2022 Fall Gas Furnace Service

Instructor: Josh Goodman

Josh.goodman@carrierenterprise.com

Carrier

CE

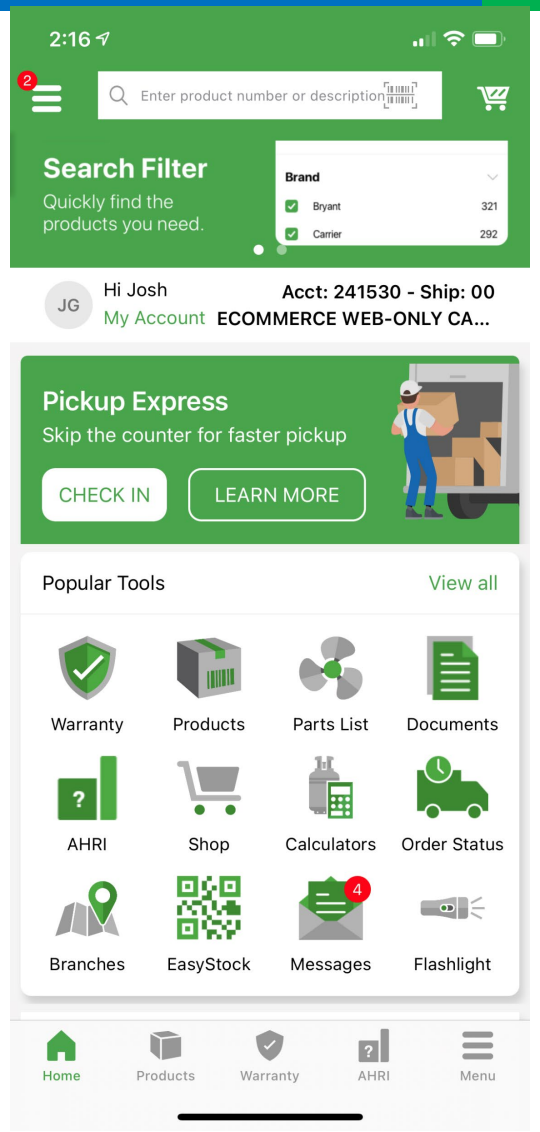
bryant

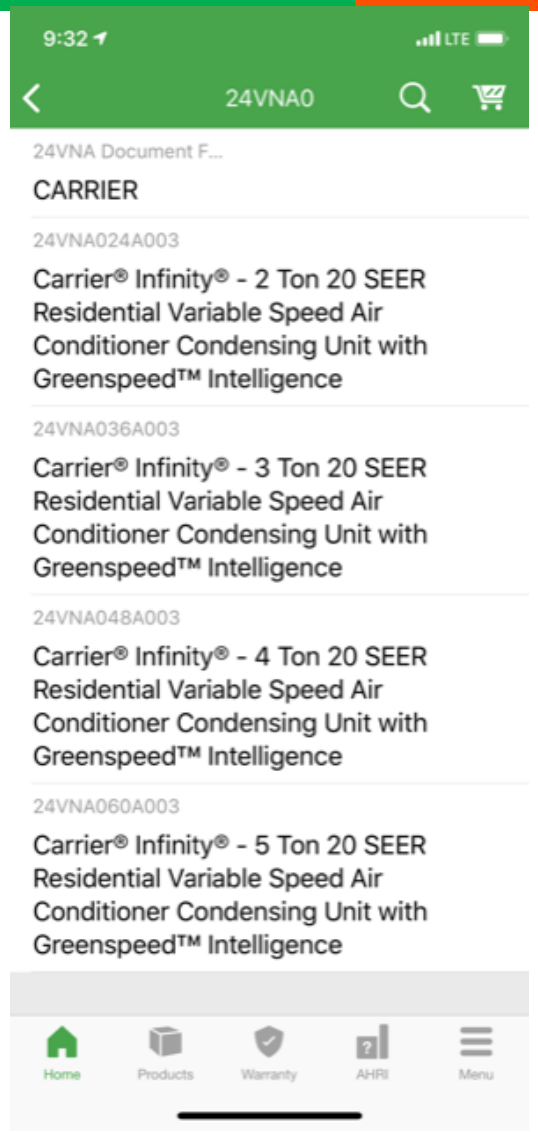
Heating & Cooling Systems

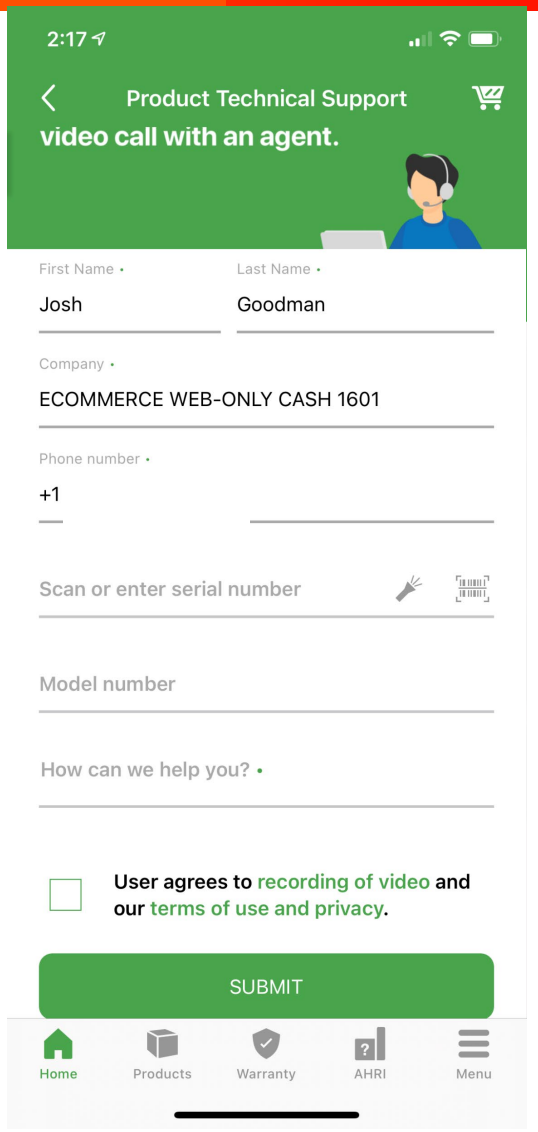
Site Demo

CEMATRAINING.COM

“CE – HVAC CONTRACTOR ASSIST”

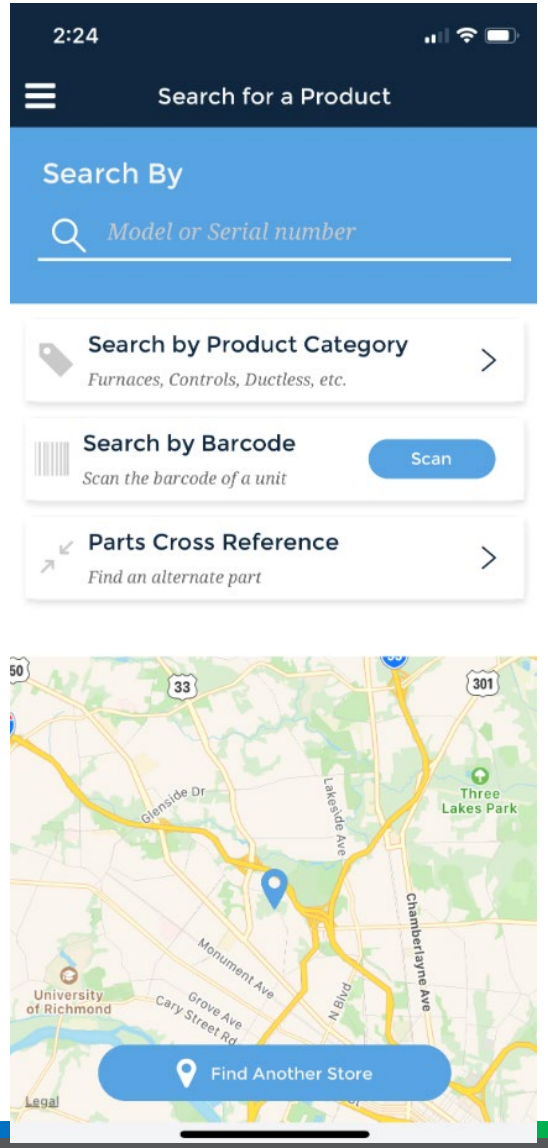


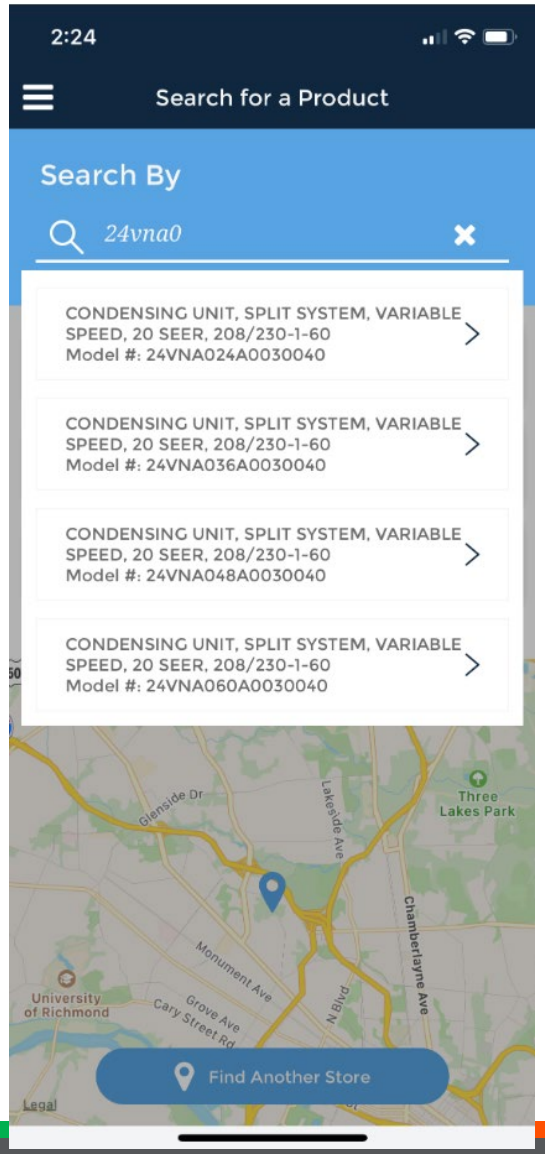


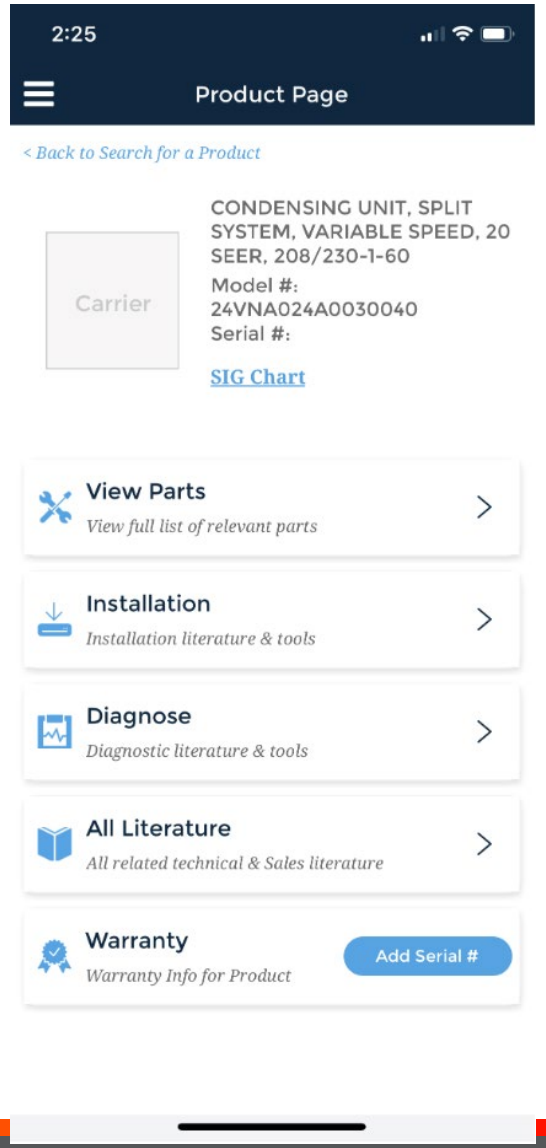


“CARRIER SERVICE TECH”

Service Tech







TECH SUPPORT

866-902-4822

Option #3

or

CE App(Wingman)

or

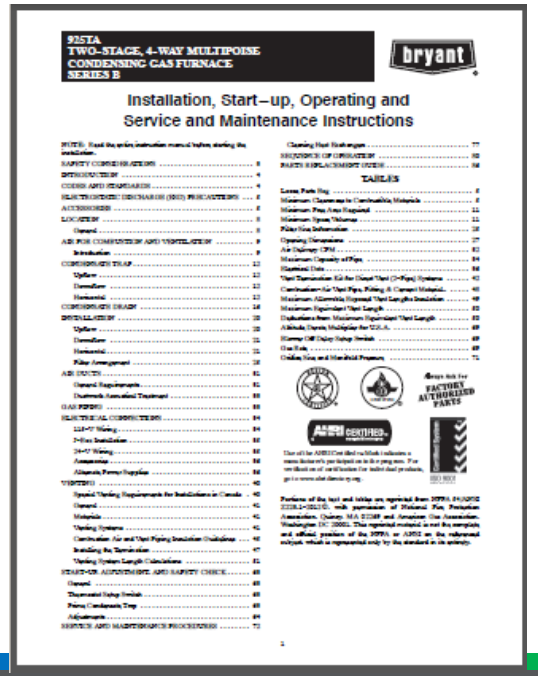
Cematraining.com

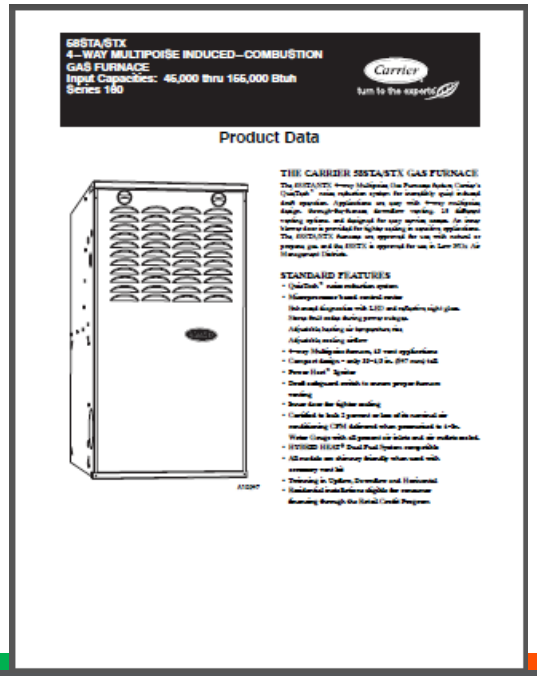
or

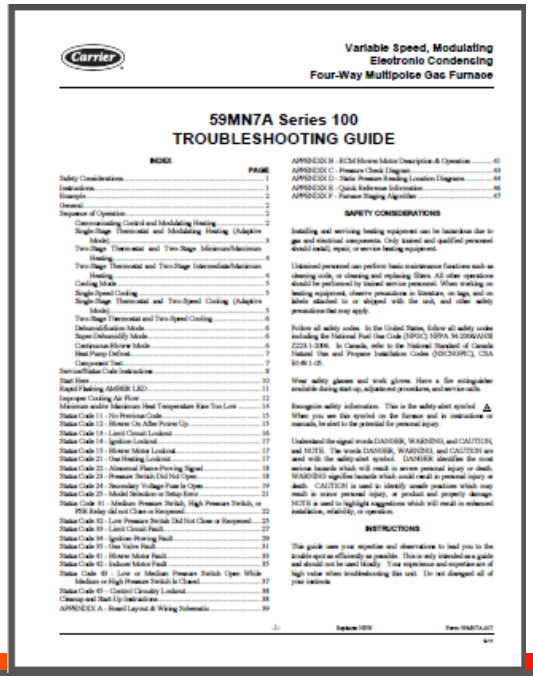
cma.techsupport@carrierenterprise.com

Available Literature

- Installation Instruction
- Product Data
- Troubleshooting Guide (Infinity/Evolution Series)







Furnace Installation Instructions

58SC0A/58SC1A
4–Way Multipoise
Non–Condensing 33–1/3 in. Gas Furnace
Input Capacities: 45,000 thru 135,000 Btuh

Carrier
turn to the experts

Installation, Start–up, Operating and Service and Maintenance Instructions

Certified System
ISO 9001 Quality

AHRI CERTIFIED

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to www.ahridirectory.org.

NOTE: Read the entire instruction manual before starting the installation.

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SAFETY CONSIDERATIONS

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, serious injury, death, or property damage.

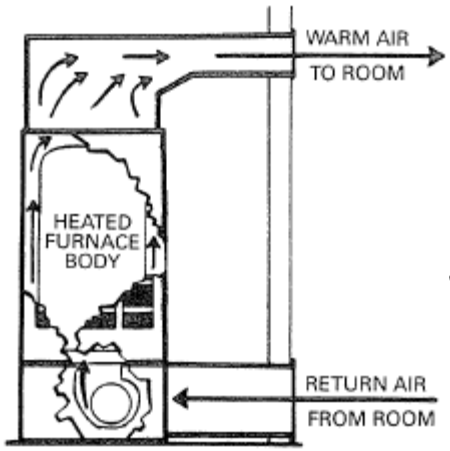
Improper installation, adjustment, alteration, service, maintenance, or use could cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified service agency must use only factory–authorized and listed kits or accessories when modifying this product.

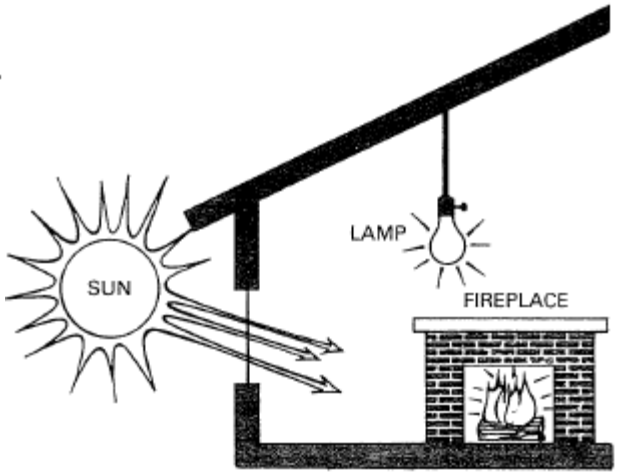
FURNACE SERVICE TRAINING

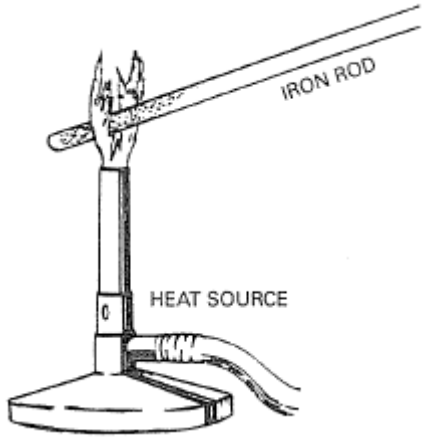
- **Objectives**
  - **Gas Heating Fundamentals**
  - **Sequence of Operation**
  - **Service Procedures**
  - **LED Flash Code**

Heat transfer

What are the 3 methods of heat transfer ?







Heat transfer

Heat transfer is accomplished in 3 ways: conduction and convection and radiation

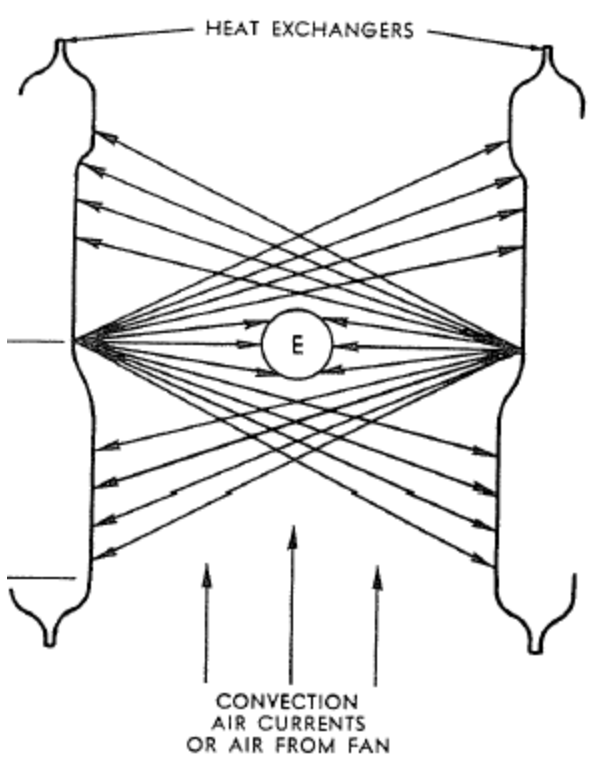
- **Convection** – transmission of heat by the circulation and mixing of air (through a fluid)

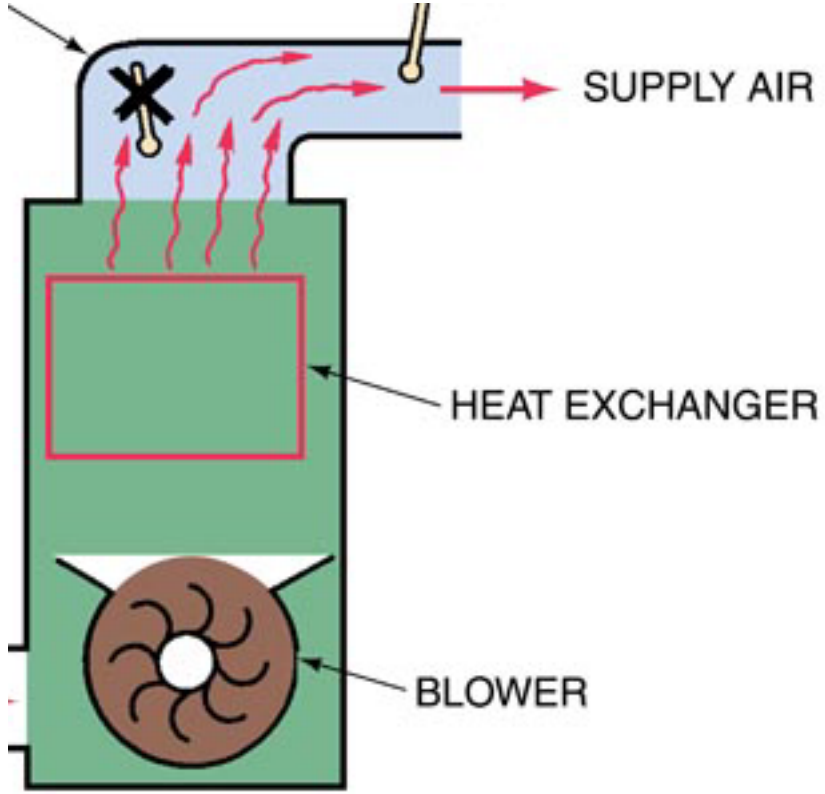
  Example: Blower in the furnace forcing air across the heat exchanger
- **Radiation** – Heat transfer through space (light)

  Example: Limit switch senses radiant heat from heat exchanger.
- **Conduction** – the transmission of heat from one part of the same piece or between pieces that are in physical contact (through a solid)

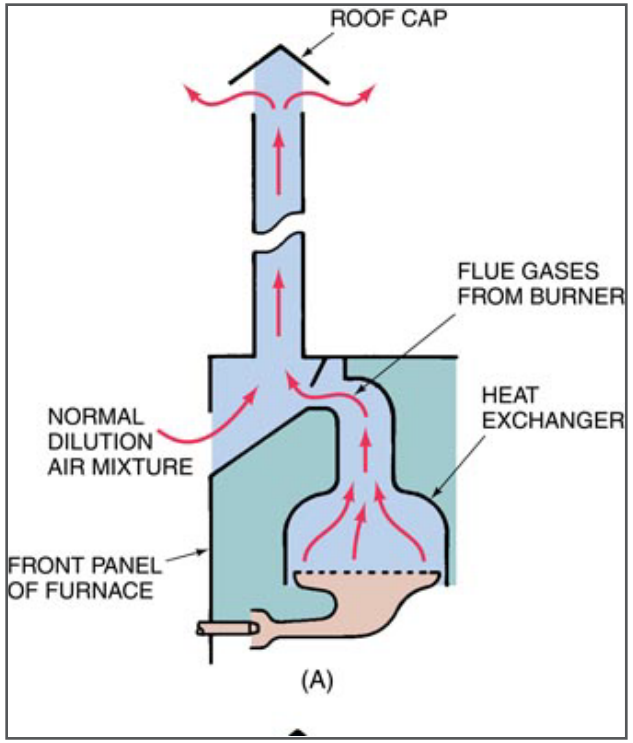
  Example: heat exchanger-flame-air

Radiant

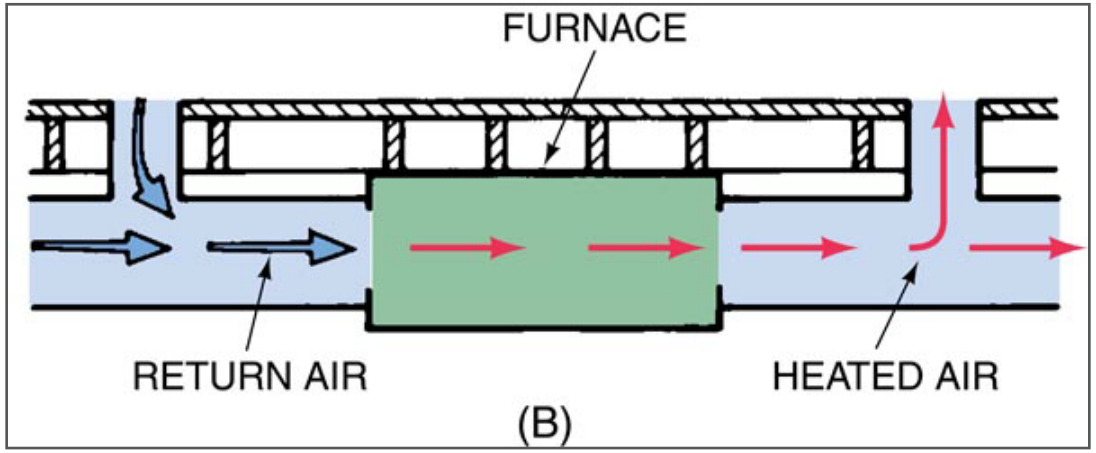

HEAT EXCHANGERS
E
CONVECTION
AIR CURRENTS
OR AIR FROM FAN

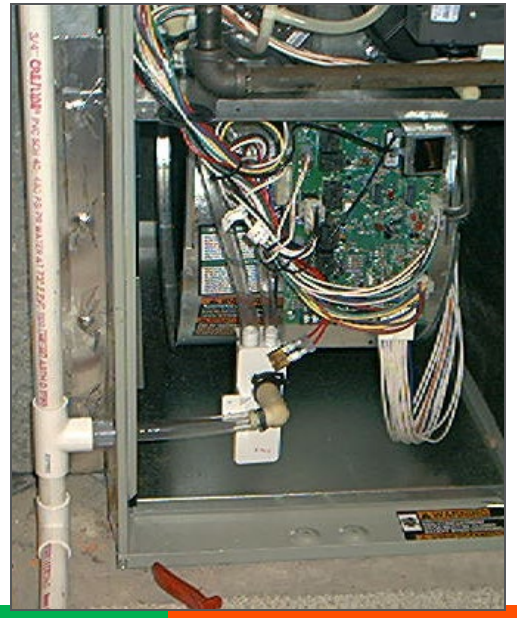

SUPPLY AIR
HEAT EXCHANGER
BLOWER

Convection



Natural



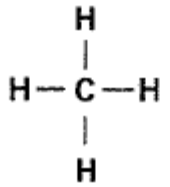


Forced

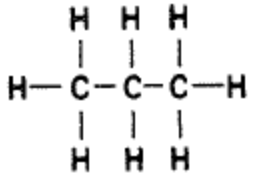
Furnace sub-systems

- Heat producing system
  - Manifold, burners, ignition, controls, heat exchanger and venting system
  - Venting system removes flue gases
- Heated air distribution system
  - Blower and controls
  - Ductwork and air distribution system

Fundamentals of Combustion



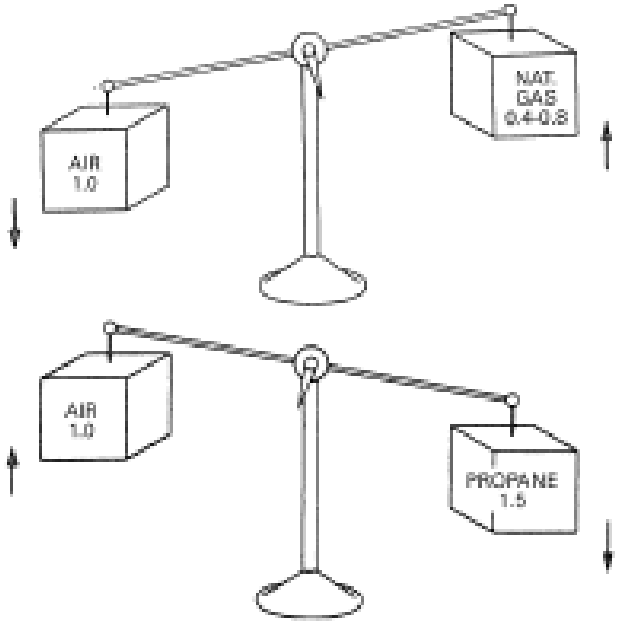
METHANE CH_4



PROPANE C_3H_8

Fundamentals of Combustion

Specific gravity of common fuel gases



Natural Gas (methane)

- **Specific Gravity of 0.6 (Lighter than air - Specific gravity of air = 1.0)**
- **Heating value of approximately 1,050 Btu per cubic foot**

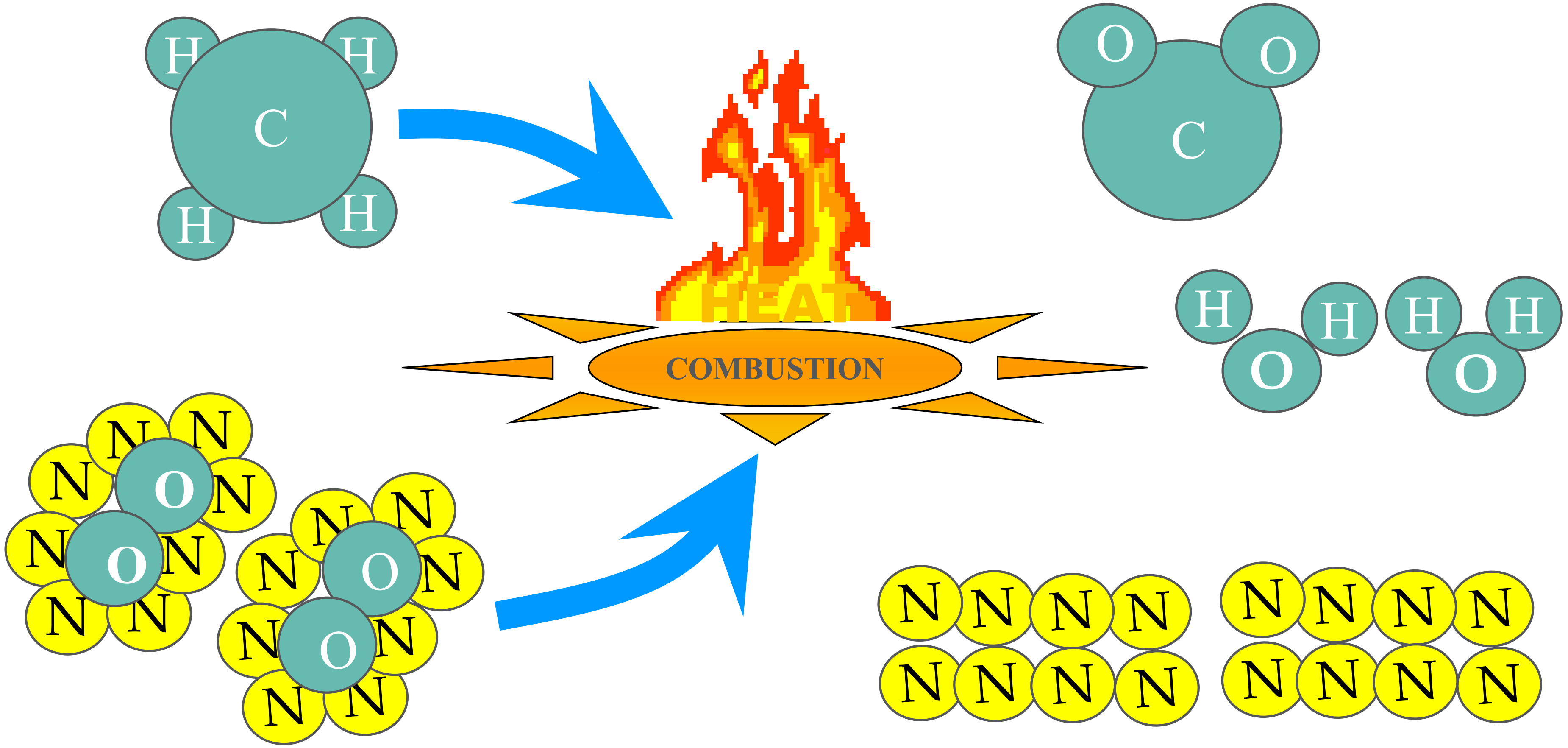
LPG Gas (Propane)

- **Specific Gravity of 1.5**
- **Heating value of approximately 2,500 Btu/cuff.**

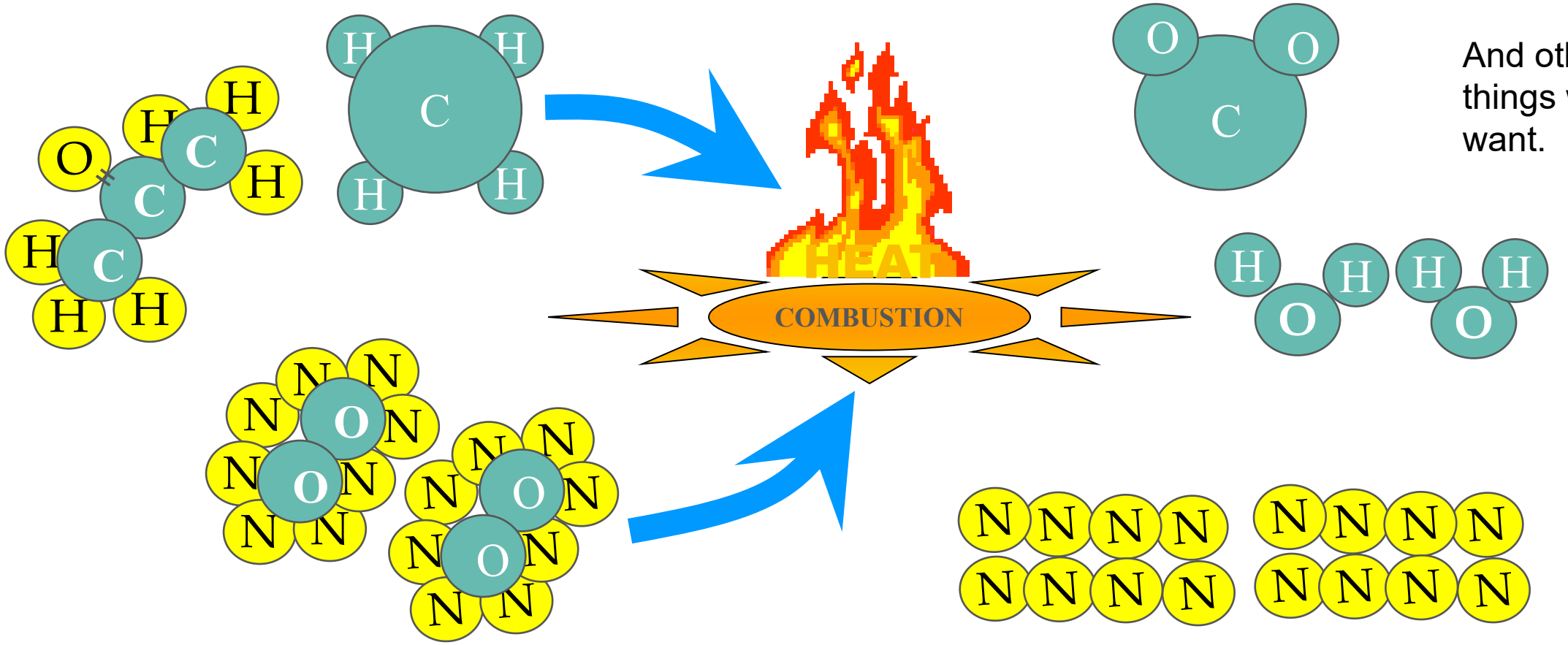
Mercaptan is the odor in natural gas & propane

Fundamentals of Combustion

Fundamentals of Combustion



Fundamentals of Combustion



And other bad things we do not want.

Combustion Air

Combustion Air

- Gas fired appliances use a 15:1 ratio of gas and combustion air mixture. (Every 1 cu. Ft. of gas requires 15 cu.ft. of combustion air)

- Combustion air need to be free from household chemicals or corrosion of the heats exchanger and vent system could occur.

Rating plate

Model Number

Serial Number

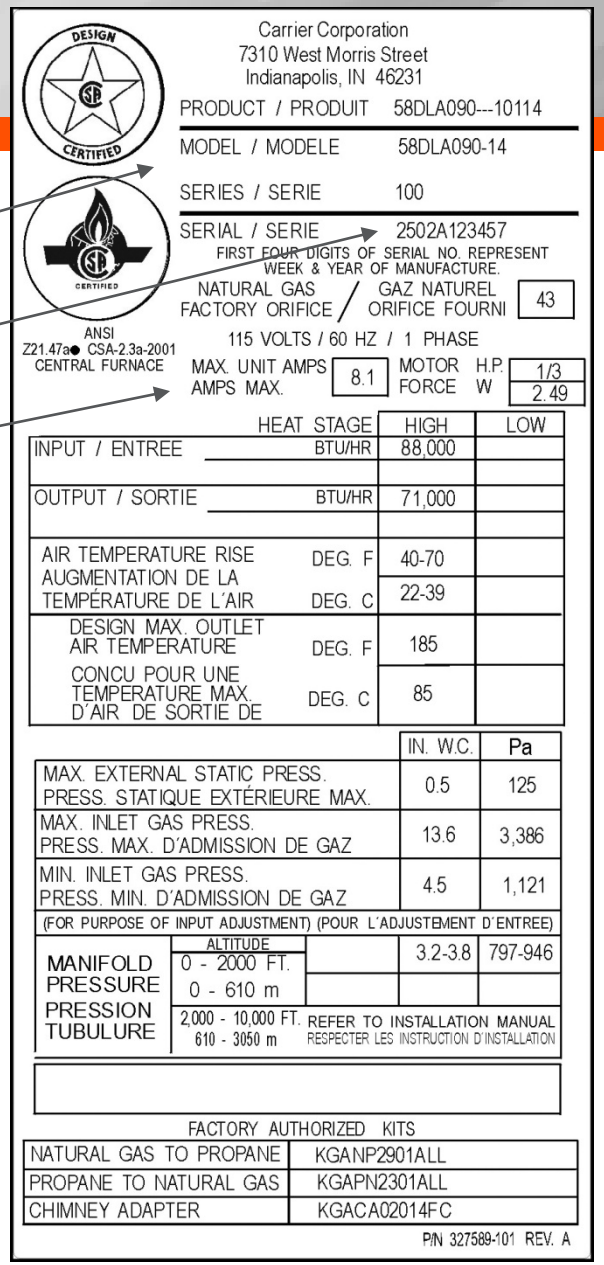
Motor Data

Burner Data

Temperature Rise Data

Operational Parameters

Authorized Accessories



Carrier Corporation
7310 West Morris Street
Indianapolis, IN 46231

PRODUCT / PRODUIT 58DLA090---10114
MODEL / MODELE 58DLA090-14
SERIES / SERIE 100
SERIAL / SERIE 2502A123457
FIRST FOUR DIGITS OF SERIAL NO. REPRESENT WEEK & YEAR OF MANUFACTURE.
NATURAL GAS FACTORY ORIFICE / GAZ NATUREL ORIFICE FOURNI 43

ANSI Z21.47a● CSA-2.3a-2001 CENTRAL FURNACE

115 VOLTS / 60 HZ / 1 PHASE
MAX. UNIT AMPS AMPS MAX. 8.1
MOTOR H.P. FORCE W 1/3 2.49

HEAT STAGE		HIGH	LOW
INPUT / ENTREE	BTU/HR	88,000	
OUTPUT / SORTIE	BTU/HR	71,000	
AIR TEMPERATURE RISE AUGMENTATION DE LA TEMPÉRATURE DE L'AIR	DEG. F	40-70	
	DEG. C	22-39	
DESIGN MAX. OUTLET AIR TEMPERATURE	DEG. F	185	
CONCU POUR UNE TEMPERATURE MAX. D'AIR DE SORTIE DE	DEG. C	85	

	IN. W.C.	Pa
MAX. EXTERNAL STATIC PRESS. PRESS. STATIQUE EXTÉRIEURE MAX.	0.5	125
MAX. INLET GAS PRESS. PRESS. MAX. D'ADMISSION DE GAZ	13.6	3,386
MIN. INLET GAS PRESS. PRESS. MIN. D'ADMISSION DE GAZ	4.5	1,121

(FOR PURPOSE OF INPUT ADJUSTMENT) (POUR L'ADJUSTEMENT D'ENTREE)

	ALTITUDE			
MANIFOLD PRESSURE PRESSION TUBULURE	0 - 2000 FT. 0 - 610 m		3.2-3.8	797-946
	2,000 - 10,000 FT. 610 - 3050 m	REFER TO INSTALLATION MANUAL RESPECTER LES INSTRUCTION D'INSTALLATION		

FACTORY AUTHORIZED KITS

NATURAL GAS TO PROPANE	KGANP2901ALL
PROPANE TO NATURAL GAS	KGAPN2301ALL
CHIMNEY ADAPTER	KGACA02014FC

P/N 327589-101 REV. A

Combustion Air

The requirements for combustion and ventilation air depend upon whether or not the furnace is located in a space having a volume of at least 50 cubic feet per 1,000 Btuh input rating for all gas appliances installed in the space.

- Spaces having less than 50 cubic feet per 1,000 Btuh require the OUTDOOR COMBUSTION AIR METHOD.

- Spaces having at least 50 cubic feet per 1,000 Btuh may use the **INDOOR COMBUSTION AIR, STANDARD or KNOWN AIR INFILTRATION** METHOD.

90% Furnace Ventilation

Direct Vent (2-pipe) Applications

When the furnace is installed as a direct vent (2-pipe) furnace, no special provisions for air for combustion are required. However, other gas appliances installed in the space with the furnace may require outside air for combustion. Follow the guidelines below to insure that other gas appliances have sufficient air for combustion.

Non-Direct Vent (1-pipe) Applications

When the furnace is installed as a non-direct vent (1-pipe) furnace, it will be necessary to insure there is adequate air for combustion. Other gas appliances installed with the furnace may also require air for combustion and ventilation in addition to the amount of combustion air and ventilation air required for the furnace. Follow the guidelines below to insure that the furnace and other gas appliances have sufficient air for combustion.

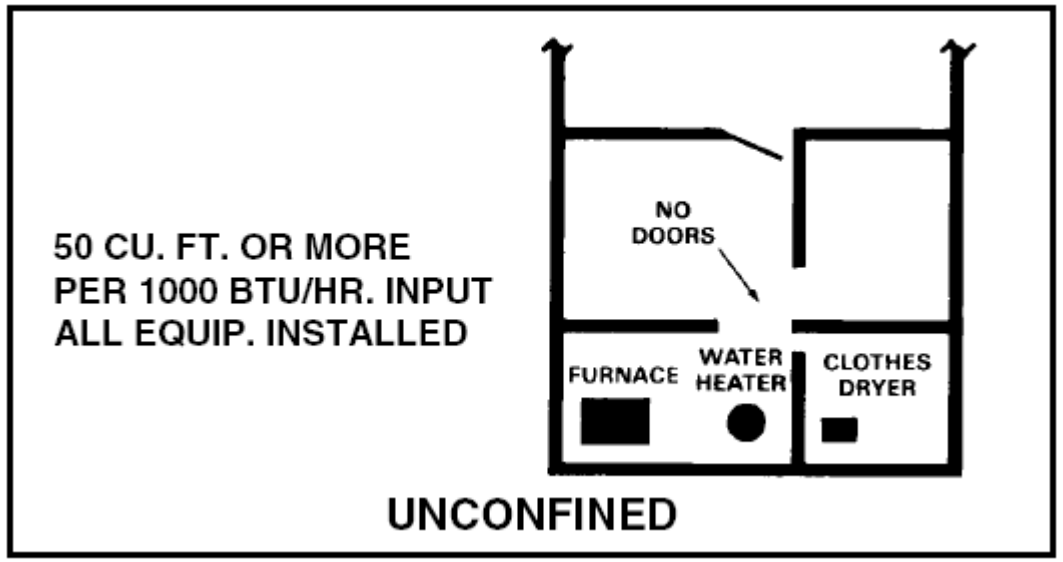
Furnace Ventilation

- This requirement applies to both 80% & 90% single pipe venting
- Confined space is a space with a volume less than 50 cu.ft per 1,000 Btu/h of the total input of all gas fired appliances
- Unconfined space is a space with a volume that is greater than 50 cu. ft per 1,000 Btu/h
- Each opening used to introduce combustion air into a confined space must have a total free area of at least 1 sq. in. per 1,000 Btu/h total input and not less than 100 sq.in.

Furnace Ventilation

Ex: My Garage
80K input gas furnace
45K input water heater
125K input 125 X 50 cu ft = 6250 cubic feet

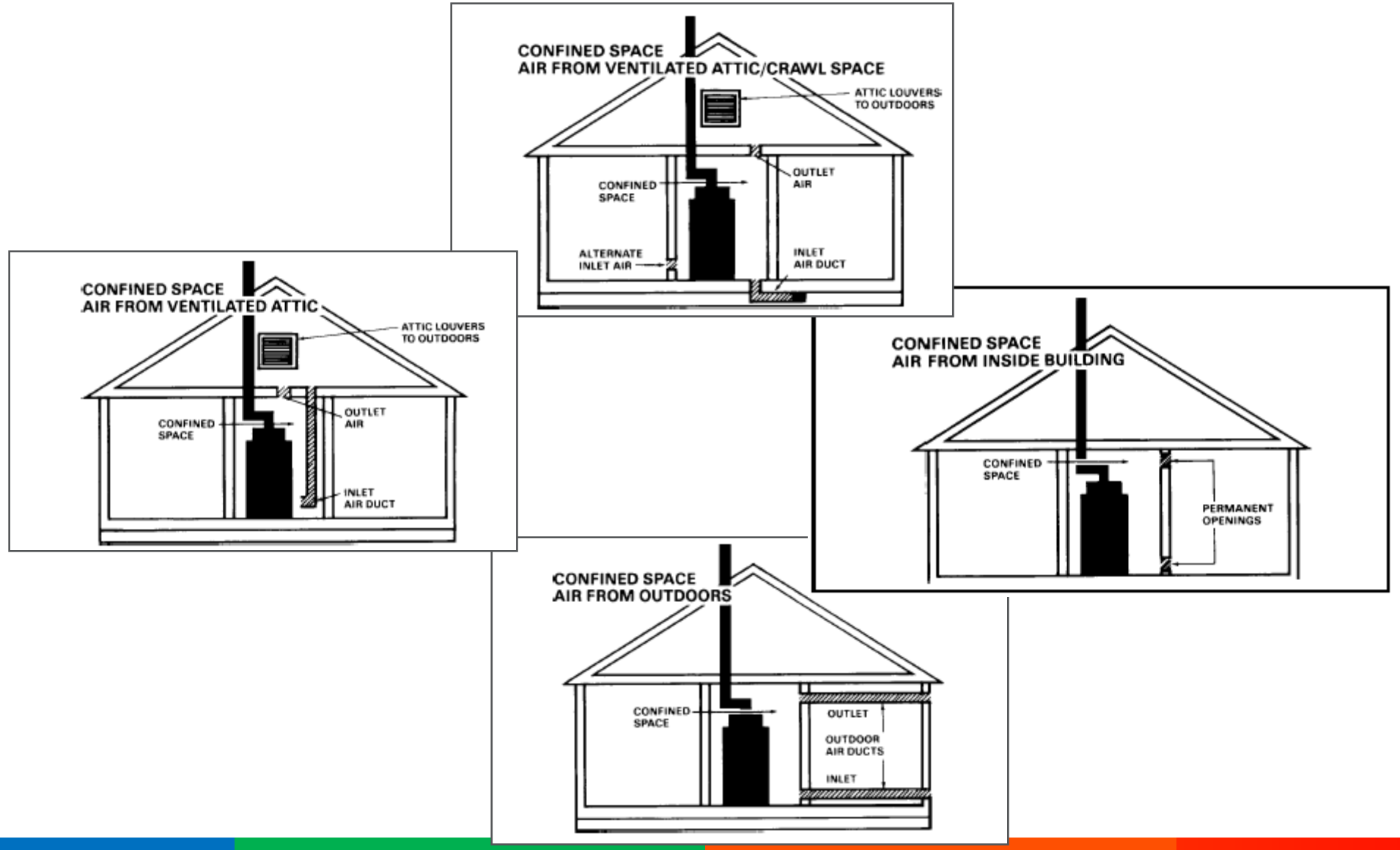
Room size 20 x 20 x 14 = 5600 cubic feet
14-foot ceiling in the garage



Ex: Smaller Utility Room or a Townhome
60K input gas furnace
40K input water heater
100K input 100 X 50 cu ft = 5000 cubic feet

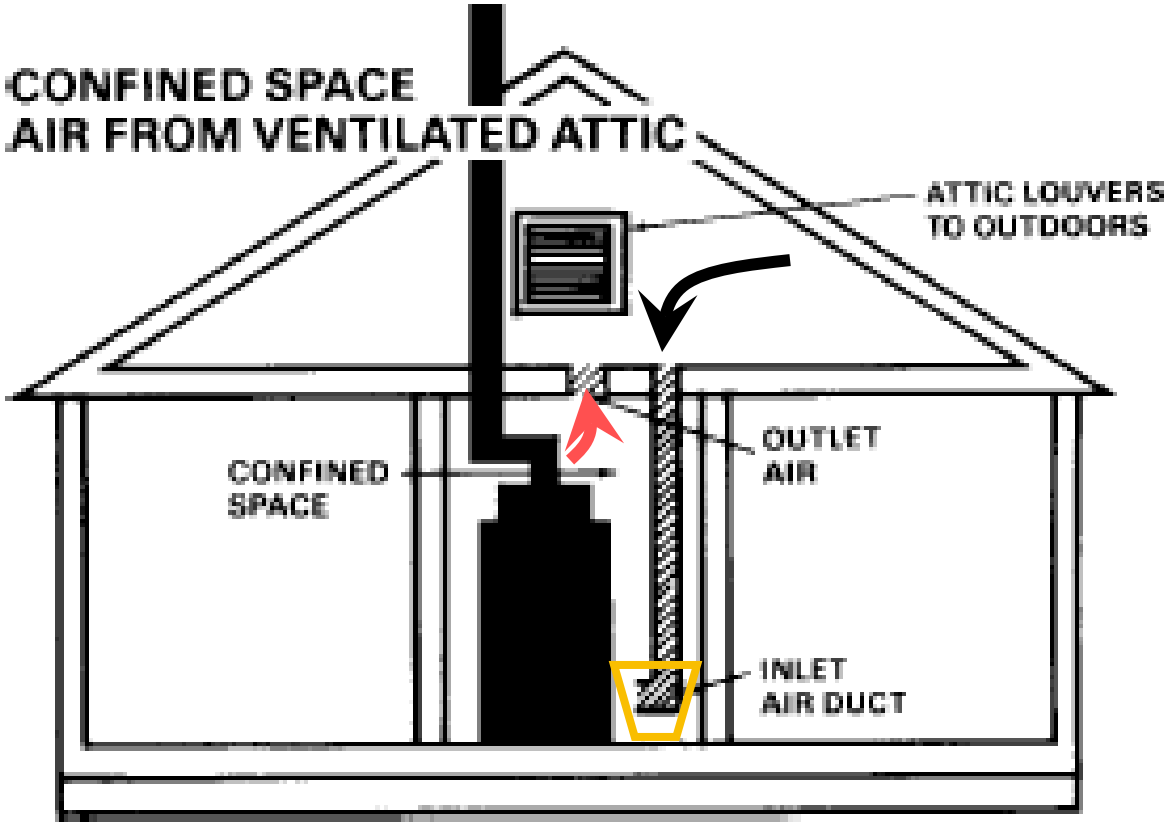
Room size 12 x 16 x 8 = 1536 cubic feet
8-foot ceiling in the utility room, maybe a floor grill in the room to the crawl space.
What if the room has a dryer that could also remove air from the room, when operating.

Furnace Ventilation



Furnace Ventilation

Furnace room vents all by itself due to natural draft.



Vent & Combustion air Design & Installation vent design rules

Do not exceed the maximum equivalent vent length in the Installation Instructions.

↓

Affect on Operation: Vent system pressure drop is too high. Burners starved of combustion air resulting in incomplete combustion.

Maximum Equivalent Vent Length (Example)

	Unit Size	80,000							100,000				
	Pipe Dia. (in)	1 ½		2		2 ½	3	4	2		2 ½	3	4
	Model Family	Single Stage 92% & 95%, Two Stage	Modulating	Single Stage 92% & 95%, Two Stage	Modulating	All			Single Stage 92% & 95%, Two Stage	Modulating	All		
Altitude (feet)	0-2000	15	25	50	95	130	175	200	20	35	80	175	200
	2001-3000	10	20	45	65	125	165	185	15	30	75	165	185
	3001-4000					115	155	175				155	175
	4001-4500		15	40		110	150	165	10		70		170
	4501-5000						145	160			65	150	165
	5001-6000			35	55	100	135	150		25		140	155
	6001-7000	N/A		30	50	90	125	140		20	60	135	145
	7001-8000						120	125	N/A		55	125	135
	8001-9000		10	25	45	80	110	115			50	115	125
	9001-10000			20	40	75	100	105		15	45	100	115

For example, a total equivalent vent length of 30 feet is needed for an 80,000 BTU condensing furnace.

Vent & Combustion air Design & Installation vent design rules

Use the smallest practical vent diameter listed in the Installation Instructions.

Affect on Operation: Vent system pressure drop is too low. Too much combustion air causes an unstable flame.

Maximum Equivalent Vent Length (Example)

	Unit Size	80,000							100,000				
	Pipe Dia. (in)	1 ½		2		2 ½	3	4	2		2 ½	3	4
	Model Family	Single Stage 92% & 95%, Two Stage	Modulating	Single Stage 92% & 95%, Two Stage	Modulating	All			Single Stage 92% & 95%, Two Stage	Modulating	All		
Altitude (feet)	0-2000	15	25	50	95	130	175	200	20	35	80	175	200
	2001-3000	10	20	45	65	125	165	185	15	30	75	165	185
	3001-4000					115	155	175				155	175
	4001-4500		15	40		110	150	165	10		70		170
	4501-5000						145	160			65	150	165
	5001-6000			35	55	100	135	150		25		140	155
	6001-7000	N/A		30	50	90	125	140		20	60	135	145
	7001-8000						120	125	N/A		55	125	135
	8001-9000		10	25	45	80	110	115			50	115	125
	9001-10000			20	40	75	100	105		15	45	100	115

For example, a total equivalent vent length of 30 feet is needed for an 80,000 BTU condensing furnace.

Vent & Combustion air Design & Installation vent design rules

Locate vent and combustion air terminations above the anticipated snow line.

↓

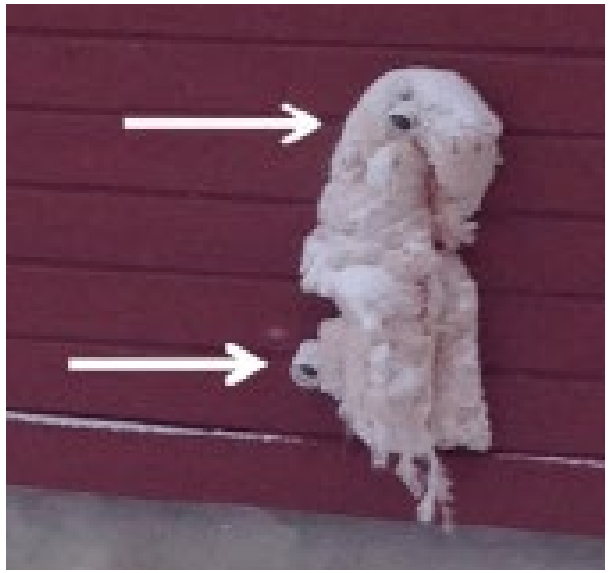
Affect on Operation: Vent or combustion air termination becomes partially or fully blocked by snow or ice. Burners starved of combustion air resulting in incomplete combustion.

Vent & Combustion air Design & Installation vent design rules

Space combustion air and vent terminations away from another fuel gas appliance vent termination, dryer vent and plumbing stack by the distance stated in the National or International Fuel Gas Code

Affect on Operation: Vent or combustion air termination becomes partially or fully blocked by ice. Burners starved of combustion air resulting in incomplete combustion.

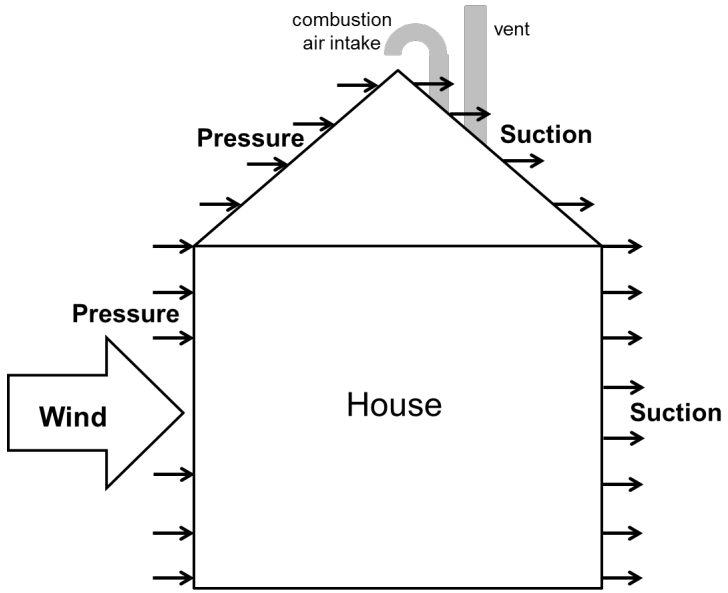
Affect on Operation: Flue gas is pulled into combustion air termination. Burners starved of oxygen resulting in incomplete combustion.

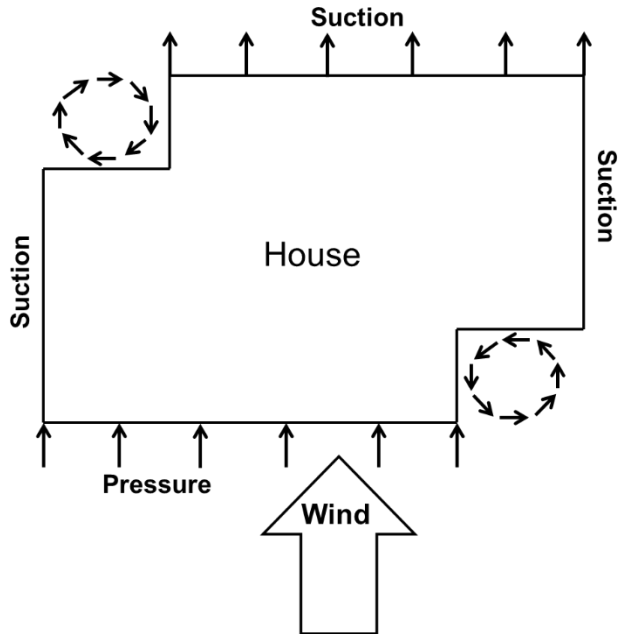


Vent & Combustion air Design & Installation vent design rules

Locate vent and combustion air termination is in a space that is protected from prevailing winds.

Affect on Operation: Inducer is unable to overcome wind pressure.

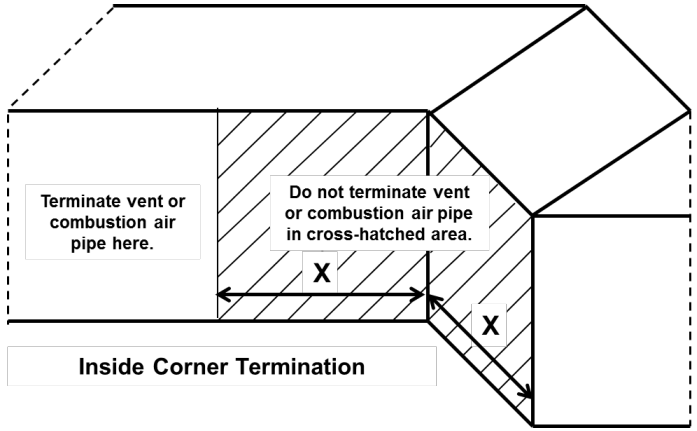




Vent & Combustion air Design & Installation vent design rules

Do not locate vent and combustion air terminations on an inside corner as described in the Installation Instructions.

Affect on Operation: Combustion products are pulled into combustion air termination. Burners are starved of oxygen resulting in incomplete combustion.

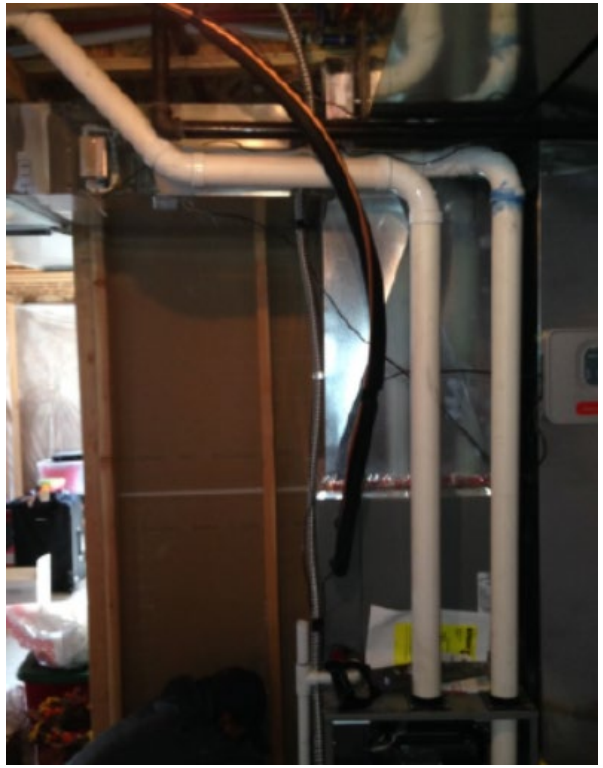


Vent & Combustion air Design & Installation vent design rules

Pipe slope is less than ¼” per foot toward furnace.

↓

Affect on Operation: Liquid water collects at elbows or horizontal sections causing partial blockage and water slugs create pressure waves.

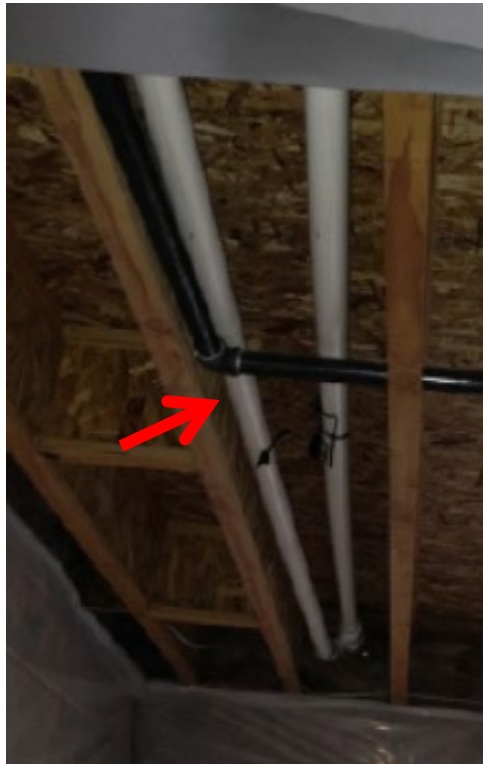


Vent & Combustion air Design & Installation vent design rules

Too much space between pipe support resulting in sags.

↓

Affect on Operation: Liquid water collects in the low section of vent pipe, which causes partial blockage and pressure changes.



Vent & Combustion air Design & Installation vent design rules

Horizontal sections less than 4 feet must have a minimum ¼” per foot slope to the furnace.

Affect on Operation: Liquid water collects in horizontal section causing partial blockage and water slugs create pressure waves.

Vent & Combustion air Design & Installation vent design rules

- Tables are based on Maximum Equivalent length
  - Starts with a maximum length
  - Deduct for type of fittings used
  - No restriction on number of elbows

Vent & Combustion air Design & Installation vent design rules

Example:
60k Btuh
2000-foot sea level

Table 17 – Maximum Equivalent Vent Length

NOTE: Maximum Equivalent Vent Length (MEVL) includes standard and concentric vent termination and does NOT include elbows. Use Table 18 - Deductions from Maximum Equivalent Vent Length to determine allowable vent length for each application.

Single Stage 92% – Ft.

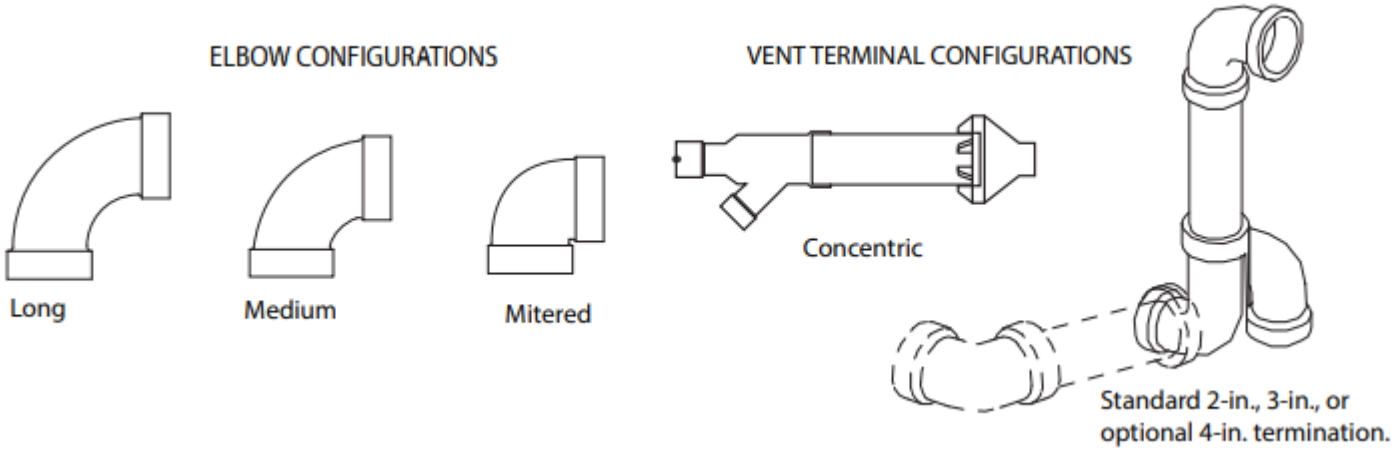
Altitude (feet)	Unit Size	40,000 [1]			60,000 [2]				80,000					100,000 [3]				120,000 [3]		
	Pipe Dia. (in)	1 ½	2	2 ½	1 ½	2	2 ½	3	1 ½	2	2 ½	3	4	2	2 ½	3	4	2 ½	3	4
	0–2000	20	85	185	20	100	175	200	15	55	130	175	200	20	80	175	200	10	75	185
	2001–3000	15	80	175		95	165	185	10	49	125	165	185	15	75	165	185		70	175
	3001–4000		70	160	16	90	155	175			115	155	175			155	175	5	65	165
	4001–4500	10		155	15	85	150	170		44	110	150	165	10	70		170	N/A	60	160
	4501–5000			145		80		165				145	160		65	150	165			
	5001–6000		60	130		75	140	155		41	100	135	150			140	155			155
	6001–7000	5	55	120	13	70	130	145	N/A	38	90	125	140		60	135	145		50	140
	7001–8000		50	110	10	65	120	135		36		120	125	N/A	55	125	135		46	130
	8001–9000	N/A	30	95	5	60	115	125		33	80	110	115		50	115	125		43	120
	9001–10000		25	85	N/A	55	105	115		30	75	100	105		45	100	115		39	115

Single Stage 92% – Metric

Altitude (meters)	Unit Size	40,000 [1]			60,000 [2]				80,000					100,000 [3]				120,000 [3]		
	Pipe Dia. (mm)	38	51	64	38	5	64	76	38	51	64	76	102	51	64	76	102	64	76	102
	0–610	6.0	25.9	56.3	6.0	30.4	53.3	60.9	4.5	16.7	39.6	53.3	60.9	6.0	24.3	53.3	60.9	3.0	22.8	56.3
	611–914	4.5	24.3	53.3		28.9	50.2	56.3	3.0	14.9	38.1	50.2	56.3	4.5	22.8	50.2	56.3		21.3	53.3
	915–1219		21.3	48.7	4.8	27.4	47.2	53.3			35.0	47.2	53.3		0.0	47.2	53.3	1.5	19.8	50.2
	1220–1370	3.0		47.2	4.5	25.9	45.7	51.8		13.4	33.5	45.7	50.2	3.0	21.3		51.8	N/A	18.2	48.7
	1371–1524			44.1		24.3		50.2			0.0	44.1	48.7		19.8	45.7	50.2			
	1525–1829		18.2	39.6		22.8	42.6	47.2		12.4	30.4	41.1	45.7		0.0	42.6	47.2			47.2
	1830–2134	1.5	16.7	36.5	3.9	21.3	39.6	44.1	N/A	11.5	27.4	.1	42.6		18.2	41.1	44.1		15.2	42.6
	2135–2438		15.2	33.5	3.0	19.8	36.5	41.1		10.9	0.0	36.5	38.1	N/A	16.7	38.1	41.1		14.0	39.6
	2439–2743	N/A	9.1	28.9	1.5	18.2	35.0	38.1		10.0	24.3	33.5	35.0		15.2	35.0	38.1		13.1	36.5
	2744–3048		7.6	25.9	N/A	16.7	32.0	35.0		9.1	22.8	30.4	32.0		13.7	30.4	35.0		11.8	35.0

Vent & Combustion air Design & Installation vent design rules

Deduct Equivalent length
From total length available



A13110

Table 18 – Deductions from Maximum Equivalent Vent Length - Ft. (M)

Pipe Diameter (in):	1-1/2		2		2-1/2		3		4	
Mitered 90° Elbow	8	(2.4)	8	(2.4)	8	(2.4)	8	(2.4)	8	(2.4)
Medium Radius 90° Elbow	5	(1.5)	5	(1.5)	5	(1.5)	5	(1.5)	5	(1.5)
Long Radius 90° Elbow	3	(0.9)	3	(0.9)	3	(0.9)	3	(0.9)	3	(0.9)
Mitered 45° Elbow	4	(1.2)	4	(1.2)	4	(1.2)	4	(1.2)	4	(1.2)
Medium Radius 45° Elbow	2.5	(0.8)	2.5	(0.8)	2.5	(0.8)	2.5	(0.8)	2.5	(0.8)
Long Radius 45° Elbow	1.5	(0.5)	1.5	(0.5)	1.5	(0.5)	1.5	(0.5)	1.5	(0.5)
Tee	16	(4.9)	16	(4.9)	16	(4.9)	16	(4.9)	16	(4.9)

Vent & Combustion air Design & Installation vent design rules

Example 1

A direct-vent 60,000 BTUH furnace installed at 2000 ft . Venting system includes **FOR EACH PIPE:** 70 feet (22 M) of vent pipe, 65 feet (20 M) of combustion air inlet pipe, (3) 90º long-radius elbows, (2) 45º long-radius elbows, and a factory accessory concentric vent kit.

Can this application use 2" (50 mm ND) PVC/ABS DWV vent piping?

Measure the required linear length of air inlet and vent pipe; insert the longest of the two here					70 ft. (22 M)	Use length of the longer of the vent or air inlet piping system
Add equiv length of (3) 90º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	3	x	3 ft. (0.9 M)	=	9 ft. (2.7 M)	From Table 18
Add equiv length of (2) 45º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	2	x	1.5 ft. (0.5 M)	=	3 ft. (0.9 M)	From Table 18
Add equiv length of factory concentric vent term					0 ft.	From Table 18
Add correction for flexible vent pipe, if any					0 ft.	From Vent Manufacturer's instructions; zero for PVC/ABS DWV
Total Equivalent Vent Length (TEVL)					82 ft. (25 M)	Add all of the above lines
Maximum Equivalent Vent Length (MEVL)					100 ft	For 2" pipe from Table 17
Is TEVL less than MEVL?					**YES**	**Therefore, 2" pipe MAY be used**

Vent & Combustion air Design & Installation vent design rules

Example 2

A direct-vent 60,000 BTUH furnace installed at 2000 ft . Venting system includes **FOR EACH PIPE:** 110 feet of vent pipe, 98 feet of combustion air inlet pipe, (3) 90º long-radius elbows, (2) 45º long-radius elbows, and a factory accessory concentric vent kit.

Can this application use 2" (50 mm ND) PVC/ABS DWV vent piping?

Measure the required linear length of air inlet and vent pipe; insert the longest of the two here					110 ft	Use length of the longer of the vent or air inlet piping system
Add equiv length of (3) 90º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	3	x	3 ft. (0.9 M)	=	9 ft. (2.7 M)	From Table 18
Add equiv length of (2) 45º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	2	x	1.5 ft. (0.5 M)	=	3 ft. (0.9 M)	From Table 18
Add equiv length of factory concentric vent term					0 ft.	From Table 18
Add correction for flexible vent pipe, if any					0 ft.	From Vent Manufacturer's instructions; zero for PVC/ABS DWV
Total Equivalent Vent Length (TEVL)					121 ft	Add all of the above lines
Maximum Equivalent Vent Length (MEVL)					100 ft	For 2" pipe from Table 17
Is TEVL less than MEVL?						No, the next larger size pipe should be used

Vent & Combustion air Design & Installation vent design rules

Example 2

A direct-vent 60,000 BTUH furnace installed at 2100 ft. (640M). Venting system includes **FOR EACH PIPE:** 110 feet of vent pipe, 98 feet of combustion air inlet pipe, (3) 90º long-radius elbows, (2) 45º long-radius elbows, and a factory accessory concentric vent kit.

Can this application use 2" (50 mm ND) PVC/ABS DWV vent piping? **Change to 2 ½" pipe – 165 feet**

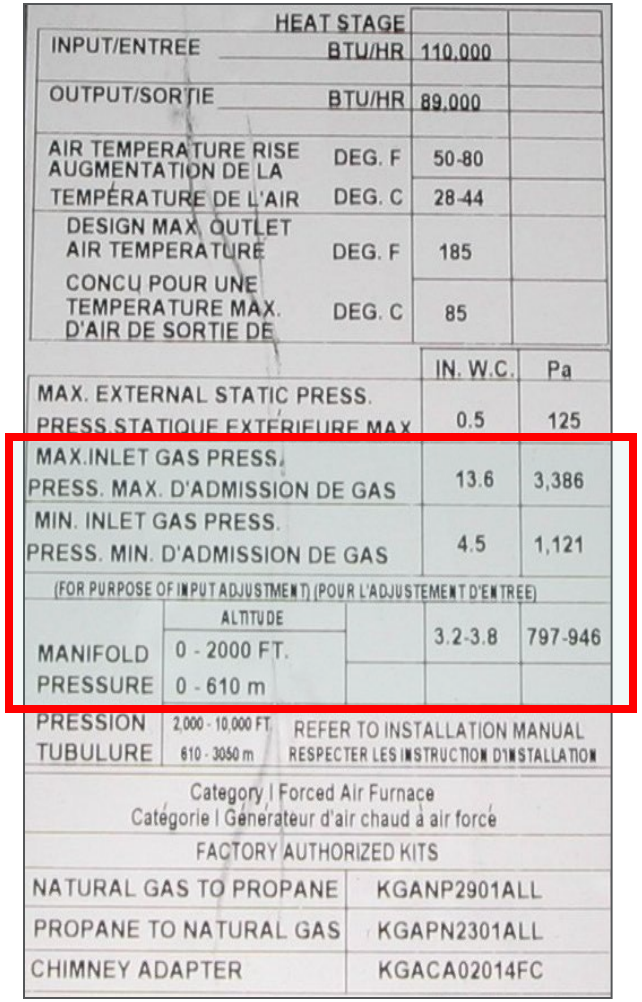
Measure the required linear length of air inlet and vent pipe; insert the longest of the two here					110 ft	Use length of the longer of the vent or air inlet piping system
Add equiv length of (3) 90º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	3	x	3 ft. (0.9 M)	=	9 ft. (2.7 M)	From Table 18
Add equiv length of (2) 45º long-radius elbows (use the highest number of elbows for either the vent or inlet pipe)	2	x	1.5 ft. (0.5 M)	=	3 ft. (0.9 M)	From Table 18
Add equiv length of factory concentric vent term					0 ft.	From Table 18
Add correction for flexible vent pipe, if any					0 ft.	From Vent Manufacturer's instructions; zero for PVC/ABS DWV
Total Equivalent Vent Length (TEVL)					121 ft	Add all of the above lines
Maximum Equivalent Vent Length (MEVL)					165 ft	For 2 ½" pipe from Table 17
Is TEVL less than MEVL?					**YES**	**There for 2 ½" pipe MAY be used**

Fuel Pressure

- Pressure of fuel used for combustion.
- Natural and LP Gas measured in Inches of water column.
- Maximum and Minimum Inlet Gas Pressure
  - Found on Furnace nameplate and LP instructions
  - See LP conversion instructions for Propane pressures

Every Installation the gas pressure must be

Every Service call the gas pressure should be checked



		HEAT STAGE	
INPUT/ENTREE	BTU/HR	110,000	
OUTPUT/SORTIE	BTU/HR	89,000	
AIR TEMPERATURE RISE AUGMENTATION DE LA TEMPÉRATURE DE L'AIR	DEG. F	50-80	
	DEG. C	28-44	
DESIGN MAX. OUTLET AIR TEMPERATURE	DEG. F	185	
CONCU POUR UNE TEMPERATURE MAX. D'AIR DE SORTIE DE	DEG. C	85	
		IN. W.C.	Pa
MAX. EXTERNAL STATIC PRESS. PRESS.STATIQUE EXTERIEURE MAX		0.5	125
MAX.INLET GAS PRESS. PRESS. MAX. D'ADMISSION DE GAS		13.6	3,386
MIN. INLET GAS PRESS. PRESS. MIN. D'ADMISSION DE GAS		4.5	1,121
(FOR PURPOSE OF INPUT ADJUSTMENT) (POUR L'ADJUSTEMENT D'ENTREE)			
MANIFOLD PRESSURE	ALTITUDE 0 - 2000 FT. / 0 - 610 m	3.2-3.8	797-946
PRESSION TUBULURE	2,000 - 10,000 FT. / 610 - 3050 m	REFER TO INSTALLATION MANUAL / RESPECTER LES INSTRUCTION D'INSTALLATION	
Category I Forced Air Furnace / Catégorie I Générateur d'air chaud à air forcé			
FACTORY AUTHORIZED KITS			
NATURAL GAS TO PROPANE	KGANP2901ALL		
PROPANE TO NATURAL GAS	KGAPN2301ALL		
CHIMNEY ADAPTER	KGACA02014FC		

To check whether a furnace is over/under fired…..

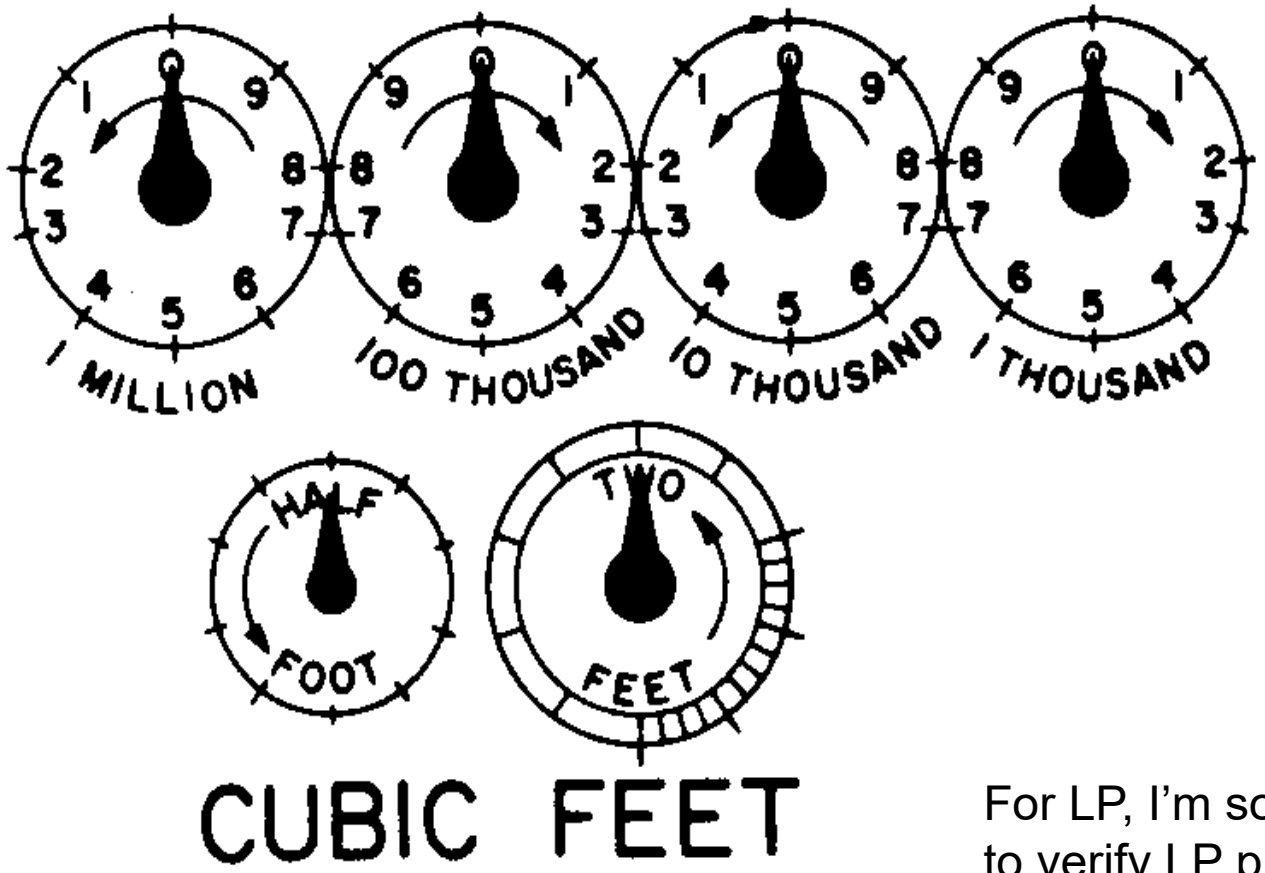
Clock the Gas Meter

Carrier

CE

bryant
Heating & Cooling Systems

Gas Furnace Input



For LP, I'm sorry you are going to have to verify LP pressures with a manometer or gas pressure testing device.

Gas Furnace Input

- Make sure no other appliances are on during the test.
- Set the thermostat to heat mode and 90 degrees.
- Record the seconds required to consume 1 cubic foot of gas on the meter
- The furnace needs to run for 15 mins on the highest stage
- Determine temperature rise between the supply and return air

Gas Furnace Input

The Ultimate GOAL Example

How long does it take to consume 1 cubic foot of gas in seconds

60 Minutes in an hour, and 60 seconds in a minute = 3600 seconds in an hour

3600 / seconds = cubic feet of gas per an hour

=

Cubic feet per an hour X 1050(specific heat content per a cubic foot **AVG**)

=

BTUH input

Excludes Dry wells, always contact the supplier for the daily heat content

BTU's per a cubic foot of natural gas

The BTU content per a cubic foot of natural gas fluctuates daily

For todays examples we will use 1050 per a cu. Ft.

Virginia Heat Content of Natural Gas Deliveries to Consumers (BTU per Cubic Foot)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	1,038	1,032	1,033	1,028	1,030	1,039	1,043	1,038	1,043	1,042	1,046	1,045
2014	1,044	1,040	1,039	1,041	1,038	1,040	1,041	1,040	1,038	1,046	1,055	1,054
2015	1,056	1,053	1,051	1,045	1,055	1,055	1,056	1,054	1,055	1,053	1,051	1,057
2016	1,055	1,055	1,056	1,052	1,054	1,052	1,054	1,054	1,053	1,052	1,055	1,054
2017	1,057	1,052	1,057	1,055	1,051	1,052	1,051	1,051	1,050	1,051	1,052	1,057
2018	1,053	1,049	1,056	1,050	1,048	1,051	1,046	1,050	1,049	1,050	1,056	1,061
2019	1,055	1,056	1,057	1,053	1,049	1,048	1,049	1,050	1,046	1,051	1,050	1,053
2020	1,052	1,052	1,051	1,047	1,046	1,049	1,045	1,046	1,051	1,047		

Maryland Heat Content of Natural Gas Deliveries to Consumers (BTU per Cubic Foot)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	1,041	1,037	1,032	1,027	1,037	1,042	1,060	1,056	1,062	1,059	1,061	1,059
2014	1,053	1,048	1,045	1,049	1,047	1,052	1,051	1,051	1,049	1,052	1,057	1,057
2015	1,059	1,061	1,058	1,051	1,058	1,057	1,055	1,049	1,050	1,053	1,049	1,050
2016	1,061	1,055	1,050	1,048	1,047	1,046	1,052	1,051	1,046	1,042	1,045	1,050
2017	1,054	1,056	1,055	1,043	1,046	1,041	1,044	1,047	1,045	1,042	1,038	1,048
2018	1,051	1,043	1,052	1,045	1,041	1,038	1,040	1,034	1,035	1,035	1,045	1,042
2019	1,050	1,050	1,050	1,045	1,039	1,036	1,039	1,040	1,036	1,036	1,045	1,048
2020	1,047	1,045	1,041	1,038	1,035	1,036	1,040	1,038	1,036	1,034		

This information was found on EIA.gov
US Energy Information Administration
or
Visit cematraining.com for current information

Gas Furnace Input

The Ultimate GOAL Example

How long does it take to consume 1 cubic foot of gas in seconds

60 Minutes in an hour, and 60 seconds in a minute = 3600 seconds in an hour

3600 / **38** seconds = **95** cubic feet

=

95 X 1050(avg)

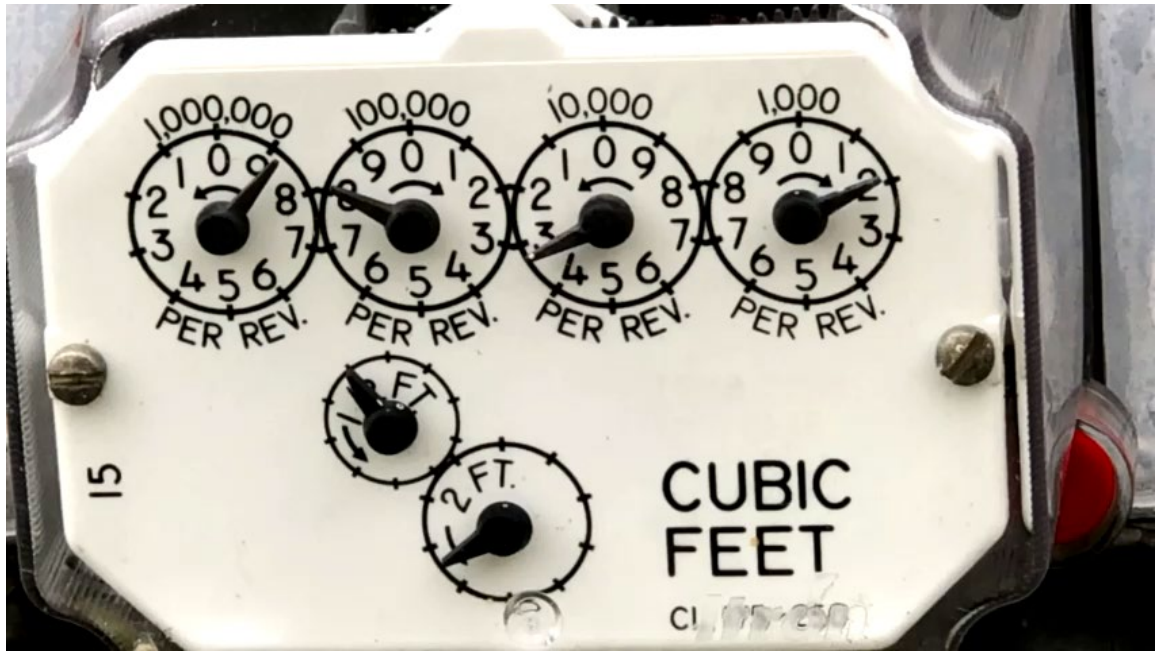
=

99,750 BTUH input

Excludes Dry wells, always contact the supplier for the daily heat content

Clocking the gas meter

Clocking the gas meter

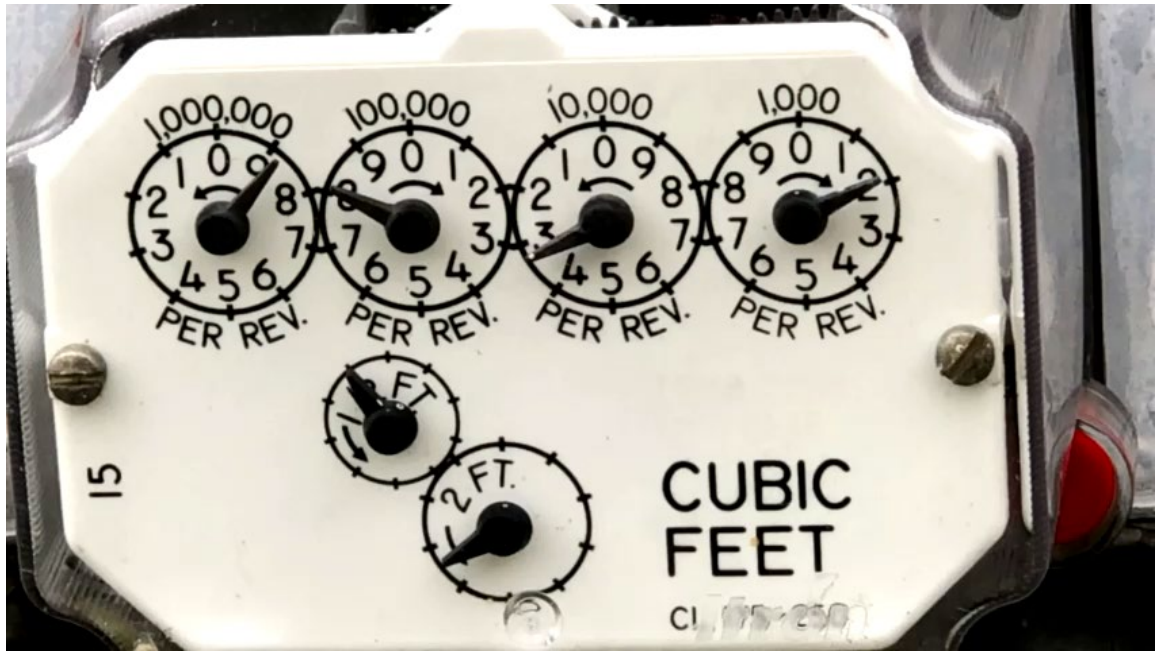


We clocked the meter, and it takes 62 seconds to consume 1 cubic foot of gas

3600 / 62 sec = 58 cubic feet consumed per an hour

58 X 1050 (avg BTU content per a cu. ft.) = 60,900 BTUH input

Clocking the gas meter

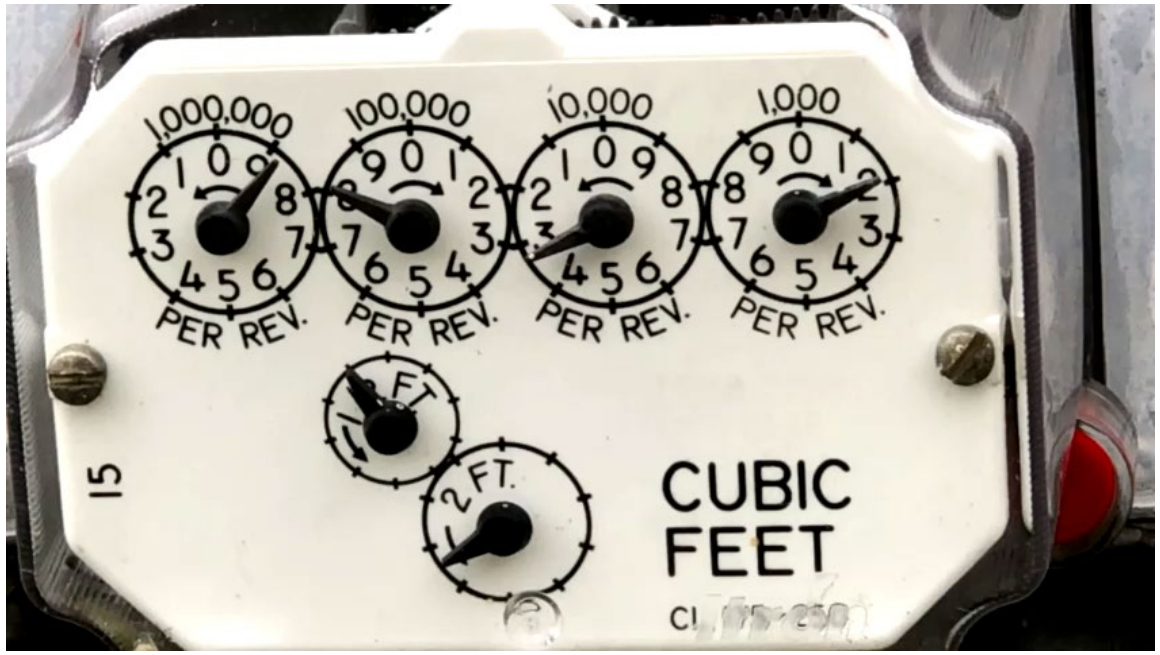


We clocked the meter, and it takes 46 seconds to consume 1 cubic foot of gas

3600 / 46 sec = 78 cubic feet consumed per an hour

78 X 1050 (avg BTU content per a cu. ft.) = 81,900 BTUH input

Clocking the gas meter



We clocked the meter, and it takes 32 seconds to consume 1 cubic foot of gas

3600 / 32 sec = 112.5 cubic feet consumed per an hour

112.5 X 1050 (avg BTU content per a cu. ft.) = 118,125 BTUH input

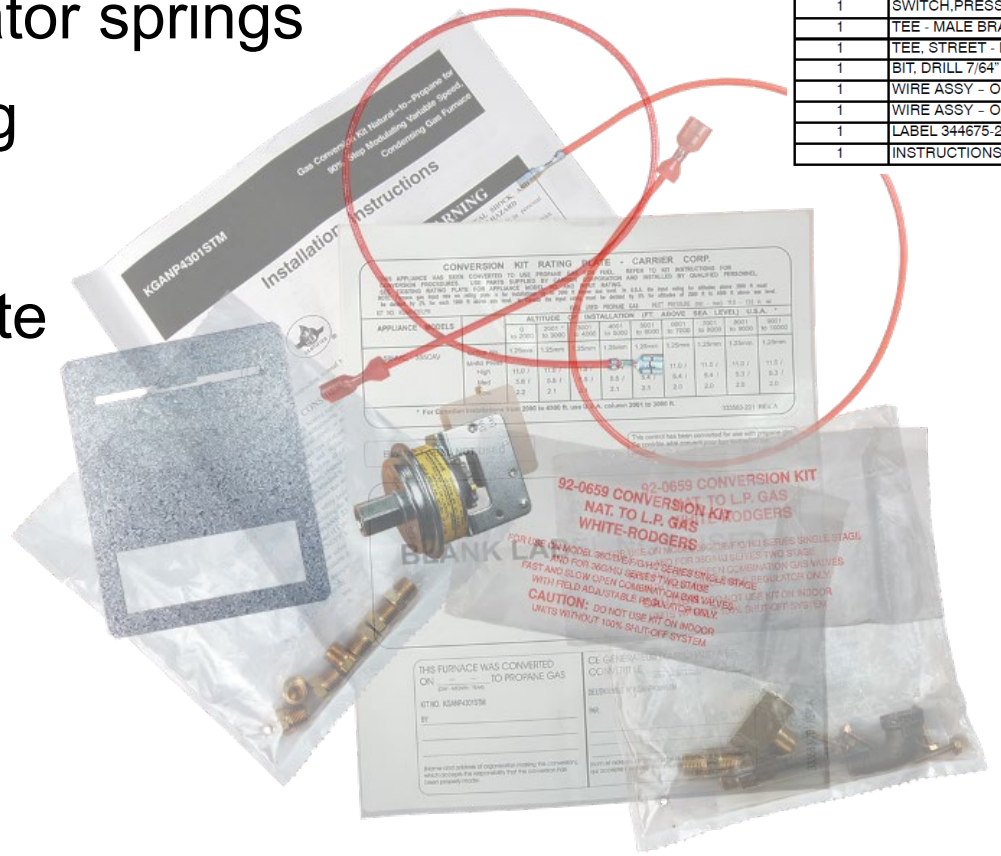
Propane Conversion (LP)

- Units are shipped ready for Natural Gas
- Units must be converted to Propane (LP)
- Read instructions ***BEFORE*** you start.
- Specific instructions for each Furnace model
- Pay attention to the Orifice sizing chart.

Propane Conversion (LP)

- Install correct burner orifices
- Re-install burner manifold
- Replace and pre-adjust regulator springs
- Install LGPS and modify wiring
- Check inlet gas pressure
- Check and adjust gas input rate
- Check LGPS

Table 1	KIT Contents
QUANTITY	DESCRIPTION
1	VALVE CVRSN KIT - W/R SPRING 92-0659
1	JUMPER PLUG
7	ORIFICE - 1.25mm
7	MIXER SCREW – CONDENSING FURNACES
1	CONNECTOR - BRASS 1/8" NPT X2"
1	CONNECTOR, SPLC - 3/16"
1	CONNECTOR - 1/4QC ME BOTH ENDS
1	ELBOW,STREET - 150# 1/8" NPT
1	ELBOW,STREET - BRASS 1/8" NPT
1	NIPPLE - HEX (BRASS)
1	SWITCH,PRESSURE
1	TEE - MALE BRANCH (BRASS)
1	TEE, STREET - MALE BRANCH (BRASS)
1	BIT, DRILL 7/64" CONDENSING
1	WIRE ASSY – ORANGE
1	WIRE ASSY – ORANGE
1	LABEL 344675-201 through 344675-205
1	INSTRUCTIONS



Propane Conversion (LP)

Figure 2 Manifold Assembly

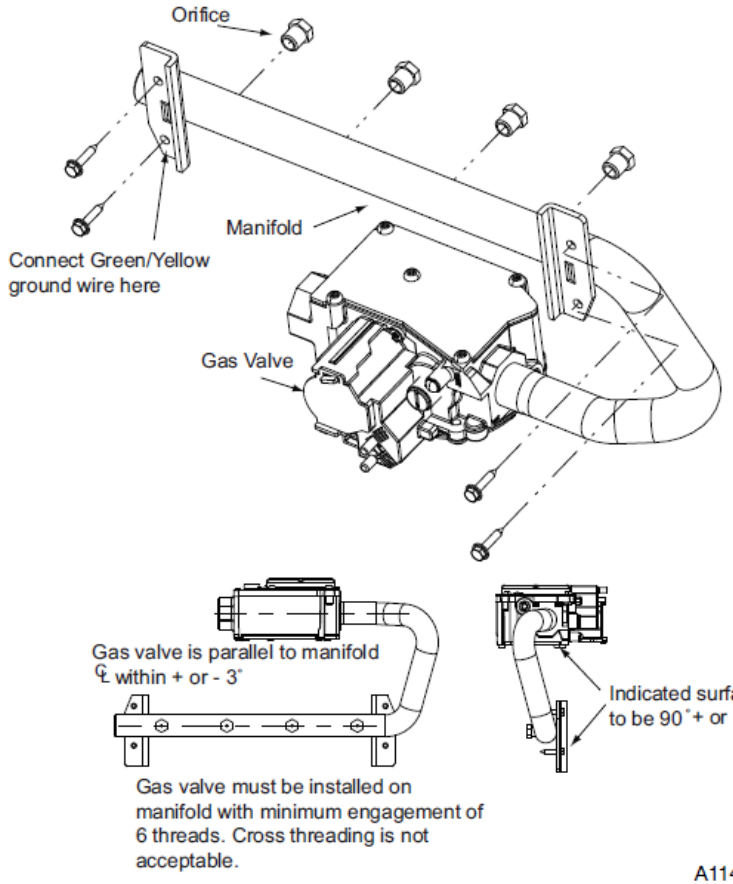


Figure 5 Conversion Kit Rating Plate (40,000 BTUH to 140,000 BTUH ONLY)

Single-Stage Gas Valve

CONVERSION KIT RATING PLATE

THIS APPLIANCE HAS BEEN CONVERTED TO USE PROPANE GAS FOR FUEL. REFER TO KIT INSTRUCTIONS FOR CONVERSION PROCEDURES. USE PARTS SUPPLIED BY MANUFACTURER AND INSTALLED BY QUALIFIED PERSONNEL. SEE EXISTING RATING PLATE FOR APPLIANCE MODEL NO. AND INPUT RATING.

NOTE: Furnace gas input rate on rating plate is for installations up to 2000 ft. (610m) above sea level. In U.S.A. the input rating for altitudes above 2000 ft. (610m) must be derated by 2% for each 1000 ft. (305m) above sea level. In Canada the input rating must be derated by 5% for altitudes of 2000 ft. (610m) to 4500 ft. (1372m) above sea level.

KIT NO.: AGAGC9NPS01A (SUPERSEDES: KGBNP50011SP, KGANP51012SP, KGCNP5201VSP, NAHD00901LP, NAHB01001LP)

FUEL USED: PROPANE GAS
INLET PRESSURE (min - max): 12.0 - 13.6 in. wc

APPLIANCE MODELS Δ		ALTITUDE OF INSTALLATION (FT. ABOVE SEA LEVEL) U.S.A. *								
		0 to 2000	2001 * to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
59S(P/C/E), 91(2/5)S, 92(2/5)S, PG9(2/5)S, PG9(2/5)ES, (F/G)9MXE, F9MES, (N/R)9MS, (N/R)95ES, (N/R)92ES, WF(A/H/S)	Orifice No.	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm
	Manifold Pressure									
		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0

* For Canadian Installations from 2000 to 4500 ft. (610m to 1373m) use U.S.A. column 2001 to 3000 ft. (611m to 914m).
Δ THIS KIT IS FOR 40K THROUGH 140K INPUT MODELS ONLY

344675-201 REV.C A190112

Two-Stage Gas Valve

CONVERSION KIT RATING PLATE

THIS APPLIANCE HAS BEEN CONVERTED TO USE PROPANE GAS FOR FUEL. REFER TO KIT INSTRUCTIONS FOR CONVERSION PROCEDURES. USE PARTS SUPPLIED BY MANUFACTURER AND INSTALLED BY QUALIFIED PERSONNEL. SEE EXISTING RATING PLATE FOR APPLIANCE MODEL NO. AND INPUT RATING.

NOTE: Furnace gas input rate on rating plate is for installations up to 2000 ft. (610m) above sea level. In U.S.A. the input rating for altitudes above 2000 ft. (610m) must be derated by 2% for each 1000 ft. (305m) above sea level. In Canada the input rating must be derated by 5% for altitudes of 2000 ft. (610m) to 4500 ft. (1372m) above sea level.

KIT NO.: AGAGC9NPS01A (SUPERSEDES: KGBNP50011SP, KGANP51012SP, KGCNP5201VSP, NAHD00901LP, NAHB01001LP)

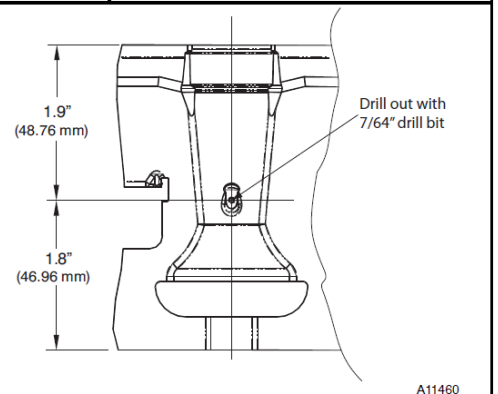
FUEL USED: PROPANE GAS
INLET PRESSURE (min - max): 12.0 - 13.6 in. wc

APPLIANCE MODELS Δ		ALTITUDE OF INSTALLATION (FT. ABOVE SEA LEVEL) U.S.A. *								
		0 to 2000	2001 * to 3000	3001 to 4000	4001 to 5000	5001 to 6000	6001 to 7000	7001 to 8000	8001 to 9000	9001 to 10000
59T(N/P), 986T, 92(5/6)T, PG96V, PG95X, (F/G)9MV, (F/G)9MXT, (F/G)96C, (F/G)96V	Orifice No.	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm	1.25mm
	Manifold Pressure									
	HIGH	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	LOW	5.8	5.5	5.5	5.5	5.4	5.4	5.4	5.3	5.3

* For Canadian Installations from 2000 to 4500 ft. (610m to 1373m) use U.S.A. column 2001 to 3000 ft. (611m to 914m).
Δ THIS KIT IS FOR 40K THROUGH 140K INPUT MODELS ONLY

344675-208 REV.A A190117

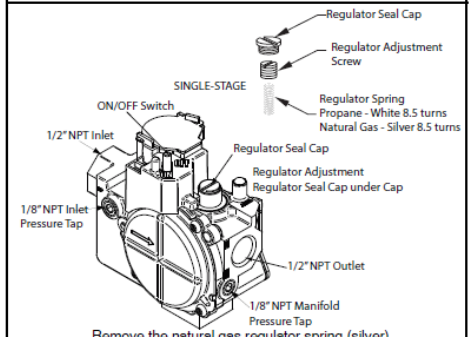
Figure 7 Mixer Screw Location



Propane Conversion (LP)

Figure 10 Gas Valve (Single Stage)

Gas Valve (Single Stage) without Tower Pressure Ports



Remove the natural gas regulator spring (silver)
Install the propane regulator spring (white)

Gas Valve (Single Stage) with Tower Pressure Ports

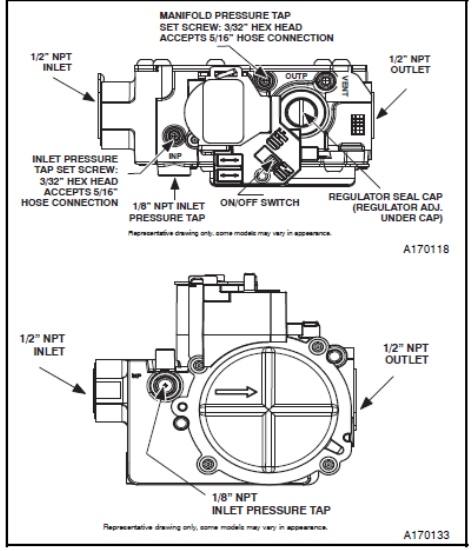
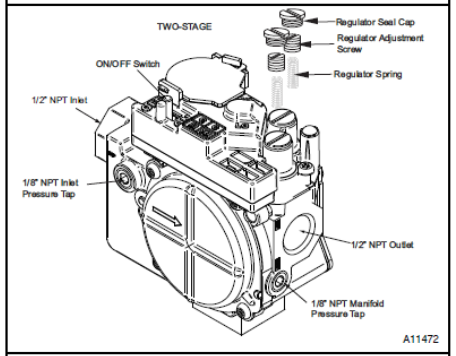
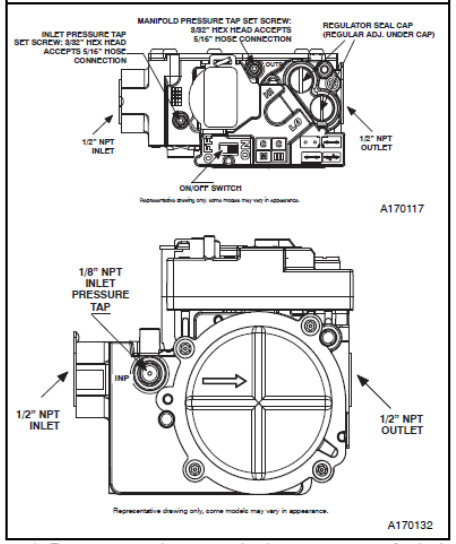


Figure 11 Gas Valve (Two-Stage)

Automatic Gas Valve (Two-Stage) without Tower Pressure Ports



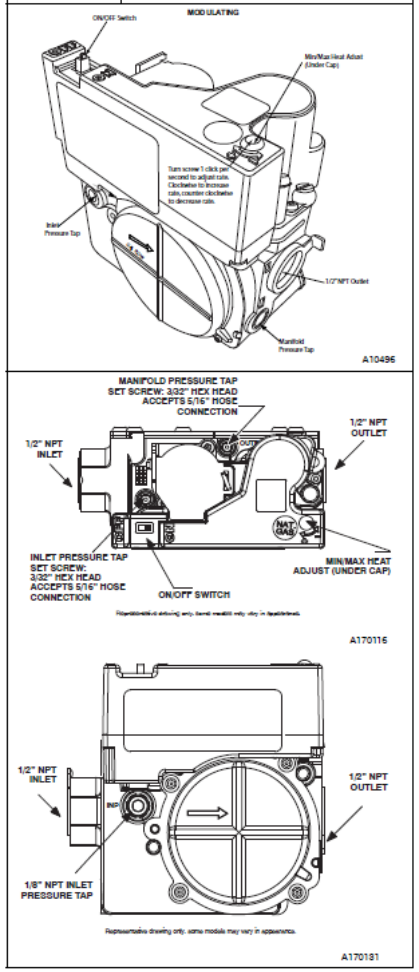
Automatic Gas Valve (Two-Stage) with Tower Pressure Ports



1. Remove caps that conceal adjustment screws for high heat and low heat gas-valve regulators. (See **Figure 11**)
2. Remove the high heat and low heat regulator adjustment screws.
3. Remove the high heat and low heat regulator springs (silver).
4. Install the high heat and low heat propane gas regulator springs (white).
5. Install the high heat and low heat regulator adjustment screws.
6. Turn high heat stage adjusting screw clockwise (in) 13.5 full turns. This will increase the manifold pressure closer to the propane set point.
7. Turn low heat stage adjusting screw clockwise (in) 9.5 full turns. This will increase the manifold pressure closer to the propane low heat set point.
8. Do not install regulator seal caps at this time.

Propane Conversion (LP)

Figure 14 Automatic Control Valve (Modulating) without Tower Pressure Ports



Modulating Gas Valve

Refer to **Figure 12** and **Figure 13**.

Figure 12 Propane Jumper

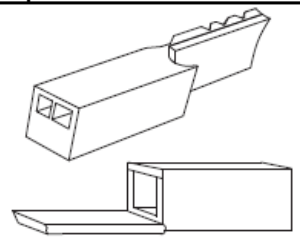
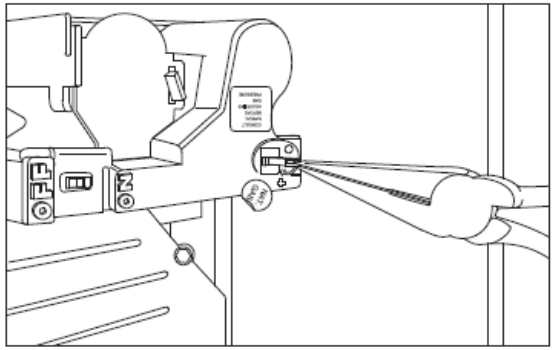


Figure 13 Installing Propane Jumper

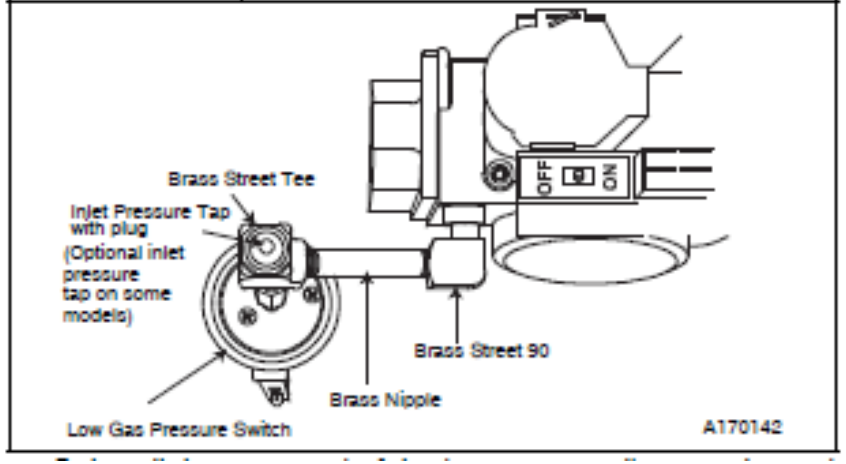


NOTE:The Propane jumper for the modulating gas valve is very small. Needle-nose pliers are required to insert the jumper into the valve. If the jumper is not installed, the valve will not operate properly on propane.

1. Locate the round "NAT GAS" sticker on the top of the gas valve.
2. Peel the sticker off and discard.
3. Note the small square opening in the top of the gas valve.
4. Note the two jumper pins inside the modulating gas valve.
5. Remove the small black plastic propane jumper from the envelope.
6. Use needle-nosed pliers to hold the jumper by the tab on the end.
7. Insert the jumper on the pins inside the gas valve.
8. Cover the opening in the gas valve with the label marked "LP GAS

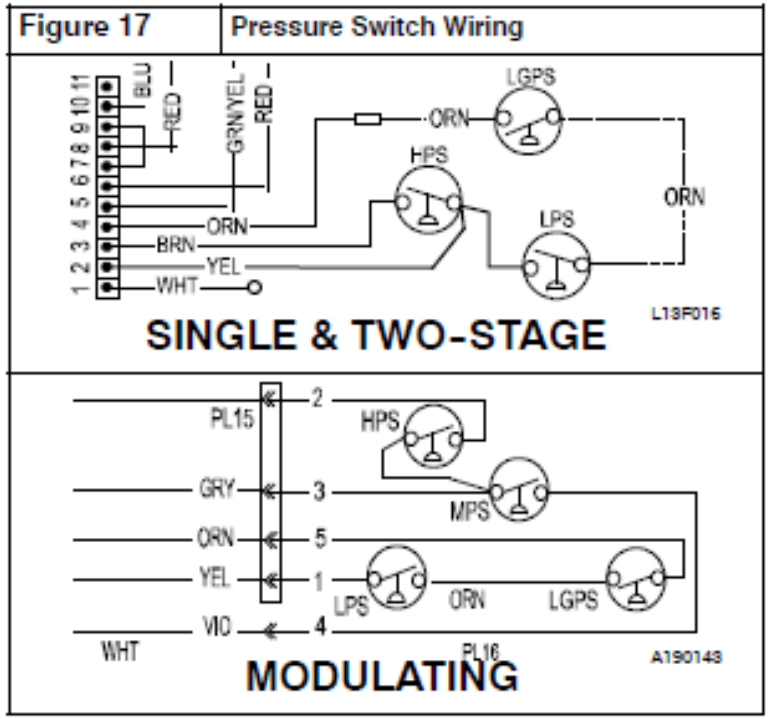
Propane Conversion (LP)

Figure 16	LGPS for casing wider than 14-3/16 and vent does not pass between inducer and burner assembly



Always check gas pressure both supply and manifold

Figure 17	Pressure Switch Wiring

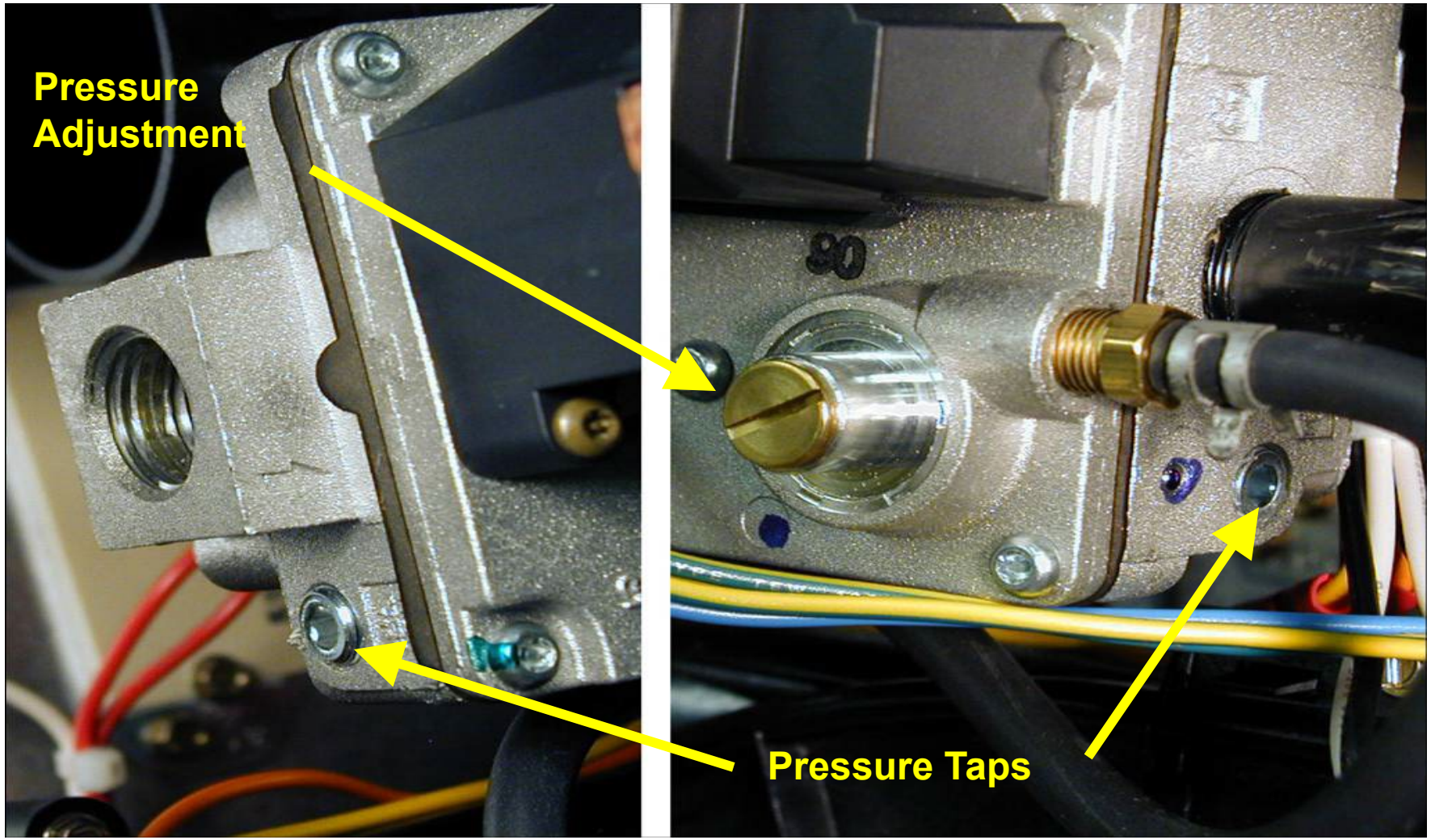


Adjusting the gas valve pressure

- Verify Incoming pressure first.
- Verify manifold pressure needed for your application.
- Make sure to zero the manometer before checking pressures.
- On sealed combustion furnaces remove burner box cover. (Not necessary on new 35” 90+ Furnaces)

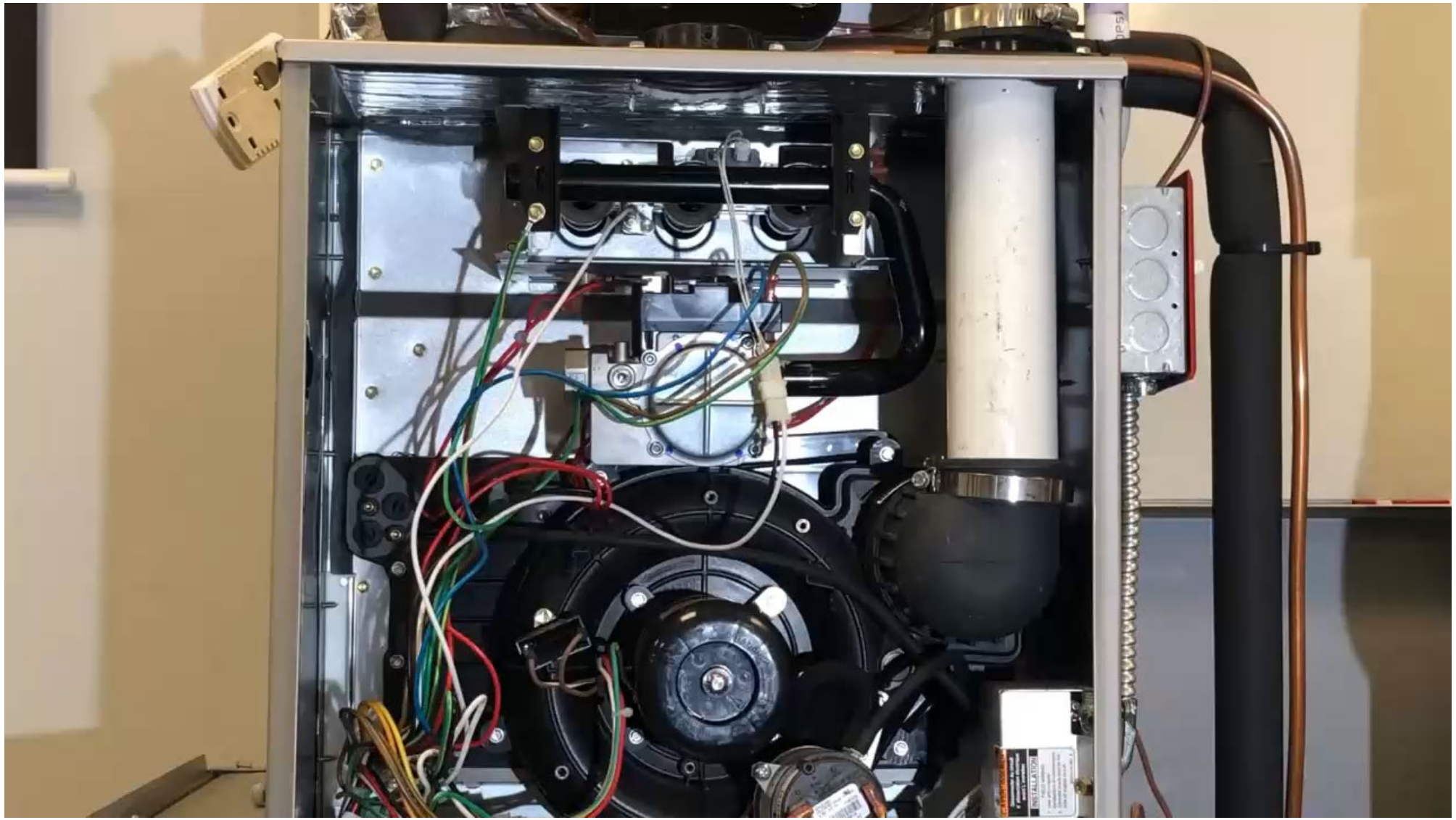
Adjusting the gas valve pressure

Single stage



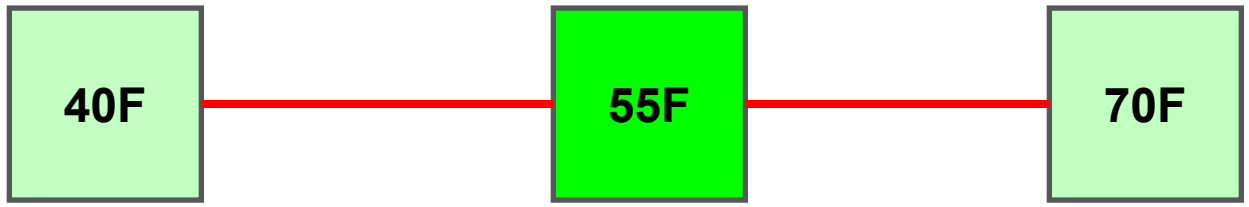
LP conversion &adjusting the gas valve pressure

2-stage



Temperature Rise

- Difference in temperature of air entering the pre-heat exchanger and exiting air post-heat exchanger.
- See Furnace Nameplate
- Our Goal is middle of the range
- Example:



Temperature Rise

- If Temperature Rise is outside of the range listed on the furnace name plate check:
  - Firing Rate (clock the gas meter) adjust gas pressures
  - Make sure the unit is firing within 2% of furnace input rating
  - Check External Static Pressure
  - Make fan speed adjustment (fixed speed motors)
  - Evaluate Duct System

Sequence of Operation

- Thermostat calls for heat and applies 24v to W1
- The control board checks all circuit to ensure they are in the standby position
- **Inducer Pre-purge Period**
  - 15 seconds long, and begins when LPS contacts close
- **Ignitor Warm-up**
  - 17 seconds long
- **Trial-for-Ignition Sequence**
  - GVR on the board closes to energize the gas valve
  - 5 seconds after the valve opens a 2-sec flame proving the HSI will remain on
- **Flame-Proving**
  - When the flame is proven, the fan on delay starts
  - If not proven the CPU will repeat the Trails-for-Ignition 3 more time before going into lock out.

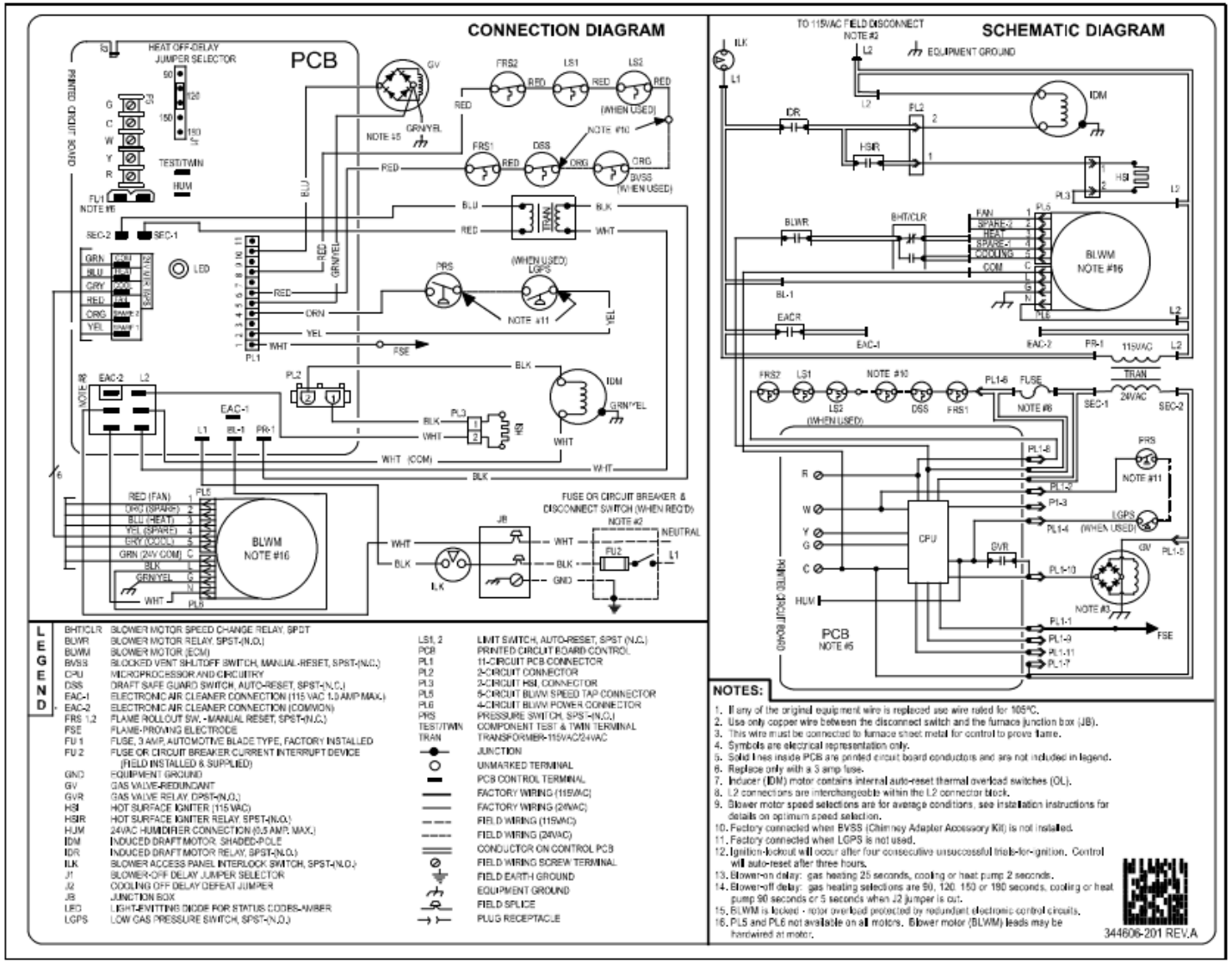
Sequences of Operation

The Installation instructions for each Carrier/Bryant furnace will include step-by-step sequences for each mode of operation (heating, cooling, continuous fan et c.)

The sequences for the lower tier equipment will be less involved than those of the higher tier but all are an excellent tool for troubleshooting as it helps a technician understand in what order things need to happen for a furnace to start and run correctly.

We will use typical sequences to learn how to troubleshoot a furnace.

1 Stage Furnace



Thermostat calls for heat

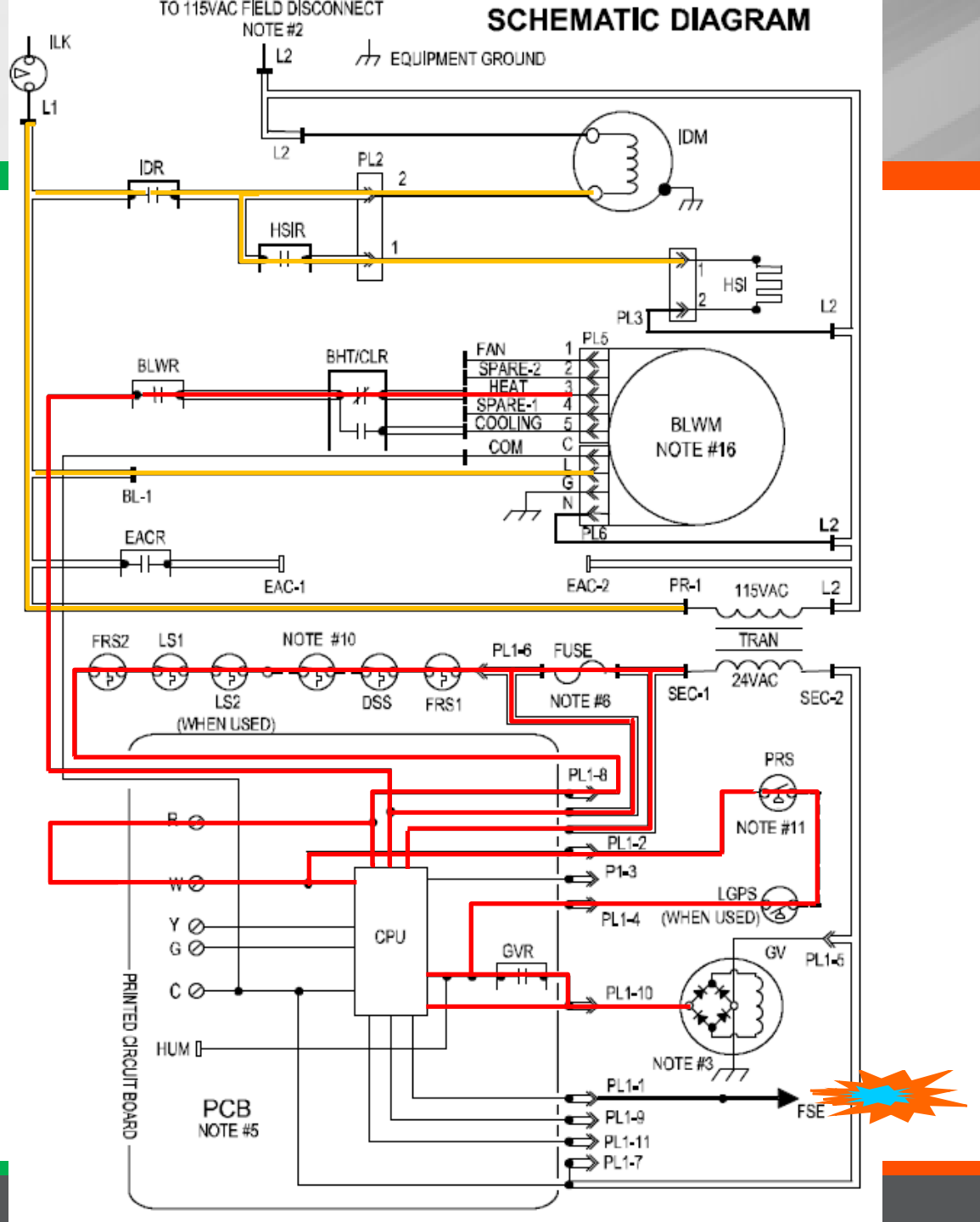
CPU verifies the PRS is in the open position, if open, the CPU starts the inducer(IDM) and then the pressure switch closes.

Inducer Pre-purge runs for 15 secs, then the HSI is energized for a 17 sec warm up period

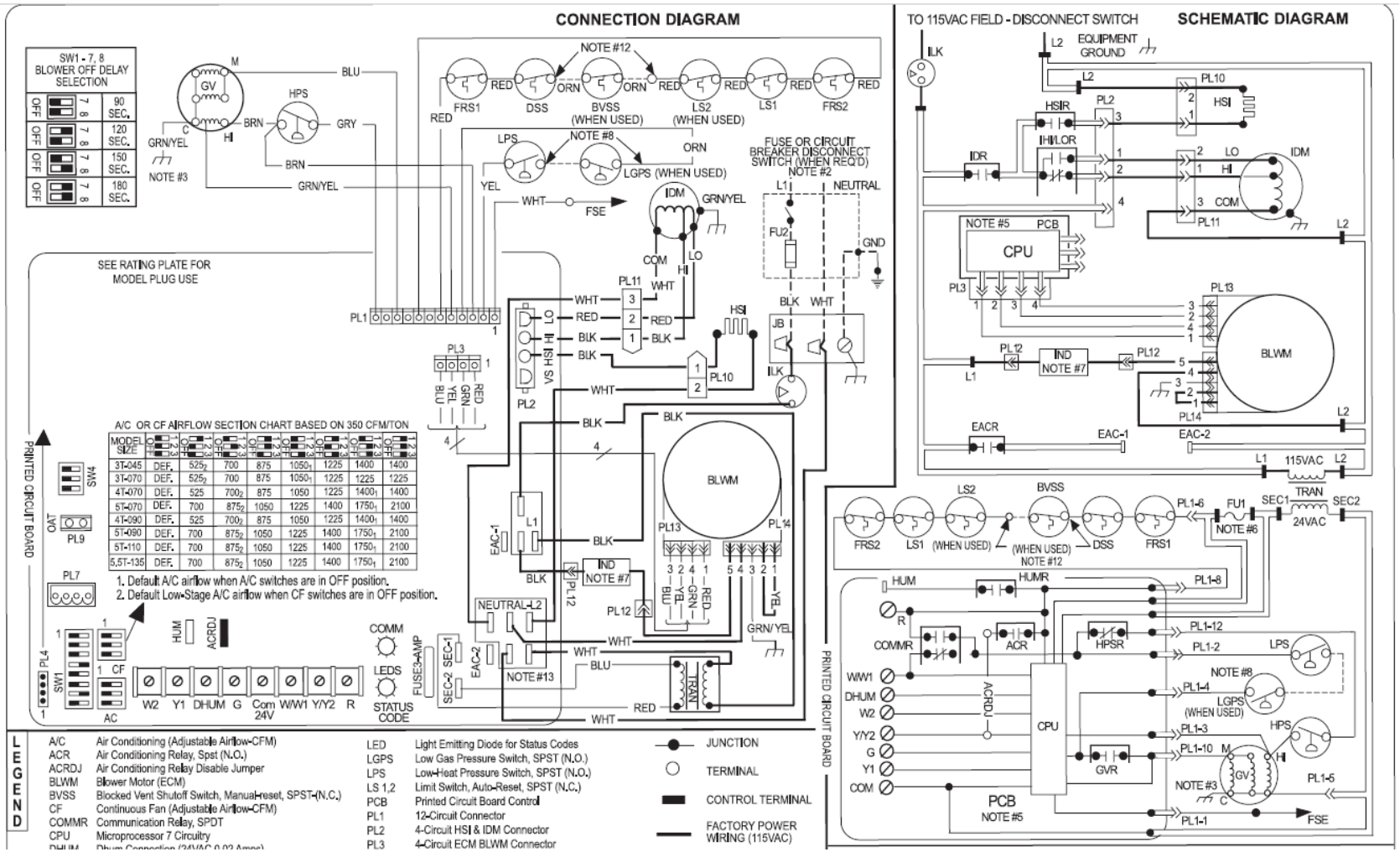
The gas valve is energized

5 seconds after the valve opens a 2-sec flame proving window happens and the HSI will remain on

Once flame is proven then the blower on delay is started



2-Stage Furnace



Thermostat calls for W1

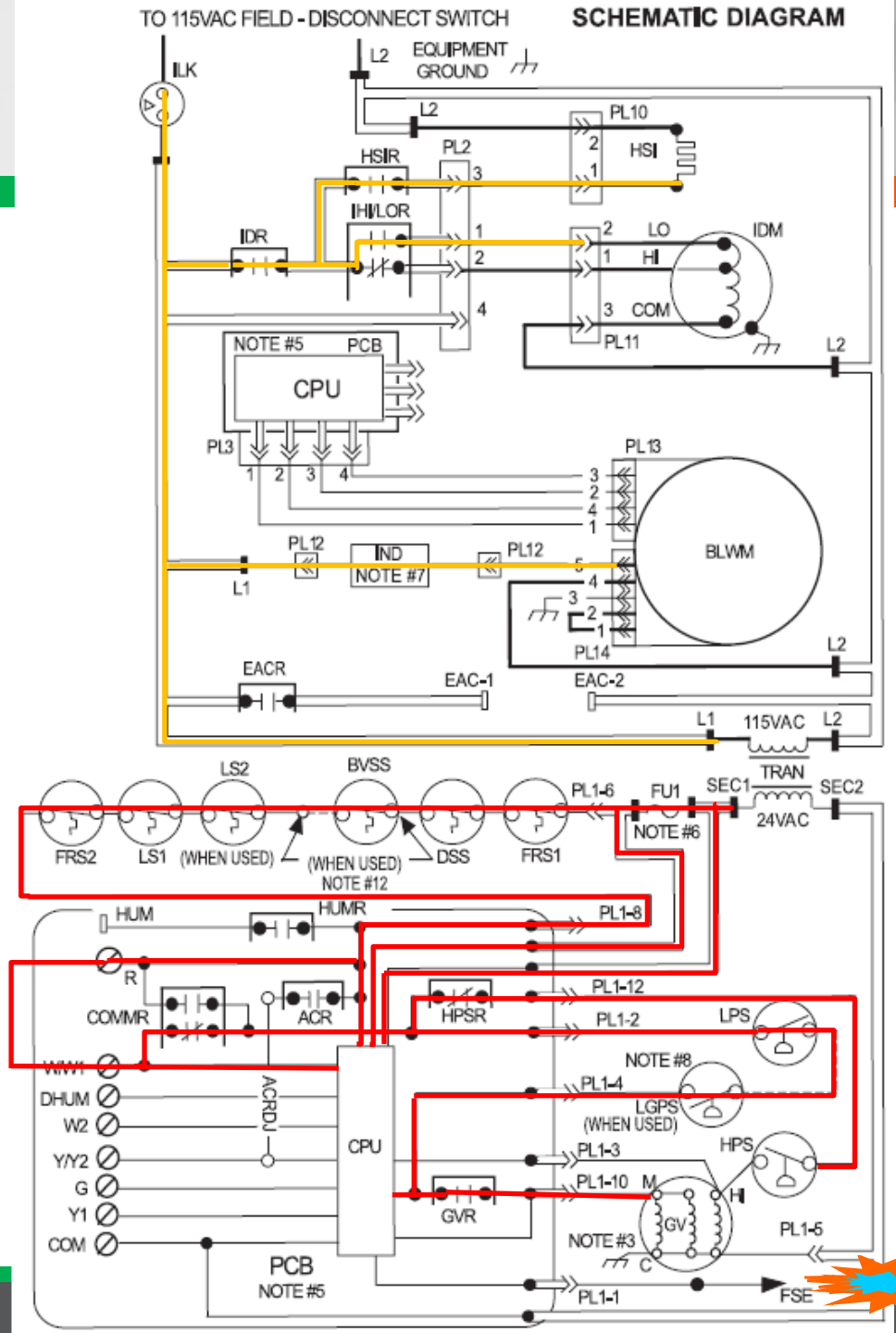
CPU verifies the LPS and HPS are open, if open, the CPU starts the inducer(IDM)

Inducer Pre-purge runs for 15 secs the LPS closes

Then the HSI is energized for a 17 sec warm up period

The gas valve is energized

5 seconds after the valve opens a 2-sec flame proving window happens and the HSI will remain on



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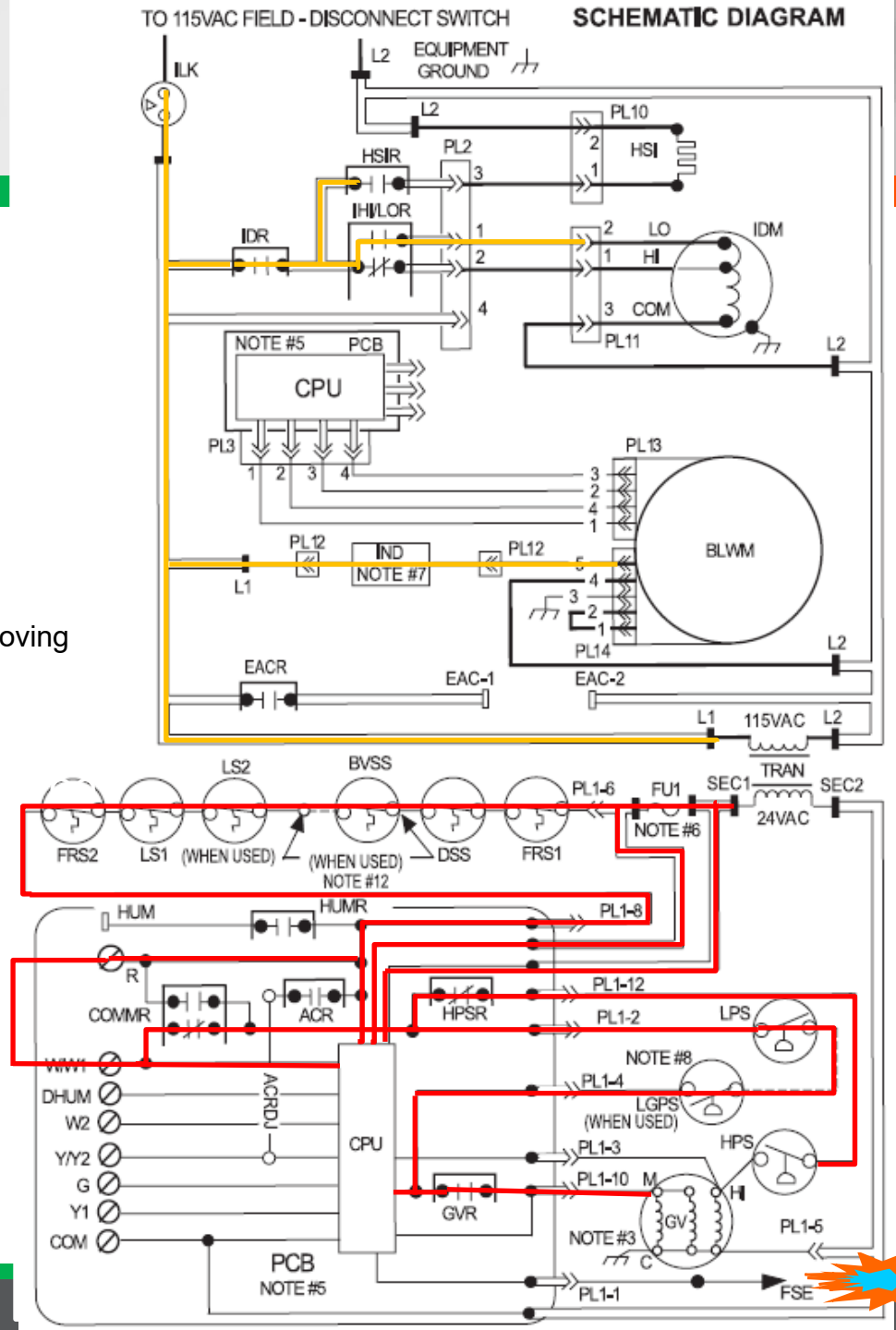
The gas valve is energized

5 seconds after the valve opens a 2-sec flame proving window happens and the HSI will remain on

Once flame is proven then the HSI will shut off and the blower on delay is started.

Twenty-five seconds for single-stage and high fire on 2-stage units.

Low and intermediate fire will have a delay of 45 seconds on 2-stage and modulating furnaces.



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5 seconds after the valve opens a 2-sec flame proving window happens and the HSI will remain on

The gas valve is energized

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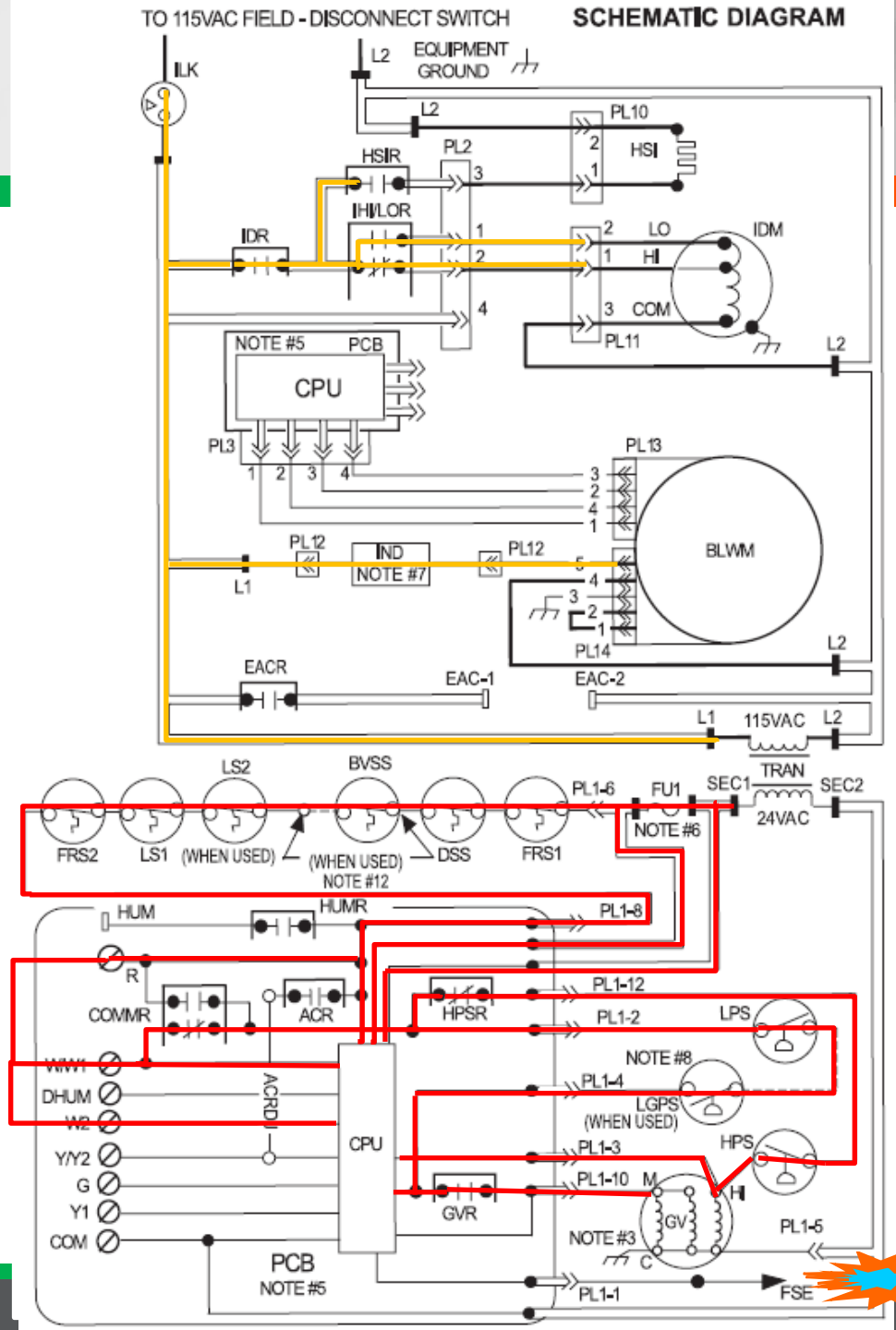
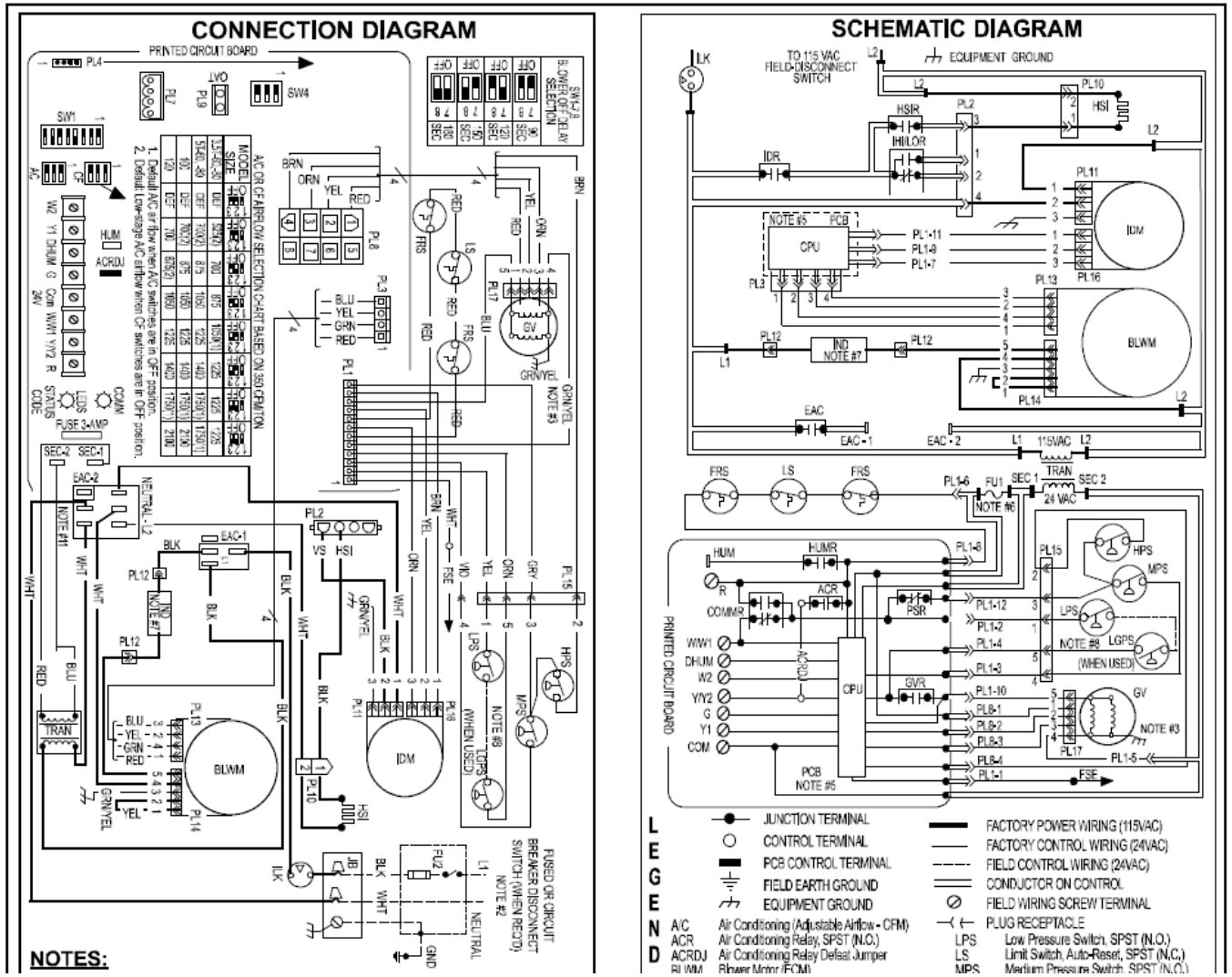
Low and intermediate fire will have a delay of 45 seconds on 2-stage and modulating furnaces.



Thermostat calls for W2

The CPU changes the inducer speed to HI, when the HPS is closes the gas valve is in HI stage

Modulating Furnace



Thermostat calls for heat

The CPU tells the inducer to start running.

The inducer will speed up until the LPS and MPS are closed.

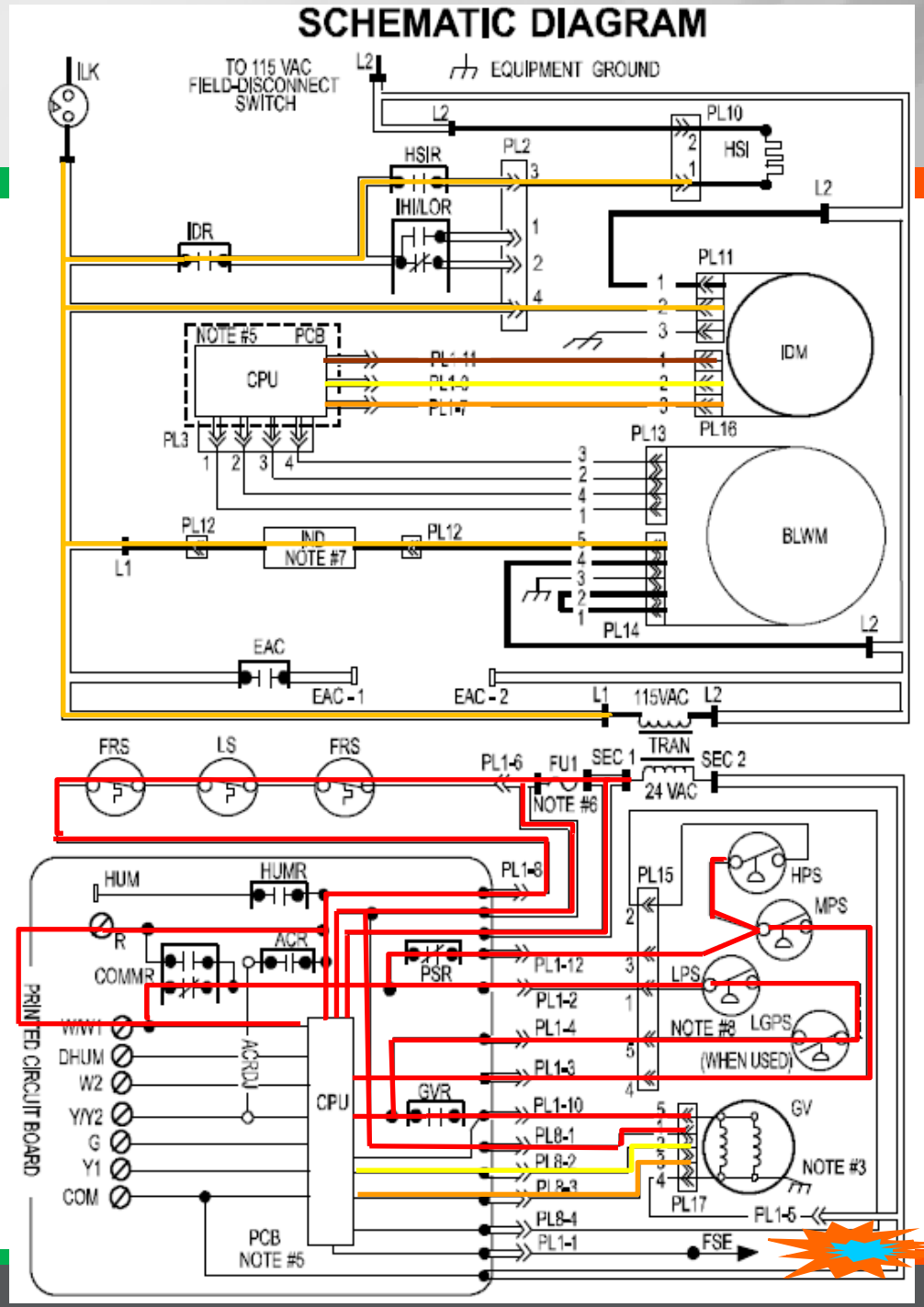
The inducer starts a 45 sec Pre-purge.

The HSI is energized for a 17 sec warm-up period.

The CPU tells the gas valve what rate to operate at and the gas valve responds back confirming the command.

The board then closes the GVR relay for 5 sec, 2 sec flame proving.

After ignition, the furnace will then modulate to the current demand of the UI or logic and start the blower on delay



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The HSI is energized for a 17 sec warm-up period.

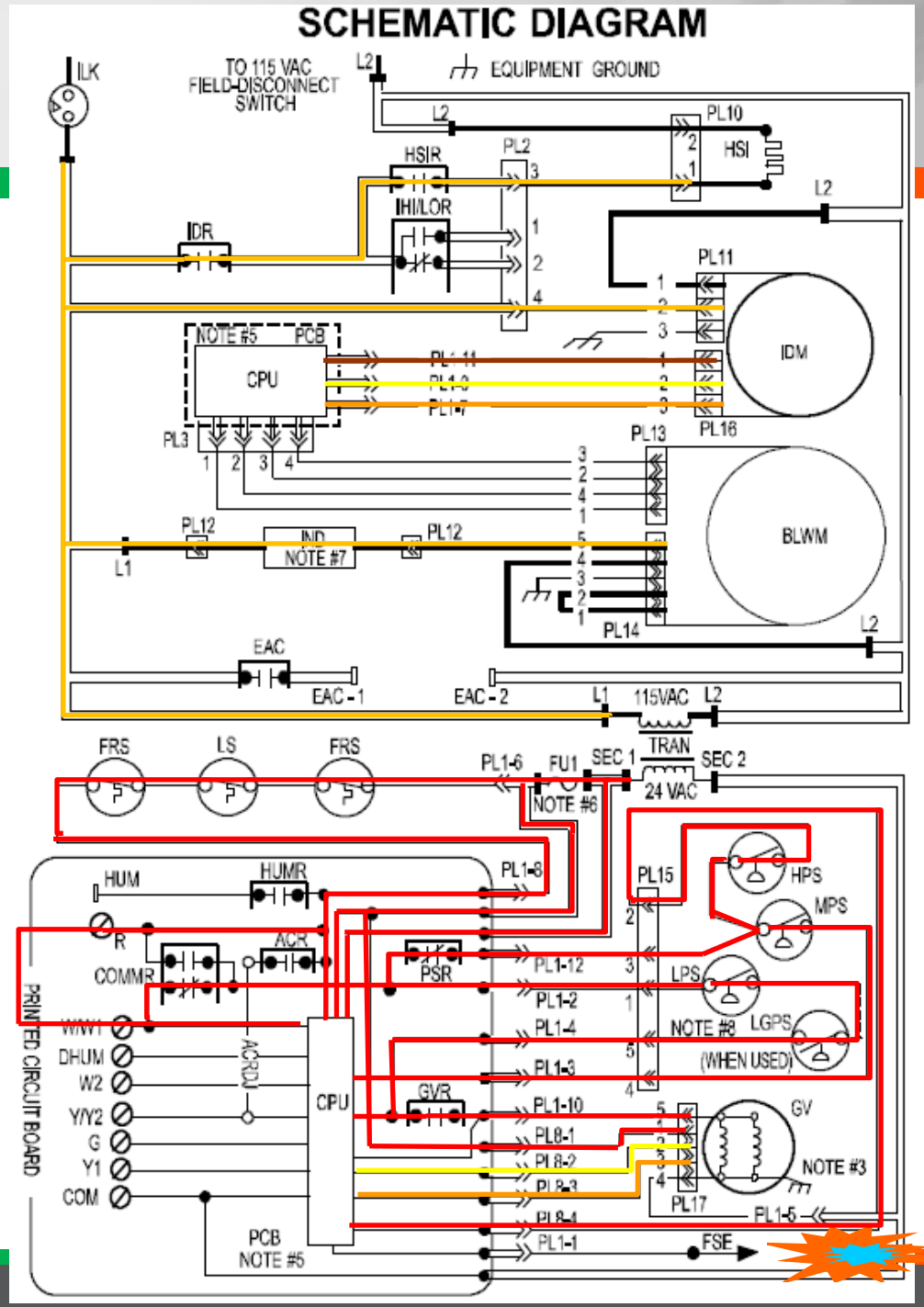
The CPU tells the gas valve what rate to operate at and the gas valve responds back confirming the command.

The board then closes the GVR relay for 5 sec, 2 sec flame proving.

After ignition, the furnace will then modulate to the current demand of the UI or logic and start the blower on delay

The CPU will tell the inducer to speed up until the HPS is closed

The CPU then tells the gas valve to adjust to new demand

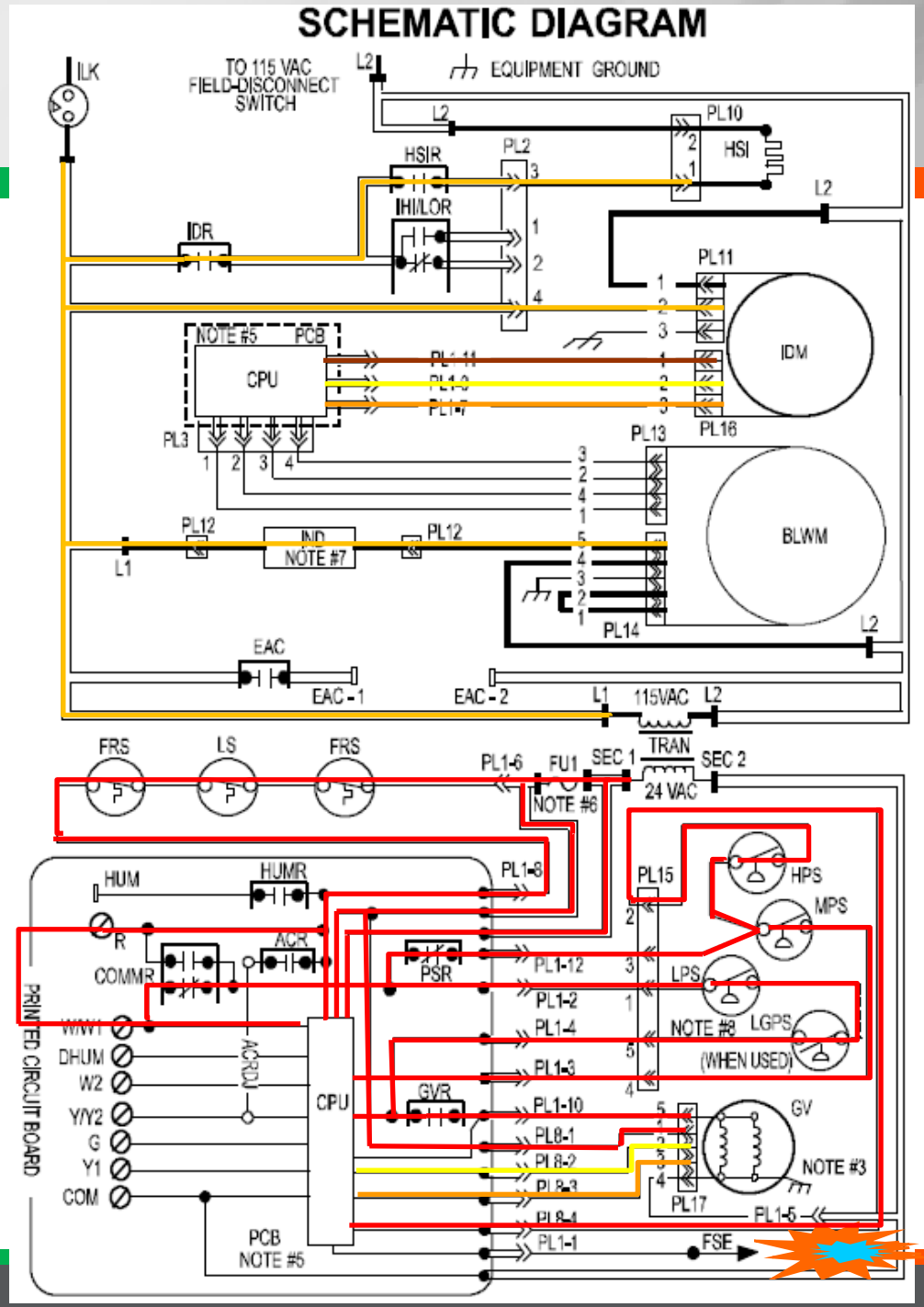


Unit stage up

The CPU will tell the gas valve and the inducer to step down to a lower demand opening the HPS

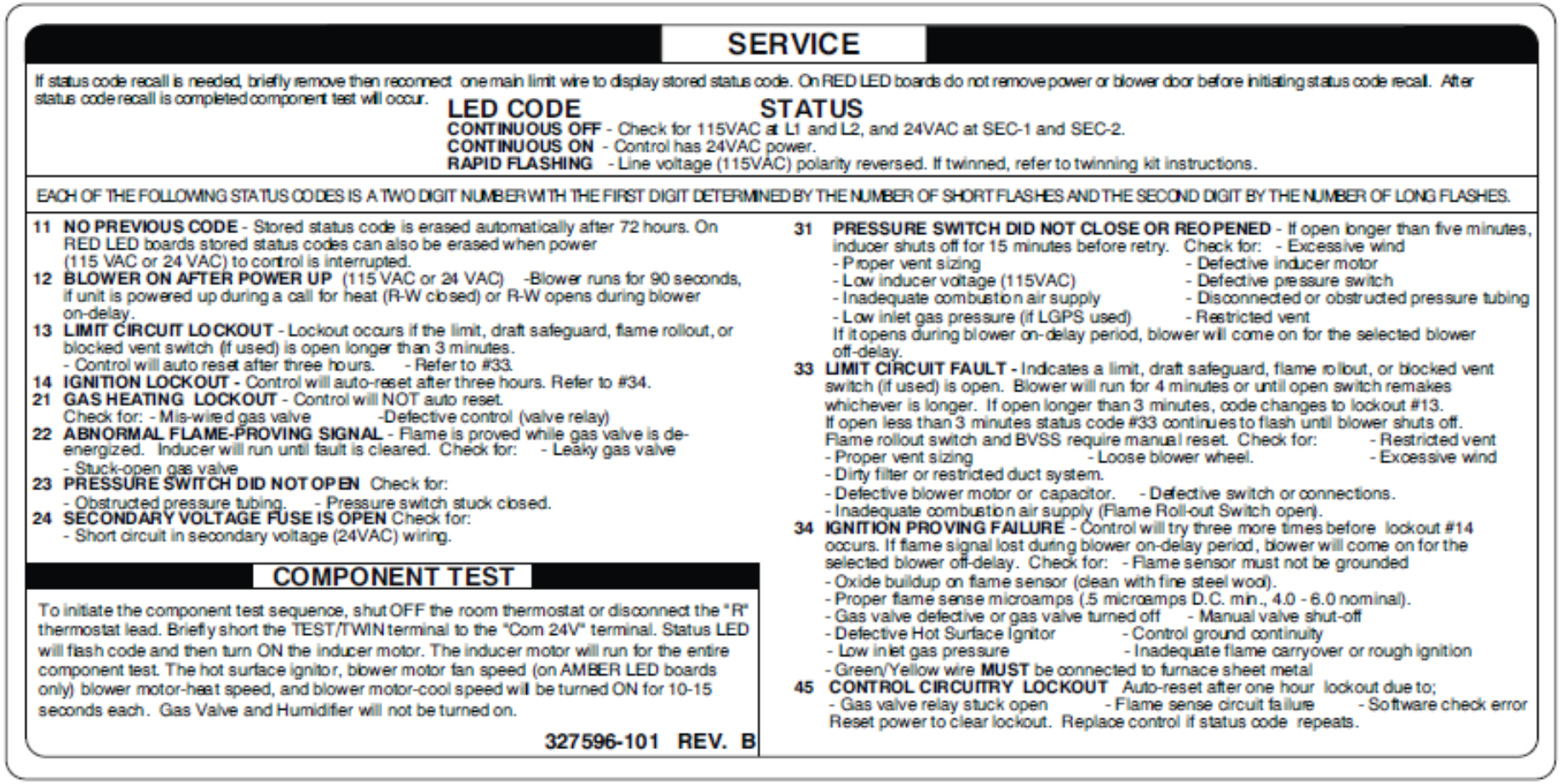
And then

If lower demand is needed The CPU will tell the gas valve and the inducer to step down to a lower demand opening the MPS



Unit stage down

Furnace Labels



SERVICE

If status code recall is needed, briefly remove then reconnect one main limit wire to display stored status code. On RED LED boards do not remove power or blower door before initiating status code recall. After status code recall is completed component test will occur.

LED CODE **STATUS**

CONTINUOUS OFF - Check for 115VAC at L1 and L2, and 24VAC at SEC-1 and SEC-2.
CONTINUOUS ON - Control has 24VAC power.
RAPID FLASHING - Line voltage (115VAC) polarity reversed. If twinned, refer to twinning kit instructions.

EACH OF THE FOLLOWING STATUS CODES IS A TWO DIGIT NUMBER WITH THE FIRST DIGIT DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND DIGIT BY THE NUMBER OF LONG FLASHES.

11 NO PREVIOUS CODE - Stored status code is erased automatically after 72 hours. On RED LED boards stored status codes can also be erased when power (115 VAC or 24 VAC) to control is interrupted.

12 BLOWER ON AFTER POWER UP (115 VAC or 24 VAC) -Blower runs for 90 seconds, if unit is powered up during a call for heat (R-W closed) or R-W opens during blower on-delay.

13 LIMIT CIRCUIT LOCKOUT - Lockout occurs if the limit, draft safeguard, flame rollout, or blocked vent switch (if used) is open longer than 3 minutes.
- Control will auto reset after three hours. - Refer to #33.

14 IGNITION LOCKOUT - Control will auto-reset after three hours. Refer to #34.

21 GAS HEATING LOCKOUT - Control will NOT auto reset.
Check for: - Mis-wired gas valve -Defective control (valve relay)

22 ABNORMAL FLAME-PROVING SIGNAL - Flame is proved while gas valve is de-energized. Inducer will run until fault is cleared. Check for: - Leaky gas valve
- Stuck-open gas valve

23 PRESSURE SWITCH DID NOT OPEN Check for:
- Obstructed pressure tubing. - Pressure switch stuck closed.

24 SECONDARY VOLTAGE FUSE IS OPEN Check for:
- Short circuit in secondary voltage (24VAC) wiring.

COMPONENT TEST

To initiate the component test sequence, shut OFF the room thermostat or disconnect the "R" thermostat lead. Briefly short the TEST/TWIN terminal to the "Com 24V" terminal. Status LED will flash code and then turn ON the inducer motor. The inducer motor will run for the entire component test. The hot surface ignitor, blower motor fan speed (on AMBER LED boards only) blower motor-heat speed, and blower motor-cool speed will be turned ON for 10-15 seconds each. Gas Valve and Humidifier will not be turned on.

327596-101 REV. B

31 PRESSURE SWITCH DID NOT CLOSE OR REOPENED - If open longer than five minutes, inducer shuts off for 15 minutes before retry. Check for: - Excessive wind
- Proper vent sizing - Defective inducer motor
- Low inducer voltage (115VAC) - Defective pressure switch
- Inadequate combustion air supply - Disconnected or obstructed pressure tubing
- Low inlet gas pressure (if LGPS used) - Restricted vent

If it opens during blower on-delay period, blower will come on for the selected blower off-delay.

33 LIMIT CIRCUIT FAULT - Indicates a limit, draft safeguard, flame rollout, or blocked vent switch (if used) is open. Blower will run for 4 minutes or until open switch remakes whichever is longer. If open longer than 3 minutes, code changes to lockout #13. If open less than 3 minutes status code #33 continues to flash until blower shuts off. Flame rollout switch and BVSS require manual reset. Check for: - Restricted vent
- Proper vent sizing - Loose blower wheel. - Excessive wind
- Dirty filter or restricted duct system.
- Defective blower motor or capacitor. - Defective switch or connections.
- Inadequate combustion air supply (Flame Roll-out Switch open).

34 IGNITION PROVING FAILURE - Control will try three more times before lockout #14 occurs. If flame signal lost during blower on-delay period, blower will come on for the selected blower off-delay. Check for: - Flame sensor must not be grounded
- Oxide buildup on flame sensor (clean with fine steel wool).
- Proper flame sense microamps (.5 microamps D.C. min., 4.0 - 6.0 nominal).
- Gas valve defective or gas valve turned off - Manual valve shut-off
- Defective Hot Surface Ignitor - Control ground continuity
- Low inlet gas pressure - Inadequate flame carryover or rough ignition
- Green/Yellow wire **MUST** be connected to furnace sheet metal

45 CONTROL CIRCUITRY LOCKOUT Auto-reset after one hour lockout due to;
- Gas valve relay stuck open - Flame sense circuit failure - Software check error

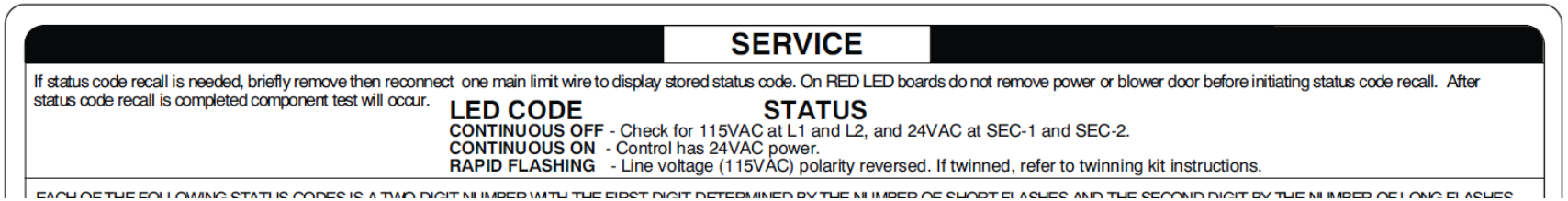
Reset power to clear lockout. Replace control if status code repeats.

Service Label

Code 11 No Previous Code

All furnace boards can show the last fault code that the board experienced and the ability to perform a component test.
How these functions are performed depends on which board the furnace has.

Consult Installation Instructions or Service Label on Furnace before opening blower compartment for Previous Code Retrieval



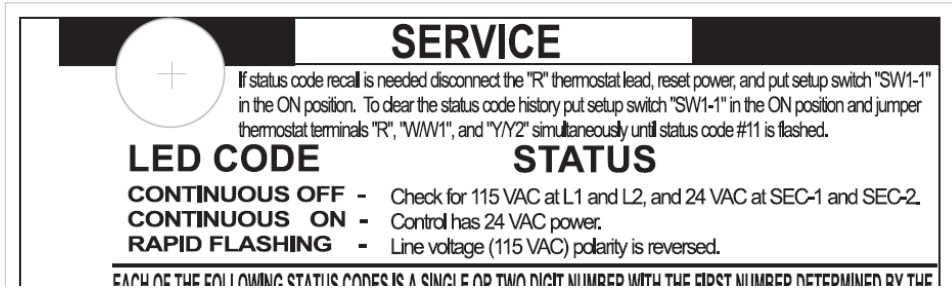
SERVICE

If status code recall is needed, briefly remove then reconnect one main limit wire to display stored status code. On RED LED boards do not remove power or blower door before initiating status code recall. After status code recall is completed component test will occur.

LED CODE	STATUS
CONTINUOUS OFF	- Check for 115VAC at L1 and L2, and 24VAC at SEC-1 and SEC-2.
CONTINUOUS ON	- Control has 24VAC power.
RAPID FLASHING	- Line voltage (115VAC) polarity reversed. If twinned, refer to twinning kit instructions.

EACH OF THE FOLLOWING STATUS CODES IS A TWO DIGIT NUMBER WITH THE FIRST DIGIT DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND DIGIT BY THE NUMBER OF LONG FLASHES

Typical Low Tier Furnace Service Label



SERVICE

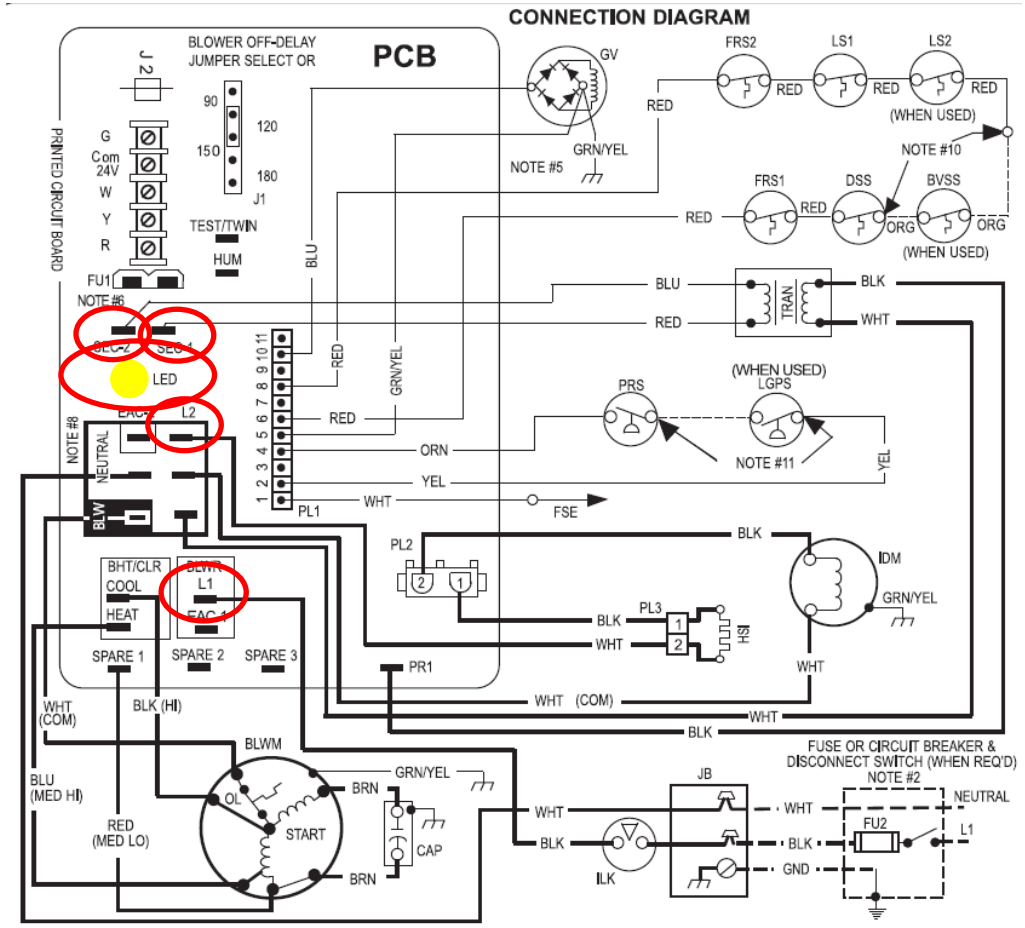
If status code recall is needed disconnect the "R" thermostat lead, reset power, and put setup switch "SW1-1" in the ON position. To clear the status code history put setup switch "SW1-1" in the ON position and jumper thermostat terminals "R", "W/W1", and "Y/Y2" simultaneously until status code #11 is flashed.

LED CODE	STATUS
CONTINUOUS OFF -	Check for 115 VAC at L1 and L2, and 24 VAC at SEC-1 and SEC-2.
CONTINUOUS ON -	Control has 24 VAC power.
RAPID FLASHING -	Line voltage (115 VAC) polarity is reversed.

EACH OF THE FOLLOWING STATUS CODES IS A SINGLE OR TWO DIGIT NUMBER WITH THE FIRST NUMBER DETERMINED BY THE

Typical High Tier Furnace Service Label

Status Light

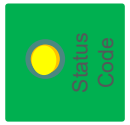


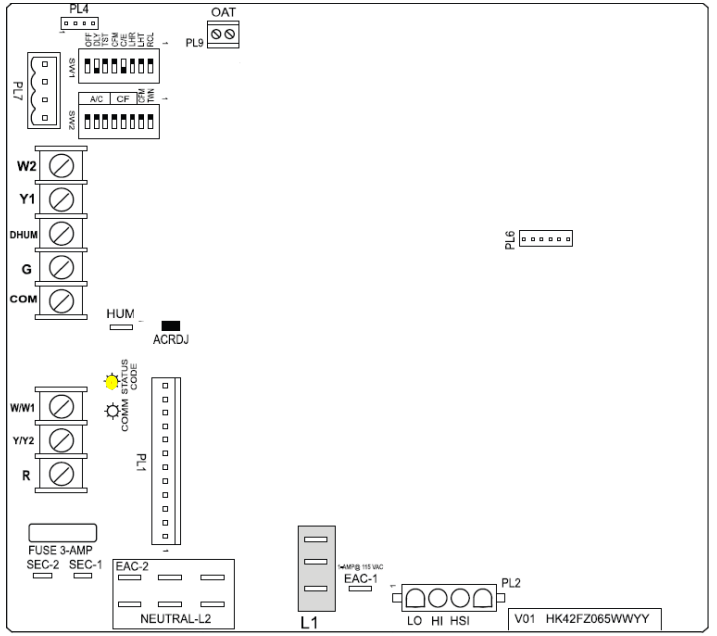
If Status Light is on continuously, furnace is powered, and board has 24 VAC power

If Status Light is off:

- Check for Line Voltage into furnace (L1 & L2)
- Check for Low voltage from transformer

Status Light & Codes





STATUS CODES ARE A TWO DIGIT NUMBER WITH THE FIRST DIGIT DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND DIGIT BY THE NUMBER OF LONG FLASHES.

Rapid Flash

On all furnace boards, a rapidly flashing Status Light indicates an issue with polarity:

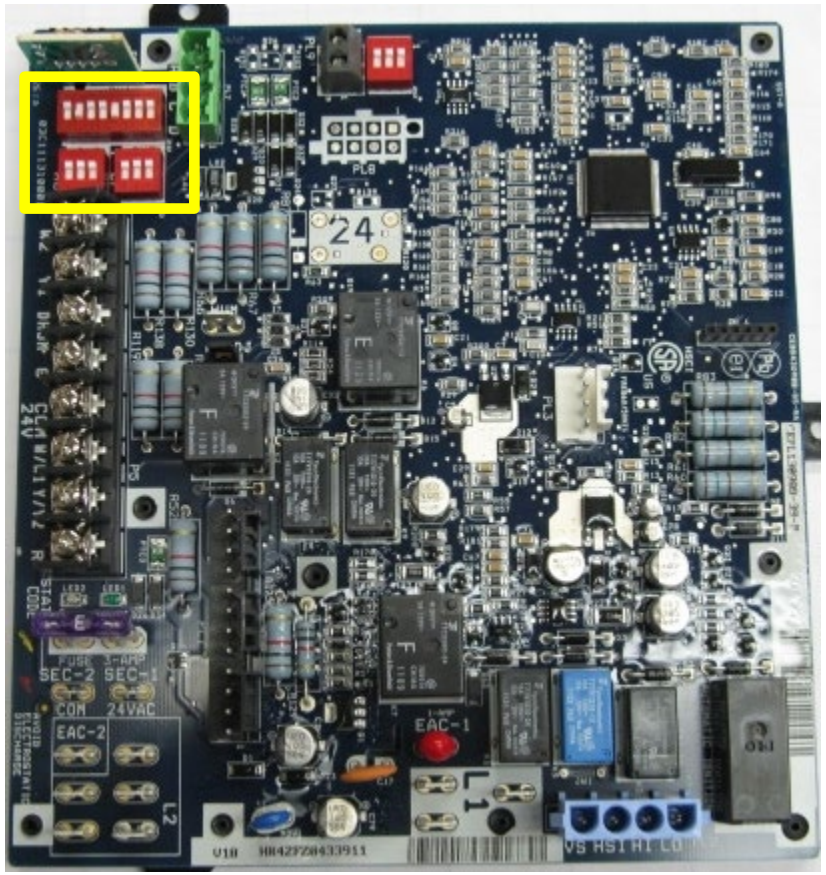
- Voltage Polarity is reversed
- Furnace is not grounded
- Transformers are out of phase in twinned units

If on startup Status Light flashes and furnace is not twinned:

Check for voltage across N and chassis ground. If there is 115-vac, switch incoming lines. If there is no voltage, check to see if furnace is properly grounded back to service panel.

If there is no voltage and the furnace is properly grounded back to the service panel, replace the furnace control board.

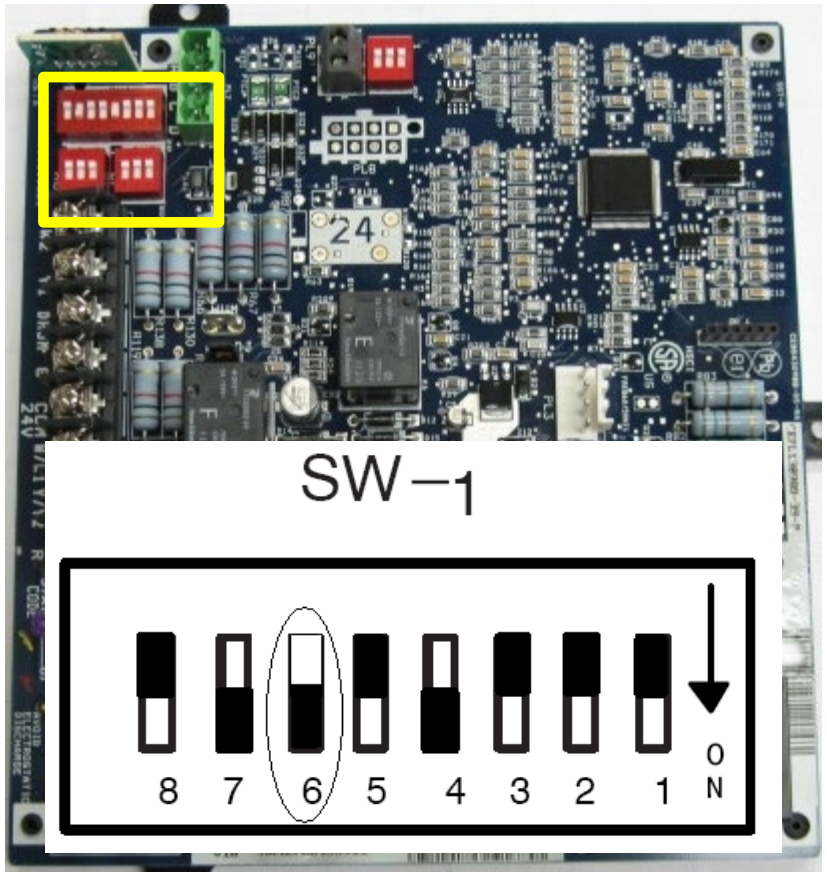
Self Check Diagnostics



- Remove power
- Disconnect R to stat on board

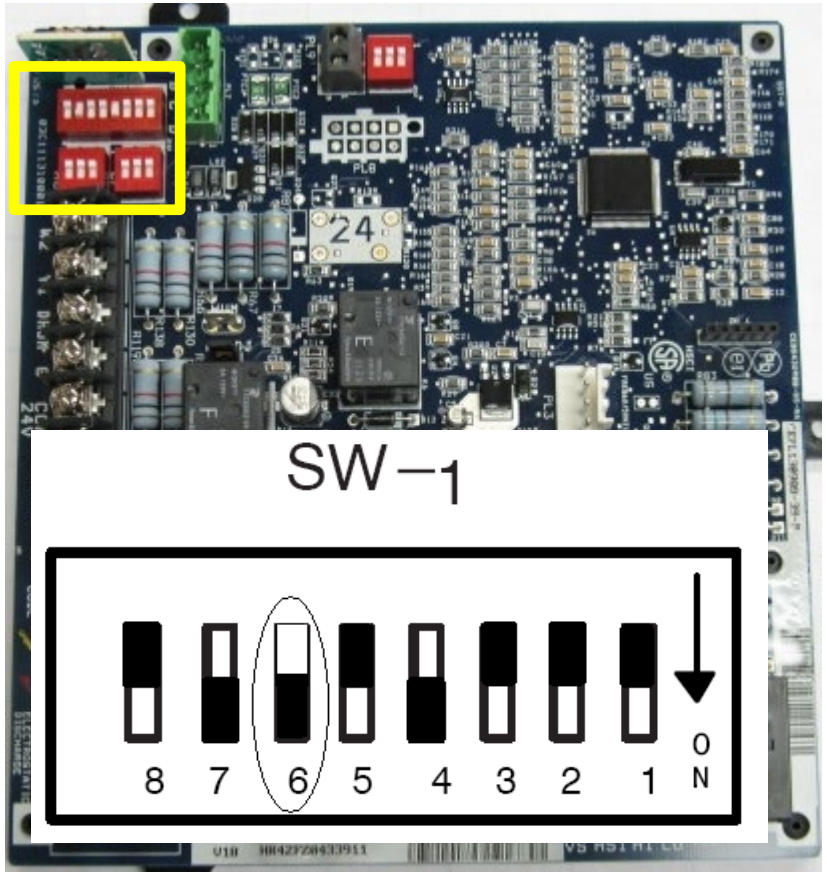
  or
- Unplug the UI ABCD plug
- Set switch SW1-6 to on
- Then power unit

Self Check Diagnostics



- Once the switch SW1-6 is turned on
- Power on the unit
- The Inducer will be energized at high-speed and stays energized until the blower shuts off
- The HSI is energized for 15 seconds and then de-energized
- Then the blower will be energized for 15 seconds at some range
- Single Stage - Blower and inducer will de-energize at the same time
- 2-Stage – The blower will be de-energized and the inducer will slow down to first stage operation for 10 secs and then de-energize

Self Check Diagnostics



Single Stage or 2-stage

It helps show all the major components are working.

On a modulating gas furnace, it helps troubleshoot codes

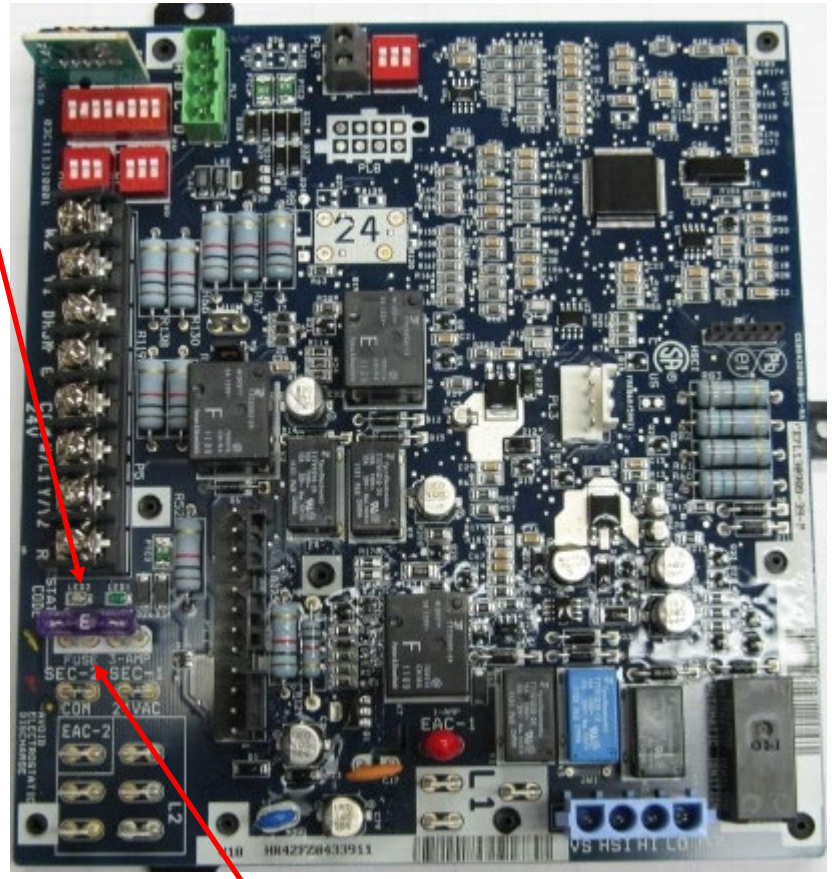
25 Set up error

35 Gas valve fault

41 Blower motor fault

42 Inducer motor fault

Code 24 - Low Voltage Fuse Open



All furnaces have low voltage fuses on their boards.

Low voltage from transformer powers board before passing through fuse.

If fuse opens, board will display code 24.

To troubleshoot, remove all external wiring from unit (thermostat, OD unit, zoning kits, accessories) check all wiring to ground. Run furnace. Add back wiring.

Code 12 - Start Up - informational alert

When power is applied to a any furnace board, the board will give a code 12 if there is an active heat call (24v on W1 or W2) when the power is applied.

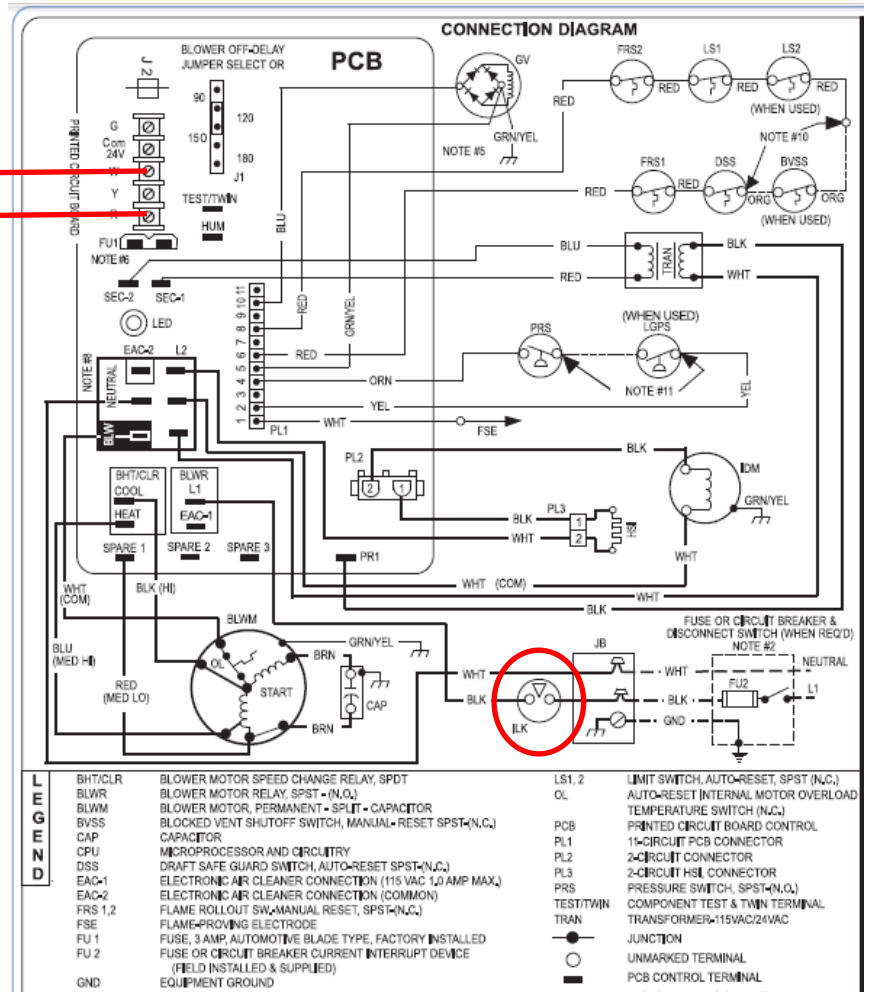
This is more of an alert than a fault and is in place because the board interprets the power up with a callfor heat(24v on W1 or W2) as a power interruption during a heat call and wants to clear the furnace of any residual heat.

The furnace will run the blower fan for 90 seconds and shut if off before resuming the normal sequence of operation for a heat call.

This is a very common code while servicing as power may be interrupted often while troubleshooting.

A good practice while troubleshooting a furnace (or any air handler) is to remove thermostat wiring and to use jumpers (alligator clips) to initiate call for different modes after power is returned to the unit.

Code 12 – Start Up – informational alert



Blower access panel interlock switch (ILK) comes on all furnaces.

May be taped closed for troubleshooting. Don't forget to remove tape when finished.

When troubleshooting furnace, disconnect all outside wiring, outdoor equipment and accessories.

Common Communications Codes

- Code 16 Loss of communications.
- Code 179 no communications to the outdoor unit.
- Code 178 no communications to the indoor unit.
- Check and tighten all wiring connections.
- You can test with the UI at the outdoor unit and wire it direct to the indoor.
- The communications ABCD plugs into the back of the UI.

Same on all unit's that use the ABCD plug

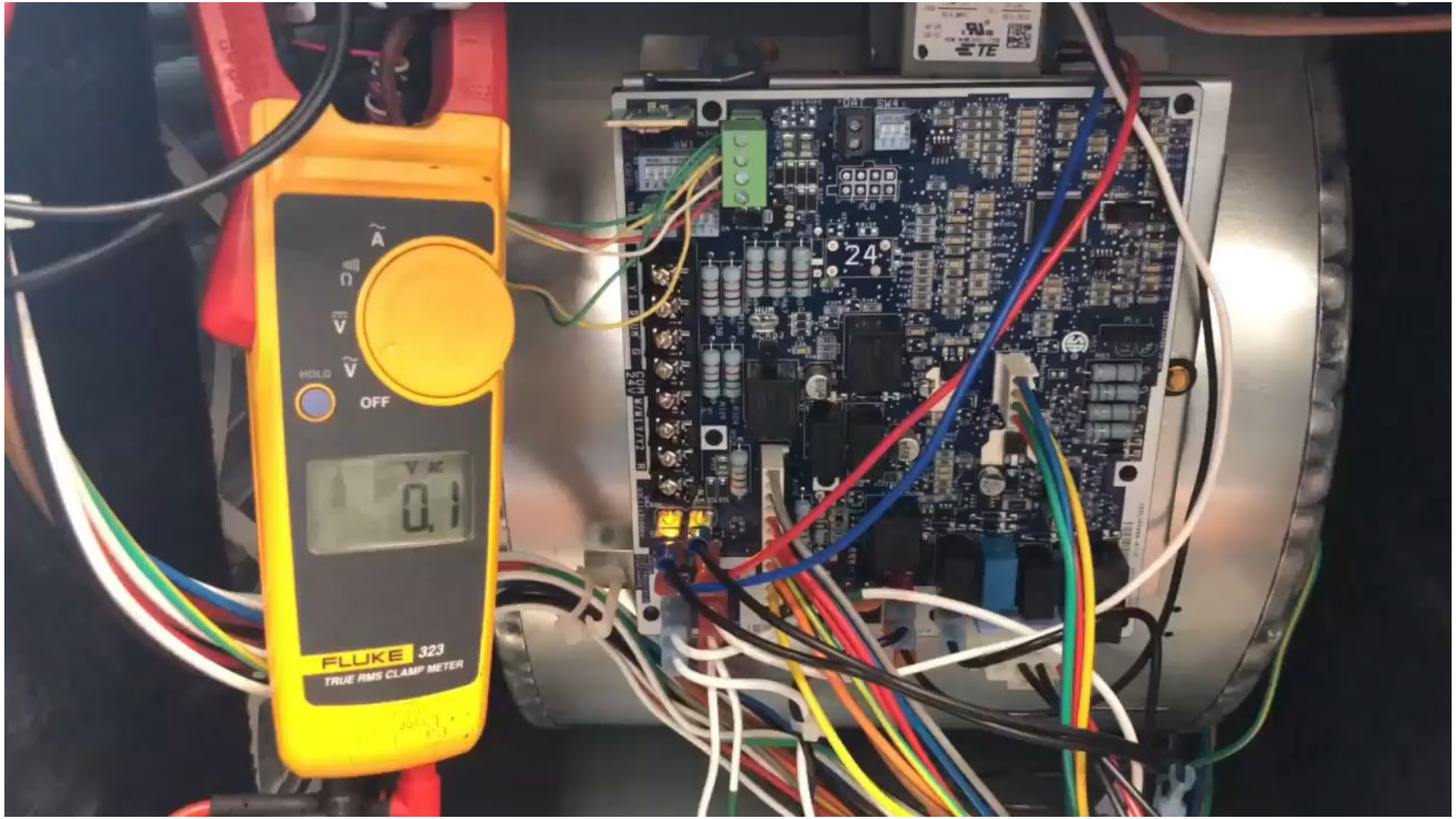
So, is it the board or the wire?

Check voltages with the ABCD 4-wire plug disconnected from the board. If the voltage behavior does not the match table, the board most likely has failed.

Check voltages with the ABCD 4-wire plug, connected to the board. If the voltage behavior does not match the table, check the wiring for shorts or bad UI.

-Voltage Readings - With board Power applied, and No U.I. connected	
A to B	~3 vdc
A to C	~3 vdc
B to C	~.01 to 0.3 vdc
C to D	24 vac
-Voltage Readings - With board Power applied, and U.I. Applied	
A to B	~2.5 to 3.9 vdc (pulsating)
A to C	~2.5 to 3.9 vdc (pulsating)
B to C	~0.1 to 0.9 vdc (pulsating)
C to D	24 vac

Checking Communication



Checking Communication

End of deck 1, change to deck 2

2022 Gas Furnace Service part 2

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