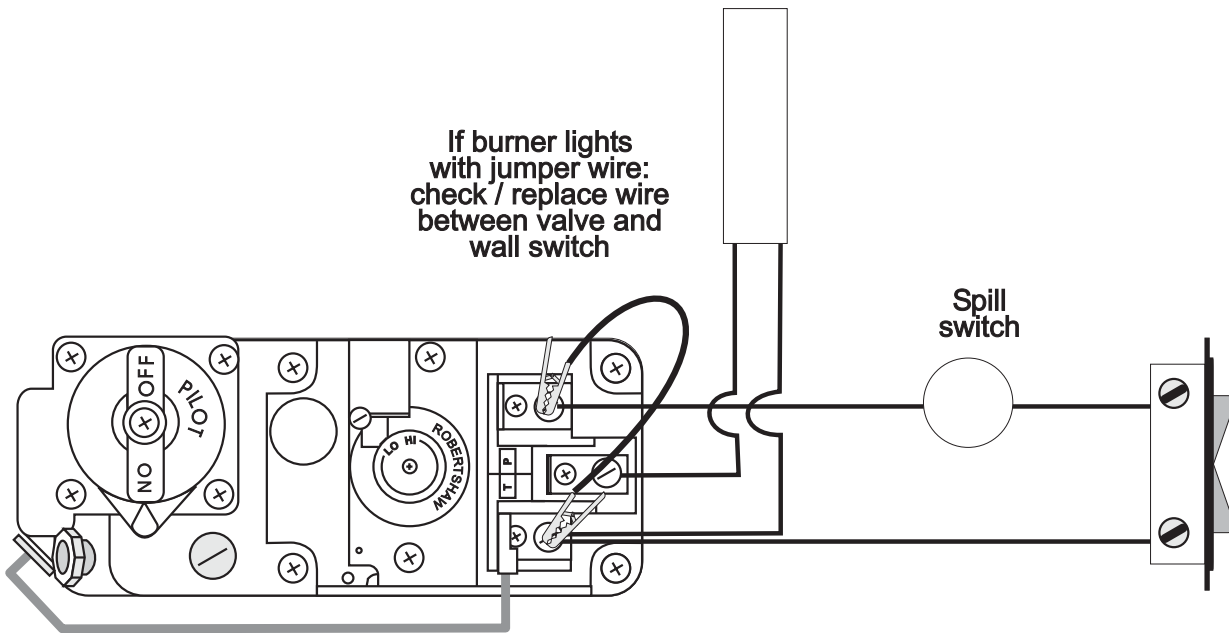


ROBERTSHAW VALVE

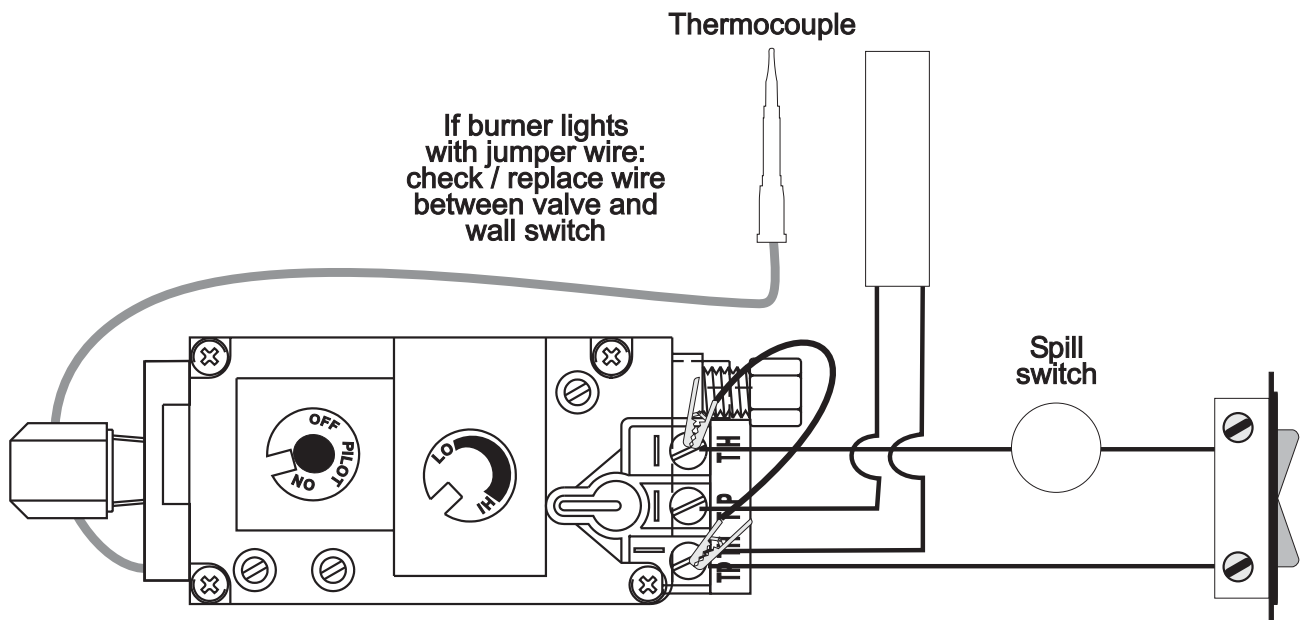


S.I.T. VALVE

SWITCH JUMPER WIRE TEST TS-12



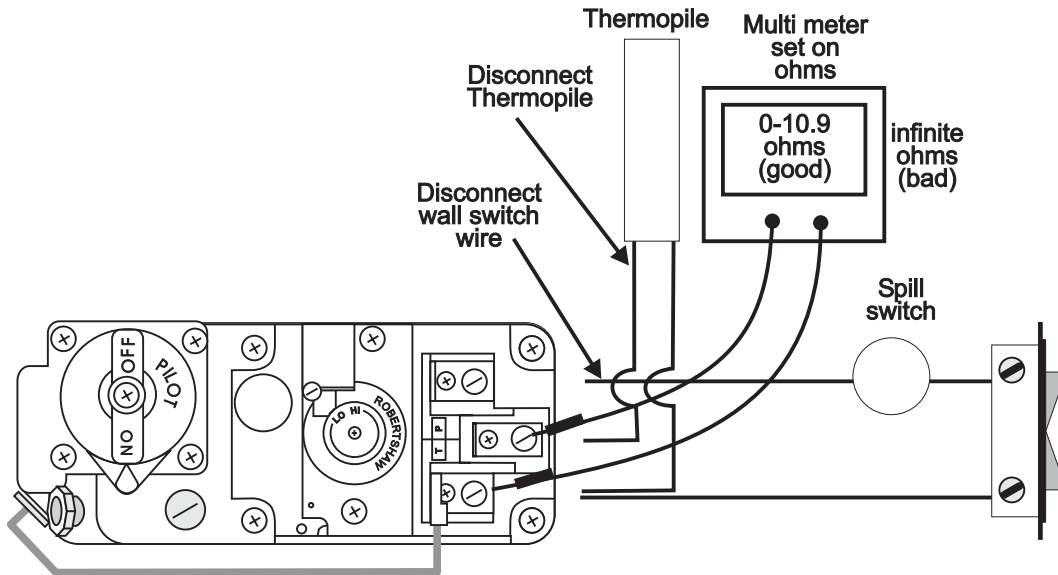
ROBERTSHAW VALVE



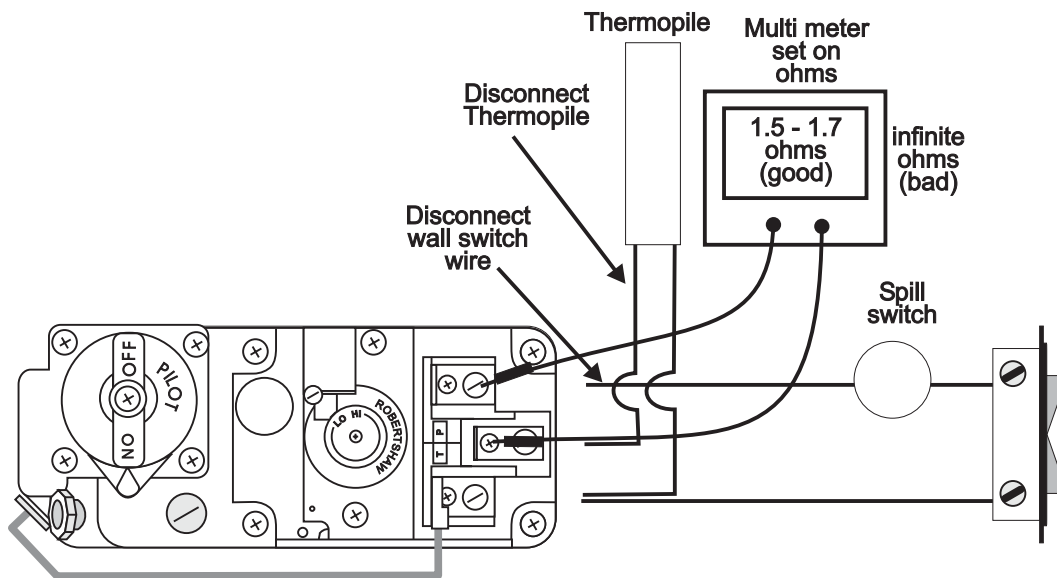
S.I.T. VALVE



VALVE OPERATING HEAD TEST TS-13

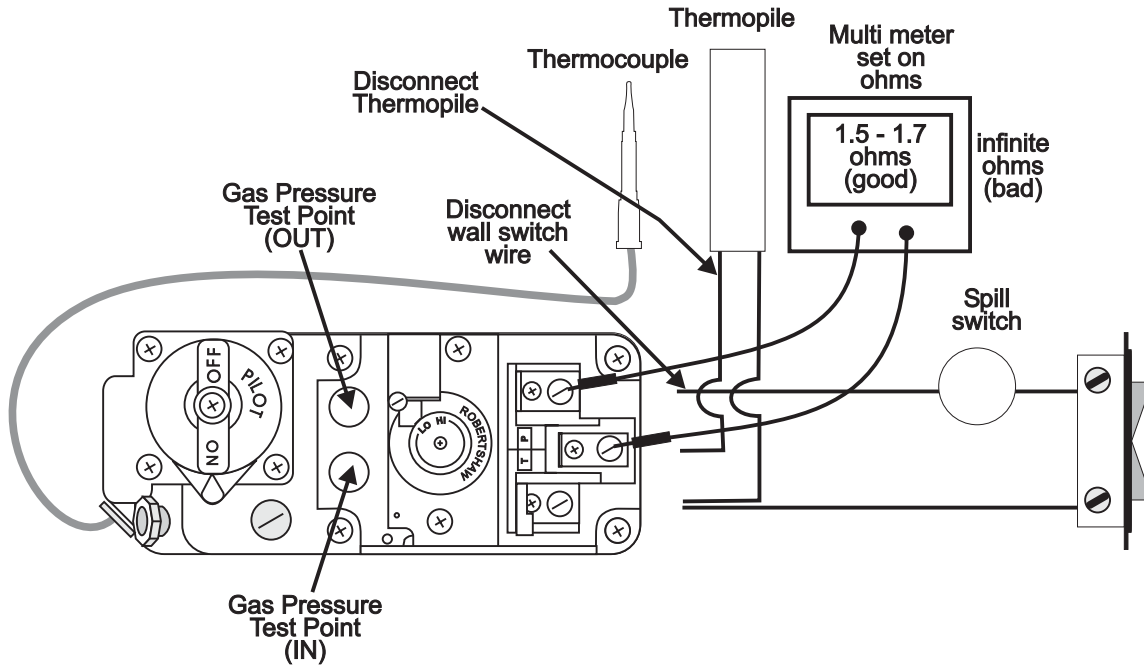


ROBERTSHAW VALVE (1)

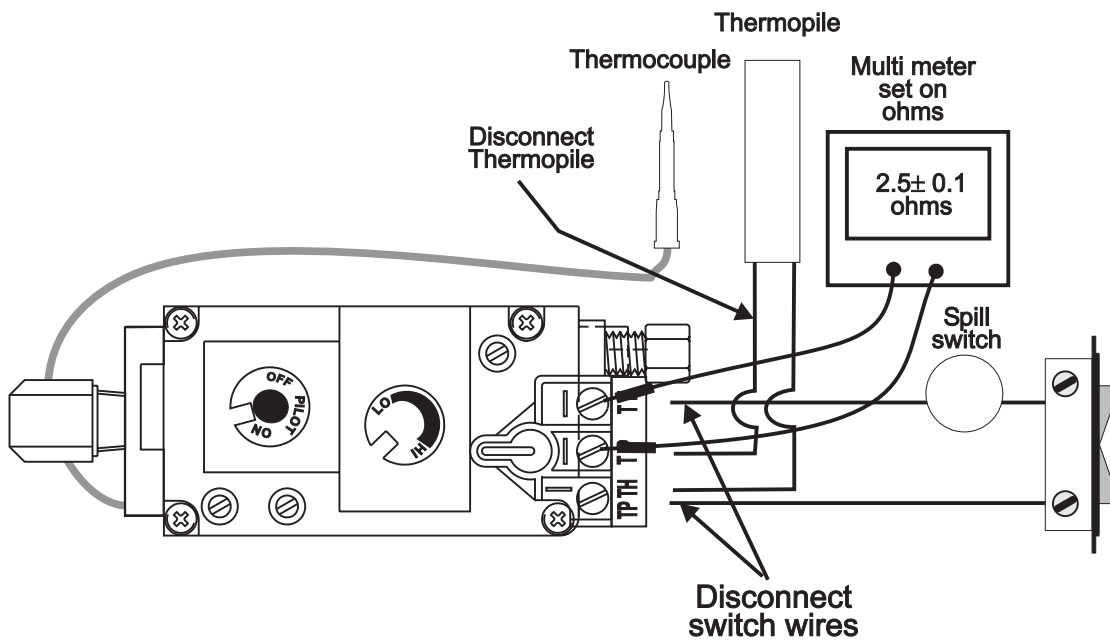


ROBERTSHAW VALVE (2)

VALVE OPERATING HEAD TEST TS-13A



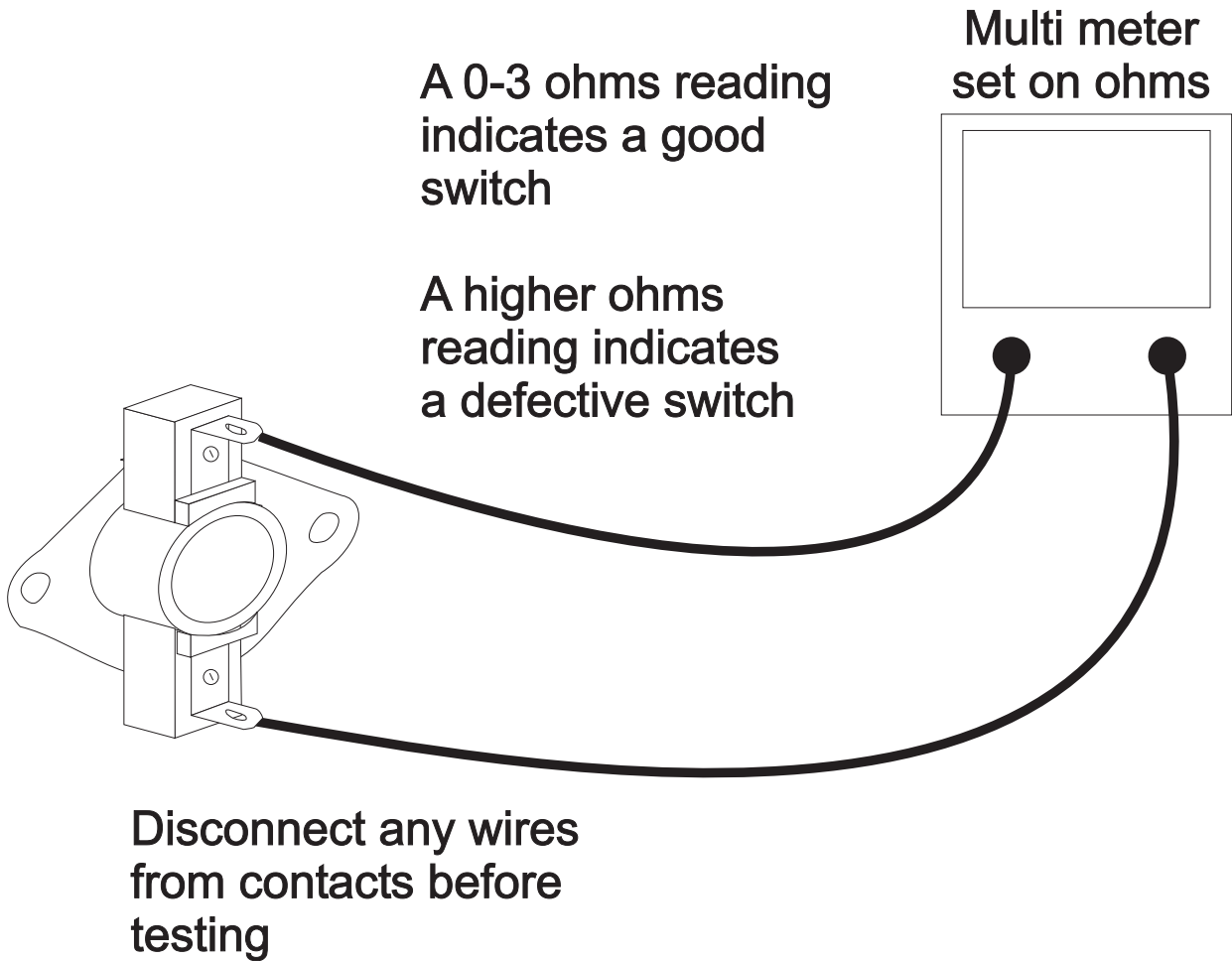
ROBERTSHAW QUICK DROP-OUT VALVE



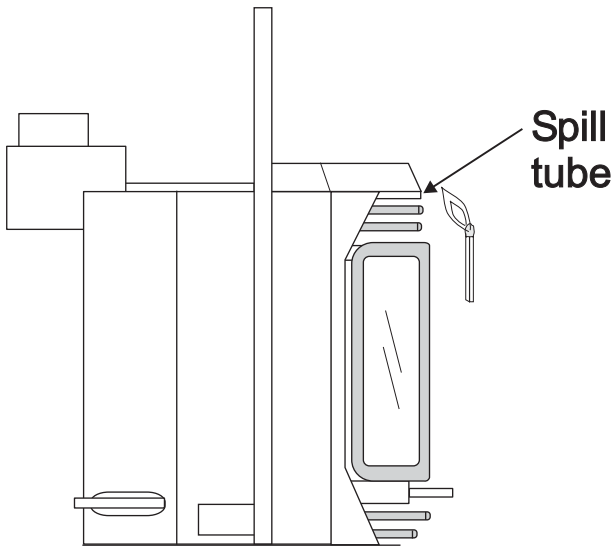
S.I.T. VALVE



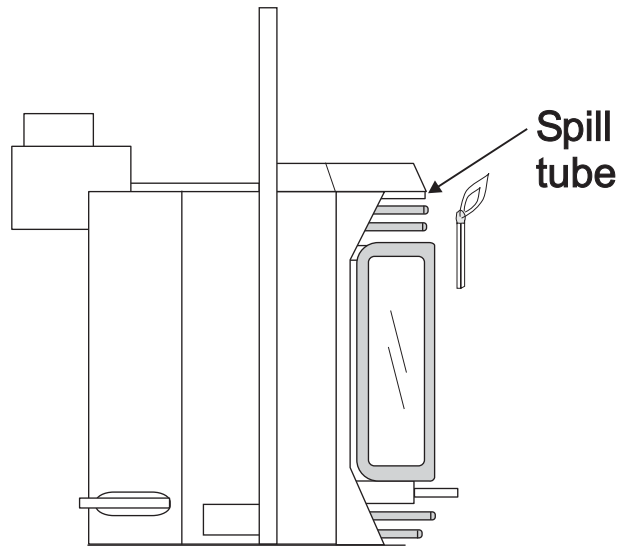
SPILL SWITCH TESTING TS-14



**FLUE GAS SPILLAGE TEST
TS-15**

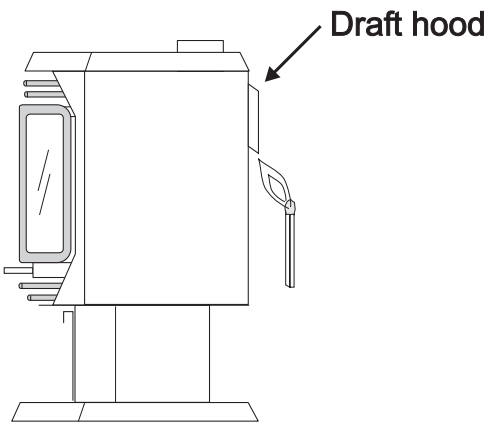


**Flame in
Drawn in: No spillage/
Good draft**

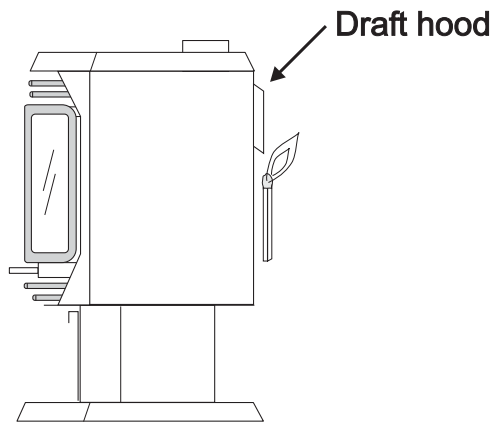


**Flame out
Blown out: Spillage/Backdrafting**

**FLUE GAS SPILLAGE TEST
TS-15A**



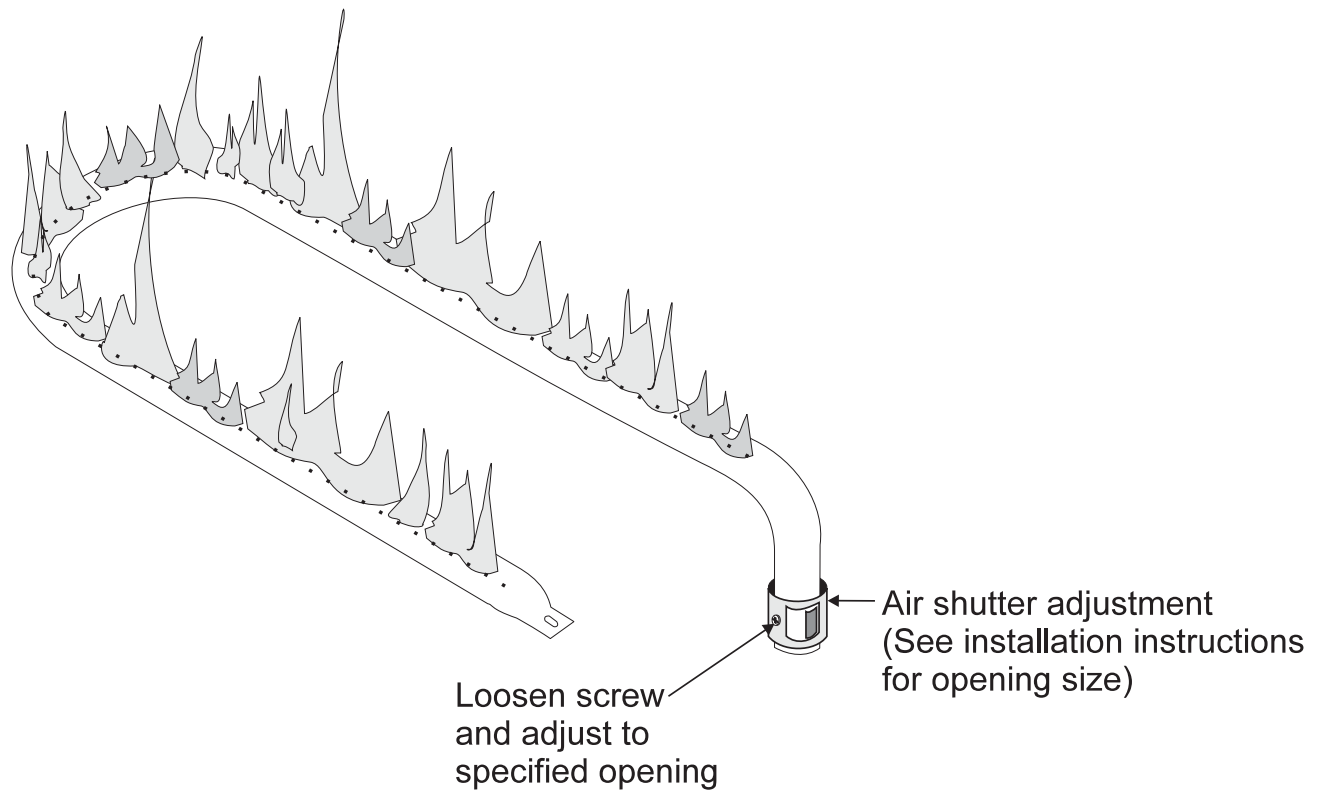
**Flame in
Drawn in: No spillage/
Good Draft**



**Flame out
Blown out: Spillage/ Backdrafting**



AIR SHUTTER ADJUSTMENT TS-16



Closed - Tall yellow (potential for carbon) Open - Short blue



TABLE 1

MASONRY CHIMNEY LINER DIMENSIONS WITH CIRCULAR EQUIVALENTS			
NOMINAL LINER SIZE IN INCHES	INSIDE DIMENSIONS IN LINER INCHES	INSIDE DIA. OR EQUIVALENT DIA. IN INCHES	EQUIVALENT AREA SQUARE INCHES
4 X 8	2-1/2 X 6-1/2	4	12.2
		5	19.6
		6	28.3
		7	38.3
		7.4	42.7
8 x 8	6-3/4 x 6-3/4	8	50.3
8 x 12	6-1/2 x 10-1/2	9	63.6
		10	78.5
12 x 12	9-3/4 x 9-3/4	10.4	83.3
		11	95
12 x 16	9-1/2 x 13-1/2	11.8	107.5
		12	113
		14	153.9
16 x 16	13-1/4 x 13-1/4	14.5	162.9
		15	176.7
16 x 20	13 x 17	16.2	206.1
		18	254.4
20 x 20	16-3/4 x 16-3/4	18.2	260.2
		20	314.1
20 x 24	16-1/2 x 20-1/2	20.1	314.2
		22	380.1
24 x 24	20-1/4 x 20-1/4	22.1	380.1
		24	452.3
		24.1	456.2
24 x 28	20-1/2 x 24-1/4	26.4	543.3
		27	572.5
28 x 28	24-1/4 x 24-1/4	27.9	607
		30	706.8
30 x 30	25-1/2 x 25-1/2	30.9	749.9
		33	855.3
30 x 36	25-1/2 x 31-1/2	34.4	929.4
		36	1017.9
36 x 36	31-1/2 x 31-1/2		

When liner sizes differ dimensionally from those shown in Table 1, equivalent diameters may be determined from published tables for square and rectangular ducts of equivalent carrying capacity or by other engineering methods.



Table 2
Vent Tables (Including 2 x 90° Elbows)
Capacity of Type B Double-Wall Vents with Type B Double-Wall
Connectors Serving a Single Category Appliance

		Vent and connector diameter - D (inches)																							
		3"			4"			5"			6"			7"			8"			9"					
HEIGHT (FT.)	LATERAL (FT.)	Appliance Input Rating in Thousands of Btu Per Hour																							
		FAN			NAT			FAN			NAT			FAN			NAT			FAN			NAT		
		Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.	Min.	Max.	Max.
6	0	0	78	46	0	152	86	0	251	141	0	375	205	0	524	285	0	698	370	0	897	470			
	2	13	51	36	18	97	67	27	157	105	32	232	157	44	321	217	53	425	285	63	543	370			
	4	21	49	34	30	94	64	39	153	103	50	227	153	66	316	211	79	419	279	93	536	362			
8	6	25	46	32	36	91	61	47	149	100	59	223	149	78	310	205	93	413	273	110	530	354			
	0	0	84	50	0	165	94	0	276	155	0	415	235	0	583	320	0	780	415	0	1006	537			
	2	12	57	40	16	109	75	25	178	120	28	263	180	42	365	247	50	483	322	60	619	418			
10	5	23	53	38	32	103	71	42	171	115	53	255	173	70	356	237	83	473	313	99	607	407			
	8	28	49	35	39	98	66	51	164	109	64	247	165	84	347	227	99	463	303	117	596	396			
	0	0	88	53	0	175	100	0	295	166	0	447	255	0	631	345	0	847	450	0	1096	585			
15	2	12	61	42	17	118	81	23	194	129	26	289	195	40	402	273	48	533	355	57	684	457			
	5	23	57	40	32	113	77	41	187	124	52	280	188	68	392	263	81	522	346	95	671	446			
	10	30	51	36	41	104	70	54	176	115	67	267	175	88	376	245	104	504	330	122	651	427			
20	0	0	94	58	0	191	112	0	327	187	0	502	285	0	716	390	0	970	525	0	1263	682			
	2	11	69	48	15	136	93	20	226	150	22	339	225	38	475	316	45	633	414	53	815	544			
	5	22	65	45	30	130	87	39	219	142	49	330	217	64	463	300	76	620	403	90	800	529			
30	10	29	59	41	40	121	82	51	206	135	64	315	208	84	445	288	99	600	386	116	777	507			
	15	35	53	37	48	112	76	61	195	128	76	301	198	98	429	275	115	580	373	134	755	491			
	0	0	97	61	0	202	119	0	349	202	0	540	307	0	776	430	0	1057	575	0	1384	752			
50	2	10	75	51	14	149	100	18	250	166	20	377	249	33	531	346	41	711	470	50	917	612			
	5	21	71	48	29	143	96	38	242	160	47	367	241	62	519	337	73	697	460	86	902	599			
	10	28	64	44	38	133	89	50	229	150	62	351	228	81	499	321	95	675	443	112	877	576			
100	15	34	58	40	46	124	84	59	217	142	73	337	217	94	481	308	111	654	427	129	853	557			
	20	48	52	35	55	116	78	69	206	134	84	322	206	107	464	295	125	634	410	145	830	537			
	0	0	100	64	0	213	128	0	374	220	0	587	336	0	853	475	0	1173	650	0	1548	855			
150	2	9	81	56	13	166	112	14	283	185	18	432	280	27	613	394	33	826	535	42	1072	700			
	5	21	77	54	28	160	108	36	275	176	45	421	273	58	600	385	69	811	524	82	1055	688			
	10	27	70	50	37	150	102	48	262	171	59	405	261	77	580	371	91	788	507	107	1028	668			
200	15	33	64	NR	44	141	96	57	249	163	70	389	249	90	560	357	105	765	490	124	1002	648			
	20	56	58	NR	53	132	90	66	237	154	80	374	237	102	542	343	119	743	473	139	977	628			
	30	NR	NR	NR	73	113	NR	88	214	NR	104	346	219	131	507	321	149	702	444	171	929	594			
300	0	0	101	67	0	216	134	0	397	232	0	633	363	0	932	518	0	1297	708	0	1730	952			
	2	8	86	61	11	183	122	14	320	206	15	497	314	22	715	445	26	975	615	33	1276	813			
	5	20	82	NR	27	177	119	35	312	200	43	487	308	55	702	438	65	960	605	77	1259	798			
400	10	26	76	NR	35	168	114	45	299	190	56	471	298	73	681	426	86	935	589	101	1230	773			
	15	59	70	NR	42	158	NR	54	287	180	66	455	288	85	662	413	100	911	572	117	1203	747			
	20	NR	NR	NR	50	149	NR	63	275	169	76	440	278	97	642	401	113	888	556	131	1176	722			
500	30	NR	NR	NR	69	131	NR	84	250	NR	99	410	259	123	605	376	141	844	522	161	1125	670			
	0	NR	NR	NR	0	218	NR	0	407	NR	0	665	400	0	997	560	0	1411	770	0	1908	1040			
	2	NR	NR	NR	10	194	NR	12	354	NR	13	566	375	18	831	510	21	1155	700	25	1536	935			
600	5	NR	NR	NR	26	189	NR	33	347	NR	40	557	369	52	820	504	60	1141	692	71	1519	926			
	10	NR	NR	NR	33	182	NR	43	335	NR	53	542	361	68	801	493	80	1118	679	94	1492	910			
	15	NR	NR	NR	40	174	NR	50	321	NR	62	528	353	80	782	482	93	1095	666	109	1465	895			
700	20	NR	NR	NR	47	166	NR	59	311	NR	71	513	344	90	763	471	105	1073	653	122	1438	880			
	30	NR	NR	NR	NR	NR	NR	78	290	NR	92	483	NR	115	726	449	131	1029	627	149	1387	849			
	50	NR	NR	NR	NR	NR	NR	NR	NR	NR	147	428	NR	180	651	405	197	944	575	217	1288	787			



Table 3
NG & LP Gases
Btu Per Hour at Sea Level

	Natural Gas	Propane
Btu per Cubic Foot =	1,000	2,500
Specific Gravity =	0.6	1.53
Pressure at Orifice, Inches Water Column	3.5"	11"
Orifice Coefficient =	0.9	0.9

For Altitudes above 2,000 feet, first select the equivalent orifice size at sea level refer to CAN/CGA-B149 in Canada and the National Fuel Gas Code in the U.S.

DRILL SIZE DECIMAL OR DMS	GAS INPUT, BTU PER HOUR		DRILL SIZE DECIMAL OR DMS	GAS INPUT, BTU PER HOUR	
	Natural Gas	Propane		Natural Gas	Propane
80	520	1,430	53	10,020	27,790
79	590	1,655	52	11,430	31,730
78	720	2,015	51	12,690	35,330
77	920	2,545	50	13,880	38,500
76	1,130	3,140	49	15,110	41,850
75	1,250	3,465	48	16,370	45,450
74	1,430	3,985	47	17,450	48,400
73	1,630	4,525	46	18,570	51,500
72	1,770	4,920	45	19,030	52,900
71	1,910	5,320	44	20,910	58,050
70	2,220	6,180	43	22,420	62,200
69	2,420	6,710	42	24,730	68,700
68	2,720	7,560	41	26,060	72,450
67	2,900	8,040	40	27,220	75,400
66	3,090	8,550	39	28,010	77,850
65	3,470	9,630	38	29,200	81,000
64	3,670	10,200	37	30,640	85,000
63	3,880	10,800	36	32,190	89,200
62	4,090	11,360	35	34,250	95,000
61	4,310	11,930	34	34,900	97,000
60	4,530	12,570	33	36,120	101,000
59	4,760	13,220	32	38,030	105,800
58	4,990	13,840	31	40,740	113,200
57	5,230	14,550	30	46,790	129,700
56	6,130	16,990	29	52,350	145,700
55	7,680	21,200	28	55,880	154,700
54	8,580	23,850	27	58,730	163,100



Table 4
Number Drill Sizes

No.	Inches	No.	Inches	No.	Inches
80	.0135	53	.0595	26	.147
79	.0145	52	.0635	25	.1495
78	.016	51	.067	24	.152
77	.018	50	.070	23	.154
76	.020	49	.073	22	.157
75	.021	48	.076	21	.159
74	.0225	47	.0785	20	.161
73	.024	46	.081	19	.166
72	.025	45	.082	18	.1695
71	.026	44	.086	17	.173
70	.028	43	.089	16	.177
69	.0293	42	.0935	15	.180
68	.031	41	.096	14	.182
67	.032	40	.098	13	.185
66	.033	39	.0995	12	.189
65	.035	38	.1015	11	.191
64	.036	37	.104	10	.1935
63	.037	36	.1065	9	.196
62	.038	35	.110	8	.199
61	.039	34	.111	7	.201
60	.040	33	.113	6	.204
59	.041	32	.116	5	.2055
58	.042	31	.120	4	.209
57	.043	30	.1285	3	.213
56	.0465	29	.136	2	.221
55	.052	28	.1405	1	.228
54	.055	27	.144		



Table 5
Maximum Capacity of Pipe in Thousands of Btu per Hour
for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of
0.3 Inch Water Column
 (Based on a 0.60 Specific Gravity & 1,025 Btu/scf Gas)

Nominal Iron Pipe Size	Internal Pipe Dia.	Length of Pipe, Feet																
		10	20	30	40	50	60	70	80	90	100	125	150	175	200			
Inches	Inches	10	20	30	40	50	60	70	80	90	100	125	150	175	200			
1/4	0.364	33	23	18	15	14	12	11	11	10	9	8	8	7	6			
3/8	0.493	74	50	41	35	31	28	26	24	23	22	18	17	15	14			
1/2	0.622	135	94	75	65	57	51	47	44	41	39	35	32	29	27			
3/4	0.824	285	195	156	133	118	108	98	92	86	81	74	66	60	56			
1	1.049	533	359	292	251	220	200	184	174	164	154	133	123	113	102			
1-1/4	1.38	1,076	748	605	513	451	410	379	359	328	313	282	256	231	215			
1-1/2	1.61	1,640	1,128	912	779	687	625	574	543	502	471	420	389	359	328			
2	2.067	3,126	2,153	1,691	1,486	1,302	1,179	1,076	1,015	953	892	799	174	666	625			
2-1/2	2.469	4,920	3,382	2,767	2,358	2,050	1,896	1,742	1,640	1,537	1,435	1,281	1,158	1,076	1,004			
3	3.068	8,713	6,047	4,818	4,203	3,690	3,331	3,075	2,870	2,665	2,563	2,255	2,050	1,896	1,742			
4	4.026	17,938	12,300	9,943	8,508	7,585	6,970	6,355	5,945	5,535	5,228	4,613	4,203	3,895	3,587			



Table 6
Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour
for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of
0.3 Inch Water Column
 (Based on a 0.60 Specific Gravity & 1,025 Btu/scf Gas)

Outside Diameter Inches	Length of Pipe, Feet															
	10	20	30	40	50	60	70	80	90	100	125	150	175	200		
3/8	21	14	11	10	9	8	7	7	6	6	5	5	4	4		
1/2	43	30	24	21	18	16	151	4	13	12	11	10	9	8		
5/8	88	60	48	41	37	34	31	29	27	26	23	21	18	17		
3/4	154	106	85	73	65	58	53	50	47	44	39	36	33	31		
7/8	217	150	120	102	91	83	76	71	67	63	55	50	46	43		



Table 7
Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour for Gas Pressures of Undiluted Liquefied Petroleum Gases (at 11 Inch Water Column Inlet Pressure)
 (Based on a Pressure Drop of 0.5 inch Water Column)

Outside Diameter Inches	Length of Pipe, Feet										
	10	20	30	40	50	60	70	80	90	100	
3/8	29	26	21	19	-	-	-	-	-	-	-
1/2	92	62	50	41	37	35	31	29	27	26	
5/8	199	131	107	90	79	72	67	62	59	55	
3/4	329	216	181	145	131	121	112	104	95	90	
7/8	501	346	277	233	198	187	164	155	146	138	



CONVERSION TABLE

Multiply this	by this	to obtain	
British thermal unit (Int.)	1055.06	joule	J
Btu per cubic foot	37.2591	kilojoule per cubic meter	kJ/m ³
Btu per cubic foot °F	67.0661	kilojoule per cubic meter degree Celsius	kJ/(m ³ °C)
Btu per pound	2.326	kilojoule per kilogram	kJ/kg
Btu per pound °F	4.1868	kilojoule per kilogram degree Celsius	kJ/kg°C
centimeter	0.39370	inch	
centimeter of water (4°C)	98.06378	pascal	Pa
cord (stacked volume 128 ft ³) (solid volume 71 - 85 ft ³)	3.6246	cu. meter (stacked volume) (solid volume 2.0 - 2.4 m ³)	m ³
cubic centimeter	0.06102	cubic inch	
cubic centimeter	0.001	liter	L
cubic foot	0.028317	cubic meter	m ³
cubic foot	28.31685	liter	L
cubic foot per hour	28.31685	liter per hour	L/h
cubic foot per minute	0.4719474	liter per second	L/s
cubic foot per second	0.2831685	cubic meter per second	m ³ /s
cubic foot per second	28.31685	liter per second	L/s
cubic inch	16.387064	cubic centimeter	cm ³
cubic inch	16387.064	cubic millimeter	mm ³
cubic meter	0.2759	cord	
cubic meter	1.3080	cubic yard	
cubic meter	35.3147	cubic foot	
cubic meter	219.97	gallon	
degree (angle)	0.017453	radian	rad
degree (temperature)	see end of this table		
foot	0.3048	meter	m
foot	304.8	millimeter	mm
foot of water (4°C)	2.98898	kilopascal	kPa
foot per minute	0.00508	meter per second	m/s
foot per second	0.3048	meter per second	m/s
gallon (imperial)	4.54609	liter	L
gallon (US)	3.785412	liter	L
gallon per minute	0.075768	liter per second	L/s
horsepower (boiler)	9.80950	kilowatt	kW
horsepower (boiler)	33461	Btu	Btu
horsepower (electric)	746	watt	W
horsepower (electric)	0.746	kilowatt	kW
horsepower (550 ft lb/s)	0.74569	kilowatt	kW
horsepower hour	2.68452	megajoule	MJ
inch	2.54	centimeter	cm



Multiply this	by this	to obtain	
inch	0.0254	meter	m
inch	25.4	millimeter	mm
inch of water (4°C)	0.249	kilopascal	kPa
joule	0.0009478	Btu (international)	
joule	0.2778 x 10 ⁶	kilowatt hour	kW h
joule per liter	0.026839	Btu per cubic foot	
kilogram	2.20462	pound	
kilojoule per cubic meter	0.026839	Btu per cubic foot	
kilojoule per cubic meter	0.004309	Btu per gallon	
kilojoule per kilogram	0.429923	Btu per pound	
kiloliter	35.315	cubic foot	
kiloliter	219.969	gallon	
kilometer	0.621371	mile	
kilometer per hour	0.277778	meter per second	m/s
kilopascal	0.2953	inch of mercury (0°C)	
kilopascal	4.01474	inch of water (4°C)	
kilowatt	0.94781	Btu (international)	
kilowatt	1.34048	horsepower (electric)	
kilowatt hour	3412	Btu (international)	
kilowatt hour	3.6	megajoule	MJ
liter	0.035315	cubic foot	
liter	0.219969	gallon	
liter per second	2.11888	cubic foot per minute	
liter per second	13.1982	gallon per minute	
meter	39.370	inch	
meter	3.28084	foot	
meter	1.0936	yard	
mile	1.609344	kilometer	km
millimeter	0.03937	inch	
ounce-force per square inch	0.430922	kilopascal	kPa
pint	0.568261	liter	L
pound	453.59237	gram	g
pound	0.45359	kilogram	kg
pound per cubic foot	16.01846	kilogram per cubic meter	kg/m ³
pound per cubic inch	27.67990	gram/cubic centimeter	g/cm ³
pound per cubic inch	27.67990	kilogram per liter	kg/L
pound per cubic yard	0.593276	kilogram per cubic meter	kg/m ³
pound per hour	0.453592	kilogram per hour	kg/h
pound-force per square foot	0.04788	kilopascal	kPa
pound-force per square inch	6.894757	kilopascal	kPa
quart	1.136522	liter	L
quart (US)	0.946353	liter	L



Multiply this	by this	to obtain	
square centimeter	0.1550	square inch	
square centimeter	0.0001	square meter	m ²
square centimeter	100	square millimeter	mm ²
square foot	0.0929030	square meter	m ²
square inch	6.4516	square centimeter	cm ²
square inch	645.16	square millimeter	mm ²
square meter	10.7639	square foot	
square meter	1.19599	square yard	
square millimeter	0.001	square centimeter	cm ²
square millimeter	0.001550	square inch	
square yard	0.8361274	square meter	m ²
ton - long (2240 pounds)	1.016046	tonne or metric ton	t
ton - short (2000 pounds)	0.907184	tonne or metric ton	t
watt hour	3.600	kilojoule	kJ
watt hour	3.412	Btu (international)	
watt per square foot	10.76391	watt per square meter	W/m ²
yard	0.9144	meter	m

Temperature Conversions

degree Celsius $(^{\circ}\text{C} \times 1.8) + 32 = \text{degree Fahrenheit}$
degree Fahrenheit $(^{\circ}\text{F} - 32) \times 0.555 = \text{degree Celsius}$

FIREPLACE PRODUCTS INTERNATIONAL LTD.
manufactures products under the following brandnames:



WATERFORD

Fine Porcelain Enamel, Cast Iron Stoves from Ireland