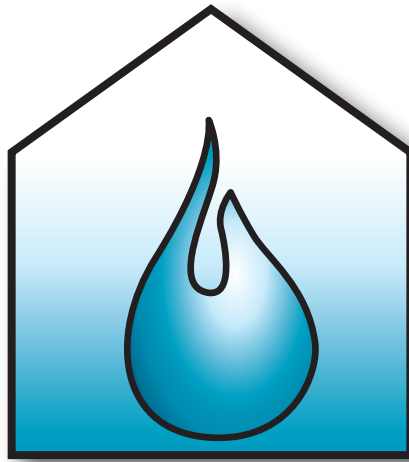


FOR
THE
HEATING
PROFESSIONAL



Guide
to
**Power Gas
Burners**

Beckett

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Before Calling a Manufacturer's Tech Service . . .

Before contacting us about your burner, you must have a completely filled out copy of the ***Contractor Start-Up Form*** (Located inside of last page). This information is crucial for troubleshooting and obtaining the correct replacement parts.

Please refer to the latest edition of the Beckett CG4 gas burner manual for complete specifications and installation instructions regarding the Beckett CG4 burner. The procedures in this document should be used as a supplement to the equipment manufacturer's recommended installation and service instructions and do not preclude other accepted guideline documents on good industry practice.

This is a guide to power gas burners; it is not intended to supersede the appliance or burner manufacturer's published specifications. Always follow the appliance or burner manufacturer's published instructions, wiring diagrams and recommendations.

For technical assistance please call 1-800-645-2876 (8:00am - 5:00pm EST, Mon-Fri)

ANSI Z21.17 Gas Conversion Burner Standard, requires specific warnings to be placed on the cover of all instruction manuals for gas conversion burners. Below are examples of these types of warnings which must be understood and followed.

! WARNING

Fire or Explosion Hazard



Can cause severe injury, death or property damage

If the information in these instructions is not followed exactly, a fire or explosion may result causing personal injury, death or property damage.

- ***Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.***
- ***WHAT TO DO IF YOU SMELL GAS***
 - Do not try to light any appliance
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- ***Installation and service must be performed by a qualified installer, service agency or the gas supplier.***

! WARNING

Fire, Explosion or Carbon Monoxide Poisoning Hazard



Can cause severe injury, death or property damage

This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. (In Canada, in accordance with the requirements of the CAN/CGA-B149 Installation Codes.) If the information in these instructions is not followed exactly, a fire, explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instructions supplied with the kit.

Safety Check-off List

Recommendations

- ☐ Follow installation manual instructions.
- ☐ Verify incoming gas pressure.
- ☐ Verify the BTU rating of gas meter.
- ☐ Verify that the pipe size meets the input BTU rating of the appliance (Reference **Tables 4,5,6 & 7** in following pages).
- ☐ Verify combustion air supply meets code requirements (consult local authorities for prevailing codes).
- ☐ Verify area around appliance is free of lint or pet hair.
- ☐ Verify condition and size of chimney and venting. Venting must comply with code, including construction, size and liner requirements.
- ☐ Verify condition and routing of smoke pipe. Total length should be as short as possible (Note the quantity of ells, tees and location of draft regulators).
- ☐ Verify type of draft regulator.
- ☐ Verify clearances to combustibles, including chimney connector, burner, and appliance.
- ☐ **NOTICE:** A manometer and combustion analyzer are required tools for proper installation and adjustment.

When Converting from Oil to Gas

- ☐ Thoroughly clean heat exchanger of appliance.
- ☐ Replace chamber kit.
- ☐ Seal up boiler sections, clean out plates and boiler mounting plate.
- ☐ Install double action draft regulator.
- ☐ Install thermal safety switch (Ex. Field Controls GSK-3 or similar).
- ☐ Adjust burner to operate at no less than 90% of input of the appliance rating plate ($GPH \times 140,000 \times .9 = \text{lowest BTU firing rate}$).
- ☐ Stack temperature must be set for a minimum of 325°F or appliance manufacturer's recommended setting.
- ☐ Failure to maintain proper stack temperature could result in flue gas condensing and cause chimney damage which could result in CO leakage into dwelling.

Installation

Flue Pipe

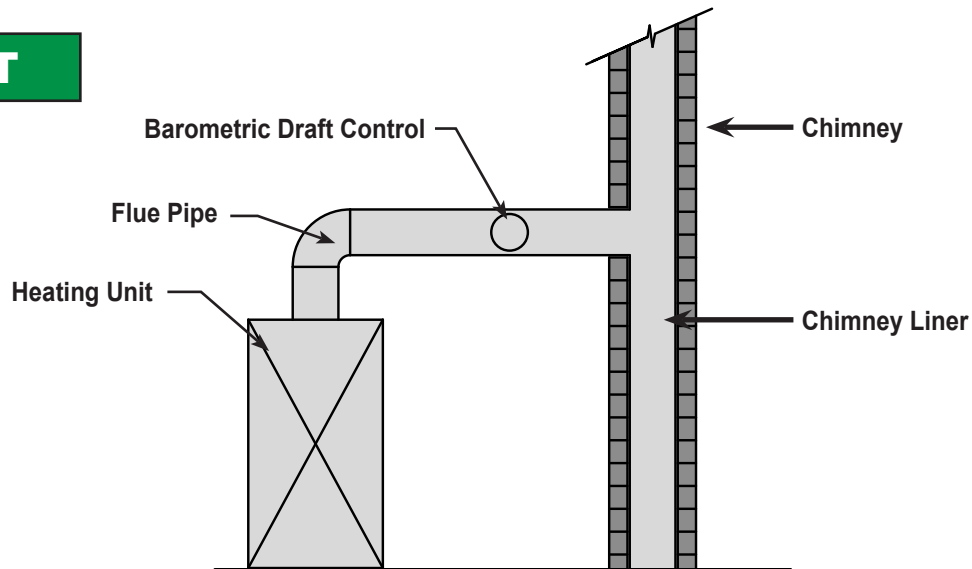
The flue pipe should be same size as the breech connection on the appliance. For modern units this should cause no problem in sizing the flue pipe.

NOTICE

- Please reference appliance instruction for chimney size.
- Chimney liners may be required by local code.

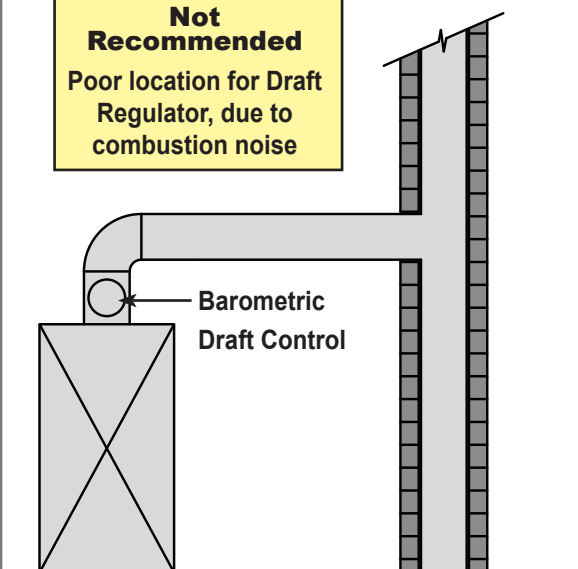
Figure 1 - Venting Single Appliance with Power Gas Burner

BEST



Not Recommended

Poor location for Draft Regulator, due to combustion noise



Not Recommended

Draft Regulator should not be installed in a bullheaded tee. Strongly recommend ells or 45°.

Barometric Draft Control

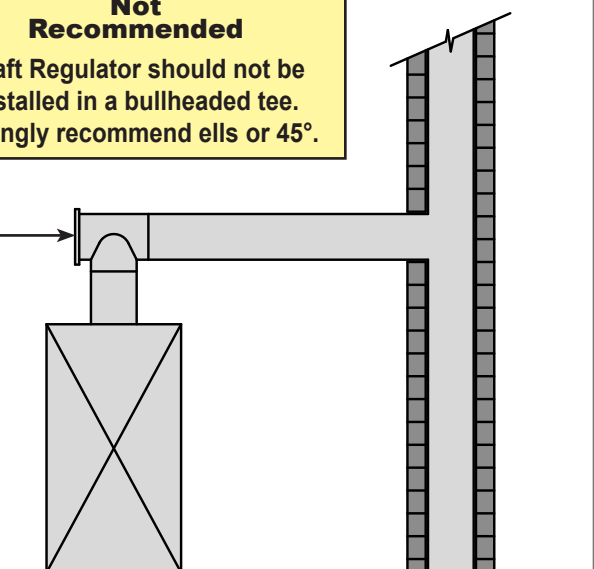
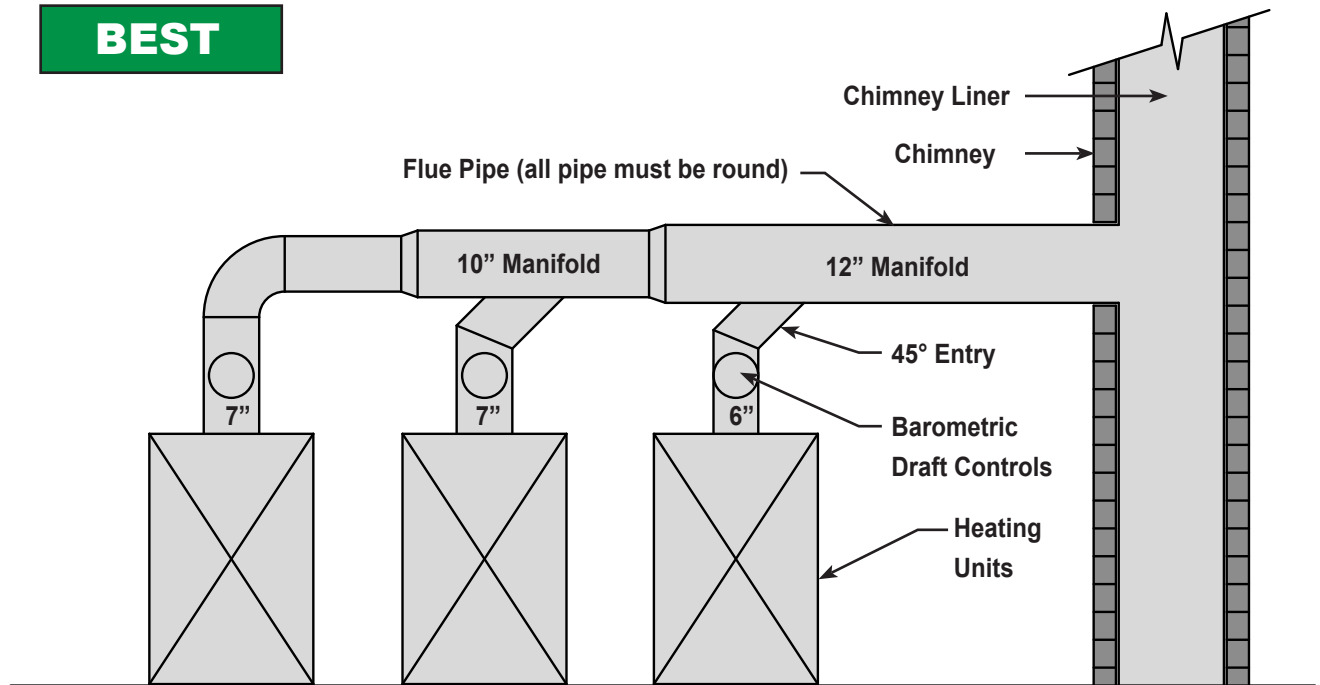


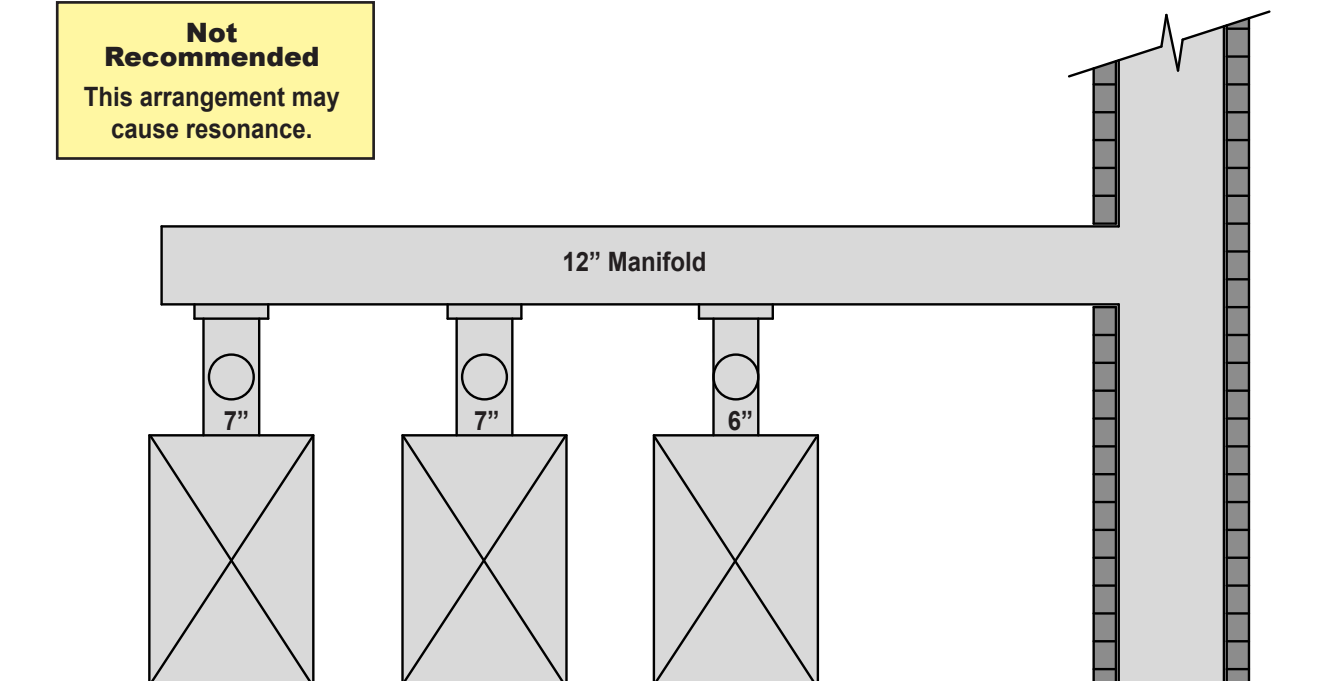
Figure 2 - Venting Multiple Appliances with Power Gas Burners

BEST



Not Recommended

This arrangement may cause resonance.



Thermal Safety Switch

Some local codes and gas utilities require the installation of a thermal safety switch on the double-acting draft regulator, or draft hood. This is a recommended practice and provides the following protection:

The thermal safety switch senses flue gas spillage caused by blocked flue exhaust, prolonged down-draft, or insufficient draft. The safety is wired in series with the burner control circuit. When the spillage of hot flue gases is detected it will shut off the burner.

For thermal safety switch application details, go to www.fieldcontrols.com.

See wiring section of this Guide Book for sample wiring locations of a Thermal Safety Switch.

Draft Regulator

When converting from oil to gas, the draft regulator must either be replaced or newly installed. It shall be a double-acting type, agency recognized for use with gas vent systems, such as Field Controls MG-1, or equivalent. (ANSI 21.8 "Installation of Gas Conversion Burner")

Stack Temperature & Carbon Monoxide



WARNING *Failure to maintain proper stack temperature could result in flue gas condensing and cause chimney damage which could result in CO leakage into dwelling.*

- The above warning regarding stack temperature is one that you will find throughout instruction manuals for gas appliances or gas burners. **Installation and adjustment of a gas burner has critical steps that must not be taken lightly.** Each year thousands of people are affected by carbon monoxide (CO) poisoning.
- High CO readings are the result of improper application, lack of combustion air, and/or improper ratio of air to fuel. **Merely adjusting a fire "by eye" is not acceptable.** A properly maintained, calibrated electronic combustion analyzer must be used to make final adjustments.

- Dew point is another factor in combustion which must be considered while finalizing adjustments (some combustion analyzers can calculate this). Flue gases will condense below the dew point. Dew points are inversely proportional to the percentage of excess air. As an example, the dew point of natural gas at 6% O₂/40% EA is approximately 130°F. Flue gases may condense within the flueways when heat exchanger temperatures are at or below the calculated dew point. Chimneys and connectors may also be subjected to condensation.
- **Figure 3** shows that gas fuels have higher dew points than oil or coal, so greater care must be taken with them to avoid condensation.
- Please see charts on the following page.

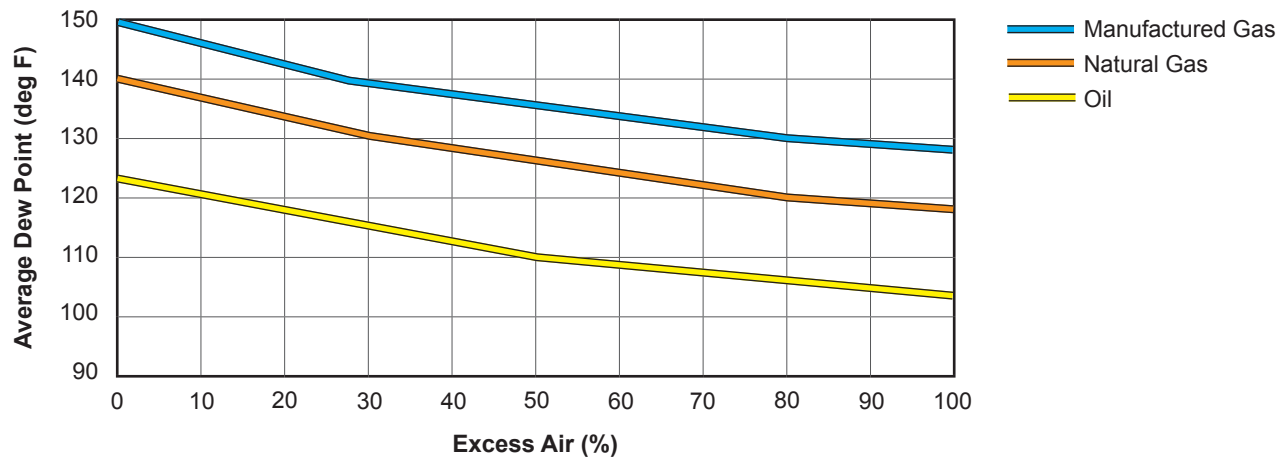
Carbon Monoxide Signs & Symptoms

Carbon monoxide is toxic to all aerobic forms of life. It is easily absorbed through the lungs. Inhaling even relatively small amounts of the gas can lead to hypoxic injury, neurological damage, and even death. Different people and populations may have a different carbon monoxide tolerance levels. On average, exposures at 100 ppm or greater is dangerous to human health. In the United States, the OSHA limits long-term workplace exposure levels to less than 50 ppm averaged over an 8-hour period; in addition, employees are to be removed from any confined space if an upper limit ("ceiling") of 100 ppm is reached. Carbon monoxide exposure may lead to a significantly shorter life span due to heart damage. The carbon monoxide tolerance level for any person is altered by several factors, including activity level, rate of ventilation, a pre-existing cerebral or cardiovascular disease, cardiac output, anemia, sickle cell disease and other hematological disorders, barometric pressure, and metabolic rate.

The acute effects produced by carbon monoxide in relation to ambient concentration in parts per million are listed in **Table 2**.

Figure 3

Flue Gases
Average Dew Point for Typical Fuels

**Table 1 - Combustion Efficiency (%) for Natural Gas***

Excess %		Net Stack Temperature (°F)				
Air	Oxygen	200	300	400	500	600
9.5	2	85.4	83.1	80.8	78.4	76.0
15.0	3	85.2	82.8	80.4	77.9	75.4
28.1	5	84.7	82.1	79.5	76.7	74.0
44.9	7	84.1	81.2	78.2	75.2	72.1

*This is typical data. Results will vary with air and fuel properties.

Table 2 - Carbon Monoxide Effect on Human Body

Concentration	Symptoms
35 ppm (0.0035%)	Headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%)	Slight headache in two to three hours
200 ppm (0.02%)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%)	Frontal headache within one to two hours
800 ppm (0.08%)	Dizziness, nausea, and convulsions within 45 min; insensible within 2 hours
1,600 ppm (0.16%)	Headache, tachycardia, dizziness, and nausea within 20 min; death in less than 2 hours
3,200 ppm (0.32%)	Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%)	Headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death in less than 20 minutes.
12,800 ppm (1.28%)	Unconsciousness after 2–3 breaths. Death in less than three minutes.

Combustion Air Requirements

Indoor Combustion Air

In many cases, a burner operating in an indoor space of a conventional frame, brick or stone building will receive adequate air supply from leakage in the building itself. The standard method for determining the required indoor room volume is 50 cu.ft. per 1000 Btu/hr for the total input rating of all appliances in that space (in accordance with NFPA 54).

EXAMPLE: A basement has a 90,000 Btu/hr gas burner and a 30,000 Btu/hr water heater. The total input is 120,000 Btu/hr. The required space is:

$$120,000 \text{ Btu/hr} \times \frac{50 \text{ cu.ft.}}{1,000 \text{ Btu/hr}} = 6,000 \text{ cu. ft.}$$

The volume calculation above may include adjacent rooms provided the room is connected by 2 openings (not furnished with doors). One opening must be within 12 inches from the top, and one opening 12 inches from the bottom of the enclosure. Each opening must have a minimum free area of 1 sq. in. per 1000 Btu/hr, but not less than 100 sq. in.

From the previous example: The total input rate for all air using appliances was 120,000 Btu/hr. The opening size must be:

$$\frac{120,000 \text{ Btu/hr}}{1,000 \text{ Btu/hr}} \times 1 \text{ sq.in.} = 120 \text{ sq.in.}$$

Each opening should be 120 sq. in.

For the *Known Air Infiltration Rate Method* or combining spaces on different levels, refer to NFPA 54.

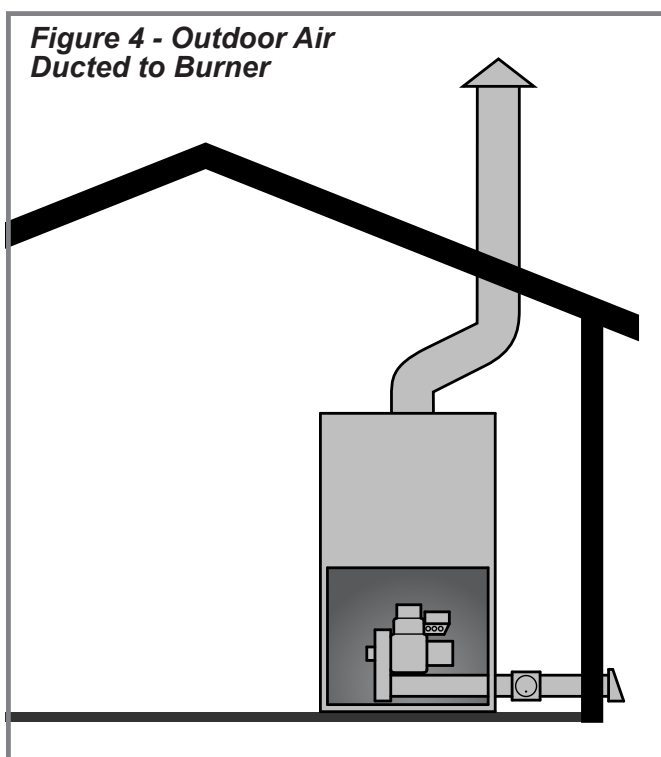
Outdoor Combustion Air

If the burner is located in a tightly constructed building where there is inadequate outside air infiltration, outside combustion air must be supplied by some other means.

One method to accomplish this is through 2 permanent openings in an exterior wall. The openings must begin 12 inches from the top, and one opening 12 inches from the bottom of the enclosure. If directly connecting to the outdoors, or through vertical ducts, each opening must have a free area of 1 sq.in. / 4,000 Btu/hr of the total input rating of all appliances in the space. For horizontal ducts connecting to the outdoors, each opening must have a free area of 1 sq.in. / 2,000 Btu/hr of total input ratings for the space.

Another method is to supply outside air directly to the gas burner through round, smooth duct work (see **Figure 4**). Some manufacturers offer accessories which allow outside combustion air duct work to be coupled to the gas burner. These kits must meet the *Engineered Installation* requirements of NFPA 54 and be approved by authorities having jurisdiction. It is important that you comply strictly with the manufacturer's instructions.

Refer to NFPA 54 for additional methods such as *One Permanent Opening (Outdoor) Method*, *Combination Indoor/Outdoor Method*, and *Mechanical Air Supply Method*.



Gas Piping Installation

Below is an example of a warning that will be in a gas burner installation manual.



WARNING Install a Drip Leg in Gas Supply Piping

Foreign matter could lodge in gas valve cutoff seals, resulting in gas leak-through, explosion or fire.

Install a full-size drip leg or dirt pocket in the piping directly ahead of the main shutoff valve to capture foreign matter.

When installing gas piping to a conversion gas burner or gas appliance, a drip leg is required to help keep particles/grit from getting in the gas valve. Please see **Figure 5** for the proper location of a drip leg.

Gas Supply Piping

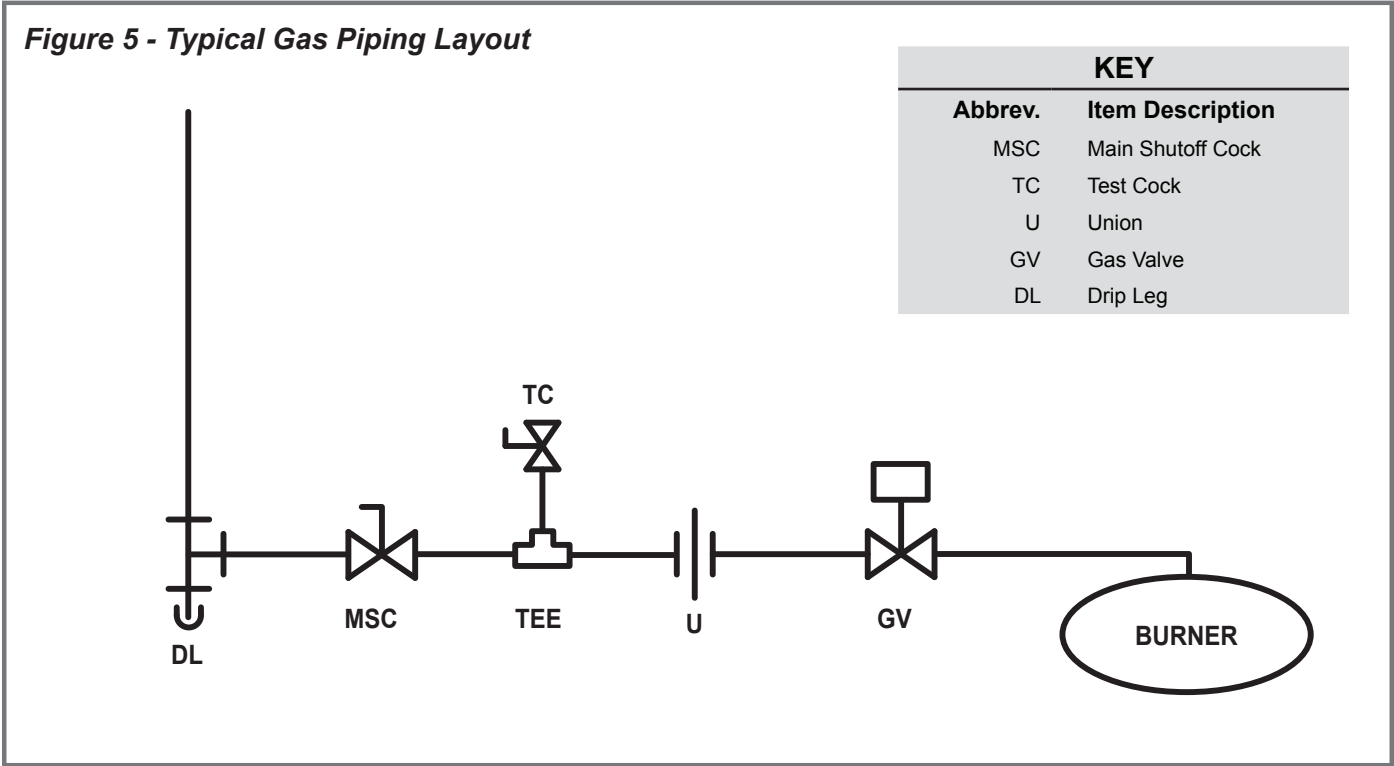
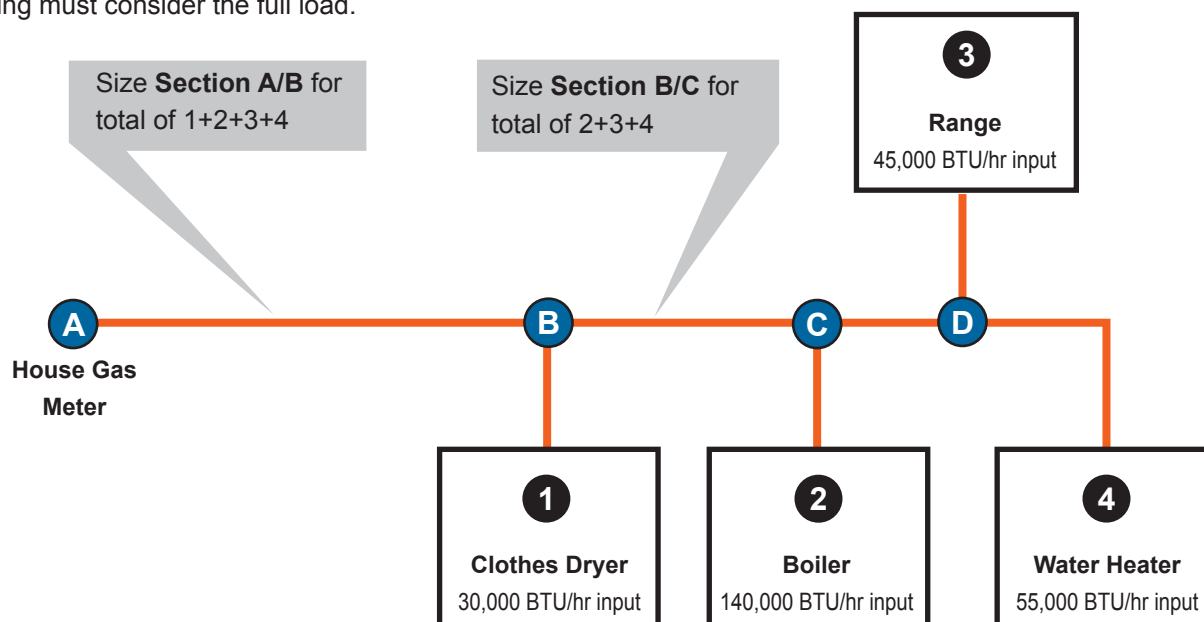


Table 3. Natural Gas Supply Piping Capacity

<ul style="list-style-type: none"> ◦ Schedule 40 metallic pipe with 0.50 psi or less inlet pressure and 0.30" W.C. pressure drop ◦ Maximum capacity in cubic feet of gas per hour (CFH). Natural gas with 0.60 specific gravity. 					
Pipe Length (ft.)	Pipe Size (inches)				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	890
40	63	130	245	500	760
50	56	115	215	440	670
60	50	105	195	400	610
70	46	96	180	370	560
80	43	90	170	350	530
90	40	84	160	320	490
100	38	79	150	305	460
110	34	72	130	275	410
120	31	64	120	250	380
150	28	59	110	225	350

Figure 6 - Natural Gas Piping

Sizing must consider the full load.



This is an example of the Longest Length Method (Reference “**Table 3. Natural Gas Supply Piping Capacity**” on page 11, 90’ pipe length row):

- Consider that the longest length is 85 feet.
- Add BTU input for all appliances in the system to determine maximum load.
- Section A-B = 270,000 BTU/hr input. The 320 value listed in the table will cover the 270,000 load on this segment. Following this column to the top, 1.25” will be the correct pipe size.
- Section B-C carries 240,000 BTU/hr after we subtract the Clothes Dryer. The 320 value listed in the table is still needed to cover this load and following this column to the top, 1.25” will again be the correct pipe size.
- Section C-D carries 100,000 BTU/hr after subtracting the Boiler. The 160 value is needed to cover this load and following the column to the top, 1.0” will be the correct pipe size.
- Sizing each branch to the 90’ pipe length, **Branch 1** (30,000 BTU/hr) will be 0.5”. **Branch 2** (80,000 BTU/hr) will be 0.75”. **Branch 3** (45,000 BTU/hr) will be .75” pipe and **Branch 4** will need .75” pipe.

NOTICE

The methods used above and additional information can be found in NFPA 54, National Fuel Gas Code.

Propane Installations

To convert the burner to propane simply purchase the proper sized restrictor and follow the instructions. Pressures and set up are exactly the same once the restrictor is installed.

Make certain that supply piping is properly sized. There are two supply sizes to consider with propane, the

line from first to second stage regulator and then from the second stage regulator to the burner gas valve. Regulators, tank and line sizes must be correct. If in doubt consult the propane supplier for assistance.

Use the charts below for line sizes. Additional information can be found in NFPA 58, Liquefied Petroleum Gas Code.

Table 4 - First Stage Pipe Sizing (Between First and Second Stage Regulators)

10 PSIG inlet with a 1 PSIG Pressure Drop, maximum capacity of pipe or tubing in thousand of BTU/hr for LP-Gas

Size of Pipe or Copper Tubing, Inches		Length of Pipe or Tubing, Feet									
		10	20	30	40	50	60	70	80	90	100
Copper Tubing Size (O.D.)	3/8	558	383	309	265	235	213	196	182	171	161
	1/2	1,387	870	700	599	531	481	443	412	386	365
	5/8	2,360	1622	1,303	1,115	988	896	824	767	719	679
	3/4	3,993	2,475	2,205	1,887	1,672	1,515	1,394	1,297	1,217	1,149
Schedule 40 Pipe Size	1/2	3,339	2,295	1,843	1,577	1,398	1,267	1,165	1,084	1,017	961
	3/4	6,982	4,799	3,854	3,298	2,923	2,649	2,437	2,267	2,127	2,009
	1	13,153	9,040	7,259	6,213	5,507	4,989	4,590	4,270	4,007	3,785
	1-1/4	27,004	18,560	14,904	12,756	11,306	10,244	9,424	8,767	8,226	7,770
	1-1/2	40,461	27,809	22,331	19,113	16,939	15,348	14,120	13,136	12,325	11,642
	2	77,924	53,556	43,008	36,809	32,623	29,559	27,194	25,299	23,737	22,422

Size of Pipe or Copper Tubing, Inches		Length of Pipe or Tubing, Feet									
		125	150	175	200	225	250	275	300	350	400
Copper Tubing Size (O.D.)	3/8	142	130	118	111	104	90	89	89	82	76
	1/2	323	293	269	251	235	222	211	201	185	172
	5/8	601	546	502	467	438	414	393	375	345	321
	3/4	1,018	923	843	790	740	700	664	634	584	543
Schedule 40 Pipe Size	1/2	852	772	710	660	619	585	556	530	488	454
	3/4	1,780	1,613	1,484	1,381	1,296	1,224	1,162	1,109	1,020	949
	1	3,354	3,039	2,796	2,601	2,441	2,305	2,190	2,089	1,922	1,788
	1-1/4	6,887	6,240	5,741	5,340	5,011	4,733	4,495	4,289	3,945	3,670
	1-1/2	10,318	9,349	8,601	8,002	7,508	7,092	6,735	6,426	5,911	5,499
	2	19,871	18,005	16,564	15,410	14,459	13,658	12,971	12,375	11,385	10,591

Note:

1. For allowable pressure drops other than 1 psi, calculate the adjusted demand and then use capacities from the table.

$$\text{Adjusted demand (BTU/hr.)} = \text{Actual Demand (BTU/hr.)} \times \sqrt{\frac{\text{Table Press Drop (1 psi)}}{\text{Desired Press Drop (psi)}}}$$

Table 5 - First Stage Polyethylene Plastic Tubing Sizing

10 PSIG Inlet with a 1 PSIG Pressure Drop

Maximum capacity of plastic tubing in thousands of BTU/hr of LP-Gas

Size of Plastic Tubing		Length of Pipe or Tubing, Feet									
NPS	SDR	10	20	30	40	50	60	70	80	90	100
1/2 CTS	7.00	1,387	954	762	653	578	524	482	448	421	397
1/2	9.33	3,901	2,681	2,143	1,835	1,626	1,473	1,355	1,261	1,183	1,117
3/4	11.00	7,811	5,369	4,292	3,673	3,256	2,950	2,714	2,525	2,369	2,238
1 CTS	11.00	9,510	6,536	5,225	4,472	3,864	3,591	3,304	3,074	2,884	2,724
1	11.00	14,094	9,687	7,744	6,628	5,874	5,322	4,896	4,555	4,274	4,037
1-1/4	10.00	24,416	16,781	13,416	11,482	10,106	9,220	8,433	7,891	7,404	6,994
1-1/2	11.00	n/a	n/a	20,260	17,340	15,368	13,924	12,810	11,918	11,182	10,562
2	11.00	66,251	45,534	36,402	31,155	27,612	25,019	23,017	21,413	20,091	18,978

Size of Plastic Tubing		Length of Pipe or Tubing, Feet									
NPS	SDR	125	150	175	200	225	250	275	300	350	400
1/2 CTS	7.00	352	319	294	273	256	242	230	219	202	188
1/2	9.33	990	897	826	778	721	681	646	617	567	528
3/4	11.00	1,963	1,797	1,653	1,539	1,443	1,363	1,294	1,235	1,136	1,057
1 CTS	11.00	2,414	2,188	2,013	1,872	1,757	1,659	1,576	1,503	1,383	1,287
1	11.00	3,578	3,242	2,983	2,775	2,603	2,459	2,336	2,228	2,050	1,907
1-1/4	10.00	6,199	5,616	5,167	4,807	4,510	4,260	4,046	3,860	3,551	3,304
1-1/2	11.00	9,361	8,482	7,803	7,259	6,811	6,434	6,111	5,830	5,363	4,989
2	11.00	16,820	15,240	14,020	13,043	12,236	11,560	10,979	10,474	9,636	8,965

CTS = Copper Tube Size, SDR=Standard Dimension Ratio

Table 6 - Second Stage or Integral Twin Stage Pipe Sizing

11 Inches Water Column Inlet with a 1/2 inch Water Column Drop.

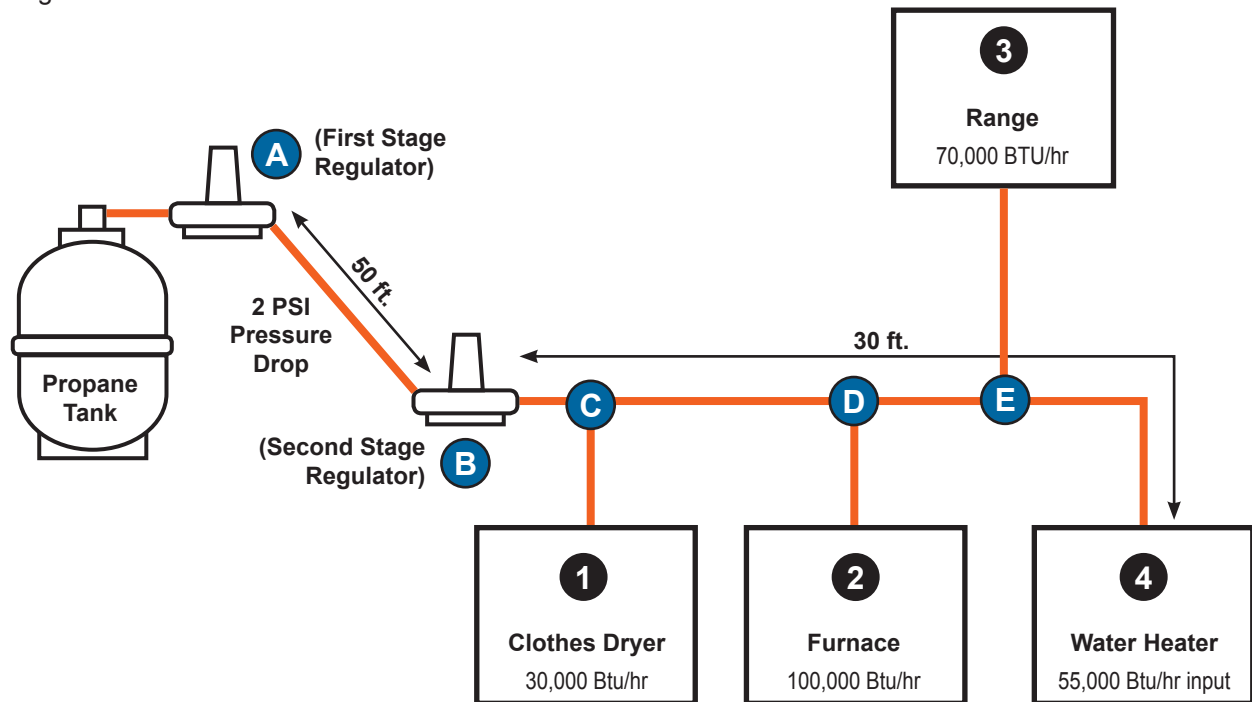
Maximum capacity of pipe or tubing in thousands of BTU/hr of LP-Gas

Size of Pipe or Copper Tubing, Inches		Length of Pipe or Tubing, Feet									
		10	20	30	40	50	60	70	80	90	100
Copper Tubing Size (O.D.)	3/8	49	34	27	23	20	19	n/a	16	n/a	14
	1/2	110	76	61	52	46	42	38	36	33	32
	5/8	206	141	114	97	86	78	71	67	62	59
	3/4	348	239	192	164	146	132	120	113	105	100
	7/8	536	368	296	253	224	203	185	174	161	154
Schedule 40 Pipe Size	1/2	291	200	161	137	122	110	102	94	87	84
	3/4	608	418	336	287	255	231	212	198	185	175
	1	1,146	788	632	541	480	435	400	372	349	330
	1-1/4	2,353	1,617	1,299	1,111	985	892	821	764	717	677
	1-1/2	3,525	2,423	1,946	1,665	1,476	1,337	1,230	1,144	1,074	1,014
	2	6,789	4,666	3,747	3,207	2,842	2,575	2,369	2,204	2,068	1,954

Size of Pipe or Copper Tubing, Inches		Length of Pipe or Tubing, Feet									
		125	150	175	200	225	250	275	300	350	400
Copper Tubing Size (O.D.)	3/8	12	11	n/a	10	n/a	9	n/a	8	7	7
	1/2	28	26	n/a	22	n/a	19	n/a	18	16	15
	5/8	52	48	n/a	41	n/a	36	n/a	33	30	28
	3/4	89	80	n/a	69	n/a	61	n/a	55	51	47
	7/8	137	124	n/a	106	n/a	94	n/a	85	78	73
Schedule 40 Pipe Size	1/2	74	67	62	58	54	51	48	46	43	40
	3/4	155	141	129	120	113	107	101	97	89	83
	1	292	265	244	227	213	201	191	182	167	156
	1-1/4	600	544	500	465	437	412	392	374	344	320
	1-1/2	899	815	749	697	654	618	587	560	515	479
	2	1,731	1,569	1,443	1,343	1,260	1,190	1,130	1,078	992	923

Figure 7 - Propane Line Sizes

Sizing must consider the full load.



First Stage:

Section A-B = 255,000 Btu/hr demand and 2 psi allowable pressure drop. Use **Table 4** to determine the copper tubing size. Calculate adjusted demand: $255,000 \text{ Btu/hr} \times 0.707 = 180,312 \text{ Btu/hr}$ (see **Table 4**, Note 1 on Pg. 13). In the 50ft. length column, choose a capacity that exceeds the adjusted demand. The capacity of 235,000 Btu/hr will meet the (adjusted) demand of 180,312 Btu/hr. This corresponds to 3/8" copper tubing.

Second Stage: Using **Table 6** and only the 30 ft. column (longest length method)

Section B-C = 255,000 Btu/hr demand requires 7/8" copper tubing or 3/4" pipe.

Section C-D = 225,000 Btu/hr demand requires 7/8" copper tubing or 3/4" pipe.

Section D-E = 125,000 Btu/hr demand requires 3/4" copper tubing or 1/2" pipe.

Section C-1 = 30,000 Btu/hr demand requires 1/2" copper tubing or 1/2" pipe.

Section D-2 = 100,000 Btu/hr demand requires 5/8" copper tubing or 1/2" pipe.

Section E-3 = 70,000 Btu/hr demand requires 5/8" copper tubing or 1/2" pipe.

Section E-4 = 55,000 Btu/hr demand requires 1/2" copper tubing or 1/2" pipe.

This section of wiring diagrams is not intended to supersede the control/limits manufacturer's published specifications. Always follow the appliance manufacturer's published instructions, wiring diagrams and recommendations.

The below warning is typically found in instruction manuals of gas controls and gas appliances and must be understood and followed.

WARNING

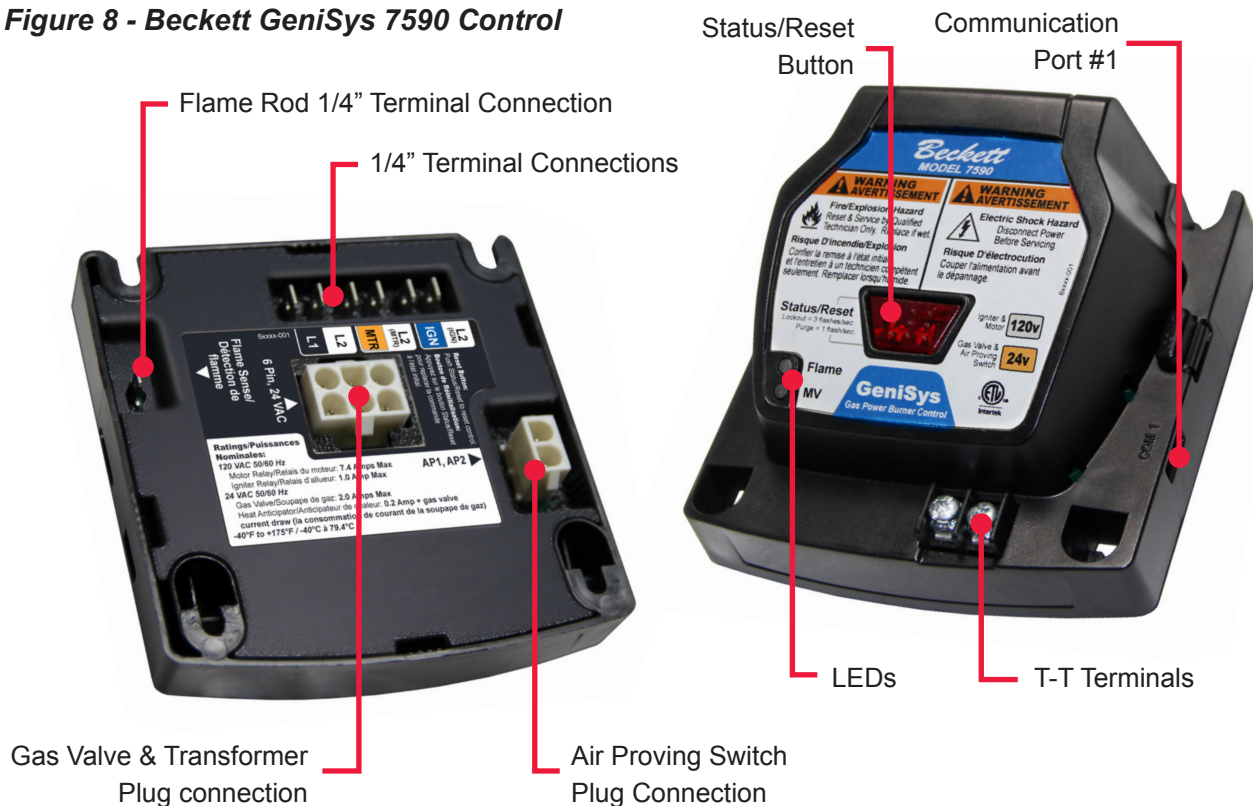
Electrical Shock, Fire, Explosion and Burn Hazards

This control must be installed, adjusted and put into operation only by a trained, licensed, qualified professional or service agency in accordance with the latest revision of the National Electric Code ANSI/NFPA 70 (Canada CSA C22.1) state, local codes and authorities having jurisdiction.

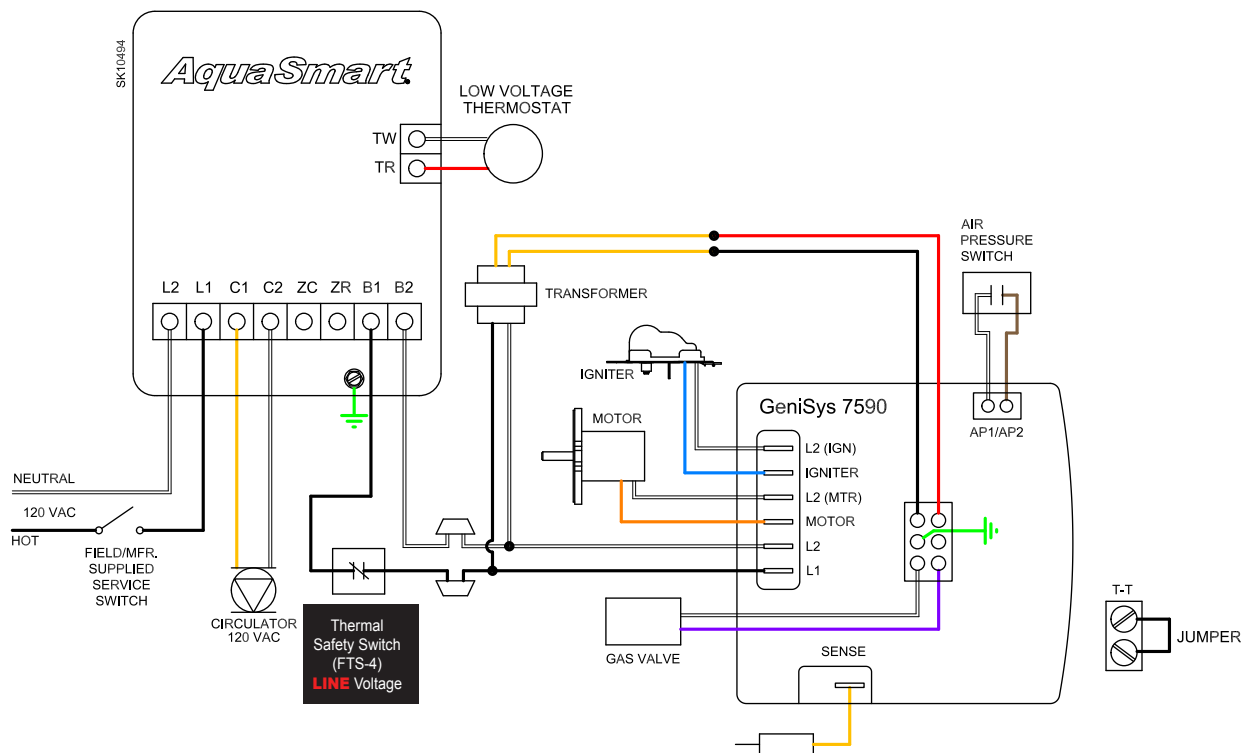
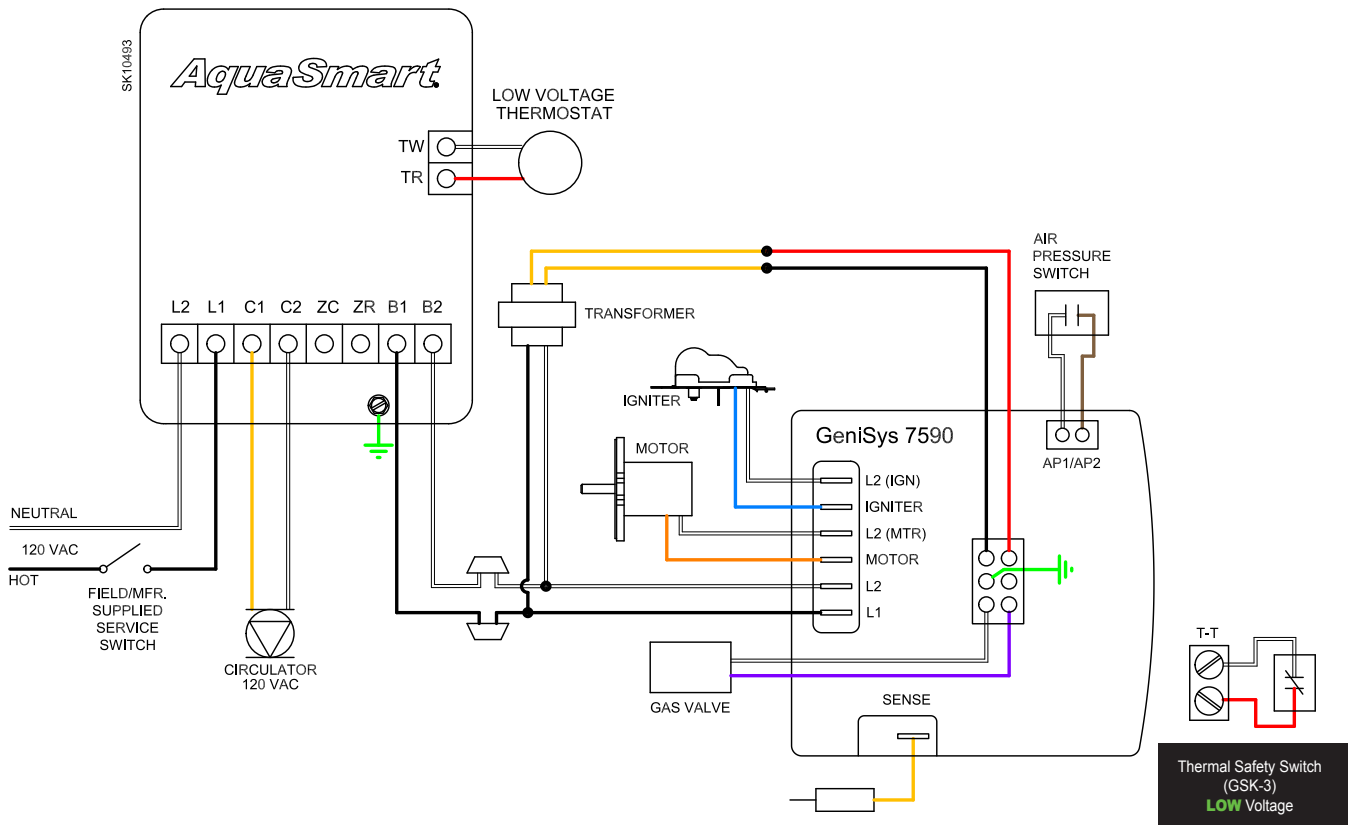
- Follow the appliance manufacturer's wiring diagrams and note all safety controls.
- Typical safety controls include high temperature or pressure limits, low water cut-offs, anti-scald valves, pressure relief valves and water feed valves.
- Verify all limits and safety controls are installed and functioning correctly, as specified by the appliance manufacturer, applicable safety standards, codes and all authorities having jurisdiction.
- Provide ground wiring to the appliance, burner and controls.

Wiring with the Beckett GeniSys 7590

Figure 8 - Beckett GeniSys 7590 Control



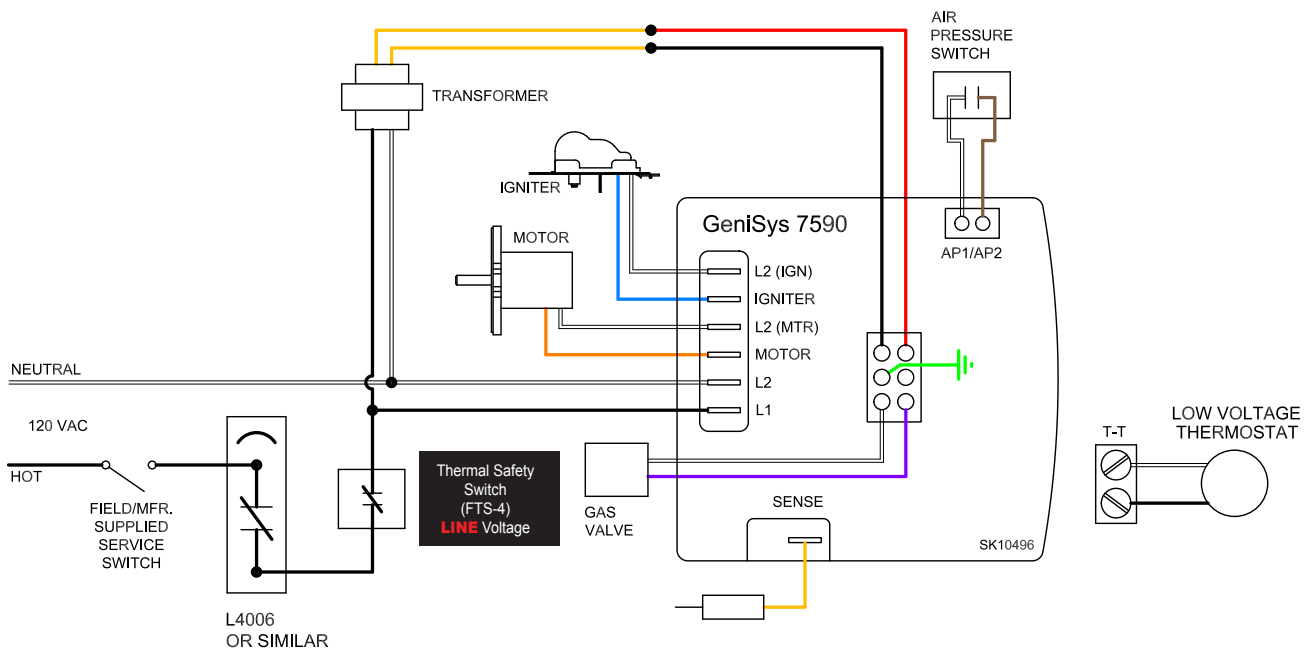
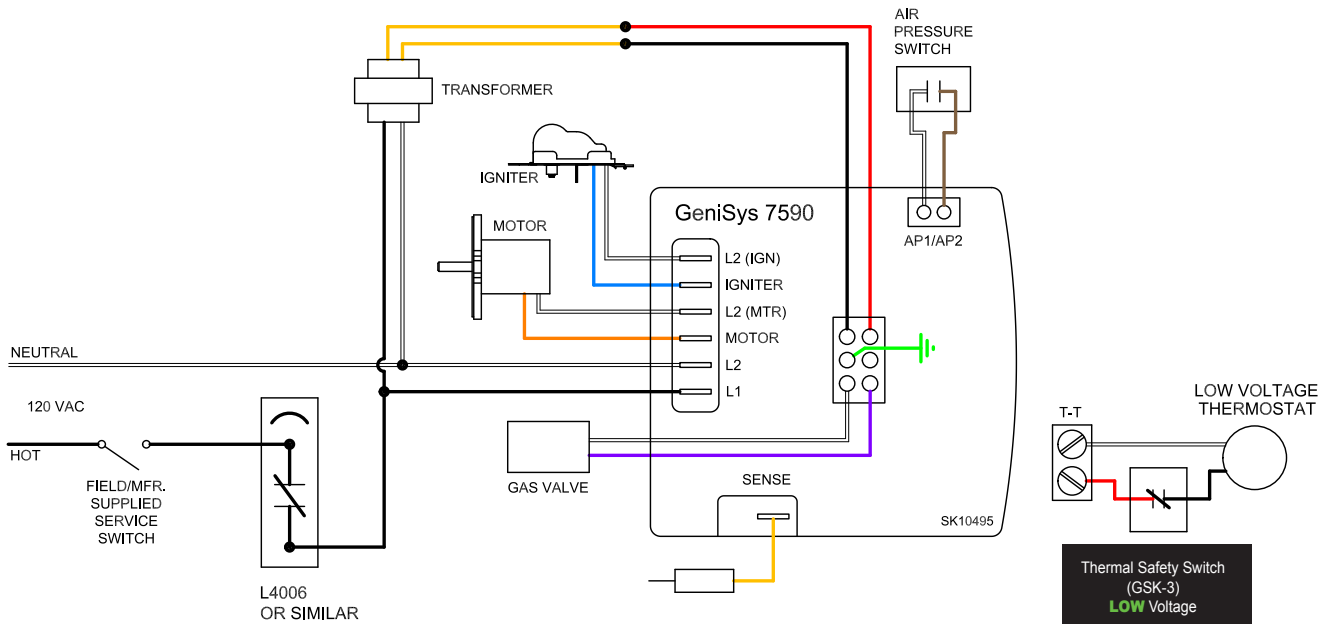
7590 to AquaSmart 7600A & Thermal Safety Switch



7590 to Honeywell L4006 (or similar) & Thermal Safety Switch

NOTICE

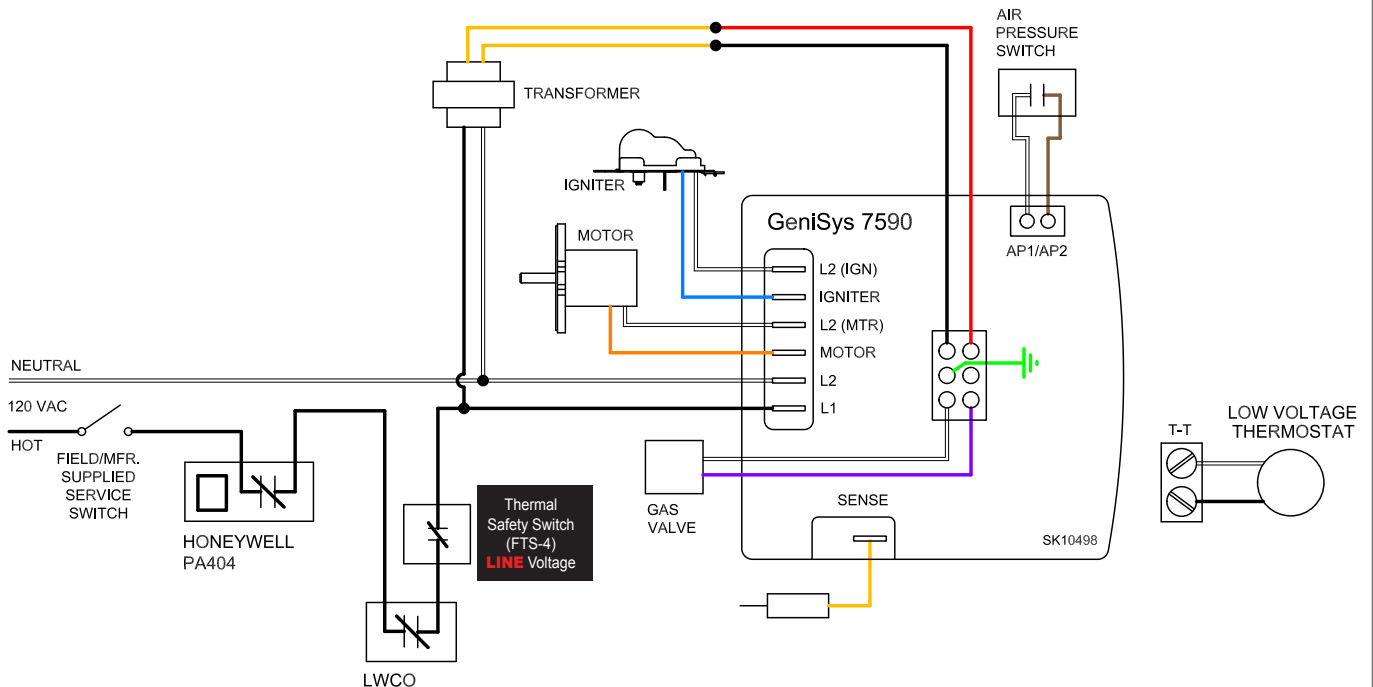
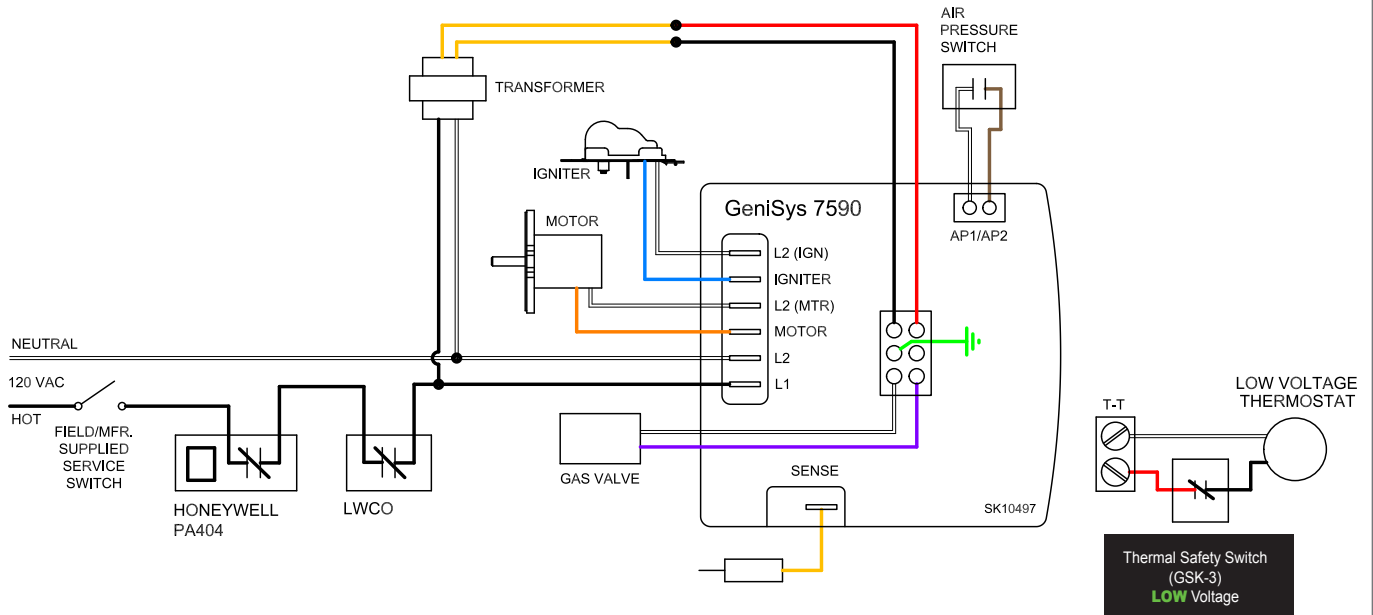
Please carefully follow Honeywell's manufacturer directions regarding installation, wiring, & service.



7590 to Honeywell Pressure Switch & McDonnell/Miller 67 (or similar) Low Water Cut-off & Thermal Safety Switch

NOTICE

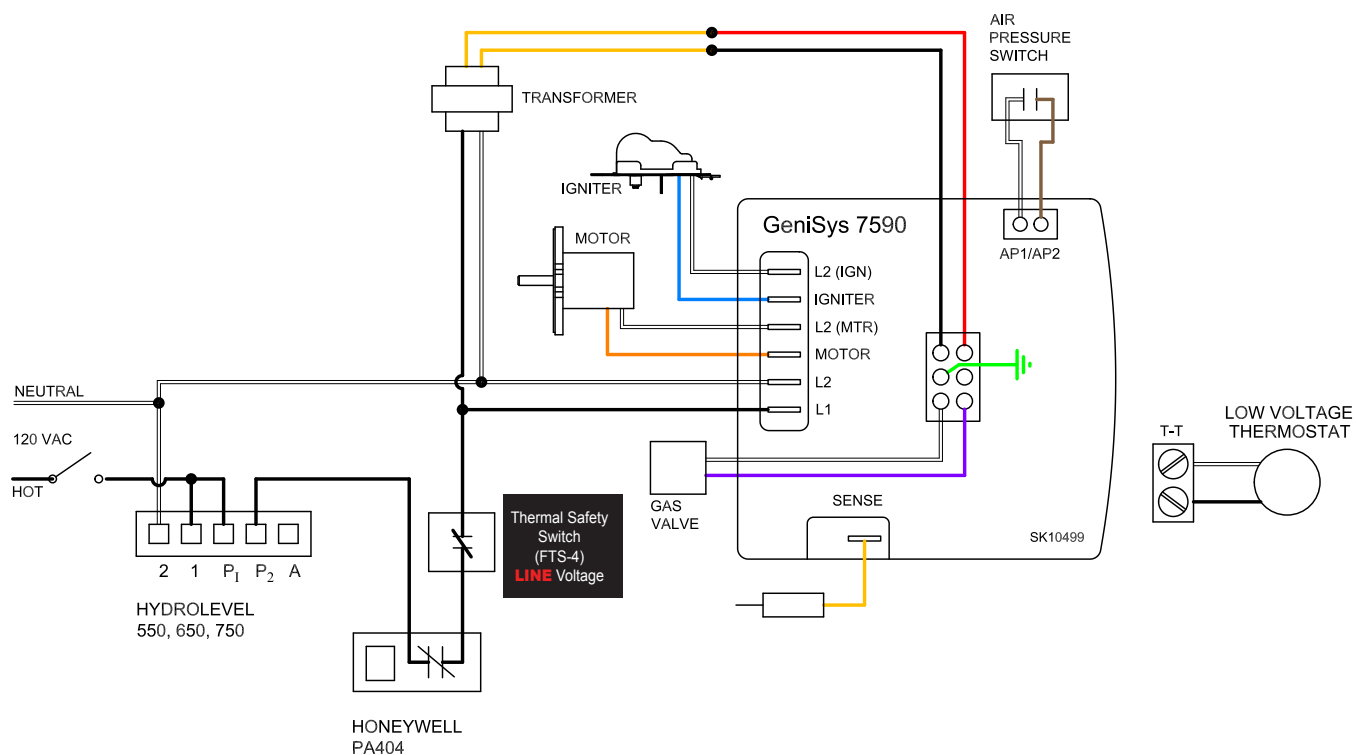
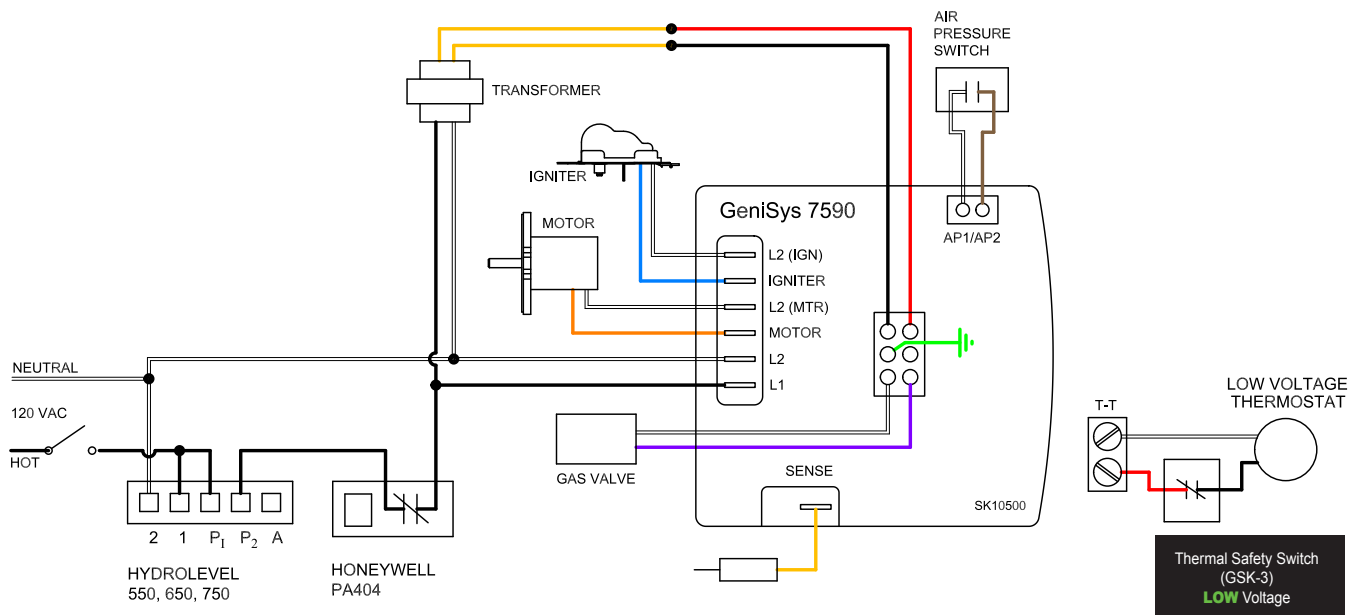
Please carefully follow McDonnell/Miller's manufacturer directions regarding installation, wiring, & service.



7590 to Hydrolevel Safeguard Low Water Cut-off & Honeywell Pressure Switch & Thermal Safety Switch

NOTICE

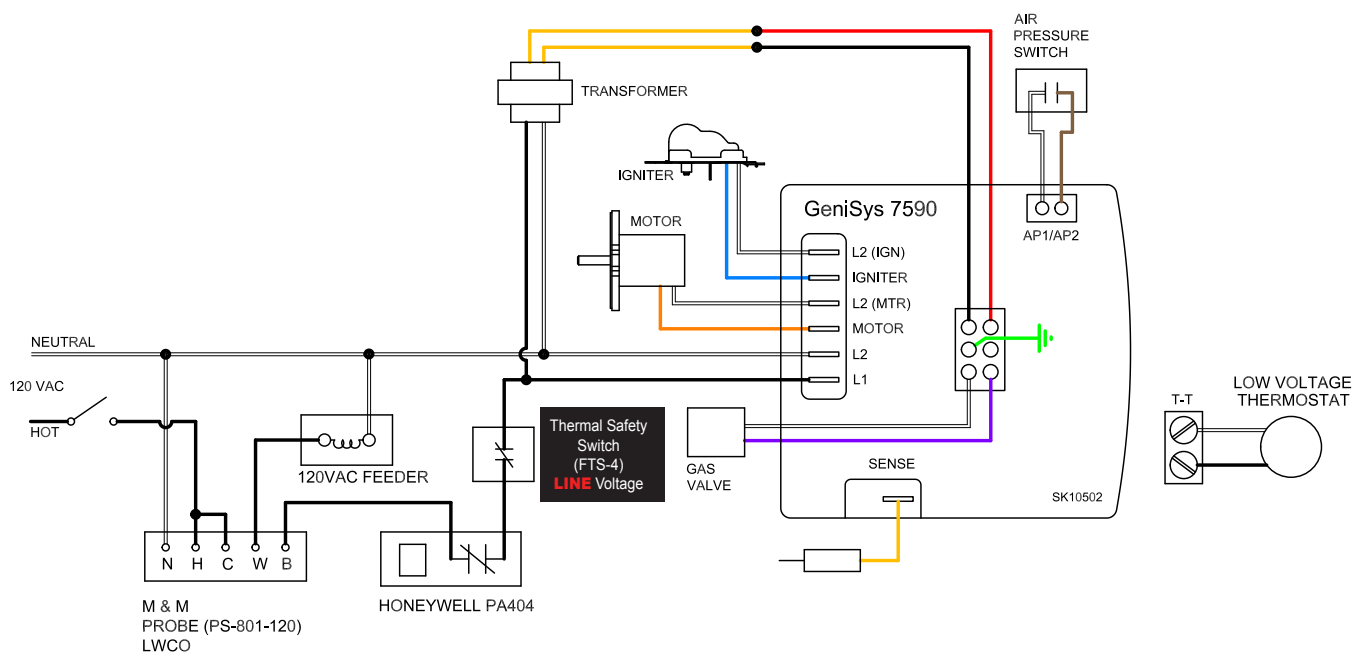
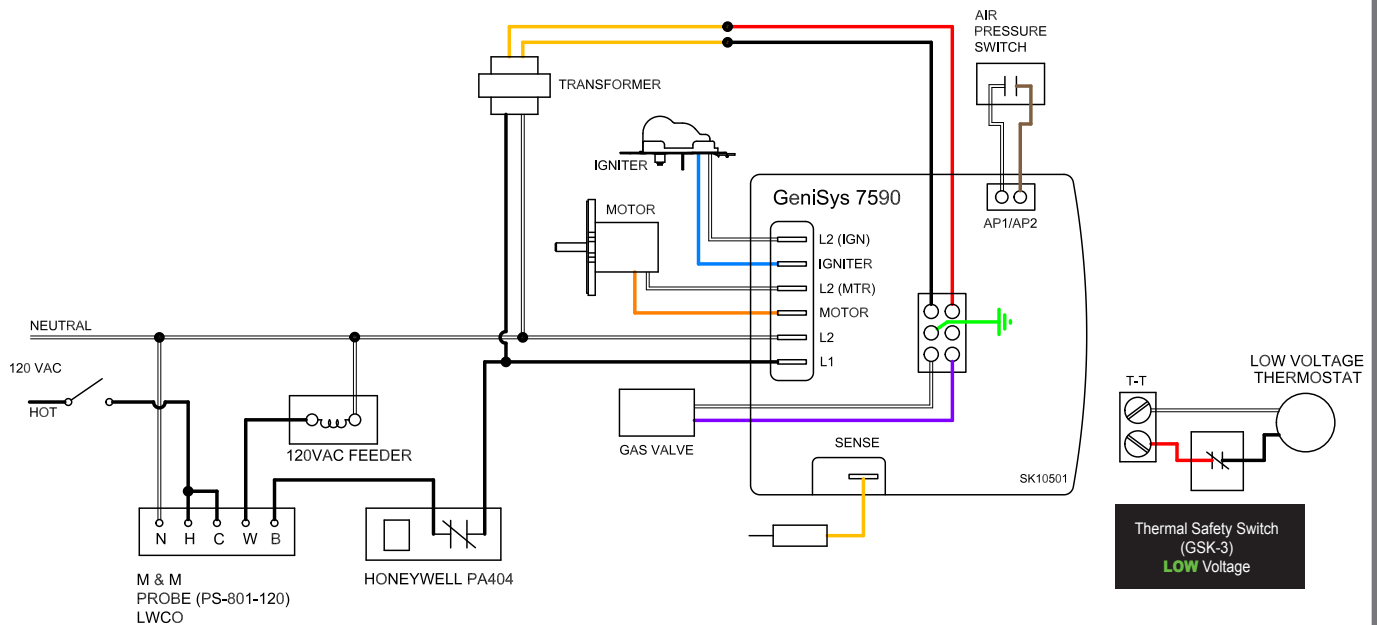
Please carefully follow Hydrolevel's and Honeywell's manufacturer directions regarding installation, wiring, & service.



7590 to McDonnell & Miller Probe Low Water Cut-off & Honeywell Pressure Switch & Thermal Safety Switch

NOTICE

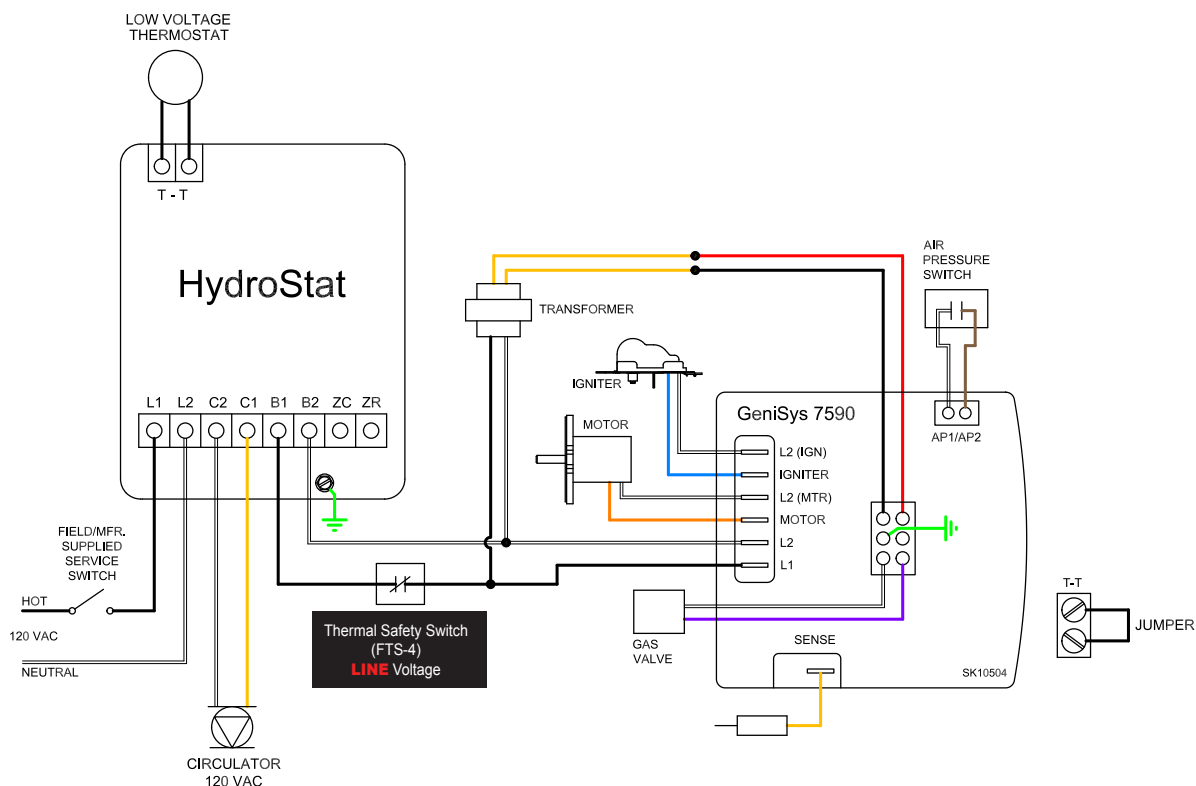
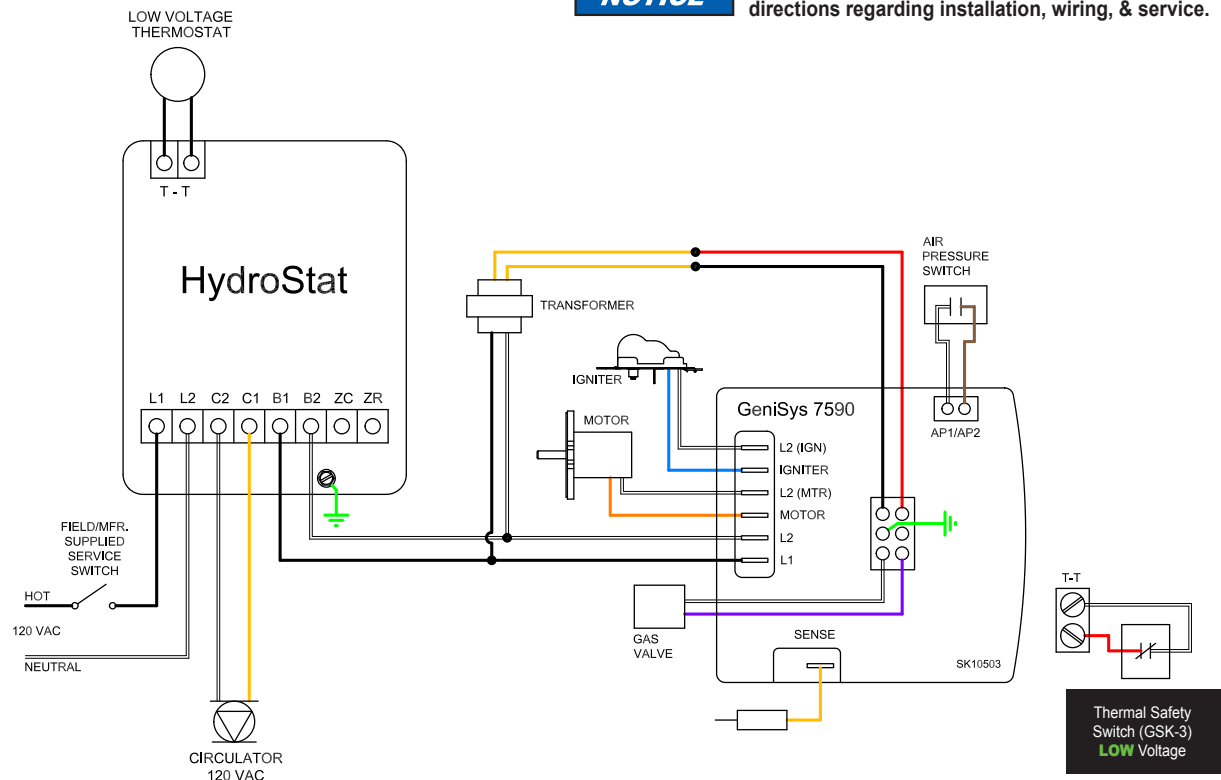
Please carefully follow McDonnell/Miller's and Honeywell's manufacturer directions regarding installation, wiring, & service.



7590 to HydroStat & Thermal Safety Switch

NOTICE

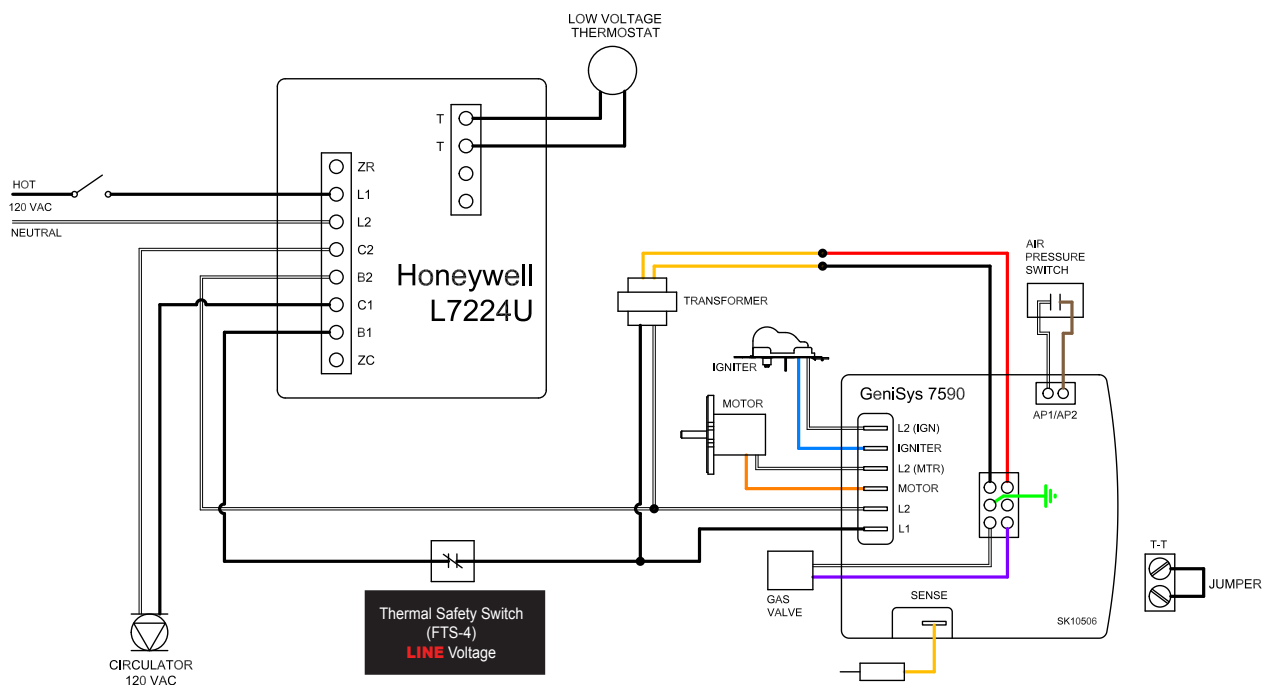
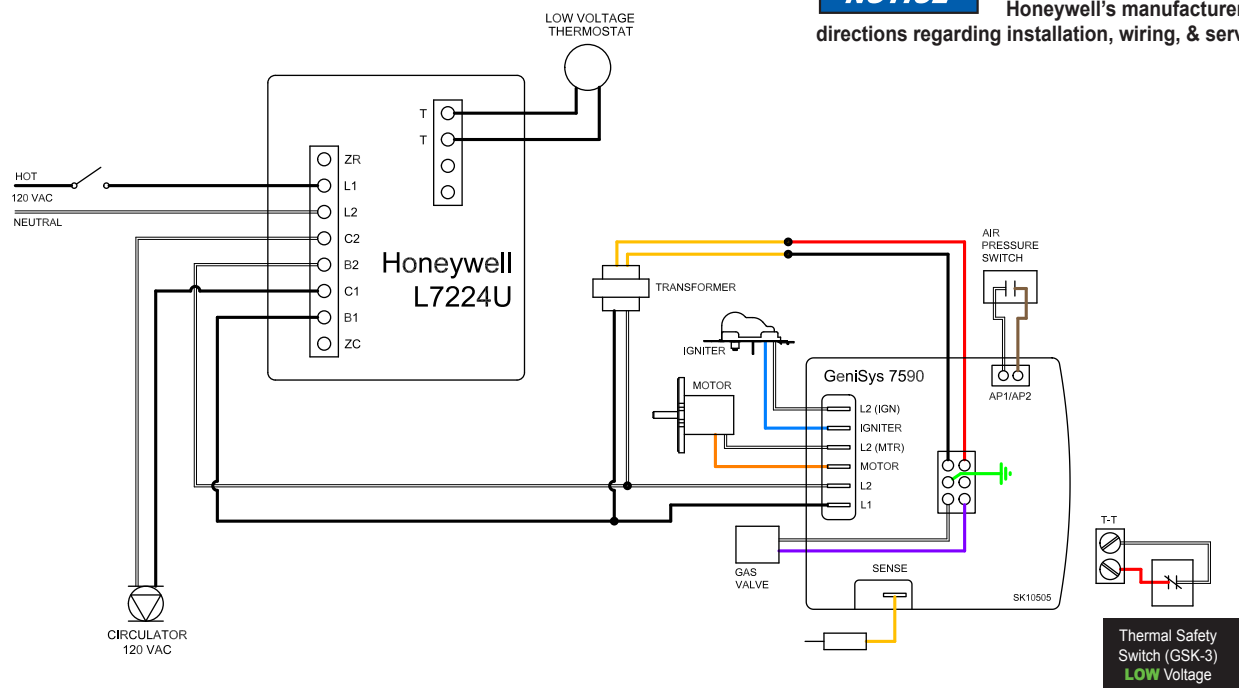
Please carefully follow HydroStat's manufacturer directions regarding installation, wiring, & service.



7590 to Honeywell L7224U & Thermal Safety Switch

NOTICE

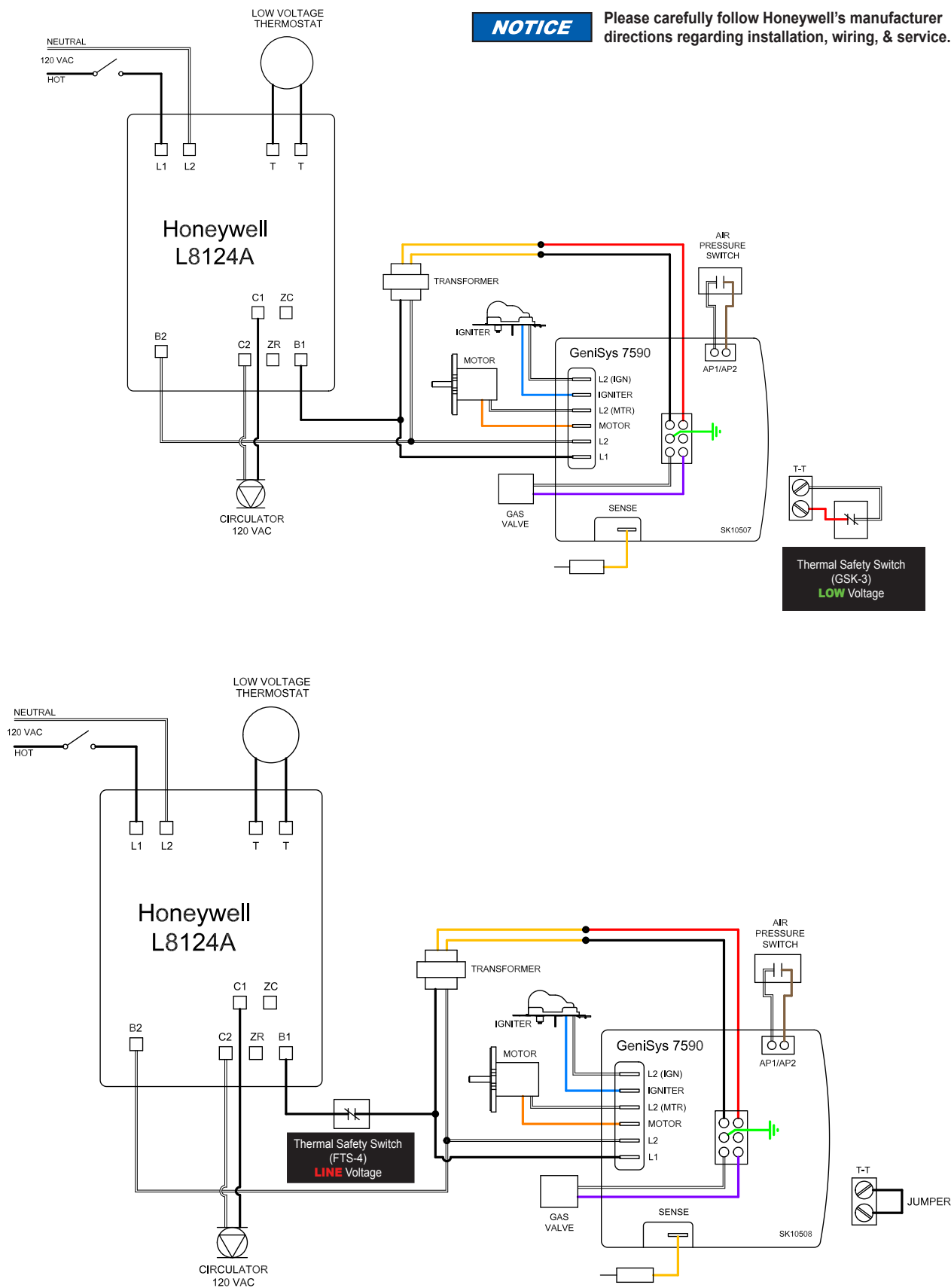
Please carefully follow Honeywell's manufacturer directions regarding installation, wiring, & service.



7590 to Honeywell L8124A & Thermal Safety Switch

NOTICE

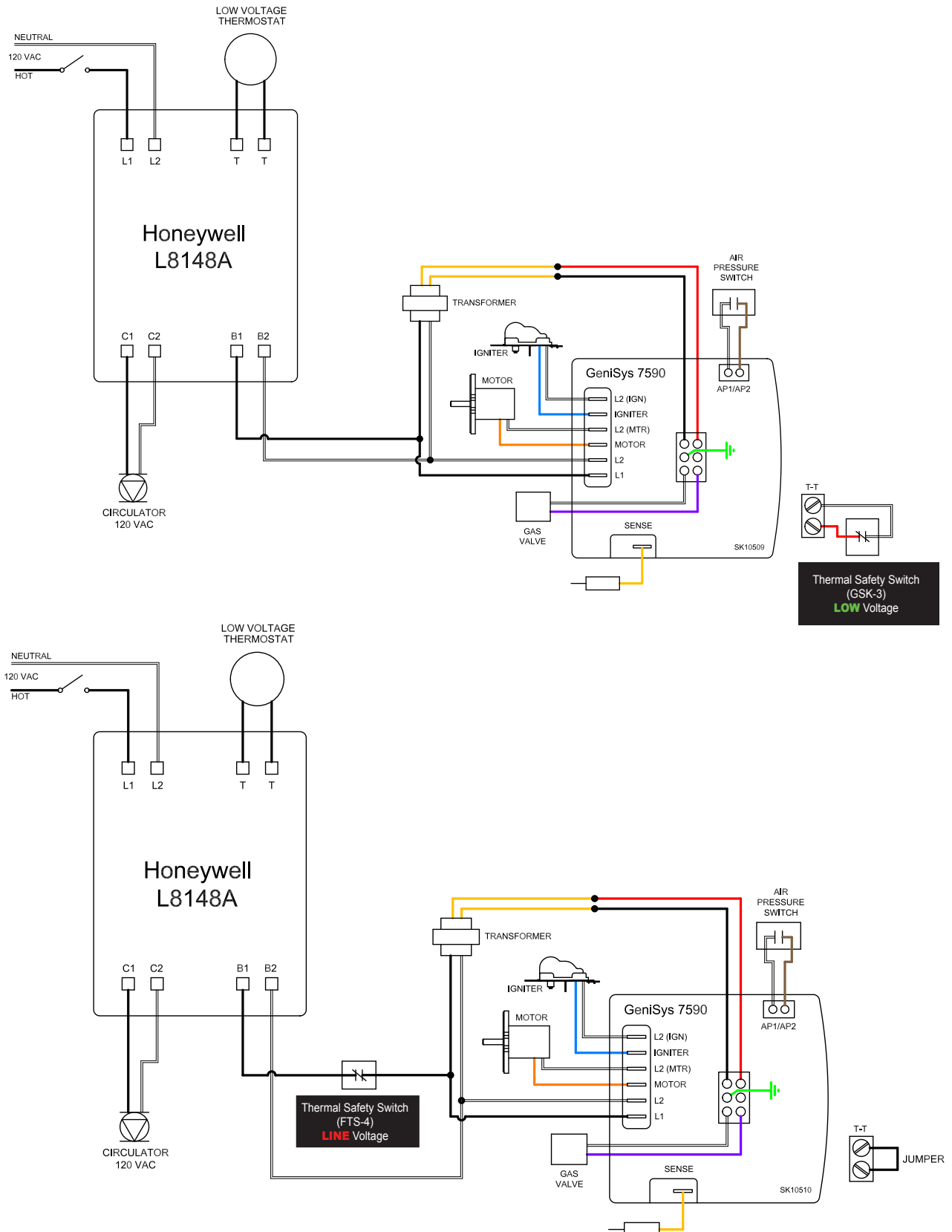
Please carefully follow Honeywell's manufacturer directions regarding installation, wiring, & service.



7590 to Honeywell L8148A & Thermal Safety Switch

NOTICE

Please carefully follow Honeywell's manufacturer directions regarding installation, wiring, & service.



Placing the Burner in Service

The gas burner must be installed and prepared for start-up by a qualified service technician. After the burner installation is complete prepare the appliance for testing.

The following calibrated test equipment is required to properly install the appliance. Whether these are included in one kit or are individual test components, they should be calibrated and in good working order.

- A combustion analyzer capable of measuring oxygen (or carbon dioxide), carbon monoxide, stack temperature, ambient temperature, and appliance efficiency.
- Electrical multi-meter capable of measuring voltage, ohms, amps, and DC micro-amps for measuring the flame signal. These could be included in one meter or separate meters, but should be calibrated and accurate.
- Calibrated manometers and gauges capable of measuring all pressure ranges in the gas supply and appliance draft. This could typically range from a few PSI to 0.1" W.C.
- Gas Leak detection equipment.

Attach a gas pressure manometer to the gas valve after purging air from the gas lines. Thoroughly leak-check all fittings when purging is complete and after commissioning the burner.

Starting a Burner for the First Time

Before you start a burner for the first time, or re-start it after work has been done that would modify its electrical or fuel-handling systems it is important that you verify that it is safe to operate.

1. With the power and main gas supply to the burner turned off, make sure gas has not accumulated in the boiler or flues.
2. Examine the boiler room and make sure that there is an adequate supply of fresh air, that the appliance's vent system is not obstructed and that stack connections do not show open leakage paths.
3. Examine the appliance and its wiring, piping, fuel supply, venting and water level (if applicable) to assure that they meet the appliance manufacturers requirements for operation.
4. Examine the fuel supply system and make sure that its connections are secure, that the gas pressure supplied to the gas train does not exceed the rating of the valves, and that the manual valve has the fuel shut off.
5. Examine the burner and make sure that its piping connections are secure, that any rate-establishing components (nozzles and orifices) are correctly installed and that air handling adjustments (shutter and band) are set to recommended initial settings
6. With the main shutoff cock closed, set the limit or controller to call for heat then apply power to start the burner.
7. In order to check the function of each component (i.e.: control sequence, airflow proving switch, ignition transformer, gas valves, safety lockout timing, etc.), with the main shutoff cock closed, monitor a complete burner run sequence. Note the control will lock out. (see control instructions for sequence & how to reset).
8. If control operation sequence and function is correct turn off power and remove sensor wire from control.
9. Turn on power and fuel and initiate call for heat. Verify that burner fires up and the gas valve closes. After control locks out, flame shall go off.
10. Turn power off and reattach sensor wire. Turn power back on. Control should reset. Initiate Call for Heat.
11. After you have observed main flame for a brief time, press the reset button on the control for 1 second to shut down and re-start the burner. Monitor the flame and safety shutoff valves to assure that shutdown is controlled by the valves and that they operate properly. With this test passed, you may safely initiate automatic start-ups on subsequent cycles.
12. While the burner is firing, examine the vent system for evidence of leaks, obstructions, and for correct function of the barometric draft control. Leak test all gas piping from the burner to the utility supply piping. If leaks are found, correct them immediately.
13. The burner is now ready to proceed to rate and combustion adjustments.

Verify the Firing Rate

The primary method for verifying the burner's firing rate, for either natural gas or propane, is to assure that the correct fuel orifice is properly installed and that the gas valve outlet pressure is accurately set to 3.5" water column.

1. Turn off electrical power to the burner and close the main shutoff cock supplying gas to the burner.
2. Remove the plug from the outlet pressure tap on the outlet end of the gas valve (**Figure 9**) and install a hose barb fitting and manometer.
3. Turn on system power and gas supply and initiate a call for heat to light the burner.
4. The manometer should show 3.5" water column pressure. If it does, turn off the burner and skip ahead to step 6. If it doesn't, let the burner continue to run and adjust the gas valve pressure regulator in the following steps.
5. Remove the regulator cover screw (see **Figure 9**) from the regulator adjustment tower and turn the regulator adjust screw clockwise to increase pressure or counterclockwise to decrease pressure. Set the regulator to produce a 3.5" water column reading in the manometer. Check the appliance breech or draft setting and adjust if necessary as it can affect the setting. Replace the regulator cover screw.
6. Turn off the burner and turn off all electrical power to the system.
7. Remove the manometer hose and barb fitting from the gas valve outlet pressure tap.
8. Replace the outlet pressure tap plug and tighten (clockwise 40 – 60 in-lbs.).
9. Turn on system power and start the burner.
10. Check for leaks at the gas valve outlet pressure tap plug using a leak detection solution or soapsuds. Bubbles forming indicate a leak. SHUT OFF GAS AND FIX ALL LEAKS IMMEDIATELY.

If the burner is firing natural gas it may be possible to verify the firing rate by "clocking" the gas meter:

1. Locate the gas meter and examine its display to be sure that you can determine a 1 cubic foot usage of gas and that the meter is temperature compensated. (**Figure 10**)
2. Contact the gas utility to find the heating value of the gas. It can vary from about 950 BTU/ft³ to about 1,100 BTU/ft³.

3. Examine the gas piping to know of any other gas appliances connected to it. Turn them off so that only this burner is using gas from the meter.
4. Start the burner and use a stopwatch to measure the number of **timed seconds** it takes for the burner to fire 1 cubic foot of gas.
5. Calculate the firing rate in BTU/Hr. using the following equation:

$$\text{Firing rate BTU/Hr.} = \text{Heating value (BTU/Ft}^3\text{)} \times 3,600 \div \text{Timed seconds}$$

For example, if the heating value is 1,050 BTU/Ft³ and you timed 1 cubic foot of gas at 42 seconds then firing rate BTU/Hr = 1050 x 3,600 ÷ 42 which calculates to 90,000 BTU/Hr.

If the burner is firing LP gas, a meter is usually not available. Contact your LP supplier for recommendations.

Figure 9 – Gas Valve Pressure Adjustment

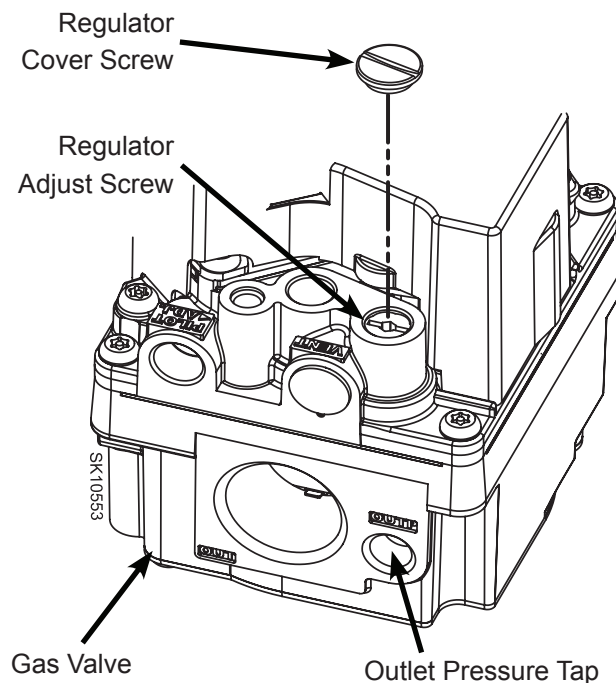
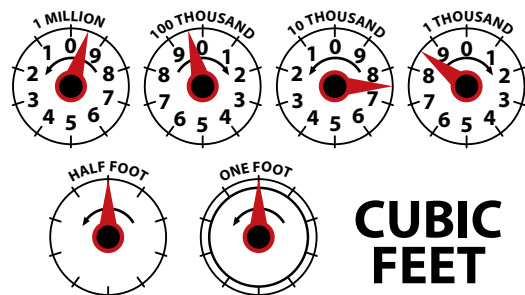


Figure 10 – Typical Gas Meter Layout



Check Operation and Safety Controls

The testing of operating and safety controls requires technical training and experience with power gas burners and appliances.

Carefully follow the manufacturer's instructions supplied with the appliance and the controls.

Verify the correct function of all operating and safety controls used in the installation.

If instructions are not available, use the following recommended procedures and record all results in a start-up log.

1. **High limit/ Pressure Control** – To check the High Limit, raise the temperature or pressure of the operating control to a higher level and lower the limit to a setting less than the operating control. Run the burner until the high limit opens and shuts the burner off. Adjust the controls back to the desired settings.
2. **Operating control** – Run the burner until the operating control shuts it off. If necessary, make adjustments to ensure the control cycles the burner in the desired temperature or pressure range.
3. **Low water cutoff (LWCO)** – With the burner firing, open the blow down valve on the low water cutoff, if applicable. As the water level drops, the LWCO switch contacts open and shut the burner off. When the water level rises, the LWCO contacts close and restart the burner. Monitor the LWCO switch operation in relation to the water level in the sight-glass for synchronization.

NOTICE

Operating controls should be set to minimize the number of firing cycles that the burner runs. High cycling rates increase the possibility of light-off lock outs.

Setting Combustion

NOTICE

Always use calibrated test instruments to set combustion levels. Verify that test instruments are calibrated and in good working condition. If not already provided, drill test access holes in the flue pipe near the breech (or upstream of the boiler breech damper, if applicable) and in the front mounting plate area for firebox pressure. Be careful not to damage any water-backed surface.

Verify that all boiler sections, canopy, and access plates or doors are fully equipped with gaskets and sealed against any leakage, which could affect the combustion test results. Before making these tests, operate the burner to allow the heating system temperature to stabilize or nearly reach steady-state levels. Record all results in the start-up log for future reference.

- **Draft** – Set the stack or over-fire draft to the level specified by the appliance manufacturer.
- **Natural Draft Applications** – Typically over-fire draft is -0.01" or -0.02" W.C.
- **Direct Venting** – Typically may not require draft adjustment.
- **High Efficiency/Positive Pressure Appliances** – (see manufacturer's recommendations).
- **Oxygen** – It is recommended that you measure the oxygen (O₂) early in the test sequence because high levels of carbon monoxide can be created at very low or even very high O₂ levels. The typical operating range is between 3% – 5%.
- **Carbon monoxide (CO)** – An operating range of 0 -50 PPM is recommended for the CG4 burner. The maximum carbon monoxide (CO) level permitted in the flue gas by the UL 795 Standard is 400 PPM (.04%).
- **Stack Temperature** – The stack temperature must be within the range specified by the appliance manufacturer. Generally a 325°F stack temperature is high enough to avoid corrosive condensation in the vent system, however a large cross sectional flow area chimney or a very tall chimney may require a higher temperature. See ANSI Z 223.1/NFPA 54 for design requirements.

Recommended Combustion Adjustment Procedure

- ## Recommended Combustion Adjustment Procedure
1. Initiate a call for heat.
 2. Adjust the draft or breech pressure to the appliance manufacturer's recommended level after flame has stabilized. A breech pressure that does not exceed -0.04 to -0.06"W.C. is generally acceptable.
 3. Measure the carbon monoxide level and adjust air settings, if necessary, to temporarily raise CO to about 50 PPM for a test point.
 4. Measure the O₂ or CO₂ at the 50 PPM CO level. For this discussion, assume the O₂ is 1.5% (11% CO₂).
 5. Open the air adjustment until the O₂ level is increased by at least 1% or to 3% O₂ (whichever is higher). This should reduce the CO level and provide a margin of reserve air to accommodate variable conditions.
 6. Sample the CO level again. It should be in the 0 to 20 PPM range.
 7. Check the draft to ensure it still meets specifications. If a major change in draft is required, repeat the above steps.
 8. Check draft regulator for spillage. Confirm the condition of the chimney if spillage is present.
 9. Verify stack temperature meets appliance manufacturer's recommendations.
 10. Perform any final adjustments and lock the air settings securely. Run the burner through several cycles to verify prompt ignition and stable burner operation.
 11. Record the combustion performance readings, burner settings and appliance data on the start-up form in the back of this manual and on the start-up tag. If the burner is firing LP gas you must also record set-up information on the propane conversion label and attach it to the appliance.
 12. Hang the start-up tag in a prominent, safe location on or near the burner for future reference.

Notes

[illegible]

Notes

[illegible]

Contractor Start-Up Form

Installation Name: _____ Installation Date: _____

Installation Address: _____

Start-Up Contractor's Name _____ Phone: _____

Name of Technician _____

■ Appliance *(Below information can be obtained from appliance name plate)*

Manufacturer: _____

Type (circle one): [**Boiler / Furnace / Other**] Model #: _____ Serial #: _____

Input MBH: _____ Original Appliance Designed for (circle one): [**Oil / Natural Gas / Propane**]

Output MBH: _____

Limits	Limit Model No. (Indicate n/a if not required by the appliance manuf.)	Operation Verified
Temperature		YES / NO
Pressure		YES / NO
LWCO		YES / NO
Other Limits		YES / NO / n/a

■ Burner

Fuel: [**Natural Gas / Propane**] Model #: _____ Serial #: _____

Combustion Head: [**F3G / F4G / F6G**] Fuel Orifice Size: _____ Air Shutter Setting: _____

Air Band Setting: _____ [**or Blank Band Installed**] Baffle: [**Installed / Not Required**]

■ Chimney/Smoke Pipe

Chimney Type: [**Masonry / Metal Vent / Direct Vent**] Location (circle one): [**Inside / Outside**]

Chimney Height: _____ Flue Pipe Size: _____ Flue Pipe Length: _____

Number of Elbows: _____ Confirm Double Acting Draft Regulator Installed: [**Yes / No**]

Thermal Safety Switch Installed [**Yes / No**] Voltage: [**120V / 24V**]

Gas Supply Piping

Pipe Diameter: _____ Length of Pipe from Burner to Meter: _____ Number of Elbows: _____

Gas Pressure to Burner Gas Valve While Burner is Operating _____ Inches W.C.

■ Combustion Readings

O₂: _____% CO: _____ PPM CO₂: _____% Stack Temperature (325°F MIN.): _____°F

Manifold Gas Pressure: _____ (Inches W.C.) Draft at Breech _____ W.C.

Limited Warranty Information

The R. W. BECKETT CORPORATION ("Beckett") warrants to persons who purchase its "Products" from Beckett for resale, or for incorporation into a product for resale ("Customers"), that its equipment is free from defects in material and workmanship. To qualify for warranty benefits, products must be installed by a qualified service agency in full compliance with all codes and authorities having jurisdiction, and used within the tolerances of Beckett's defined product specifications.

To review the complete warranty policy and duration of coverage for a specific product, or obtain a written copy of warranty form 61545, please choose one of the following options:

1. Visit our website at: www.beckettcorp.com/warranty
2. Email your request to: rwb-customer-service@beckettcorp.com
3. Write to: R. W. Beckett Corporation, P. O. Box 1289, Elyria, OH 44036

NOTE: Beckett is not responsible for any labor cost for removal and replacement of equipment.

THIS WARRANTY IS LIMITED TO THE PRECISE TERMS SET FORTH ABOVE, AND PROVIDES EXCLUSIVE REMEDIES EXPRESSLY IN LIEU OF ALL OTHER REMEDIES, AND IN PARTICULAR THERE SHALL BE EXCLUDED THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL BECKETT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE OF ANY NATURE. Beckett neither assumes, nor authorizes any person to assume for Beckett, any other liability or obligation in connection with the sale of this equipment. Beckett's liability and Customer's exclusive remedy is limited to the cost of the product.



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