ALLIED™ Air Enterprises

SERVICE MANUAL

A98USMV Gas Furnace

This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.

A98USMV series units are high-efficiency upflow, horizontal right and left) gas furnaces equipped with variable capacity gas valve, variable speed combustion air inducer and variable speed indoor blower motor. All models are designed only for direct vent (dual pipe) venting system. A98USMV units are available in heating capacities from 66,000 to 132,000 Btuh (19.3 to 38.6 kW) and cooling applications from 2 to 5 tons (7.0 kW to 17.5 kW). Refer to Technical Specifications for proper sizing.

Units are factory-equipped for use with natural gas. Kits are available for conversion to LPG operation. A98USMV models include a variable capacity integrated control that can be used with Allied Air Comfort Sync Wi-Fi® thermostat as part of a communicating comfort system. All A98USMV units meet the California Nitrogen Oxides (NOx) Standards and California Seasonal Efficiency requirements.

All specifications in this manual are subject to change. Procedures outlined in this manual are presented as recommendations only and do not supersede or replace local or state codes. In the absence of local or state codes, the guidelines and procedures outlined in this manual (except where noted) are recommendations only and do not constitute code.

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WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

WARNING

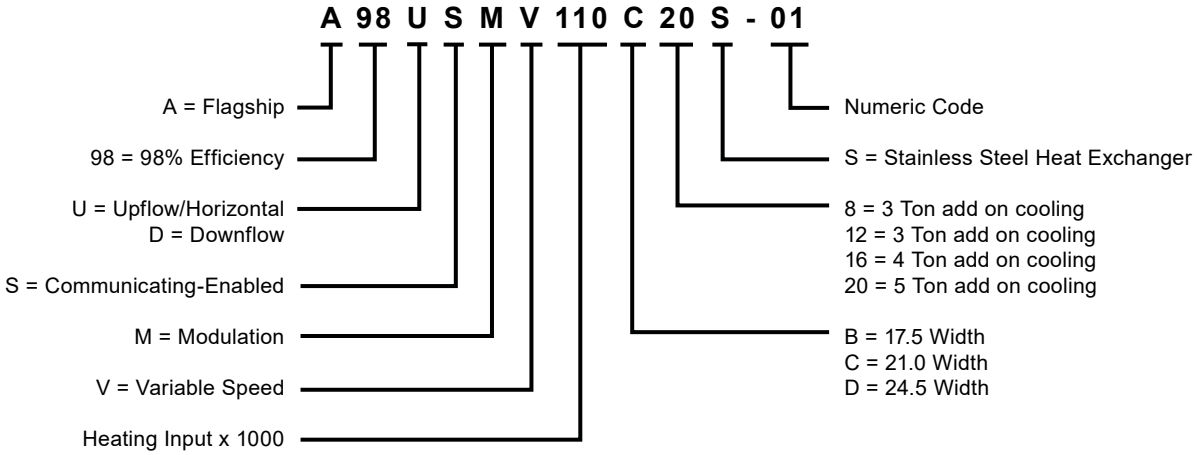
Electric shock hazard.

Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

(P) 508420-01

Technical Specifications - A98USMV

MODEL NUMBER GUIDE



PHYSICAL AND ELECTRICAL DATA

	Model	Input (Btuh)	Output * (Btuh)	AFUE (ICS)	Nominal* Cooling Capacity	Gas Inlet (in.)	Volts-Hertz-Phase	Max. Time Delay Breaker or Fuse	Nominal F.L.A.	Trans. (V.A.)	Approx. Shipping Weight (lbs.)
UPFLOW / HORIZONTAL	A98USMV070B12S	66,000	64,000	98.0%	3 Tons	1/2	120-60-1	15	7.7	40	132
	A98USMV090C12S	88,000	85,000	98.0%	3 Tons	1/2	120-60-1	15	7.7	40	146
	A98USMV090C16S	88,000	85,000	98.0%	4 Tons	1/2	120-60-1	15	10.1	40	153
	A98USMV090C20S	88,000	85,000	98.0%	5 Tons	1/2	120-60-1	20	12.8	40	156
	A98USMV110C20S	110,000	106,000	98.0%	5 Tons	1/2	120-60-1	20	12.8	40	164
	A98USMV135D20S	132,000	127,000	98.0%	5 Tons	1/2	120-60-1	20	12.8	40	179

Note: For vent length and clearances to combustibles, please reference installation instructions.
** At full capacity*

BLOWER PERFORMANCE: BOTTOM INLET

	Model	Motor Size (hp)	Blower Size	Temp Rise F°	Heating CFM @ 0" - 0.8" w.c.				Cooling Stages	Speed Adjustment	Cooling CFM @ 0" - 0.8" w.c.			
					* *	35% Input	70% Input	100% Input			Low	Medium Low	Medium High	High Default
UPFLOW / HORIZONTAL	A98USMV070B12S	1/2 HP	10 x 9	50 - 80 Max. Input	+15%	489	833	1128	2nd Stage	+10%	862	1063	1218	1369
					+7.5%	450	772	1048		Default	810	962	1130	1269
					Default	410	710	967		-10%	707	841	1007	1140
				35 - 65 Min. Input					1st Stage	+10%	604	740	843	971
					-7.5%	380	657	895		Default	558	668	770	855
					-15%	349	604	822		-10%	504	603	683	793
	A98USMV090C12S	1/2 HP	10 x 9	60 - 90 Max. Input	+15%	687	1014	1295	2nd Stage	+10%	879	1040	1212	1362
					+7.5%	654	953	1209		Default	803	946	1104	1246
					Default	621	891	1122		-10%	721	842	972	1117
				35 - 65 Min. Input					1st Stage	+10%	626	710	832	952
					-7.5%	581	828	1041		Default	569	672	764	862
					-15%	540	766	959		-10%	524	612	687	785
	A98USMV090C16S	3/4 HP	11 x 11	50 - 80 Max. Input	+15%	769	1234	1633	2nd Stage	+10%	1168	1379	1583	1771
					+7.5%	713	1155	1534		Default	1079	1267	1444	1645
					Default	656	1075	1434		-10%	938	1148	1324	1469
				35 - 65 Min. Input					1st Stage	+10%	843	1007	1159	1315
					-7.5%	595	997	1342		Default	780	915	1047	1190
					-15%	534	919	1249		-10%	693	838	959	1070
	A98USMV090C20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	583	1159	1653	2nd Stage	+10%	1385	1593	1818	2019
					+7.5%	540	1085	1553		Default	1226	1463	1647	1884
					Default	497	1012	1453		-10%	1063	1320	1504	1675
				35 - 65 Min. Input					1st Stage	+10%	933	1054	1274	1466
					-7.5%	439	917	1328		Default	836	978	1121	1336
					-15%	380	823	1203		-10%	740	868	1010	1152
	A98USMV110C20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	767	1424	1988	2nd Stage	+10%	1312	1560	1744	1955
					+7.5%	738	1349	1874		Default	1219	1405	1569	1796
					Default	708	1274	1759		-10%	1075	1272	1428	1634
				35 - 65 Min. Input					1st Stage	+10%	937	1064	1247	1407
					-7.5%	655	1187	1644		Default	864	972	1146	1282
					-15%	602	1101	1528		-10%	790	888	1025	1167
	A98USMV135D20S	1 HP	11 x 11	55 - 85 Max. Input	+15%	949	1534	2035	2nd Stage	+10%	1353	1567	1751	1994
					+7.5%	879	1426	1895		Default	1202	1448	1616	1828
					Default	808	1317	1754		-10%	1080	1290	1472	1668
				35 - 65 Min. Input					1st Stage	+10%	935	1074	1260	1450
					-7.5%	748	1235	1652		Default	834	983	1116	1306
					-15%	687	1152	1550		-10%	732	867	1023	1145

*** See installation instructions for proper blower setup*

BLOWER PERFORMANCE: SIDE INLET

	Model	Motor Size (hp)	Blower Size	Temp Rise F°	Heating CFM @ 0" - 0.8" w.c.				Cooling Stages	Speed Adjustment	Cooling CFM @ 0" - 0.8" w.c.			
					* *	35% Input	70% Input	100% Input			Low	Medium Low	Medium High	High Default
UPFLOW / HORIZONTAL	A98USMV070B12S	1/2 HP	10 x 9	50 - 80 Max. Input	+15%	484	812	1093	2nd Stage	+10%	840	1054	1208	1357
					+7.5%	446	756	1022		Default	752	946	1130	1231
					Default	407	700	951		-10%	688	805	991	1114
				35 - 65 Min. Input					1st Stage	+10%	593	706	805	959
					-7.5%	377	635	857		Default	543	642	729	824
					-15%	346	571	763		-10%	503	584	665	720
	A98USMV090C12S	1/2 HP	10 x 9	60 - 90 Max. Input	+15%	657	971	1240	2nd Stage	+10%	843	1017	1168	1300
					+7.5%	631	926	1178		Default	772	912	1054	1193
					Default	605	880	1116		-10%	698	799	946	1111
				35 - 65 Min. Input					1st Stage	+10%	610	707	797	921
					-7.5%	574	814	1020		Default	561	643	718	811
					-15%	542	747	923		-10%	526	605	667	729
	A98USMV090C16S	3/4 HP	11 x 11	50 - 80 Max. Input	+15%	747	1204	1595	2nd Stage	+10%	1140	1341	1526	1728
					+7.5%	698	1127	1495		Default	1043	1235	1398	1566
					Default	649	1051	1395		-10%	913	1124	1279	1402
				35 - 65 Min. Input					1st Stage	+10%	823	1009	1135	1292
					-7.5%	589	814	1020		Default	758	882	1026	1151
					-15%	528	747	923		-10%	684	816	928	1068
	A98USMV090C20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	609	1136	1588	2nd Stage	+10%	1335	1559	1719	1986
					+7.5%	551	1059	1496		Default	1173	1433	1568	1811
					Default	492	983	1403		-10%	1049	1283	1451	1603
				35 - 65 Min. Input					1st Stage	+10%	911	1043	1227	1434
					-7.5%	436	814	1020		Default	805	960	1087	1296
					-15%	380	747	923		-10%	700	840	991	1115
	A98USMV110C20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	733	1194	1747	2nd Stage	+10%	1270	1519	1712	1899
					+7.5%	708	1139	1657		Default	1170	1363	1555	1774
					Default	683	1085	1566		-10%	1059	1218	1401	1581
				35 - 65 Min. Input					1st Stage	+10%	918	1053	1198	1366
					-7.5%	632	1007	1457		Default	820	964	1095	1231
					-15%	580	929	1348		-10%	722	852	987	1116
	A98USMV135D20S	1 HP	11 x 11	55 - 85 Max. Input	+15%	927	1505	2001	2nd Stage	+10%	1337	1550	1720	1974
					+7.5%	844	1398	1873		Default	1194	1416	1608	1781
					Default	760	1290	1744		-10%	1076	1282	1437	1628
				35 - 65 Min. Input					1st Stage	+10%	938	1070	1236	1418
					-7.5%	703	1208	1641		Default	837	985	1114	1296
					-15%	646	1126	1537		-10%	736	870	1010	1139

*** See installation instructions for proper blower setup*

BLOWER PERFORMANCE: SIDE INLET WITH RETURN AIR BASE

	Model	Motor Size (hp)	Blower Size	Temp Rise F°	Heating CFM @ 0" - 0.8" w.c.				Cooling Stages	Speed Adjustment	Cooling CFM @ 0" - 0.8" w.c.			
					* *	35% Input	70% Input	100% Input			Low	Medium Low	Medium High	High Default
UPFLOW / HORIZONTAL	A98USMV070B12S	1/2 HP	10 x 9	50 - 80 Max. Input	+15%	471	805	1091	2nd Stage	+10%	857	1049	1206	1354
					+7.5%	435	751	1021		Default	791	946	1093	1255
					Default	399	696	951		-10%	722	845	987	1131
				35 - 65 Min. Input					1st Stage	+10%	596	717	816	950
					-7.5%	369	643	877		Default	521	657	755	840
					-15%	339	589	803		-10%	494	597	672	747
	A98USMV090C12S	1/2 HP	10 x 9	60 - 90 Max. Input	+15%	677	988	1254	2nd Stage	+10%	852	999	1166	1305
					+7.5%	639	923	1167		Default	776	907	1050	1206
					Default	600	858	1079		-10%	712	802	947	1074
				35 - 65 Min. Input					1st Stage	+10%	605	715	812	934
					-7.5%	573	806	1006		Default	571	662	735	820
					-15%	546	754	933		-10%	530	602	673	725
	A98USMV090C16S	3/4 HP	11 x 11	50 - 80 Max. Input	+15%	764	1213	1597	2nd Stage	+10%	1162	1360	1533	1742
					+7.5%	705	1132	1499		Default	1064	1240	1400	1594
					Default	645	1052	1401		-10%	928	1133	1298	1441
				35 - 65 Min. Input					1st Stage	+10%	844	955	1124	1280
					-7.5%	594	986	1323		Default	775	910	1011	1173
					-15%	542	921	1245		-10%	695	816	932	1045
	A98USMV090C20S	1 HP	11 x 11	60 - 90 Max. Input	+15%	611	1138	1589	2nd Stage	+10%	1329	1560	1740	1982
					+7.5%	554	1060	1494		Default	1177	1414	1586	1807
					Default	497	983	1399		-10%	1044	1261	1432	1619
				35 - 65 Min. Input					1st Stage	+10%	913	1037	1230	1415
					-7.5%	436	895	1288		Default	827	953	1088	1278
					-15%	375	806	1176		-10%	741	855	995	1117
	A98USMV110C20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	805	1419	1945	2nd Stage	+10%	1268	1487	1726	1913
					+7.5%	729	1329	1843		Default	1158	1369	1568	1764
					Default	652	1238	1741		-10%	1030	1224	1393	1575
				35 - 65 Min. Input					1st Stage	+10%	918	1022	1205	1371
					-7.5%	603	1139	1599		Default	839	955	1084	1235
					-15%	554	1040	1457		-10%	760	865	984	1109
	A98USMV135D20S	1 HP	11 x 11	50 - 80 Max. Input	+15%	909	1487	1983	2nd Stage	+10%	1303	1536	1687	1975
					+7.5%	828	1382	1858		Default	1164	1380	1584	1762
					Default	746	1277	1732		-10%	1065	1252	1404	1604
				35 - 65 Min. Input					1st Stage	+10%	918	1061	1214	1382
					-7.5%	690	1188	1615		Default	829	960	1091	1265
					-15%	634	1099	1497		-10%	739	858	991	1116

*** See installation instructions for proper blower setup*

ACCESSORY LIST

Catalog Number	Description
External Filter Rack Kits	
1.841018	1 pack (16 x 25)
1.841039	10 pack (16 x 25)
Natural to LP Kits	
68W77	Modulating 97/98% (including gas valve)
68W77	High Altitude > 7500 ft.
Return Air Base	
68W62	17.5" B Width
68W63	21.0" C Width
68W64	24.5” D Width
Downflow Combustible Flooring Base	
11M60	17.5" B Width
11M61	21.0" C Width
Night Service Kits	
89W52	Modulating
Horizontal Suspension Kit	
51W10	80% & 90% Kit
Flush Mount Termination (90% Furnaces only) US Only	
51W11	2” & 3.0” Vent
Concentric Vent Kit (90% Furnaces only) US Only	
71M80	1-1/2” Vent Version (United States)
69M29	2” Vent Version (United States)
60L46	3” Vent Version (United States)

For vent length and clearances to combustibles, please reference installation instructions.

Parts Arrangement

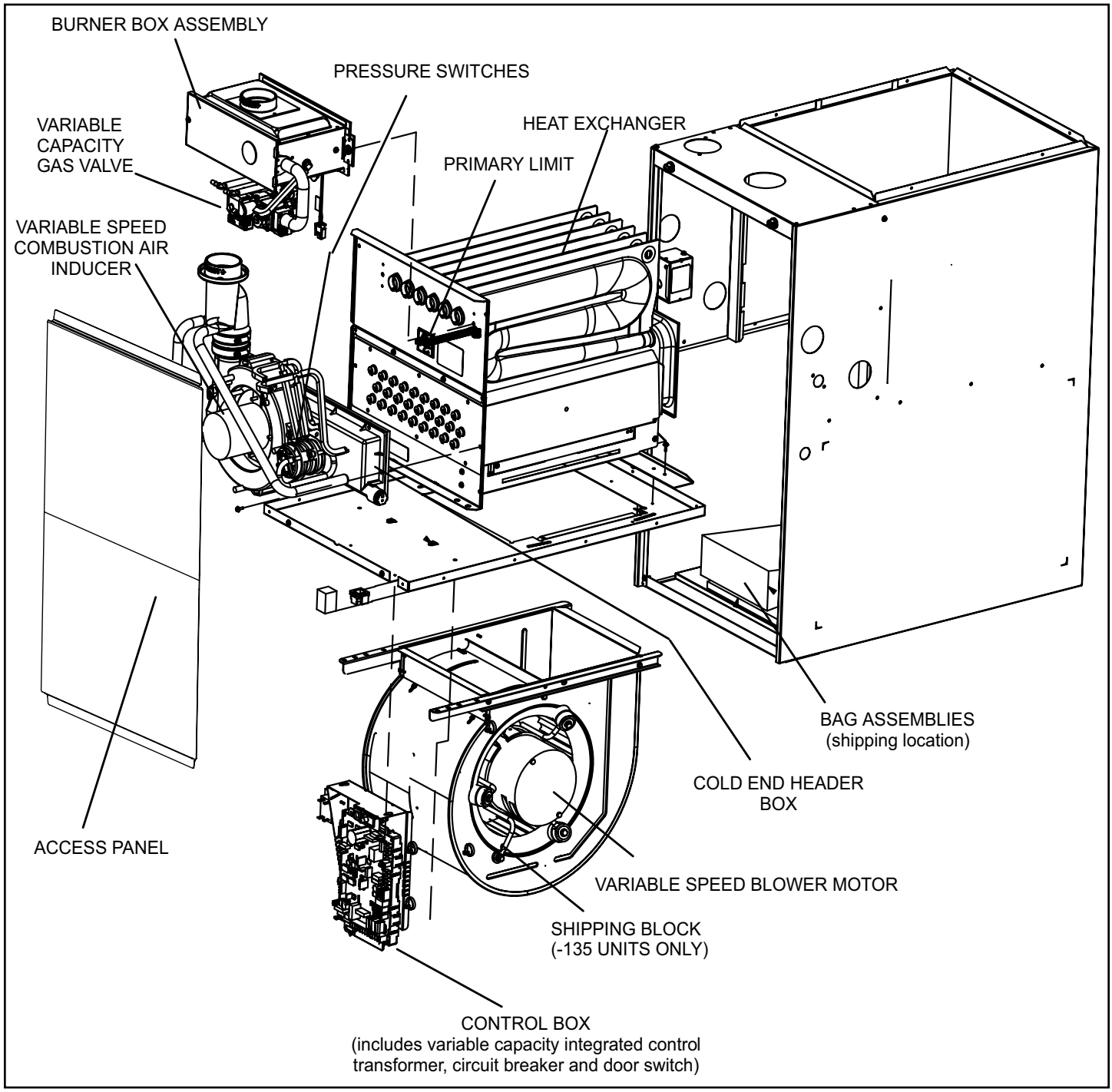


Figure 1.

Unit Components

A98USMV unit components are shown in Figure 1. The gas valve, combustion air inducer and burners can be accessed by removing the access panel. Electrical components are in the control box (Figure 2) found in the blower compartment. A98USMV units are factory-equipped with a bottom return air panel in place. The panel is designed to be field removed as required for bottom air return. Markings are provided for side return air and may be cut out in the field.

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

Control Box

Control Transformer (T1)

A transformer located in the control box provides power to the low voltage section of the unit. Transformers on all models are rated 40VA with a 120V primary and a 24V secondary.

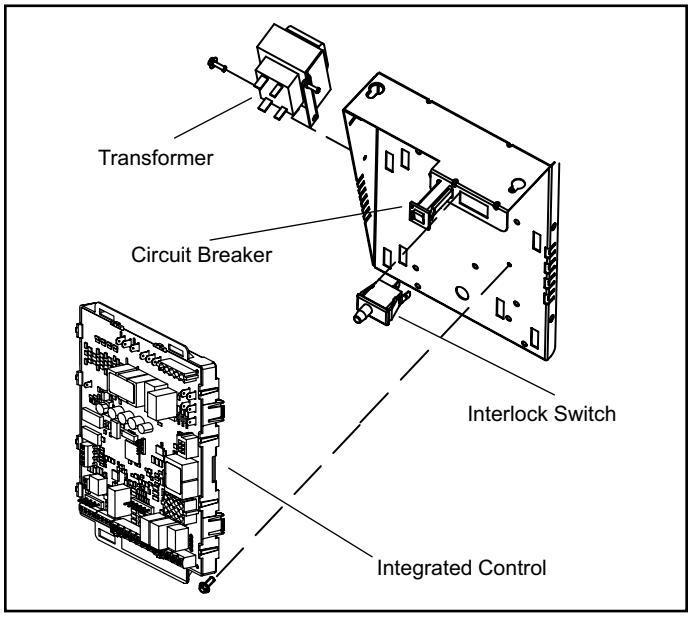


Figure 2. Control Box

Door Interlock Switch (S51)

A door interlock switch rated 14A at 125VAC is wired in series with line voltage. When the inner blower access panel is removed the unit will shut down.

Circuit Breaker (CB8)

A 24V circuit breaker is also located in the control box. The switch provides overcurrent protection to the transformer (T1). The breaker is rated 3A at 32V. If the current exceeds this limit the breaker will trip and all unit operation will shutdown. The breaker can be manually reset by pressing the button on the face. See Figure 3.

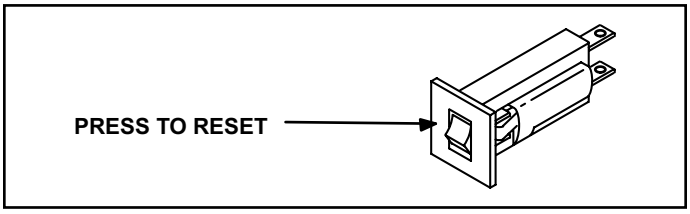


Figure 3. Circuit Breaker CB8

⚠ WARNING

Shock hazard.

Disconnect power before servicing. Integrated control is not field repairable. If control is inoperable, simply replace entire control.

Can cause injury or death. Unsafe operation will result if repair is attempted.

Integrated Control (A92)

Units are equipped with a variable capacity integrated control. This control is used with the Comfort Sync® thermostat as part of a communicating comfort system. The control can also operate with a non-communicating conventional single or two-stage thermostat. The system consists of an ignition / blower control (Figure 4 and Figure 5) with control pin designations (Table 1 through Table 2) and an ignitor. The control and ignitor work in combination to ensure furnace ignition and ignitor durability. The control provides gas ignition, safety checks and indoor blower control with two-stage gas heating. The furnace combustion air inducer, gas valve and indoor blower are controlled in response to various system inputs such as thermostat signal, pressure and limit switch signal and flame signal. The control features a seven-segment LED display, indicating furnace status (including indoor blower) and error codes. The LED flashes in single digits. For example, using Table 13 under CODE, an “E” followed by “2” followed by “5” followed by “0”, the limit switch circuit is open. The control has a 120V humidifier and a 120V accessory terminal, both rated at (1) one amp each.

Pin #	Function
1	Not Used
2	High Fire Pressure Switch
3	Rollout Switch In
4	Ground
5	24V Hot
6	Primary Limit In
7	Gas Valve
8	Gas Valve Common
9	24V Neutral
10	Ground
11	Primary Limit Switch Out
12	Low Fire Pressure Switch

Table 1. Control 12-Pin Terminal Designation

Pin #	Function
1	Data Input From Motor
2	Common
3	Not Used
4	Data Output To Motor
5	5 Volt Bias Supply
6	Not Used

Table 2. Control 6-Pin Terminal Designation

Electronic Ignition

At the beginning of the heat cycle the integrated control monitors the low fire combustion air inducer pressure switch. The control will not begin the heating cycle if the low fire pressure switch is closed (by-passed). Likewise the control will not begin the high fire heating cycle if the high fire pressure switch is closed, and will remain in low fire heat. However, if the high fire pressure switch closes during the low fire heat pre-purge, the control will allow high fire heat. Once the low fire pressure switch is determined to be open, the combustion air inducer is energized on ignition speed. When the differential in the pressure switch is great enough, the pressure switch closes and a 15-second pre-purge begins. If the switch is not proven within 2-1/2 minutes, the inducer is de-energized and the control will initiate vent calibration. If the vent calibration is unsuccessful the control goes into a 5 minute delay. The control will attempt vent calibration 3 more times before going into a 1 hour soft lockout. After the 15 second pre-purge period the ignitor warms up for 20 seconds. The gas valve then opens for a 4-second trial for ignition. The ignitor stays energized during this trial until flame is sensed. If ignition is not proven during the 4-second trial for ignition, the control will try four more times with an inter purge and warm-up time between trials of 35 seconds. After a total of five trials for ignition (including the initial trial), the control goes into Watchguard-Flame Failure mode. After a 60-minute reset period, the control will begin the ignition sequence again.

Thermostat Selection Modes

See Table 3 for DIP switch settings

The control can be made to operate in three modes: variable capacity, three-stage timed or two-stage. The variable capacity and two-stage modes are only operational with a two-stage thermostat. The thermostat selection is made using dip switches one and / or two (Figure 4) and must be positioned for the particular application.

Variable Capacity

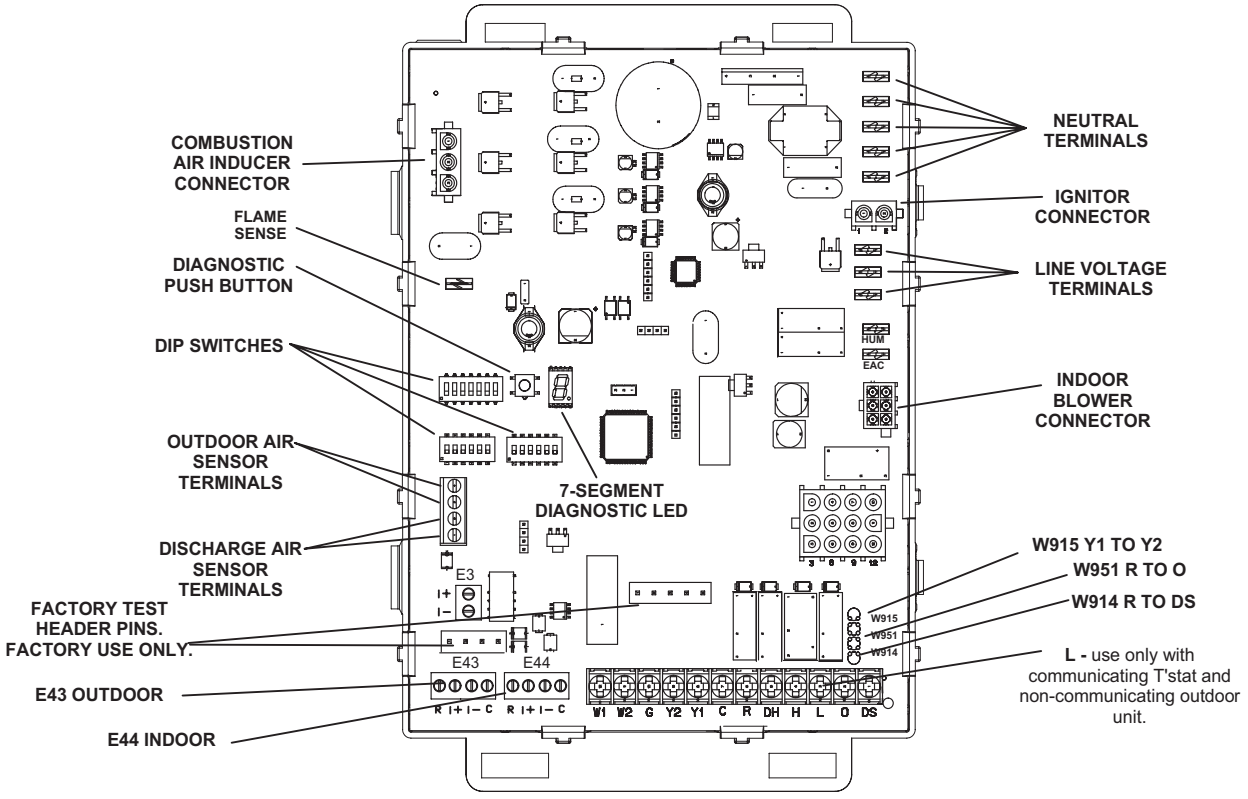
Using a two-stage thermostat the system will operate in a variable capacity sequence mode. In this mode, the control will vary the firing rate anywhere between 35% and 100% of full capacity. The indoor blower will be automatically adjusted accordingly to provide the appropriate airflow at any rate. On the initial call for low fire, the furnace will operate at 35% and will remain there until the heat call is satisfied or a call for high fire is initiated. If there is a call for high fire the rate will increase by 10% if the current rate is above 60%. However, if the current rate is below 60% the rate will increase to 70%. After this initial rate increase to 70% capacity, the furnace will increase rate by 10% every 5 minutes while a high fire heat call is present. If the high fire heat call is satisfied but the low fire heat call is still present, the furnace will remain at the current firing rate until the demand is satisfied or another call for high fire is initiated.

Three-Stage Timed Operation

Using a single-stage thermostat the system will operate in a three stage timed mode. Upon a call for heat and a successful ignition, the combustion air inducer will operate at 35% and the indoor blower will adjust to the appropriate cfm. After a field selectable 7 or 12 minute delay period, the inducer RPM will increase and the unit will operate at 70%. The indoor blower will adjust to the appropriate cfm. After a factory set non-adjustable 10 minute delay expires the furnace will increase rate to 100%. The indoor blower will adjust to the appropriate cfm.

Two-Stage Operation

The system will also operate in conventional two-stage mode. While in two-stage mode, the furnace will fire on low fire (70% rate). The combustion air inducer will operate at 70% and the indoor blower will adjust to the appropriate cfm. The unit will switch to high fire on a W2 call from the thermostat. After a 30 second recognition period (during which the integrated control will receive a continuous W2 call) expires the furnace will increase to 100% rate. The inducer will increase to 100% speed and the indoor blower will adjust to appropriate cfm. If there is a simultaneous call for first and second stage heat, the unit will fire on first stage heat and switch to second stage heat after 30 seconds of operation.



RS-BUS LINK (E3, future use)

I+ = DATA HIGH CONNECTION
I - = DATA LOW CONNECTION

RS-BUS OUTDOOR (E43)

R = 24VAC
I + = DATA HIGH CONNECTION
I - = DATA LOW CONNECTION
C = 24VAXC COMMON

RS-BUS INDOOR (E44)

R = 24VAC
I + = DATA HIGH CONNECTION
I - = DATA LOW CONNECTION
C = 24VAXC COMMON

1/4" QUICK CONNECT TERMINALS

HUM = 120 VAC OUTPUT TO HUMIDIFIER
XMFR = 120 VAC OUTPUT TO TRANSFORMER
LI = 120 VAC INPUT TO CONTROL
CIRC = 120 VAC OUTPUT TO CIRCULATING BLOWER
EAC = 120 VAC OUTPUT TO ELECTRICAL AIR CLEANER
NEUTRALS = 120 VAC NEUTRAL

THERMOSTAT CONNECTIONS (E7)

DS = DEHUMIDIFICATION SIGNAL
W2 = HEAT DEMAND FROM 2ND STAGE T/STAT
W1 = HEAT DEMAND FROM 1ST STAGE T/STAT
R = CLASS 2 VOLTAGE TO THERMOSTAT
G = MANUAL FAN FROM THERMOSTAT
C = THERMOSTAT SIGNAL GROUNCONNECTED TO TRANSFORMER GRD (TR) & CHASIS GROUND (GRD)
Y1 = THERMOSTAT 1ST STAGE COOL SIGNAL
Y2 = THERMOSTAT 2ND STAGE COOL SIGNAL
O = THERMOSTAT SIGNAL TO HEAT PUMP REVERSING VALVE
H = 24V HUMIDIFIER OUTPUT. DO NOT CONNECT TO COMFORT SYNC® THERMOSTAT
L = USE ONLY WITH A COMMUNICATING THERMOSTAT AND A NON-COMMUNICATING OUTDOOR UNIT
DH = DEHUMIDIFICATION OUTPUT COMMUNICATING THERMOSTAT ONLY

Figure 4. Integrated Control

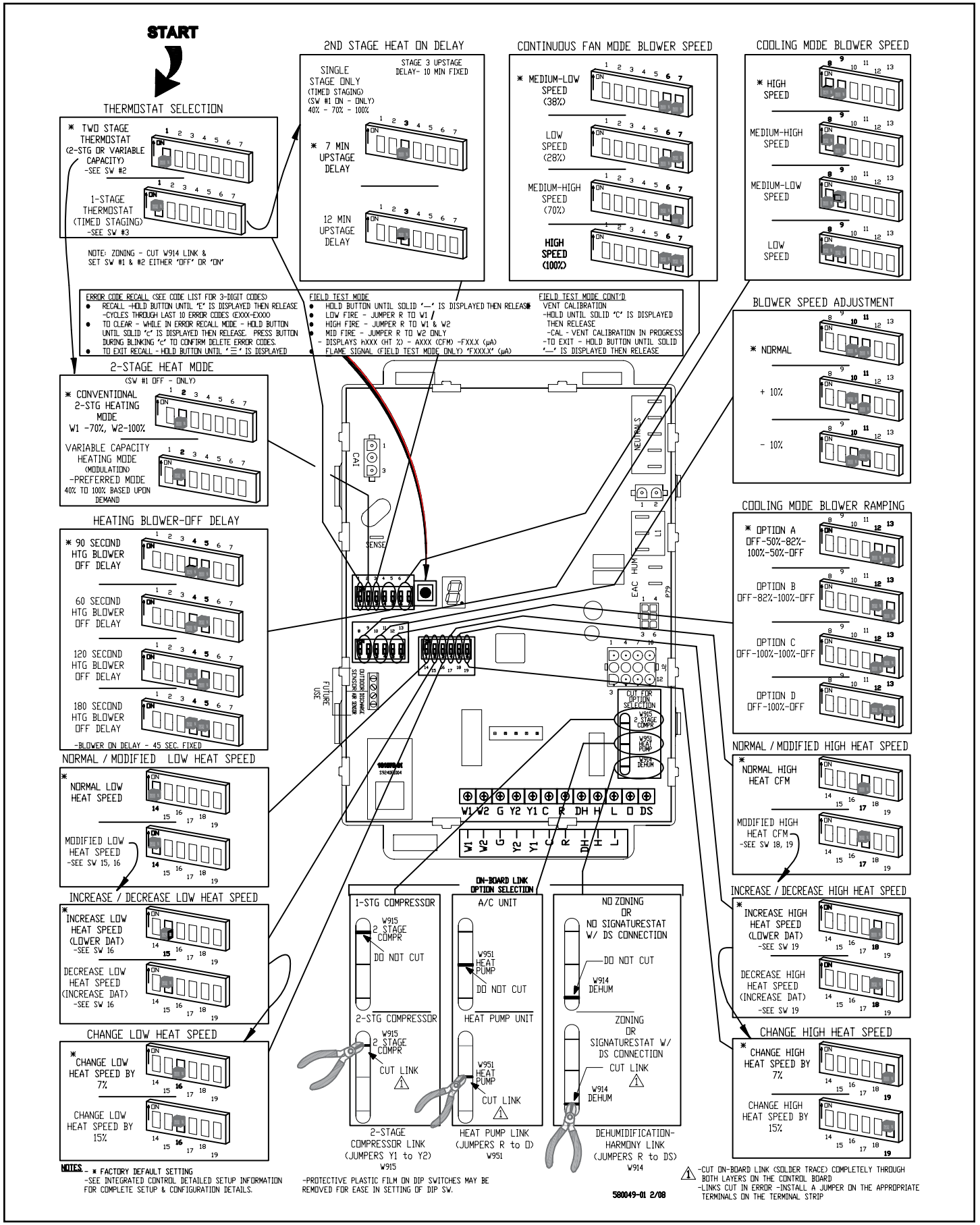


Figure 5. Integrated Control Configuration Guide

Operation	Thermostat	Switch 1	Switch 2	Switch 3
Variable Capacity Heat (35% to 100%)	Two-Stage	Off	On	Off
Three-Stage Heat (35%, 70%, 100%)	Single-Stage	On	Off	2nd Stage Delay OF = 7 minutes ON = 12 minutes 3rd Stage Delay 10 minutes fixed
Two-Stage Heat (W1 70%, W2 100%)	Two-Stage	Off	Off	Off

Table 3. Thermostat Selection Switch Settings

NOTE: *When the A98USMV is used with an Comfort Sync Wi-Fi® communicating thermostat, all indoor blower speed selections and DIP switch settings are made by the communicating thermostat.*

Heating Operation DIP Switch Settings -- Figure 4

Switch 1 -- Thermostat Selection -- This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. The DIP switch is factory-positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the DIP switch must be repositioned. See Table 3.

NOTE: *All DIP switches are factory shipped in the "OFF" position.*

Switch 2 -- Operating Mode with Two-Stage Thermostat -- If a two-stage thermostat is used, the furnace can operate in either variable-capacity or conventional two-stage mode. When variable-capacity mode is selected, the firing rate of the unit is varied to maximize comfort. Conventional twostage mode is the factory default setting. See Table 3.

Switch 3 -- Second-Stage Heat On Delay -- If a singlestage thermostat is used, the integrated control can be used to energize second-stage heat after either 7 minutes or 12 minutes of first-stage heat operation. See Table 3.

Switches 4 and 5 -- Blower-Off Delay -- The blower-on delay of 45 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 4 and 5 on the integrated control. The unit is shipped from the factory with a blower-off delay of 90 seconds. The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. Table 4 provides the blower off timings that will result from different switch settings.

Blower Off Delay (Seconds)	Switch 4	Switch 5
60	Off	On
90 (Factory)	Off	Off
120	On	Off
180	On	On

Table 4. Blower Off Delay Switch Settings

Switches 6 and 7 - Continuous Indoor Fan Operation - Blower Speed - The unit is shipped from the factory with the DIP switches positioned for medium low (38%) speed during continuous indoor blower operation. Continuous fan setting is 38% of cool setting and is not adjustable.

Switches 8 and 9 -- Cooling Mode Blower Speed -- Switches 8 and 9 are used to select cooling blower motor speed. The unit is shipped from the factory with the DIP switches positioned for high speed (4) indoor blower motor operation during the cooling mode. Table 5 provides the cooling mode blower speeds that will result from different switch settings. Refer to blower tables at the front of this manual for corresponding cfm values.

Speed	Switch 8	Switch 9
1 - Low	On	On
2 - Medium Low	Off	On
3 - Medium High	On	Off
4 - High (Factory)	Off	Off

Table 5. Cooling Mode Blower Speeds

Switches 10 and 11 -- Cooling Mode Blower Speed Adjustment -- Switches 10 and 11 are used to select blower speed adjustment settings. The unit is shipped from the factory with the DIP switches positioned for NORMAL (no) adjustment. The DIP switches may be positioned to adjust the blower speed by +10% or -10% to better suit the application. Table 6 provides blower speed adjustments that will result from different switch settings. Refer to blower tables at the front of this manual for corresponding cfm values. With switches 10 and 11 set to ON, motor will bypass ramping profiles and all delays and immediately upon a call for cool, run at COOLING speed selected. LED

will continue to operate as normal. This mode is used to check motor operation.

Adjustment	Switch 10	Switch 11
+10% (approx.)	On	Off
NORMAL (Factory)	Off	Off
-10% (approx.)	Off	On
MOTOR TEST	On	On

Table 6. Blower Speed Adjustment

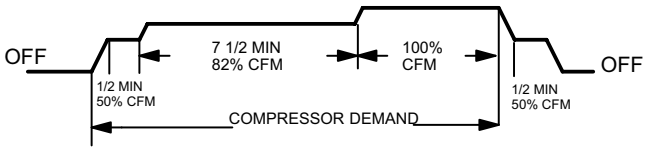
Switches 12 and 13 -- Cooling Mode Blower Speed Ramping -- Switches 12 and 13 are used to select cooling mode blower speed ramping options. Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on blower motor performance. Table 7 provides the cooling mode blower speed ramping options that will result from different switch settings. The cooling mode blower speed ramping options are detailed below.

Ramping Option	Switch 12	Switch 13
A (Factory)	Off	Off
B	On	Off
C	Off	On
D	On	On

Table 7. Cooling Mode Blower Speed Ramping

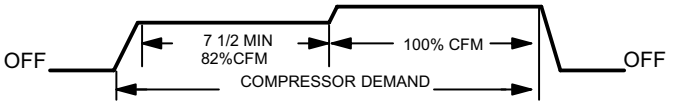
Ramping Option A (Factory Selection)

- Motor runs at 50% for 30 seconds.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 50% for 30 seconds then ramps down to stop.



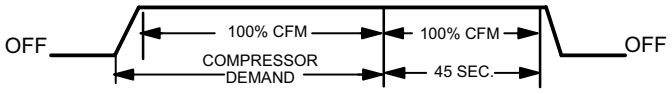
Ramping Option B

- Motor runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



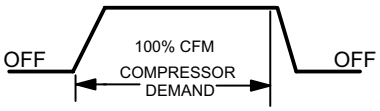
Ramping Option C

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 100% for 45 seconds then ramps down to stop.



Ramping Option D

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



Switches 14 through 19 -- Heating Mode Blower Speed -- Switches 14 through 19 are used to select heating mode blower motor speeds. These switches are factory set at the OFF position which provides 100 % of normal speed during HIGH HEAT demand, 70% of normal speed during MIDRANGE HEAT demand and 35% of normal speed during LOW HEAT demand. Switches 14, 15 and 16 are used to adjust the LOW FIRE blower motor speed. Switches 17, 18 and 19 are used to adjust the HIGH FIRE blower motor speed. Figure 6 and Table 8 and Table 9 provides the heating mode blower speeds that will result from different switch settings. Figure 6 indicates the effect the DIP switch settings have upon the heating airflow at various furnace firing rates.

Refer to blower tables at the front of this manual for corresponding cfm values.

Thermostat Demand	Blower Speed Adjustments	DIP Switch Settings		
		14	15	16
Low Heat (R to W1)	+15%	On	Off	On
	+7.5%	On	Off	Off
	Normal	Off	Off	Off
	-7.5%	On	On	Off
	-15%	On	On	On

Table 8. Low Heat Blower Speeds

Thermostat Demand	Blower Speed Adjustments	DIP Switch Settings		
		14	15	16
High Heat (R to W1 & W2)	+15%	On	Off	On
	+7.5%	On	Off	Off
	Normal	Off	Off	Off
	-7.5%	On	On	Off
	-15%	On	On	On

Table 9. High Heat Blower Speeds

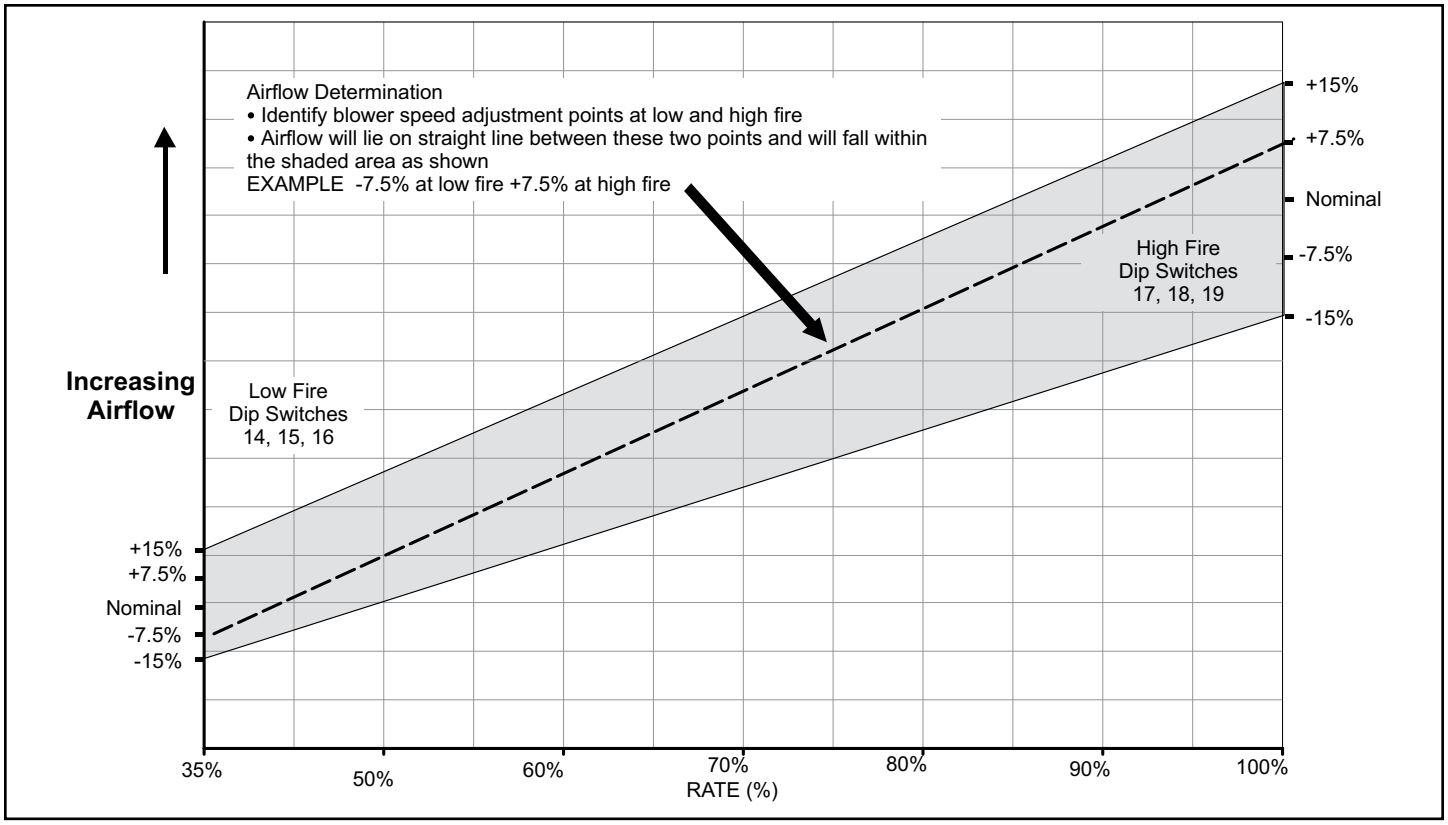


Figure 6.

On-Board Link W914 DS to R (Figure 4)

On-board link W914, is a clippable connection between terminals DS and R on the integrated control. W914 must be cut when the furnace is installed with either the zone control or a thermostat which features humidity control. If the link is left intact the PWM signal from the control will be blocked and also lead to control damage. Refer to Table 14 for operation sequence in applications including A98USMV, a thermostat which features humidity control and a single-speed outdoor unit. Table 15 gives the operation sequence in applications with a two-speed outdoor unit.

On-Board Link W951 R to O (Figure 4)

On-board link W951 is a clippable connection between terminals R and O on the integrated control. W951 must be cut when the furnace is installed in applications which include a heat pump unit and a thermostat which features dual fuel use. If the link is left intact, terminal “O” will remain energized eliminating the HEAT MODE in the heat pump.

On-Board Link W915 Y1 to Y2 (Figure 4)

On-board link W915 is a clippable connection between terminals Y1 and Y2 on the integrated control. W915 must be cut if two-stage cooling will be used. If the link is not cut the outdoor unit will operate in second-stage cooling only.

Diagnostic LED (Figure 4)

The seven-segment diagnostic LED displays operating status, target airflow, error codes and other information. Table 13 lists diagnostic LED codes.

Diagnostic Push Button (Figure 4)

The diagnostic push button is located adjacent to the seven-segment diagnostic LED. This button is used to enable the Error Code Recall mode and the Field Test mode. Press the button and hold it to cycle through a menu of options. Every five seconds a new menu item will be displayed. When the button is released, the displayed item will be selected. Once all items in the menu have been displayed, the menu resumes from the beginning until the button is released.

Error Code Recall Mode

Select ”E” from the menu to access the most recent 10 error codes. Select “c” from the Error Code Recall menu to clear all error codes. Button must be pressed a second time while “c” is flashing to confirm command to delete codes. Press the button until a solid “≡” is displayed to exit the Error Code Recall mode.

Field Test Mode

Use the diagnostic push button to scroll through the menu as described above. Release the button when the LED flashes “-” to select the Field Test mode.

While in the Field Test mode the technician can:

- Initiate furnace ignition and move to and hold low-fire rate by applying a R to W1 jumper.
- Initiate furnace ignition sequence and move to and hold high-fire rate by applying a jumper from R to W1 and W2.

- Initiate furnace ignition sequence and move to and hold mid-fire rate by applying a jumper to R and W2.
- Apply then remove the jumper from R to W1 and W2 to change the firing rate from low fire to mid fire and high fire.
- A vent calibration sequence can be initiated even if a thermostat signal is not present. Press and hold the push button until a solid “C” is displayed. Release the button and calibration will begin. The furnace will perform the high-fire and low-fire pressure switch calibrations and display “CAL”. After calibration, the LED will return to the flashing “-” display.

During Field Test mode operation, all safety switches are still in the circuit (they are not by-passed) and indoor blower performance and timings will match DIP switch selections. Current furnace firing rate, indoor blower CFM and flame signal will be displayed. To exit the Field Test mode, press and hold the button. The menu will resume from the beginning. Also, cycle the main power to exit the Field Test mode. The integrated control will automatically exit the Field Test mode after 45 minutes of operation.

Soft Disable

Soft disabling is when thermostat finds a device on the BUS that it does not recognize and the thermostat sends a the device a message to be in soft disabling mode until properly configured. Two horizontal bars will display.

Steps to follow if the damper control module is displaying the soft disable code.

1. Confirm proper wiring between all devices (thermostat, damper control module, indoor and outdoor).
2. Cycle power to the control that is displaying the soft disable code.
3. Put the room thermostat through set up.
4. Go to setup / system devices / thermostat / edit / then push reset.
5. Go to setup / system devices / thermostat / edit / then push resetAll.

These options are displayed on the menu when the button is pressed during normal operation

Display	Action (when button is released)
No change (idle)	Remain in idle mode
Solid “E”	Enter diagnostic mode
Solid “-”	Enter field test mode
NOTE - No change implies the display will continue to show whatever is currently being displayed for normal operation	

Table 10. Idle Menu Options

These options are displayed when the button is used in Field Test Mode

Display	Action (when button is released)
No change (blinking “-”)	Remain in field test mode
Solid “-”	Exit field test mode
Solid “c”	Start pressure switch calibration

Table 11. Field Test Menu Options

These options are displayed when the button is used in diagnostic recall mode

Display	Action (when button is released)
No change (displaying error history)	Remain in diagnostic recall mode
Solid (3 horizontal bars)	Exit diagnostic recall mode
Solid “c”	Clear error history
Once the button is released to clear the error history a blinking “c” will be shown on the display for up to 10 seconds. During this time the user must press and release the button one additional time to confirm the action of deleting the error history. Once the error history is deleted it cannot be recovered.	

Table 12. Diagnostic Recall Menu Options

Configuring Unit Size Codes

Power-Up - Number displayed by integrated control represents unit size code (furnace model and capacity). If three horizontal bars are displayed followed by continuous E203, furnace control does not recognize unit size code. Configure per the following:

Turn room thermostat to OFF.

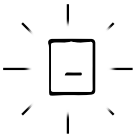
Furnace control in IDLE mode (No heating, cooling, or indoor fan operation)

No

Yes

To enter **Field Test** mode: Push and hold button next to 7-segment LED display until **solid dash** symbol appears. Release button.

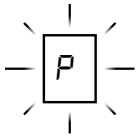
If alarm is present, furnace control will display error code. If alarm is not present, solid dash starts blinking on 7-segment LED display.



To enter **Program Unit Capacity/ Size** mode: Push and hold button next to 7-segment LED display until solid "P" symbol appears. Release button.

IMPORTANT: Field replacement controls may need to be manually configured to validate furnace unit size code.

Solid P starts blinking on 7-segment LED.



Push and hold button. Integrated control will display unit size code number for each furnace model for three seconds.

UNIT SIZE CODE	FURNACE MODEL
1	A98USMV070B12S
2	A98USMV090C12S
3	A98USMV090C16S
4	A98USMV090C20S
5	A98USMV110C20S
6	A98USMV135D20S

When the correct unit size code is displayed, release button. Selected code will flash for 10-second period. During that period, press and hold button for 5 seconds. Integrated control will store code in memory and will automatically exit **Field Test** mode and reset. (If second period expires or button is held less than 5 seconds, control will automatically exit **Field Test** mode and go into **Idle** mode without storing unit size code. If this happens, programming function must be repeated.)

Verify that the selected unit size code is correct and stored in non-volatile memory by cycling the 24 volt power to the furnace control. (At 24 volt power-up of the furnace control, the 7-segment LED will display a unit size code. If three horizontal bars display, the board does not recognize the unit size code. The programming function must be repeated.)

FINISHED

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
•	Idle mode (Decimal blinks at 1 Hertz - 0.5 seconds ON, 0.5 seconds OFF).	
A	Cubic feet per minute (cfm) setting for indoor blower (1 second ON, 0.5 seconds OFF) / cfm setting for current mode displayed.	
C	Cooling stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes.	
d	Dehumidification mode (1 second ON, 1 second OFF) / cfm setting displayed / Pause / Repeat codes.	
h	Heat pump stage (1 second ON, 0.5 seconds OFF) / % of input rate displayed / Pause / cfm setting / Pause / Repeat codes.	
H	Gas Heat stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes. Blinking during ignition.	
dF	Defrost mode.	
U	Discharge Air Temperature	
E105	Device communication problem - No other devices on RS BUS (Communication system).	Equipment is unable to communicate. Indicates numerous message errors. In most cases, errors are related to electrical noise. Make sure high voltage power is separated from RSBus. Check for mis-wired and/or loose connections between the stat, indoor unit, and outdoor unit. Check for a high voltage source of noise close to the system. Fault clears after communication is restored.
E110	Low line voltage.	Line Voltage low (Voltage tower than nameplate rating). Check power line voltage and correct. Alarm clears 5 seconds after fault recovered.
E113	High line voltage.	Line Voltage high (Voltage higher than nameplate rating). Provide power voltage within proper range. System resumes normal operation 5 seconds after fault recovered.
E114	Line voltage frequency out-of-range.	No 60 Hertz power. Check voltage and line power frequency. Correct voltage and frequency problems. System resumes normal operation 5 seconds after fault recovered.
E115	Low 24V - Control will restart if the error recovers.	24 Volt Power high (Range is 18 to 30 Volts). Check and correct voltage. Check for additional power robbing equipment connected to system. May require installation of larger VA transformer to be installed in furnace/air handler. Clears after fault recovered.
E120	Unresponsive device (Communicating systems only).	Usually caused by delay in outdoor unit responding to indoor unit poling. Recycle power. Check all wiring connections. Cleared after unresponsive device responds to any inquiry.
E124	Active communicating thermostat signal missing for more than 3 minutes (Communicating systems only).	Equipment lost communication with the thermostat. Check four wiring connections, ohm wires, and cycle power at the thermostat. Alert stops all services and waits for heartbeat message from thermostat (subnet controller). Cleared after valid thermostat (subnet) message is received.
E125	Control failed self-check, internal error, failed hardware. Will restart if error recovers, Integrated control not communicating Covers hardware errors (flame sense circuit faults, pin shorts, etc).	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.
E126	Control internal communication problem.	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.
E131	Corrupted control parameters (Verify configuration of system) (Communicating systems only).	Reconfigure the system. Replace control if heating or cooling is not available. Only applicable in the communicating mode not in startup. Exit from Commissioning and Execute Se+ factory Default mode. Control will still operate on default parameter settings.

Table 13. Integrated Diagnostic Codes/Status of Equipment

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E180	Outdoor air temperature sensor failure. Only shown if shorted or out of range (Communicating systems only)	Compare outdoor sensor resistance to temperature resistance charts in unit installation instructions. Replace sensor pack if necessary. At beginning of (any) configuration, furnace or air handler control will sense outdoor air and discharge air temperature sensor(s) If detected (reading in range), appropriate feature will be set as installed and that could be seen in 'About ' screen. In normal operation after control recognizes sensors, alarm will be sent if valid temperature reading is lost. To get rid of setting and alarm, redo configuration and make sure that temperature sensor is marked as not installed in indoor Unit 'About' screen. When indoor unit control is replaced thermostat will 'tell' new control if temperature sensor is in system or not. Clears 30 seconds after fault recovered.
E200	Hard Lock out - Rollout circuit open or previously open	Correct cause of rollout trip or replace flame rollout switch. Test furnace operation. Cleared after fault recovered.
E201	Indoor blower/communication failure - Unable to communicate with blower motor	Indoor blower communication failure including power outage. Lost communication with indoor blower motor. Possible causes: motor not powered, loose wiring. Problem may be on control or motor side. Cleared after fault recovered.
E202	Indoor blower motor mis-match - indoor motor horsepower does not match unit capacity	Incorrect appliance capacity code selected. Check for proper configuring under Unit Size Code for Furnace/Air Handler on configuration guide or in installation instructions. Cleared after the correct match is detected following a reset. (Remove thermostat from system while applying power and reprogramming)
E203	Appliance capacity size is NOT programmed. Invalid unit codes. Refer to configuration flow chart.	No appliance capacity code selected. Check for proper configuring under Unit Size Codes for Furnace on configuration guide or in installation instruction. Critical Alert Cleared after valid unit code is read following a reset (remove thermostat from system while applying power and reprogramming)
E204	Gas valve mis-wired	Check gas valve operation and wiring. Clears when repaired.
E205	Gas valve control relay contact shorted	Check wiring on control and gas valve. If wiring is correct replace control.
E207	Hot surface igniter sensed open - Refer to troubleshooting	Measure resistance of hot surface igniter. Replace if open or not within specified range found in 10M. Resumes normal operation after fault is cleared.
E223	Low pressure switch failed open	Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E224	Low pressure switch failed closed -Refer to troubleshooting	Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E225	High pressure switch failed open -Refer to troubleshooting	Check pressure(inches W.C) of high pressure switch closing on heat call. Measure operating pressure (inches w.c. Inspect vent and combustion air inducer for correct operation and restriction Resumes normal operation after fault is cleared.
E226	High pressure switch failed closed -Refer to troubleshooting	Check operation of high pressure closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E227	Low pressure switch open during trial for ignition or run mode. Refer to troubleshooting	Check operation of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E228	Combustion air inducer calibration failure	Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. Resumes normal operation after fault is cleared.

Table 13. Integrated Diagnostic Codes/Status of Equipment

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E240	Low flame current - Run mode- Refer to troubleshooting	Check micro-amperes of flame sensor using control diagnostics or field installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat all has been completed.
E241	Flame sensed out of sequence-Flame still present.	Shut off gas. Check for gas valve leak. Replace if necessary. Alert clears when fault is recovered.
E250	Limit switch circuit open - Refer to troubleshooting.	Check for proper firing rate on furnace. Ensure there is no blockage in heater. Check for proper air flow. If limit not closed within 3 minutes unit will go into 1 hour soft lockout. Resumes normal operation after fault is cleared.
E252	Discharge air temperature too high (gas heat only).	Check temperature rise airflow and input rate. Clear when heat call is finished.
E270	Soft lockout - Exceeded maximum number of retries. No flame current sensed.	Check for proper gas flow. Ensure that igniter is lighting burners. Check flame sensor current. Clears when heat call finishes successfully.
E271	Soft lockout - Exceeded maximum number of retries. Last retry failed due to the pressure switch opening.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening	Check operation of low pressure to see if it is stuck closed on heat call. Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure. Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E273	Soft lockout - Exceeded maximum number of recycles. Last recycle due to flame failure	Check micro-amperes of flame sensor using control diagnostics or field installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat call has been completed.
E274	Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or limit remained open longer than 3 minutes.	Shut down system 1-hour soft lockout. Check firing rate and air flow. Check for blockage. Clears when heat call finishes successfully.
E275	Soft lockout - Flame sensed out of sequence. Flame signal is gone.	Shut off gas. Check for gas valve leak. 1-hour soft lockout. Clears when flame has been proven stable.
E276	Watchguard calibration failure.	Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. 1-hour soft lockout. Clears when calibration has finished successfully.
E290	Ignitor circuit fault - Failed ignitor or triggering circuitry.	Measure resistance of hot surface igniter. Replace if open or not within specifications. 1-hour soft lockout. Clears when flame has been proven stable.
E291	Heat airflow restricted below the minimum.	Check for dirty filter and airflow restriction. Check blower performance. 1-hour soft lockout. Cleared when heat call finishes successfully.
E292	Indoor blower motor unable to start due to obstructed wheel seized bearings.	Indoor blower motor unable to start (seized bearing, stuck wheel, etc.) Replace motor or wheel if assembly does not operate or meet performance standards. 1-hour soft lockout. Clears after circulator successfully starts.
E294	Combustion air inducer over current.	Check combustion blower bearings wiring and amps. Replace if does not operate or does not meet performance standards. Clears after inducer current is sensed to be in-range after the ignition following the soft lockout or reset.
E295	Indoor blower motor temperature is too high.	Indoor blower motor over temperature (motor tripped on internal protector). Check motor bearings and amps. Replace if necessary. Cleared after blower demand is satisfied.
E310	Discharge error temperature sensor failure. Only shown if shorted or out of range.	Compare discharge sensor resistance to temperature resistance charts in installation instructions.. Replace sensor if necessary. Cleared in Communicating mode 30 seconds after fault recovered. In Non-Communicating mode cleared after the current heat call is completed.

Table 13. Integrated Diagnostic Codes/Status of Equipment

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E311	Heat rate reduced to match indoor blower airflow.	Warning Only. Furnace blower in cutback mode due to restricted airflow. Reduce firing rate every 60 seconds to match available CFM. Check filter and duct system. To clear replace filter if needed or repair/add duct. 2-stage controls will reduce firing rate to 1-stage. Clears when heat call finished successfully.
E312	Restricted airflow in cooling or continuous fan mode is lower than CFM setting.	Warning Only. Restricted airflow - Indoor blower is running at a reduced CFM (Cutback Mode - The variable speed motor has preset speed and torque limiters to protect the motor from damage caused by operating outside of design parameters (0 to 0.8" W.C. total external static pressure). Check filter and duct system. To clear, replace filter if needed or repair/add duct. Cleared after the current service demand is satisfied.
E313	Indoor or outdoor unit capacity mismatch. Communication only.	Incorrect indoor/outdoor capacity code selected. Check for proper configuring in installation instructions. Alarm is just a warning. The system will operate, but might not meet efficiency and capacity parameters. Alarm will clear when commissioning is complete.
E331	Global network connection - Communications link problem.	For Future Use.
E347	No 24 Volt output on Y1 of "integrated control" with non-communicating outdoor unit.	Operation stopped. Y1 relay/Stage 1 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.
E348	No 24 Volt output on Y2 of "integrated control" with non-communicating outdoor unit.	Y2 relay/Stage 2 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.
E349	No 24 Volts between R & O on "integrated control" with non-communicating outdoor unit (dual fuel model required for heat pump application).	Configuration link R to O needs to be restored. Replace link or hardware. Applicable in non-communicating mode. Critical Alert.
E401	LSOM - Compressor long run cycle or low system pressure.	Compressor ran more that 18 hours to satisfy a single thermostat demand. Critical Alert. Clears the error after 30 consecutive normal run cycles or power reset. Also monitors low pressure switch trips.
E402	LSOM - Outdoor unit system pressure trip.	Discharge or suction pressure out-of-limits, or compressor overloaded. Clears the error after 4 consecutive normal compressor run cycles.
E403	LSOM - Compressor short-cycling (Running less than 4 minutes). Outdoor unit pressure trip.	Compressor runs less than 3 minutes to satisfy a thermostat demand. Clears the error after 4 consecutive normal run cycles or power reset.
E404	LSOM - Compressor rotor locked. Compressor short-cycling. (Running less than 4 minutes.)	Compressor rotor locked up due to run capacitor shore, bearings are seized, excessive liquid refrigeration, etc. Clears the error after 4 consecutive normal run cycles or power reset.
E405	LSOM - Compressor open circuit.	Compressor circuit open (due to power disconnection, open fuse, etc.) Clears the error after 1 normal compressor run cycle.
E406	LSOM - Compressor open start circuit.	Required amount of current is not passing through Start current transformer. Clears the error after current is sensed in START sensor, or after power reset.
E407	LSOM - Compressor open run circuit.	Required amount of current is not passing through Run current transformer. Clears the error after current is sensed in RUN sensor, or 1 normal compressor run cycle, or after power reset.
E408	LSOM - Compressor contactor is welded.	Compressor runs continuously. Clears the error after 1 normal compressor run cycle or after power reset.
E409	LSOM - Compressor low voltage.	Secondary voltage s below 18VAC. After 10 minutes, operation is discontinued. Clears the code after voltage is higher than 20VAC for 2 seconds or after power reset.

Table 13. Integrated Diagnostic Codes/Status of Equipment

Operating Sequence		System Demand					System Response		
System Condition	Step	Thermostat Demand			Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		1st Stage	O	G	Status	D			
NO CALL FOR DEHUMIDIFICATION									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Compressor and indoor blower follow thermostat demand
BASIC MODE (only active on a Y1 thermostat demand)									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Thermostat energizes Y1 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.
Dehumidification Call	2	On	On	On	Demand	0 VAC	High	70%	
Dehumidification Call ONLY	1	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F.
	• On-board links at indoor unit with a single stage outdoor unit • With Condensing unit - Cut W914 (R to OS) on integrated control • With Heat Pump - Cut W914 (R to DS) and W951 (R to O) on integrated control								

Table 14. Cooling Operating Sequence
A98USMV and Single Stage Outdoor Unit

Operating Sequence		System Demand						System Response		
System Condition	Step	Thermostat Demand				Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		1st Stage	2nd Stage	O	G	Status	D			
NO CALL FOR DEHUMIDIFICATION										
Normal Operation - Y1	1	On		On	On	Acceptable	24 VAC	Low	70%	Compressor and indoor blower follow thermostat demand
Normal Operation - Y2	2	On	On	On	On	Acceptable	24 VAC	High	100%	
ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING										
BASIC MODE (only active on a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%	Thermostat energizes 2nd Stage and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%	Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
Dehumidification Call ONLY	1	On	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F.
ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING										
BASIC MODE (only active on a Y1 thermostat demand)										
Normal Operation	1	On	On	On	On	Acceptable	24 VAC	High	100%	Thermostat energizes 2nd Stage and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%*\	Dehumidification mode begins when humidity is greater than set point. Maximum overcool from cooling setpoint is 2°F.
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
Dehumidification Call ONLY	1	On	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint. Maximum overcool from cooling setpoint is 2°F.
	• On-board links at indoor unit with a two stage outdoor unit • Cut factory link from Y1 to Y2 or cut W915 (Y1 to Y2) on integrated control • With Condensing unit - Cut W914 (R to OS) on integrated control • With Heat Pump - Cut W914 (R to DS) and W951 (R to O) on integrated control									

Table 15. Cooling Operating Sequence
A98USMV and Two Stage Outdoor Unit

Indoor Blower Motor

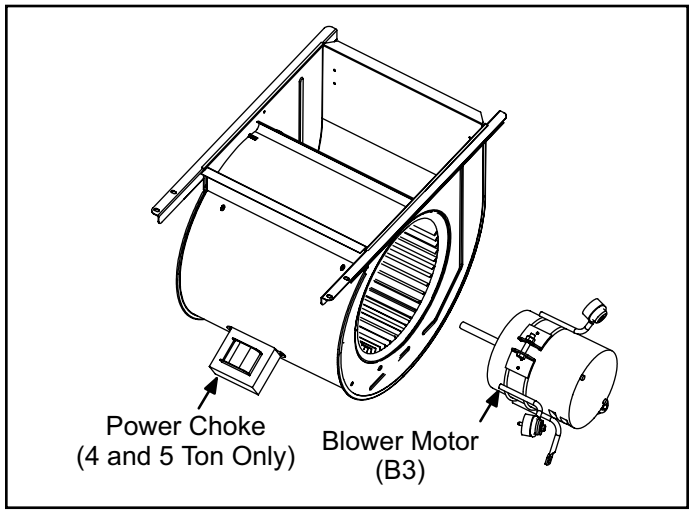


Figure 7.

> **⚠ WARNING**
>
> During blower operation, the ECM motor emits energy that may interfere with pacemaker operation. Interference is reduced by both the sheet metal cabinet and distance.

The A98USMV line uses three different motor sizes; 1/2 hp, 3/4 hp and 1hp. The motor communicates with the integrated control via a 2-way serial connection. The motor receives all necessary functional parameters from the integrated control and does not rely on a factory program like traditional variable speed motors. A98USMV units use a three-phase, electronically controlled D.C. brushless motor (controller converts single phase a.c. to three phase D.C.), with a permanentmagnet-type rotor (Figure 8). Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors.

Internal components are shown in Figure 8. The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to turn on and off in sequence by the controller.

> **⚠ IMPORTANT**
>
> Earlier ECM motors used on other Allied Air furnace models are not interchangeable with motors used on the A98USMV furnace line.

A solid-state controller is permanently attached to the motor. The controller is primarily an A.C. to D.C. converter. Converted D.C. power is used to drive the motor. The controller contains a microprocessor which monitors varying conditions inside the motor (such as motor workload).

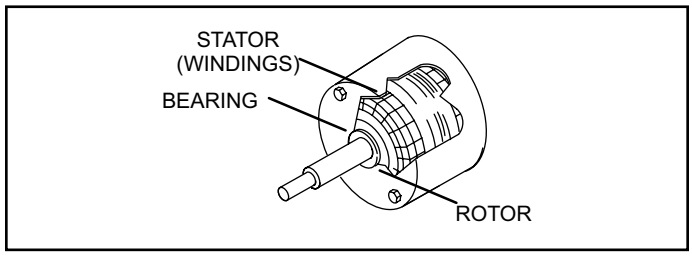


Figure 8. Blower Motor Components

The controller uses sensing devices to sense what position the rotor is in at any given time. By sensing the position of the rotor and then switching the motor windings on and off in sequence, the rotor shaft turns the blower.

All A98USMV blower motors use single phase power. An external run capacitor is not used. The motor uses permanently lubricated ball-type bearings.

Internal Operation

The motor is controlled via serial communication between the integrated control on the furnace and the controller attached to the motor shell. The messages sent back and forth between the two controls serve to communicate rotational direction, demand, motor size, current draw, torque, and rpm, among other variables.

Motor rpm is continually adjusted internally to maintain constant static pressure against the blower wheel. The controller monitors the static work load on the motor and motor amp-draw to determine the amount of rpm adjustment. Blower rpm may be adjusted any amount in order to maintain a constant cfm as shown in Blower Ratings Tables. The cfm remains relatively stable over a broad range of static pressure. Since the blower constantly adjusts rpm to maintain a specified cfm, motor rpm is not rated. Hence, the terms “cool speed”, “heat speed” or “speed tap” in this manual, on the unit wiring diagram and on blower B3, refer to blower cfm regardless of motor rpm.

Initial Power Up

When line voltage is applied to B3, there will be a large inrush of power lasting less than 1/4 second. This inrush charges a bank of DC filter capacitors inside the controller. If the disconnect switch is bounced when the disconnect is closed, the disconnect contacts may become welded. Try not to bounce the disconnect switch when applying power to the unit.

Motor Start-Up

When B3 begins start-up, the motor gently vibrates back and forth for a moment. This is normal. During this time the electronic controller is determining the exact position of the rotor. Once the motor begins turning, the controller slowly eases the motor up to speed (this is called “soft-start”). The motor may take as long as 10-15 seconds to reach full speed. If the motor does not reach 200 rpm within 13 seconds, the motor shuts down. Then the motor will immediately attempt a restart. The shutdown feature provides protection in case of a frozen bearing or blocked blower wheel. The motor may attempt to start eight times. If the motor does not start after the eighth try, the controller locks out. Reset controller by momentarily turning off power to unit.

The DC filter capacitors inside the controller are connected electrically to the motor supply wires. The capacitors take approximately 5 minutes to discharge when the disconnect is opened. For this reason it is necessary to wait at least 5 minutes after turning off power to the unit before attempting to service motor.

⚠ DANGER

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to service motor. Failure to wait may cause personal injury or death.

Power Choke (L13)

A choke coil is used on A98USMV 4 and 5 ton units equipped with 1 hp motors. The choke is located on the blower housing and is used to suppress transient current spikes.

Remove Blower from Unit

1. Remove unit access panels, control box, bolts and wiring jackplugs.
2. Slide blower out front of unit.

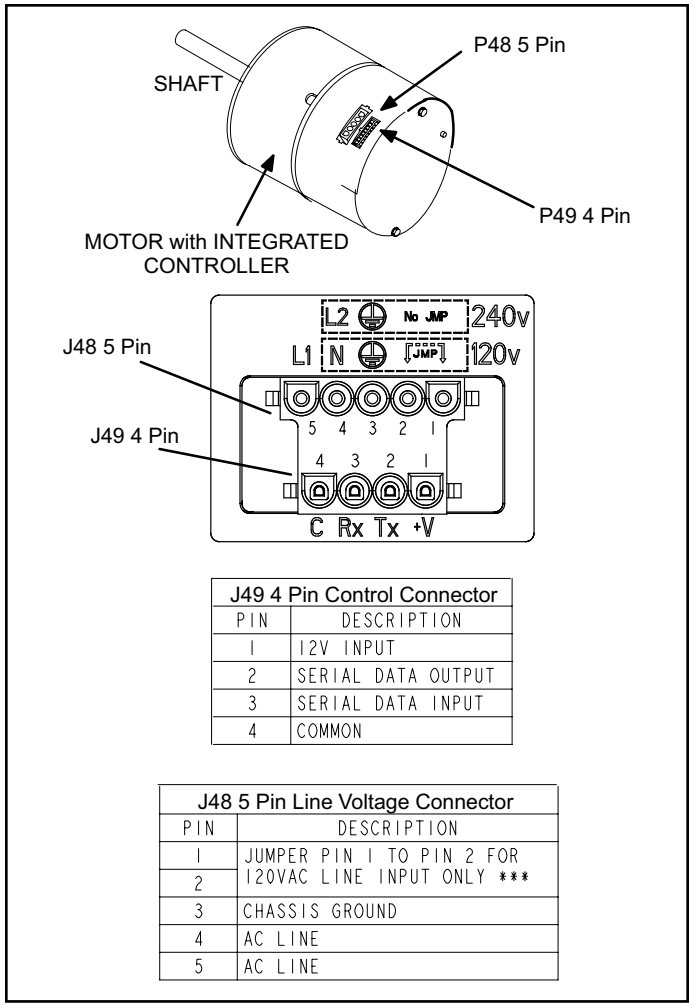
Troubleshooting Motor Operation

To verify motor operation see steps below and Figure 9 and Figure 10.

1. Remove J48 (5 pin power plug) from P48 on the motor.
2. With the power on at the furnace and door switch depressed, use a test meter to verify 120V between pins 4 and 5 on J48.
3. Reconnect J48 to P48 on the motor.
4. Remove J49 (4 pin low voltage connector) from P49 on the motor.
5. Using test jumpers, apply 24V to pins 3 and 4 on P49 on the motor.

   NOTE: *Do not apply 24V to pins 2 and 4 on P49. Doing so will cause permanent damage to the motor.*
6. Motor should run at 75%.
7. Test is complete. Remove jumpers and reconnect plugs.

Another option is to use the TECMate PRO motor tester with the 16 to 4 pin adaptor. The use of the TECMate PRO isolates the motor from the integrated control. Follow the instructions provided with the kit. If the motor runs, do not replace.



J49 4 Pin Control Connector	
PIN	DESCRIPTION
1	12V INPUT
2	SERIAL DATA OUTPUT
3	SERIAL DATA INPUT
4	COMMON

J48 5 Pin Line Voltage Connector	
PIN	DESCRIPTION
1	JUMPER PIN 1 TO PIN 2 FOR 120VAC LINE INPUT ONLY ***
2	
3	CHASSIS GROUND
4	AC LINE
5	AC LINE

Figure 9. Blower B3 Harness Connectors

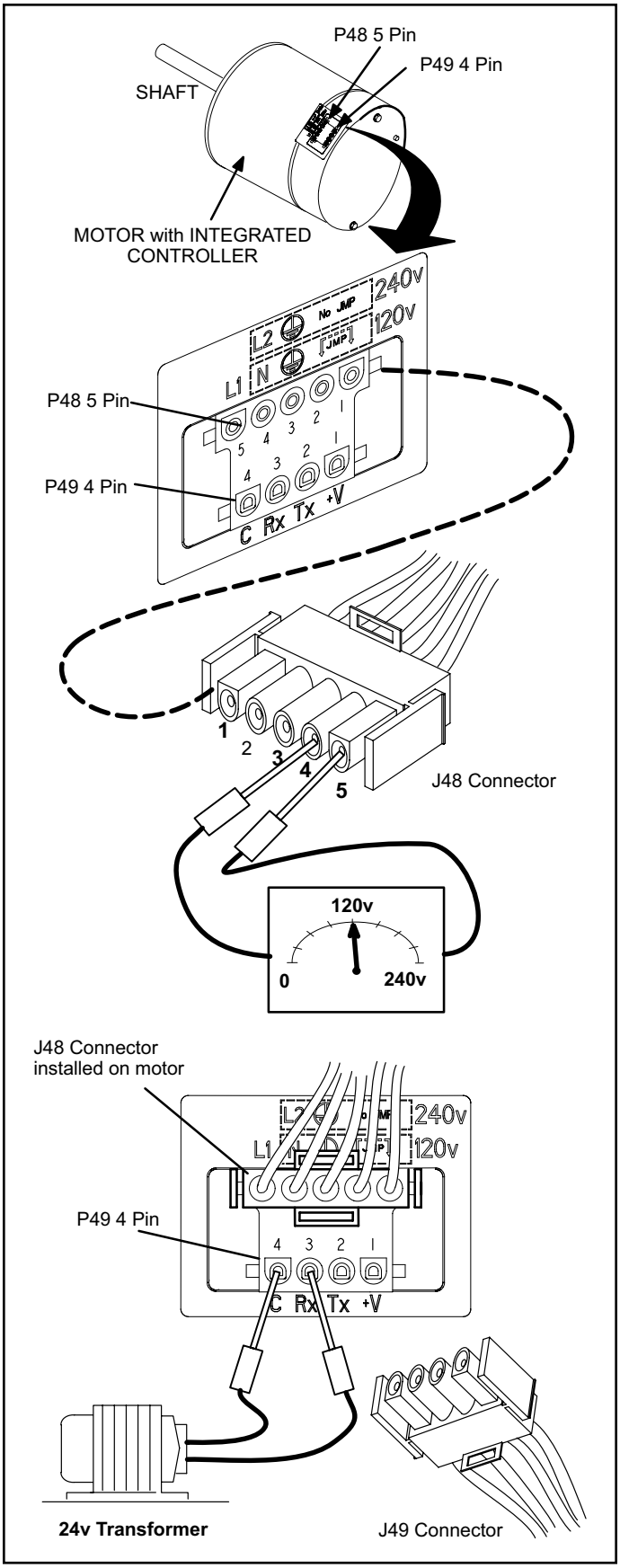


Figure 10. Blower B3 Harness Connectors

Troubleshooting Motor Windings

Ensure that motor windings are not damaged by performing the following tests:

NOTE: *If your ohm meter is not an auto-ranging type, set it to the highest ohm scale (100k ohms or greater) before performing tests.*

Scale	Measurement Range	
	in Words	in ohms
2 M	two megohm-two million ohms	0 - 2,000,000
200 K	two hundred kilo-ohm-two hundred thousand ohms	0 - 200,000
20 K	twenty kilo-ohm-twenty thousand ohms	0 - 20,000
2 K	two kilo-ohm two-thousand ohms	0 - 2,000
200	two hundred ohms	0 - 200

Table 16. Ohm Meter Range

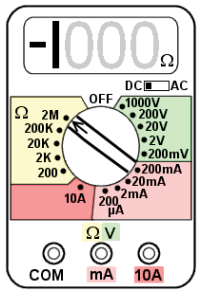


Figure 11.

TEST A

Measure the resistance between each of the three motor leads (3-pin plug) and the unpainted part of the end shield.

If the winding resistance to ground is <100k ohms, replace the motor and control module. If the resistance to ground is >100k, the motor windings are fine. Proceed to Test B.

Figure 12. Test A

TEST B

Use an ohmmeter to measure the motor phase-to-phase resistance by checking these combinations of the the 3-pin motor plug. For the purpose of this test, start at either end of the connector as lead 1.

1. The lead-to-lead resistance across any two leads should be less than 20 ohms.
2. Each lead-to-lead resistance should be the same.

If the measured resistance is greater than 20 ohms, replace the motor and control module.

Figure 13. Test B

Heating Components

Ignitor

The ignitor is made of durable silicon nitride. Ignitor longevity is enhanced by controlling voltage to the ignitor. The integrated control provides 120 volts to the ignitor for a consistent ignition. Due to this feature of the control, voltage measured with a digital meter will be slightly lower. To measure correct voltage use a true RMS meter or ignitor can be ohmed. Ohm value should be 39 to 70.

Flame Sensor

A flame sensor (Figure 14) is located on the left side of the burner support. The sensor is mounted on the flame rollout plate and the tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The control allows the gas valve to remain open as long as flame signal is sensed. To check flame sense signal use the push-button found on the integrated control and go to Field Test Mode. The menu will display the flame signal. See Table 17 for flame signal.

NOTE: *A much higher than normal micro amp reading (15 for example) may appear when checking flame signal.*

Flame Signal in Microamps		
Normal	Low	Drop Out
2.6 or greater	2.5 or less	1.1

Table 17.

Flame Rollout Switches

Flame rollout switch S47 is a high temperature limit located inside the burner box. Each furnace is equipped with two identical switches. The limit is a N.C. SPST manual-reset limit connected in series with the primary limit S10. When S47 senses rollout, the circuit breaks and the integrated control immediately stops ignition and closes the gas valve. If unit is running and flame rollout is detected, the gas valve will close and integrated control will be disabled. Rollout can be caused by a blocked heat exchanger, flue or lack of combustion air. The switch is factory set to trip (open) at 210°F and cannot be adjusted. The switch can be manually reset. To manually reset a tripped switch, push the reset button located on the center of the switch.

Burners

All units use inshot burners. Burners are factory set and require no adjustment. Always operate the unit with the burner box front panel in place. Each burner uses an orifice that is precisely matched to the burner input. Burners can be removed as a one piece assembly for service. If burner assembly has been removed, it is critical to align center of each burner to the center of the clamshell when re-installing. See more detail in Maintenance.

Heat Exchanger (Figure 15)

A98USMV units use an aluminized steel primary and stainless steel secondary heat exchanger assembly. Heat is transferred to the air stream from all surfaces of the heat exchanger. The shape of the heat exchanger ensures maximum efficiency.

The combustion air inducer pulls fresh air through the burner box. This air is mixed with gas in the burners. The gas / air mixture is then burned at the entrance of each clamshell. Combustion gases are then pulled through the primary and secondary heat exchangers and exhausted out the exhaust vent pipe.

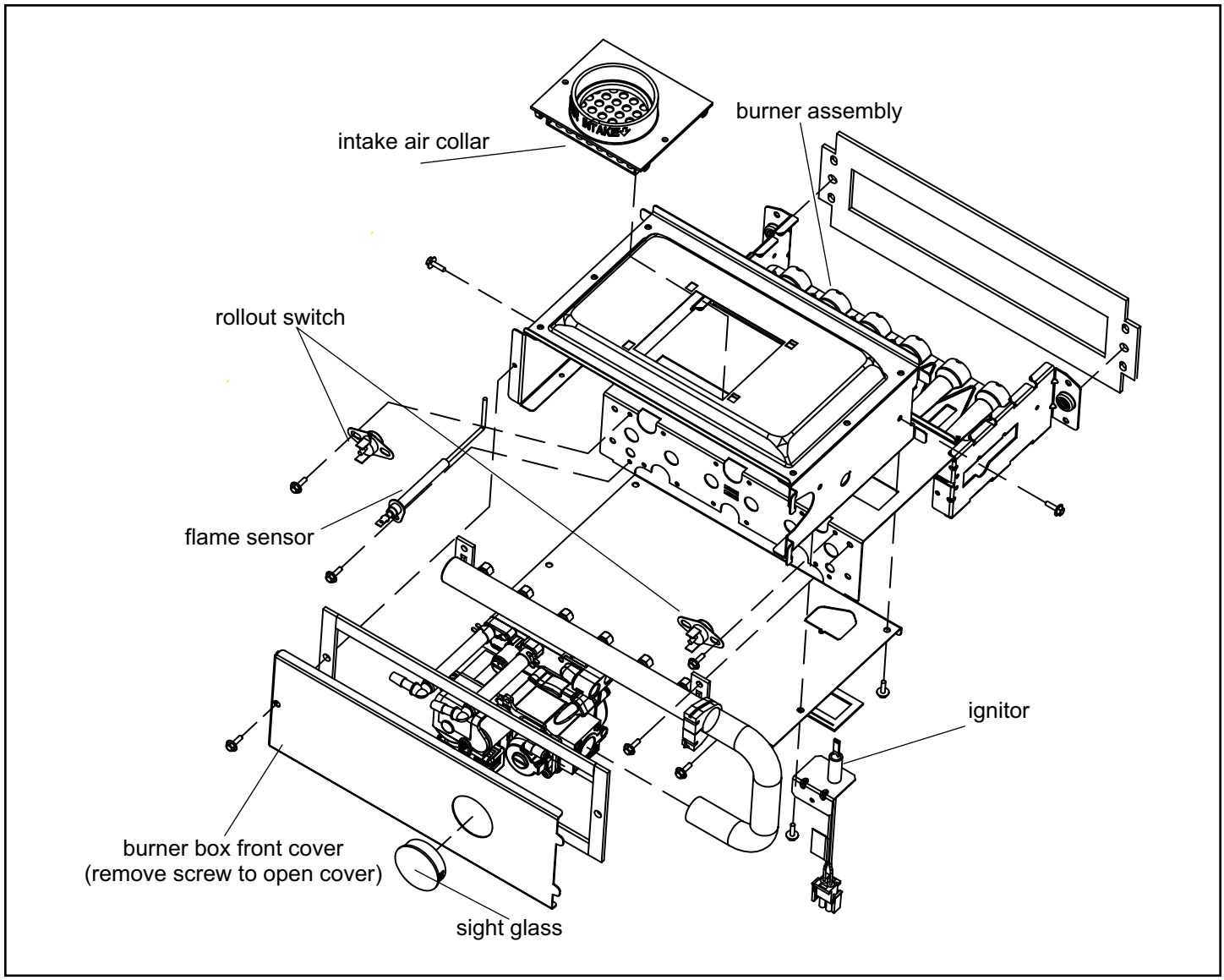


Figure 14. Burner Box Assembly

Primary Limit Control (S10)

Figure 15 shows the primary limit (S10) used on A98USMV units located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. Once the limit opens, the furnace control energizes the supply air blower and de-energizes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch is factory set and cannot be adjusted. In the event of restricted air flow, the integrated control will reduce firing rate and indoor blower airflow in 10% increments until a sustainable air flow is reached. If the furnace reaches 35% firing rate, and adequate air flow is not available, the furnace will shutdown and enter one hour watchguard. For limit replacement remove wires from limit terminals and rotate limit switch 90 degrees. Slowly remove from the vestibule panel.

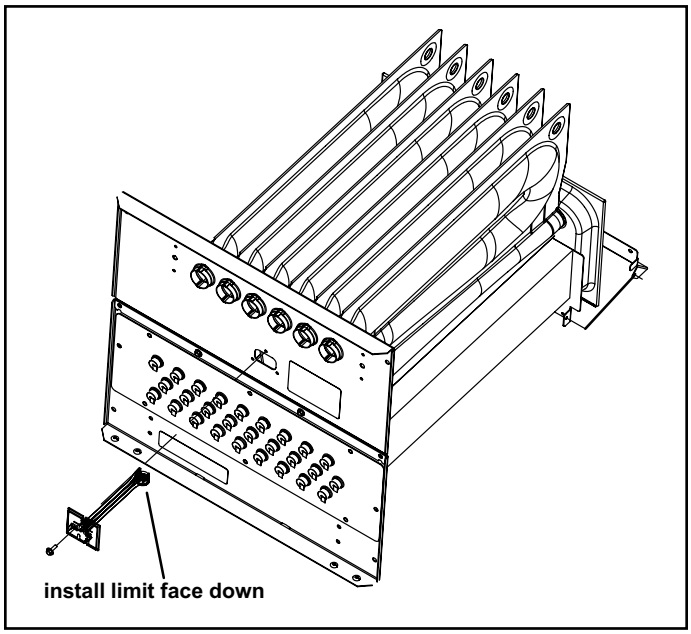


Figure 15.

Gas Valve (GV1)

The A98USMV uses a variable capacity gas valve (Figure 16) and is applicable for two-stage or variable capacity settings. See “Thermostat selection modes” in the integrated control section for more details The valve is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

A 24VAC 2-pin plug and gas control switch are located on the valve. 24V applied to the pins enables valve operation. Inlet and outlet pressure taps are located on the valve.

LPG change over kits are available from Allied Air. Kits include burner orifices and an LP gas valve.

⚠ DANGER

Danger of explosion.

There are circumstances in which odorant used with LP/propane gas can lose its scent. In case of a leak, LP/propane gas will settle close to the floor and may be difficult to smell. An LP/propane leak detector should be installed in all LP applications.

The burner box is sealed and operates under a negative pressure. A pressure hose is connected from the burner box to the gas valve. The gas valve senses the pressure in the burner box and uses that to set the maximum manifold pressure while the pressure switch with pressure conditioning device adjusts the gas flow. This will compensate for different vent configurations which can greatly affect the rate of the unit.

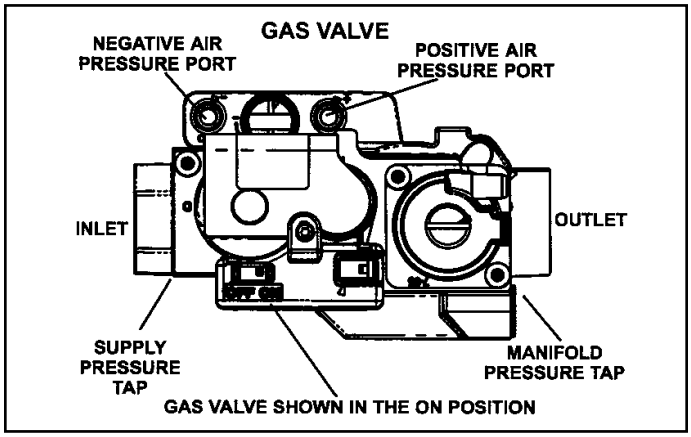


Figure 16.

Combustion Air Inducer (B6) & Pressure Switch (S18)

All A98USMV units are equipped with a combustion air inducer (B6) and dual pressure switch assembly (high fire and low fire). The pressure switch (Figure 17) serves four functions. First it establishes calibration points for the vent calibration routine. The combustion air inducer’s speed at a given firing rate is a function of the vent system resistance. The calibration routine establishes the inducer speed required to make low and high fire switches for a given vent pipe installation and interpolates the speeds required to achieve all intermediate rates between these two points. The setting for lowfire switch on the assembly is such that it does not normally enter into the vent calibration routine.

Second, the switch proves combustion air inducer operation by sensing a vacuum energizing the control circuit and allowing ignition. The low fire pressure switch provides this function.

Third, the switch interrupts the combustion process in the event vent outlet or combustion air intake blockage.

Finally, the switch interrupts the combustion process if the condensate drainage system becomes blocked to the point the condensate level builds up in the cold end header box/ secondary coil or vent system.

If the switch assembly is to be replaced, replace the entire assembly. Individual switch components cannot be replaced.

⚠ WARNING

The pressure switch is a safety shut-down control in the furnace and must not be jumpered for any reason other than troubleshooting.

To troubleshoot the pressure switch, add a temporary jumper. The unit will not fire with the switch jumpered. Therefore, the pressure switch must be bypassed after the combustion air inducer is activated. This will determine if the pressure switch and furnace are operating properly. However, this may not indicate if the sealed combustion system is operating properly.

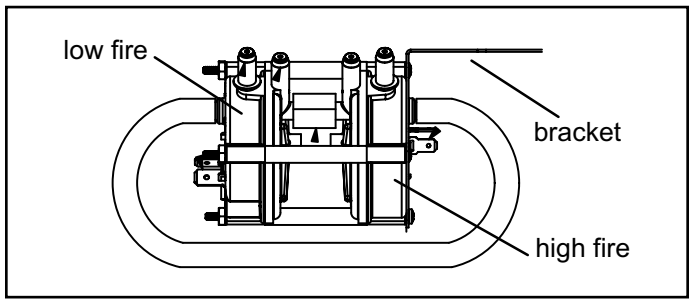


Figure 17.

Vent Calibration

The vent calibration sequence establishes furnace operating parameters in a specific installation. The integrated control runs the calibration and may be repeated as necessary to maintain proper furnace operation. Prior to calibration, all duct work (and returns) vent pipe and condensate trap (primed) must be connected.

If calibration is successful the data is stored in memory and will be used to determine furnace operation and maintain parameters during heat call. If calibration is not successful, the integrated control will proceed to a 5 minute delay and signal the appropriate code. After the 5 minute delay the calibration will be repeated 4 more times with a 5 minute delay in between. If still unsuccessful after the 4 trials (total 5) the integrated control will go into a 1 hour soft lockout.

Calibration may be initiated by:

- Initial call for heat
- Cycling main power off / on and then call for heat
- Venting conditions change (affecting high and low pressure switch operation)
- Ramp down low fire switch check failed (calibration will follow next call for heat)
- The service technician (by pressing the push button found on the integrated control until the control cycles through to “Field Test Mode”)

The integrated control will do the following during calibration:

1. Verify both low pressure switch and high pressure switch are open. If either are closed log error and end calibration.
2. Start inducer at a predetermined low RPM (1600). Wait 7.5 seconds.
3. Check low pressure switch, if open, increase RPM by 250, wait 5 seconds. Repeat this step until low pressure switch is closed.
4. Decrease RPM by 50, wait 5 seconds and look for the low pressure switch to open. Repeat this step until it is open.
5. Keep this RPM as RPM1.
6. Increase RPM by 1250. Wait 5 seconds.
7. Check high pressure switch, if open, increase RPM by 250, wait 5 seconds. Repeat this step until high pressure switch is closed.
8. Decrease RPM by 50, check after 5 seconds. Repeat this step until switch is open.
9. Keep this RPM as RPM2.
10. Calibration complete.

    NOTE: *If after a successful calibration and a heat call is present the integrated control will by-pass the prepurge state and go straight into ignitor warm up.*

After calibration, the integrated control stores the RPM1 and RPM2 values. The low fire (35%) and high fire (100%) RPM points are calculated by adding margin values to the RPM1 and RPM2 values.

The integrated control also initiates a low fire switch check at the end of a normal heating cycle described below. If this check fails the pressure switch calibration will follow on the next call for heat.

1. The inducer runs 15 seconds at the last firing rate before the heat call ended.
2. Inducer runs at 35% firing rate RPM (RPM1 + low pressure switch open RPM margin value).
3. If low pressure switch is open, set flag for calibration on next call for heat. Turn inducer off until next call for heat.
4. If low pressure switch is closed move inducer speed to RPM1. Allow 5 seconds for stabilization.

5. If low pressure switch opens turn off inducer. No further action.
6. If low pressure switch is still closed, decrease inducer speed 1/2 of the low pressure switch open RPM margin. Allow 5 seconds to stabilize.
7. If low pressure switch is open turn off inducer. No further action.
8. If low pressure switch is still closed, set flag for calibration on next call for heat and turn off inducer.

Measuring Pressure Differential (Figure 18)

Checks of pressure differential can aid in troubleshooting. Allied Air provides a kit (10L34) if necessary. When measuring the pressure differential, readings should be taken at the pressure switch. Lack of differential usually indicates problems in the intake or exhaust piping, but may indicate problems in the heat exchanger, condensing coil, header boxes, combustion inducer or other components.

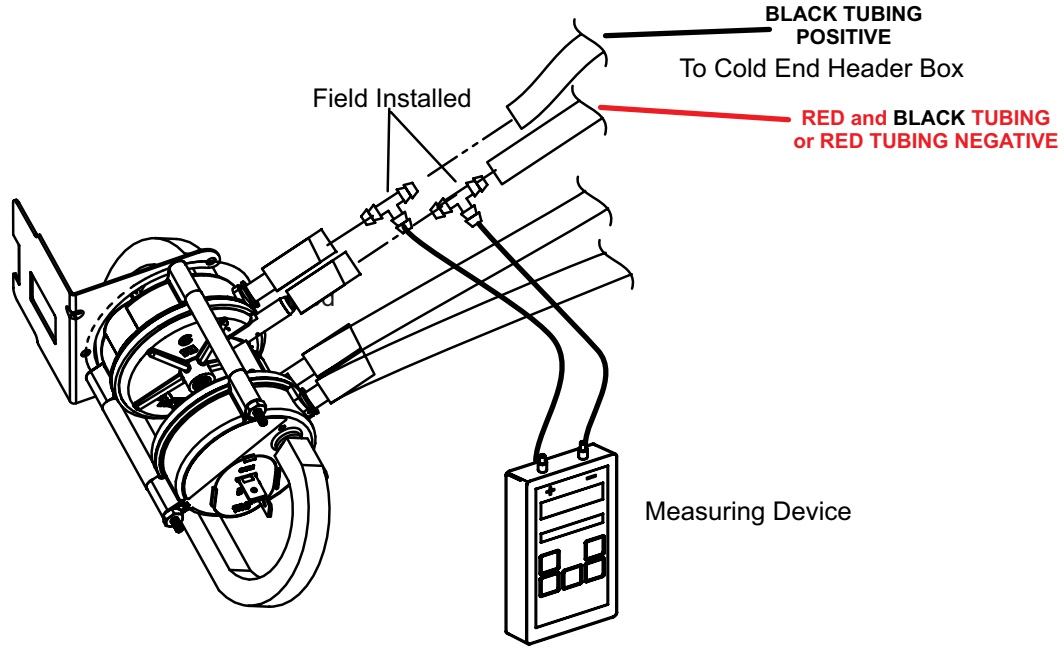
The differential pressure is the difference in pressure measured across the cold end header box orifice.

The CAI is installed on the cold end header box. The cold end header box is a single piece made of hard plastic. The box has an internal channel where the combustion air inducer creates negative pressure at unit start up. The channel contains an orifice used to regulate flow created by the CAI. The box has pressure taps for the CAI pressure switch hoses.

The pressure switch measures the pressure differential across the CAI orifice (difference in the channel and cold end header box). **If replacement is necessary, the gaskets used to seal the box to the vestibule panel and the CAI to the box must also be replaced.**

Unit	Set Point High Fire	Set Point Low Fire
All	1.00 ± 0.05	0.25 ± 0.05
*Units over 7500 ft will require a conversion kit. See Table 30.		

Table 18. Pressure Switch 0' to 7500'



1 - Remove thermostat demand and allow unit to cycle off.
2 - Install a tee in the negative (-) line (red and black tubing or red tubing) and a tee in the positive (+) line (black tubing) running from the pressure switch to the cold end header box.
3 - Install a measuring device with hose from the negative (-) side of the measuring device to the tee installed in the negative (-) line and with hose from the positive (+) side of the measuring device to the tee in the positive (+) line.

NOTE - Both sides of the cold end header box are negative. However the (+) port reads less negative pressure than the (-) port.

4 - Operate unit and observe measuring device reading. *Readings will change as heat exchanger warms.*
a. Take one reading immediately after start-up.
b. Take a second reading after unit has reached steady state (approximately 5 minutes). This will be the pressure differential.
The pressure differential should be greater than those listed in table 20.
5 - Remove thermostat demand and allow to cycle off.
6 - Remove measuring device and tee's. Reinstall combustion air sensing hoses to the pressure switch.

Figure 18. Measuring Pressure Differential

Comfort Sync Wi-Fi® Thermostat (if applicable)

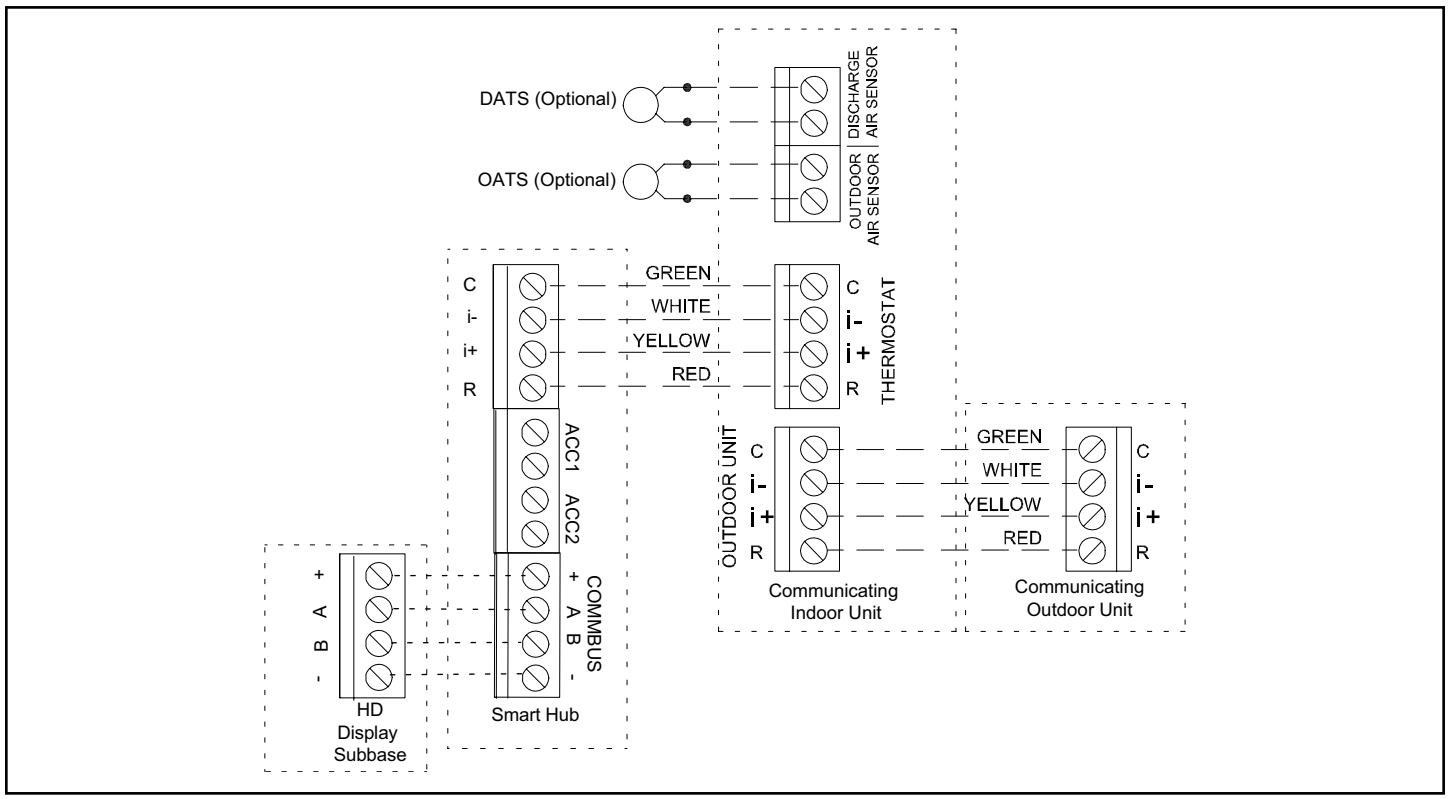


Figure 19. Comfort Sync A3 with Communicating Indoor and Outdoor Units

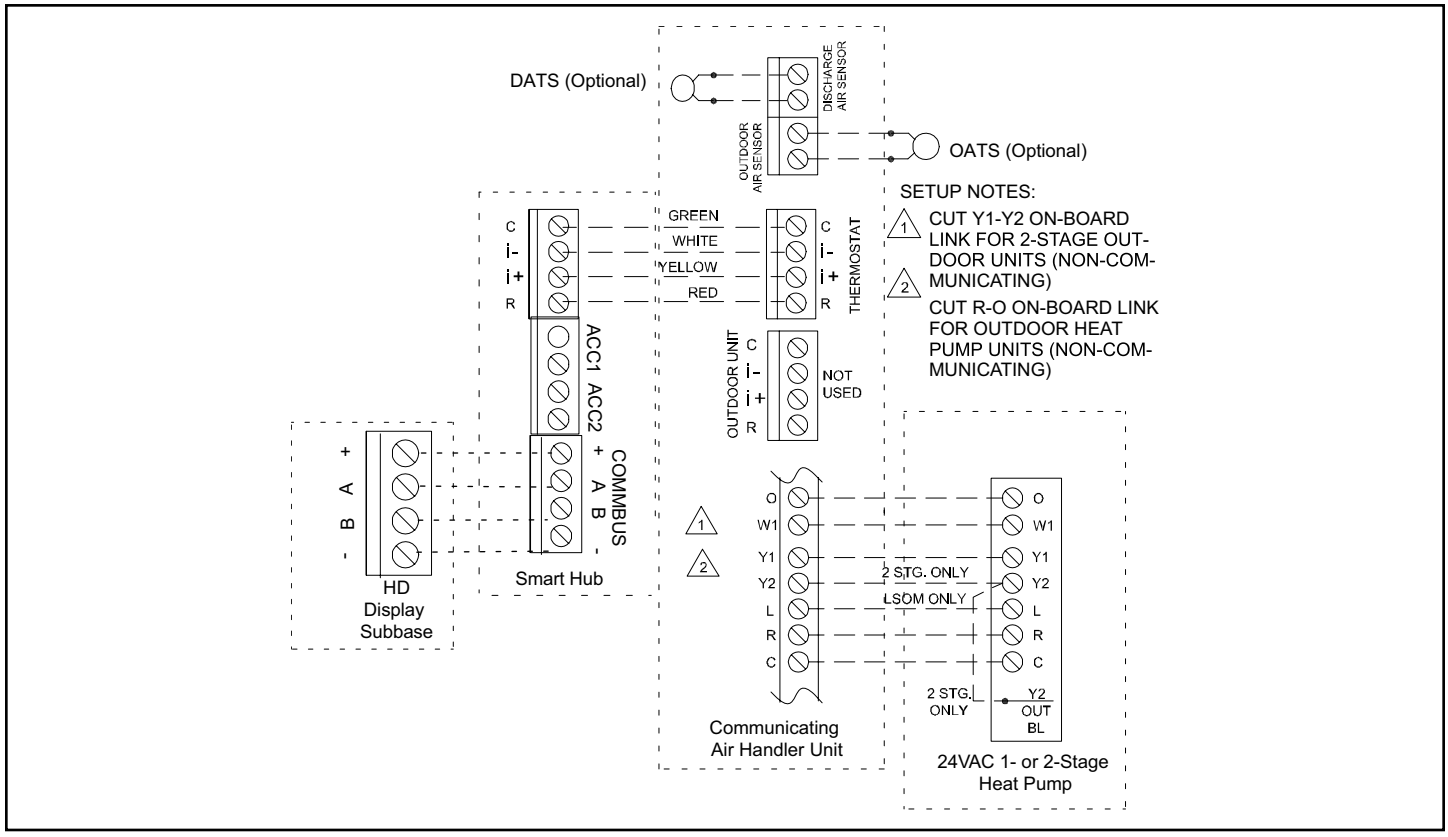


Figure 20. Comfort Sync A3, Communicating Air Handler with 24VAC 1 or 2-Stage Heat Pump

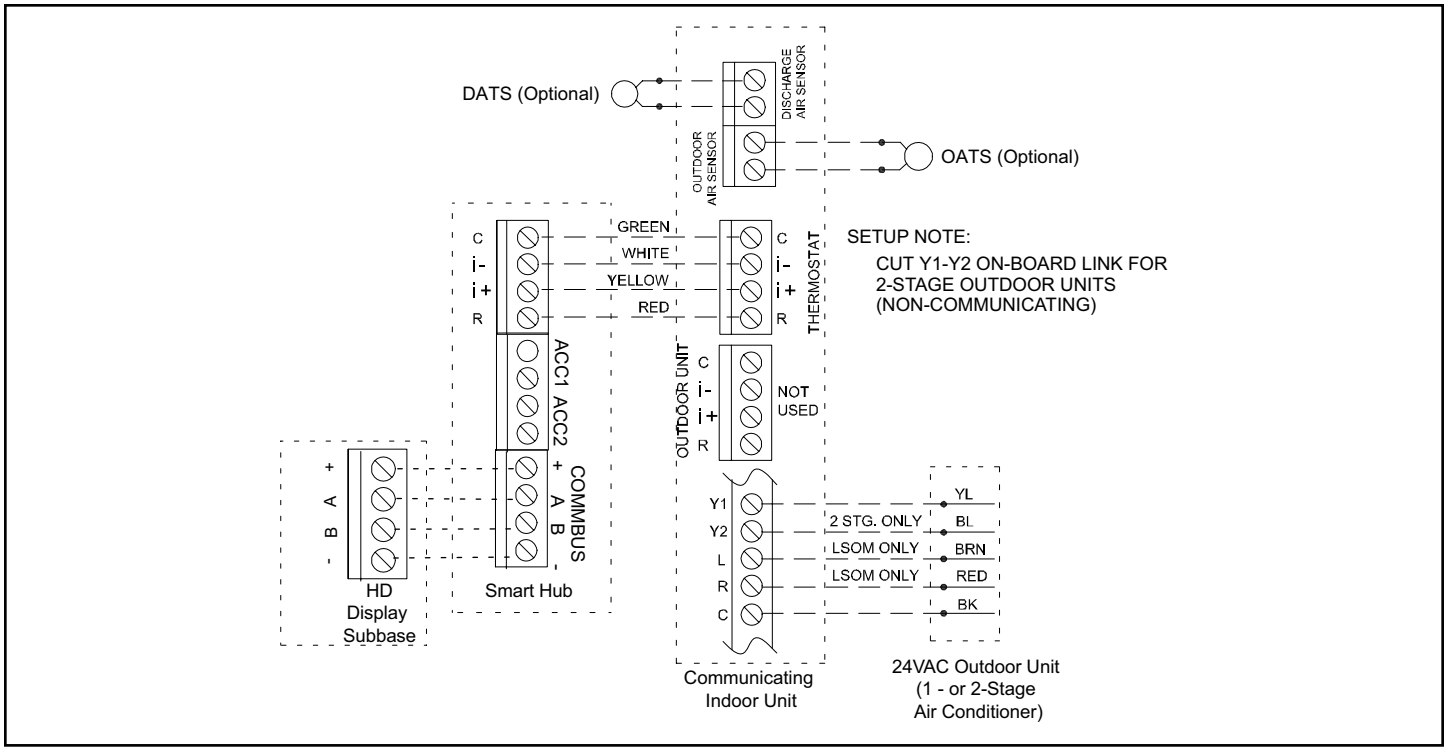


Figure 21. Comfort Sync A3, Communicating Indoor Unit with 24VAC Air Conditioner

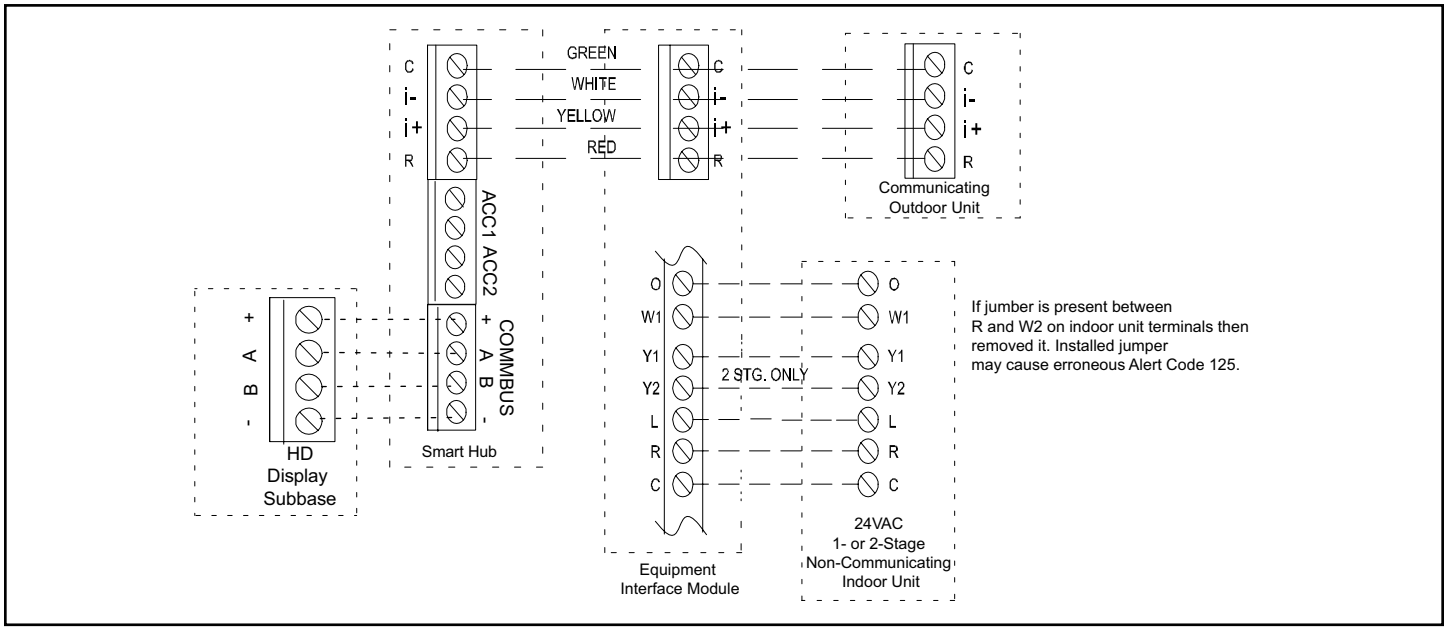


Figure 22. Comfort Sync A3 with Equipment Interface Module (EIM), 24VAC Indoor Unit and Communicating Outdoor Unit

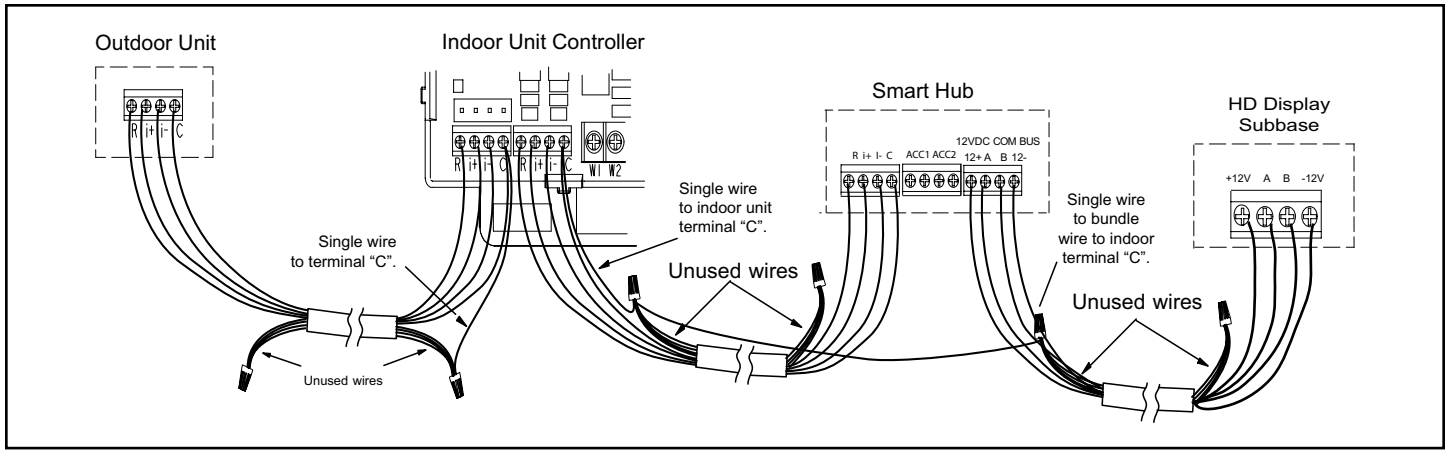


Figure 23. Wire Termination in Communicating Systems (Electrical Noise) - Typical

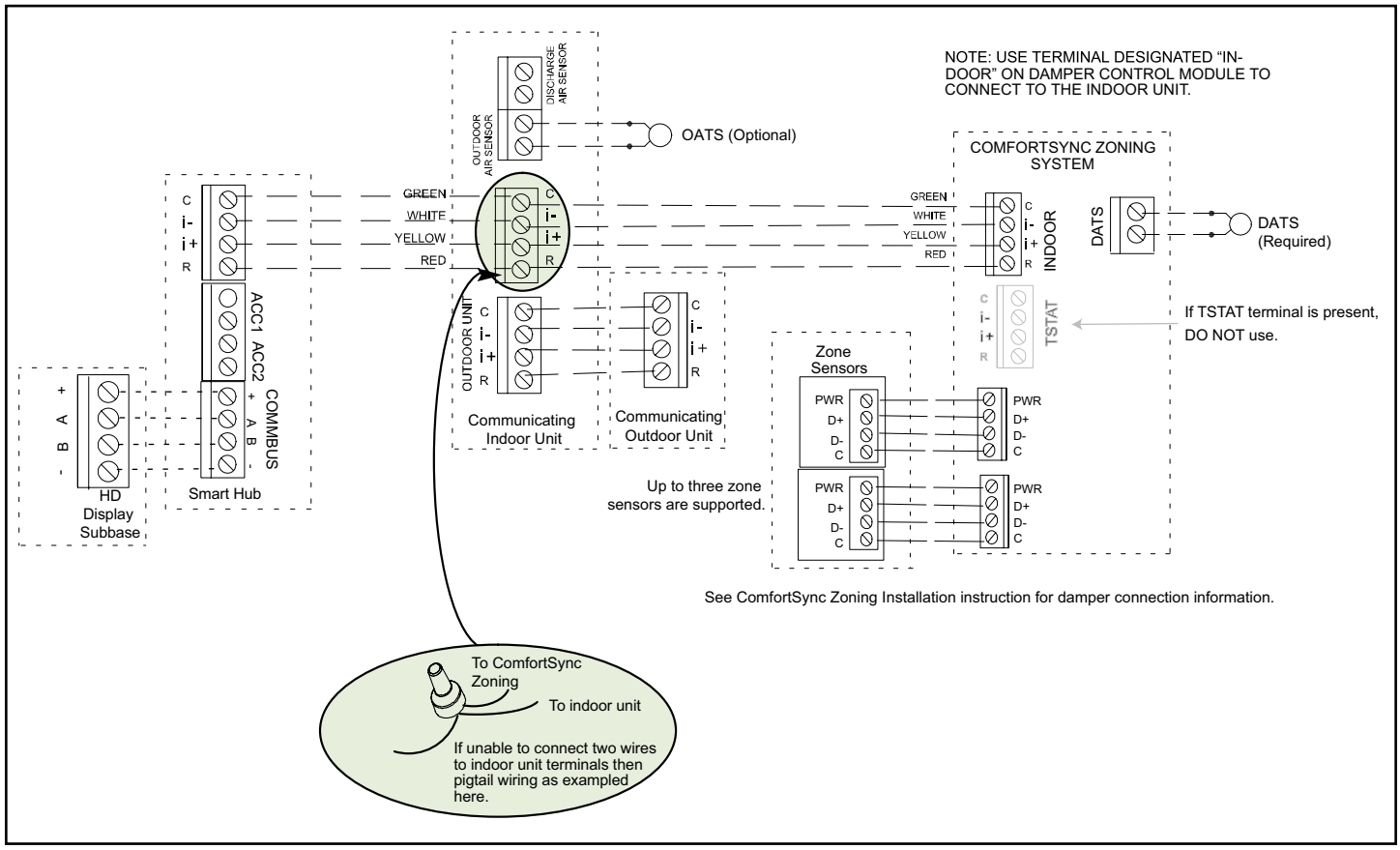


Figure 24. Comfort Sync A3, Communicating Indoor and Outdoor Units, Comfort Sync Zoning (Damper Control Module) and Zone Sensors

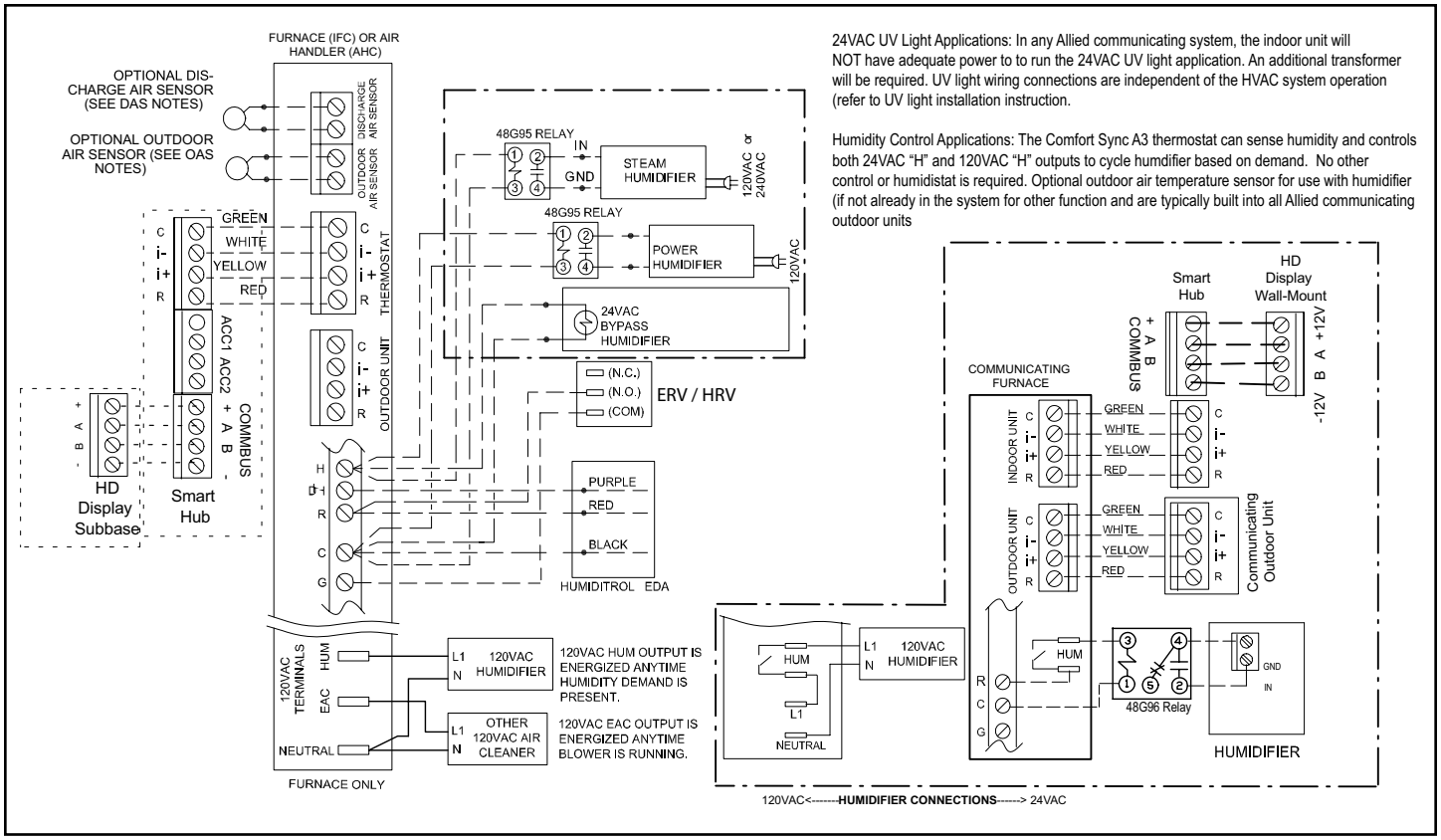


Figure 25. Comfort Sync A3 with Humidifier Accessory

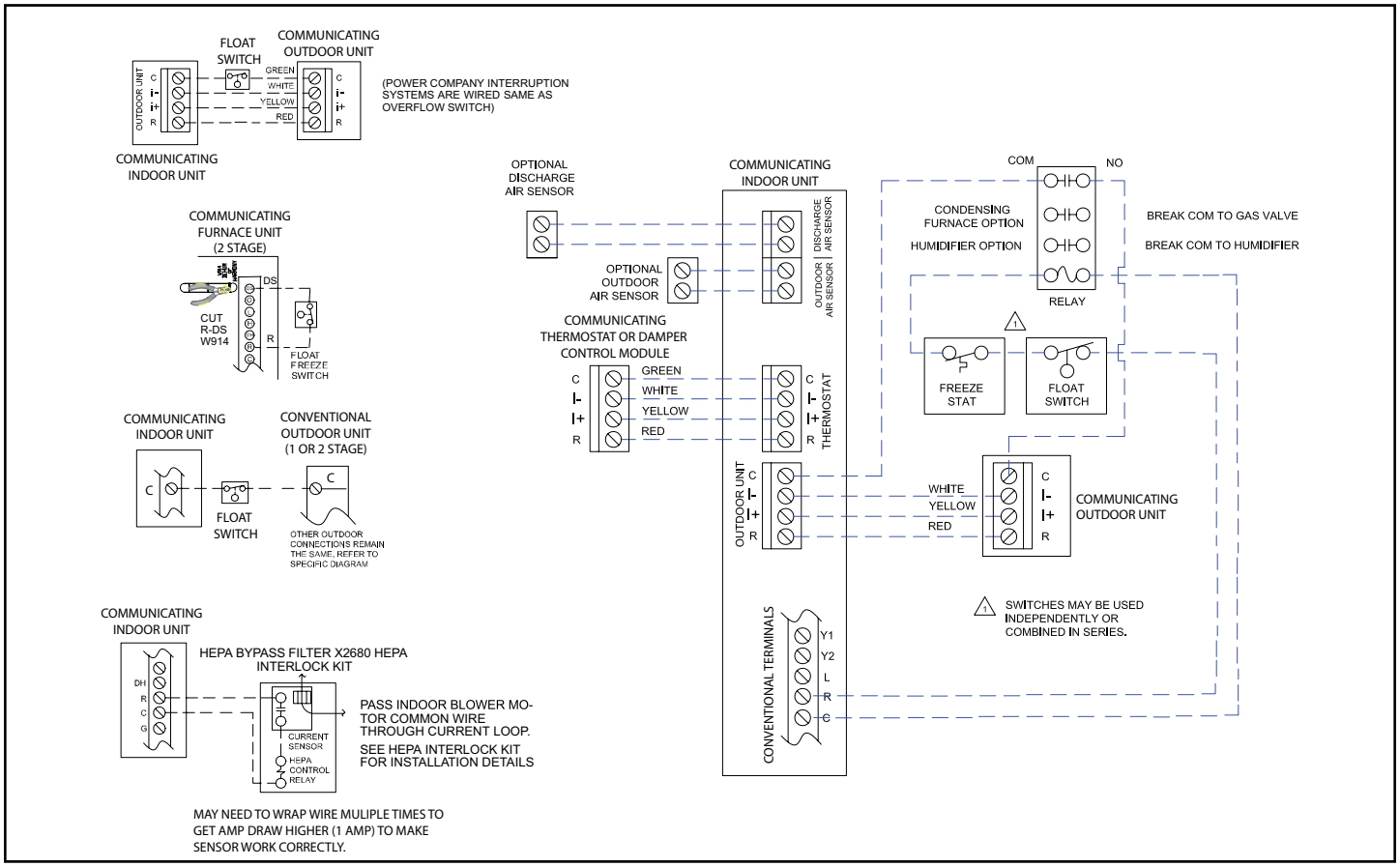


Figure 26. Installing Comfort Sync A3, Communicating Indoor Unit, Float Switch, HEPA Bypass Filter Interlock Kit, Humidifier, Relay and FreezeStat

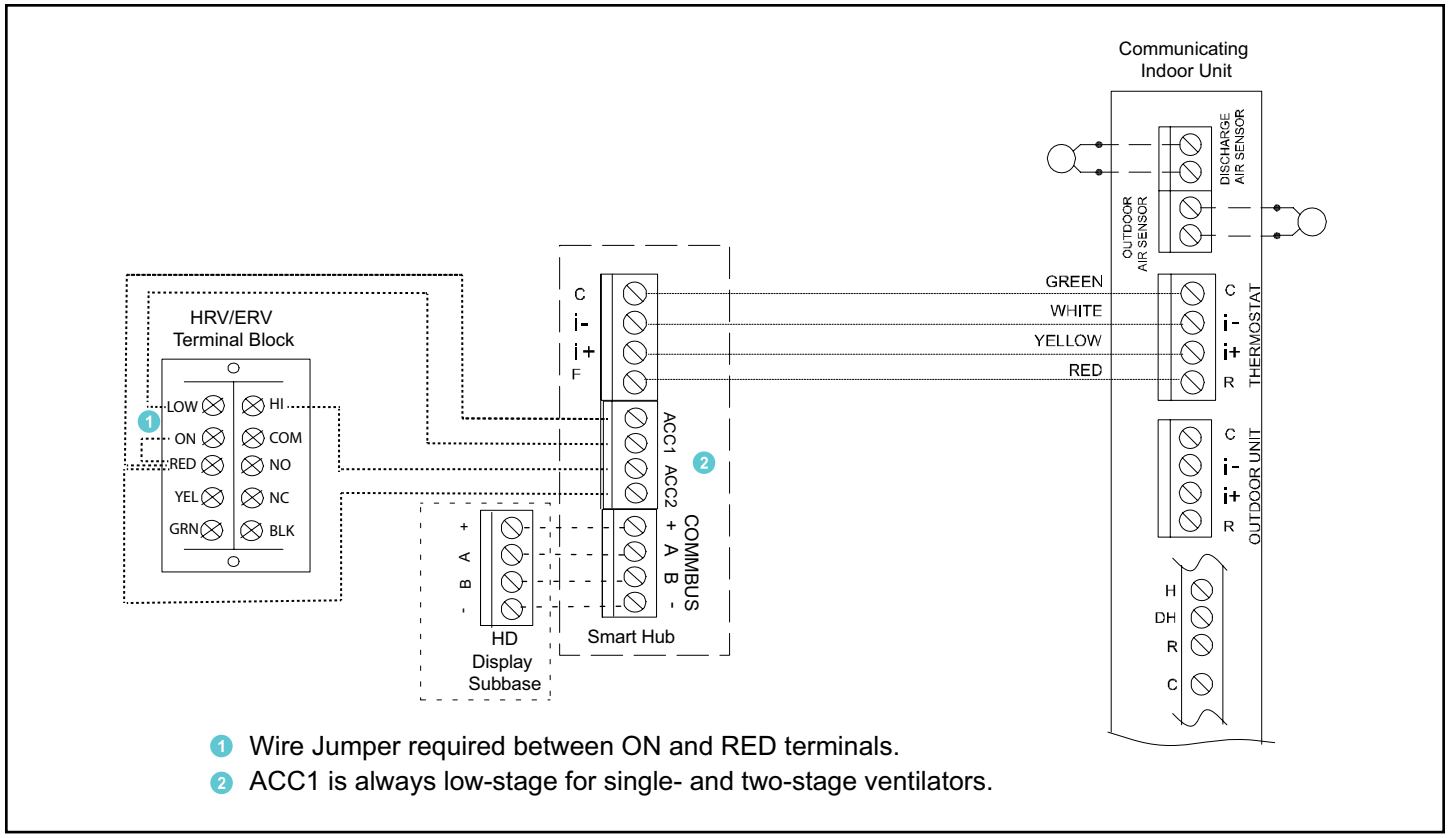


Figure 27. Comfort Sync A3 with Ventilation (Fresh Air Damper, ERV and HRV)

Placement and Installation

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the Table 19 for approved piping and fitting materials.

⚠ CAUTION

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

⚠ IMPORTANT

A98USMV exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 19. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended during cooler weather. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

Canadian Applications Only *- Pipe, fittings, primer and solvent cement used to vent (exhaust) this appliance must be certified to ULC S636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.*

Table 20 lists the available exhaust termination kits.

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
PRIMER & SOLVENT CEMENT	**ASTM SPECIFICATION**
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3138
CANADA PIPE & FITTING & SOLVENT CEMENT	**MARKING**
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	
POLYPROPYLENE VENTING SYSTEM	ULC-S636
PolyPro® by Duravent	
InnoFlue® by Centrotherm	ULC-S636
ECCO Polypropylene Vent™	ULC-S636

Table 19. Piping and Fittings Specifications

Unit	VENT PIPE DIA. (in.)	STANDARD			CONCENTRIC		
		Outdoor Exhaust Accelerator (Dia. X Length)	Outdoor Exhaust Accelerator (Dia. X Length)	Flush Mount Kit	1-1/2" Concentric Kit	2" Concentric Kit	3" Concentric Kit
		1-1/2" X 12"	2" X 12"	51W11 *	71M80 or +44W92++	69M29 or +44W92++	60L46 or 44W93+
070	[1] 1-1/2			YES	YES		
	2	YES		YES	YES		
	2-1/2	YES		YES	YES		
	3	YES		YES	YES		
090	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
110	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
135	3		YES	YES			YES

[1] 2 inch to 1-1/2 inch reducer required, must be field provided.

* Kit 51W11 is provided with a 1-1/2" accelerator, which must be used for all 45,000 and 70,000 furnace installations. When using 1-/2 in. piping, the pipe must be transitioned to 2 in. pipe when used with the Flush Mount Kit.

+ Termination kits 44W92, 44W93, 30G28 and 81J20 approved for use in Canadian installations to meet CSAB149.

++ The 44W92 concentric kit is provided with a 1-1/2" accelerator, which must be installed on the exhaust outlet when this kit is used with this furnace. When using 1-1/2 in. piping, the pipe must be transitioned to 2 in. pipe when used with the Concentric Kit.

Table 20. Outdoor Termination Kits Usage

Joint Cementing Procedure

All cementing of joints should be done according to the specifications outlined in ASTM D 2855.

NOTE: *A sheet metal screw may be used to secure the intake pipe to the connector, if desired. Use a drill or self tapping screw to make a pilot hole.*

⚠ DANGER

DANGER OF EXPLOSION!

Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation.

1. Measure and cut vent pipe to desired length.
2. Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.

   NOTE: *Check the inside of vent pipe thoroughly for any obstruction that may alter furnace operation.*
3. Clean and dry surfaces to be joined.
4. Test fit joint and mark depth of fitting on outside of pipe.
5. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

   NOTE: *Time is critical at this stage. Do not allow primer to dry before applying cement.*
6. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.
7. Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. DO NOT turn ABS or cellular core pipe.

   NOTE: *Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.*
8. After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate an improper assembly due to insufficient solvent.
9. Handle joints carefully until completely set.

Venting Practices

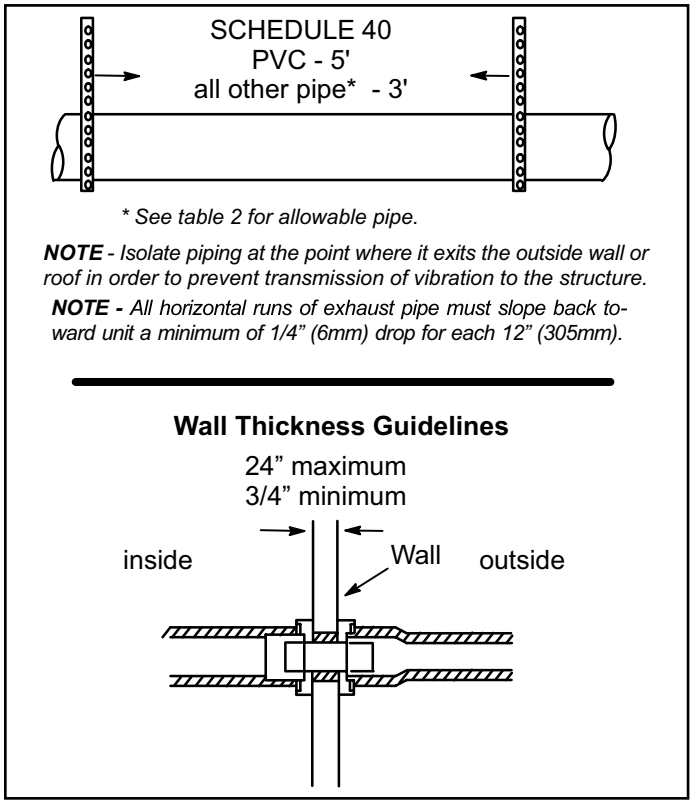


Figure 28. Piping Suspension Guidelines

- In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
- When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.

Exhaust Piping (Figure 29 and Figure 30)

Route piping to outside of structure. Continue with installation following instructions given in piping termination section.

Intake Piping (Figure 29 and Figure 30)

The A98USMV furnace may be installed only in direct vent applications.

The A98USMV is designed for combustion air intake through an inlet in the unit's top cap. Intake air piping is independent of exhaust piping.

⚠ CAUTION

Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.

⚠ CAUTION

The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

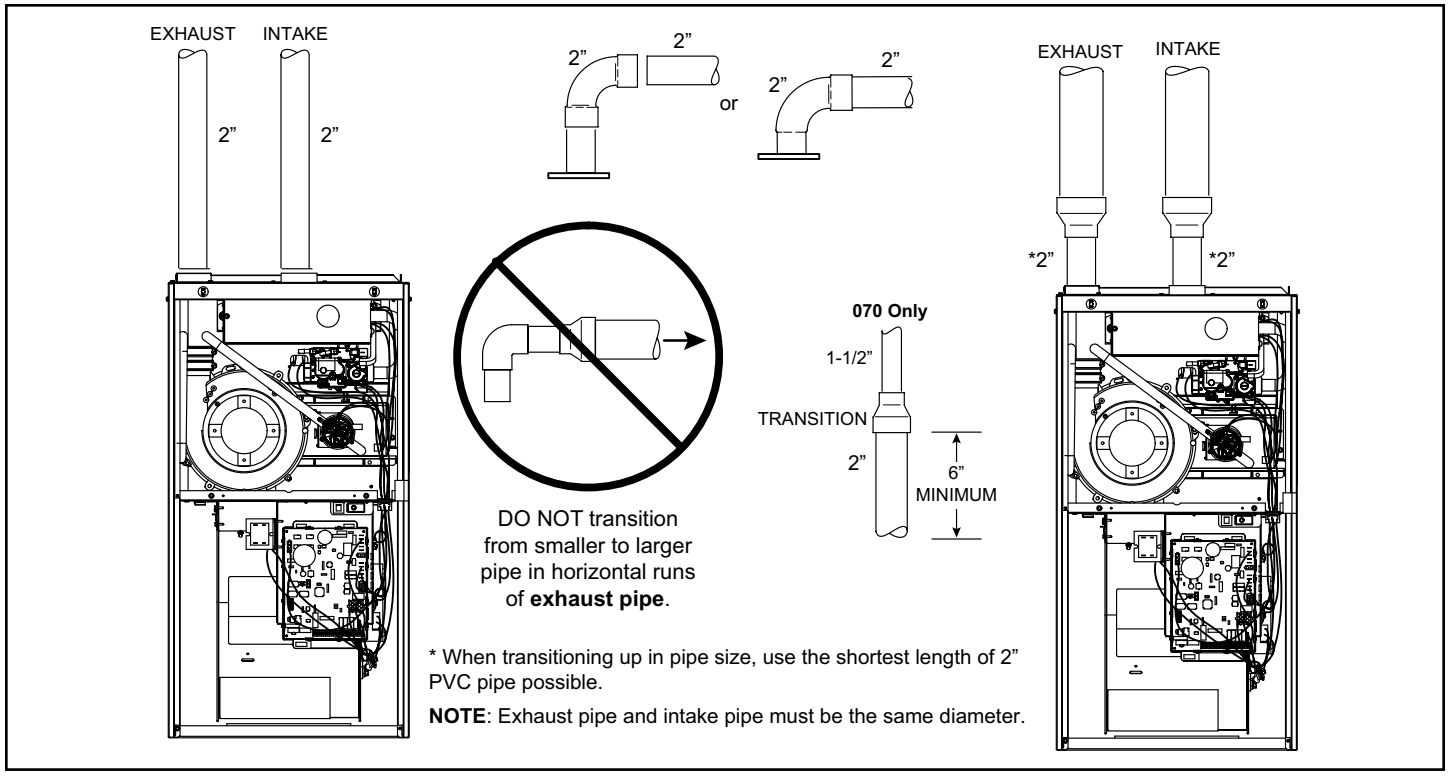


Figure 29. Typical Exhaust and Intake Pipe Connections and Condensate Trap Installation in Upflow Applications

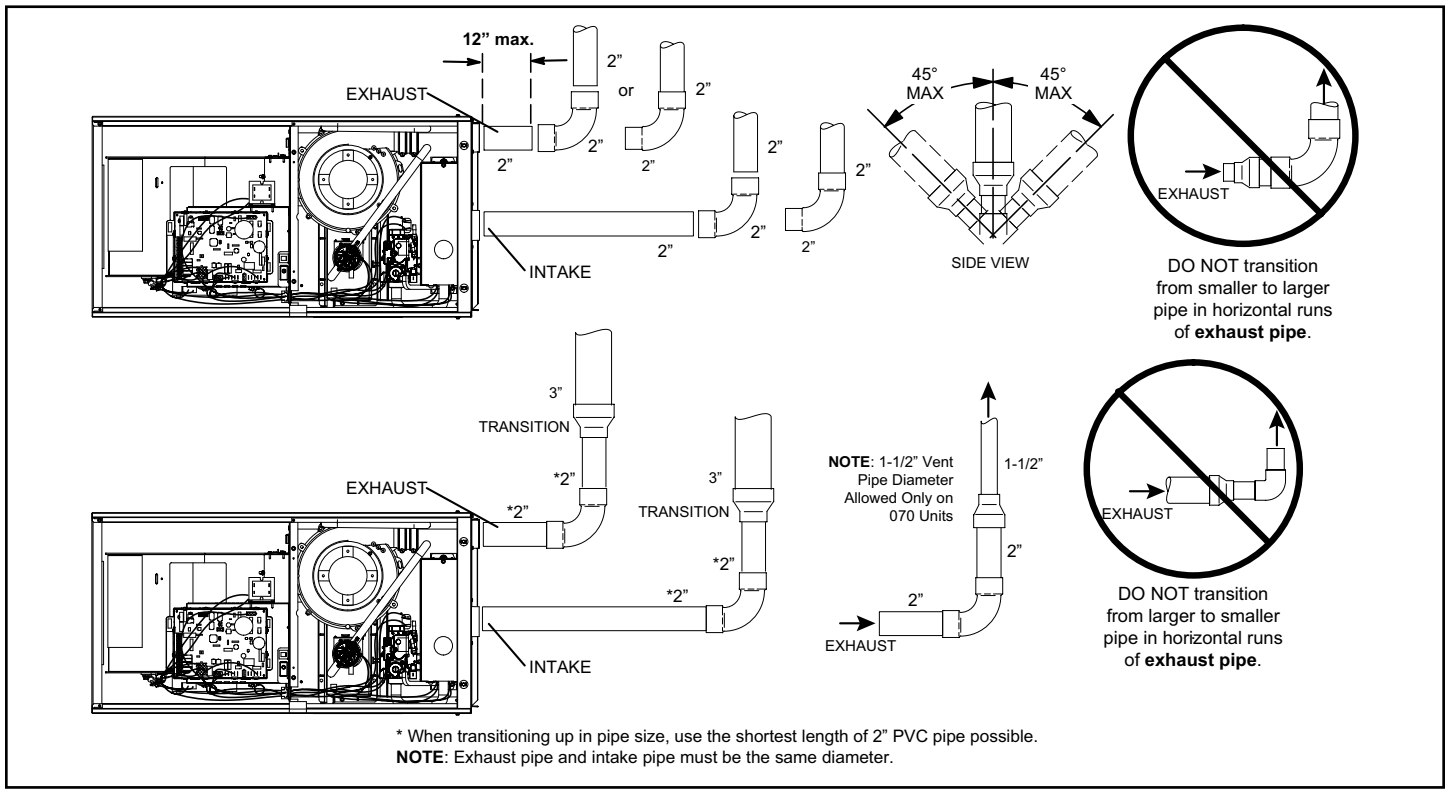


Figure 30. Typical Exhaust and Intake Pipe Connections and Condensate Trap Installation in Horizontal Air Applications (Right Hand Discharge Shown)

Vent Piping Guidelines

NOTE: *Allied Air has approved the use of DuraVent® and Centrotherm manufactured vent pipe and terminations as an option to PVC. When using the PolyPro® by DuraVent or InnoFlue® by Centrotherm venting system the vent pipe requirements stated in the unit installation instruction – minimum & maximum vent lengths, termination clearances, etc. – apply and must be followed. Follow the instructions provided with PoyPro by DuraVent and InnoFlue by Centrotherm venting system for assembly or if requirements are more restrictive. The PolyPro by Duravent and InnoFlue by Centrotherm venting system must also follow the uninsulated and unconditioned space criteria listed in Table 22.*

The A98USMV is installed as a Direct Vent gas central furnace only.

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.*

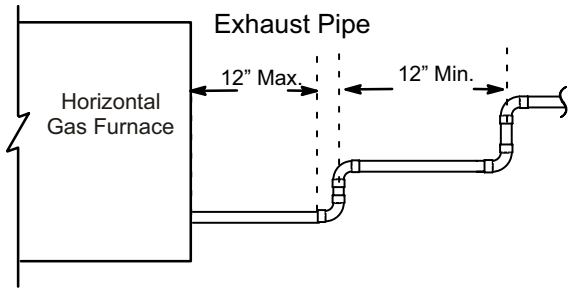
Intake and exhaust pipe sizing -- Size pipe according to Table 21 through Table 24B. Count all elbows inside and outside the home. Table 21 lists the minimum vent pipe lengths permitted. Table 24A through Table 24B list the maximum pipe lengths permitted.

Regardless of the diameter of pipe used, the standard roof and wall terminations described in section Exhaust Piping Terminations should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to Table 23.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact Allied Air Application Department for assistance in sizing vent pipe in these applications.

NOTE: *The exhaust collar on all models is sized to accommodate 2" Schedule 40 vent pipe. In horizontal applications, any transition to exhaust pipe larger than 2" must be made in vertical runs of the pipe. Therefore a 2" elbow must be added before the pipe is transitioned to any size larger than 2". This elbow must be added to the elbow count used to determine acceptable vent lengths. Contact the Application Department for more information concerning sizing of vent systems which include multiple pipe sizes. See Figure 31.*

NOTE: *It is acceptable to use any pipe size which fits within the guidelines allowed in Table 24A and Table 24B.*



NOTE - *All horizontal runs of exhaust pipe must slope back toward unit. A minimum of 1/4" (6mm) drop for each 12" (305mm) of horizontal run is mandatory for drainage.*

NOTE *- Exhaust pipe MUST be glued to furnace exhaust fittings.*

NOTE *- Exhaust piping should be checked carefully to make sure there are no sags or low spots.*

Figure 31. Horizontal Installation Offset Requirements

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

Model	Min. Equiv. Vent Length	Example
70	15 ft.*	5 ft. plus 2 elbows of 1-1/2", 2", 2-1/2" or 3" diameter pipe
90		5 ft. plus 2 elbows of 2", 2-1/2" or 3" diameter pipe
110		5 ft. plus 2 elbows of 2-1/2" or 3" diameter pipe
135		5 ft. plus 2 elbows of 3" diameter pipe

Table 21.

Use the following steps to correctly size vent pipe diameter.

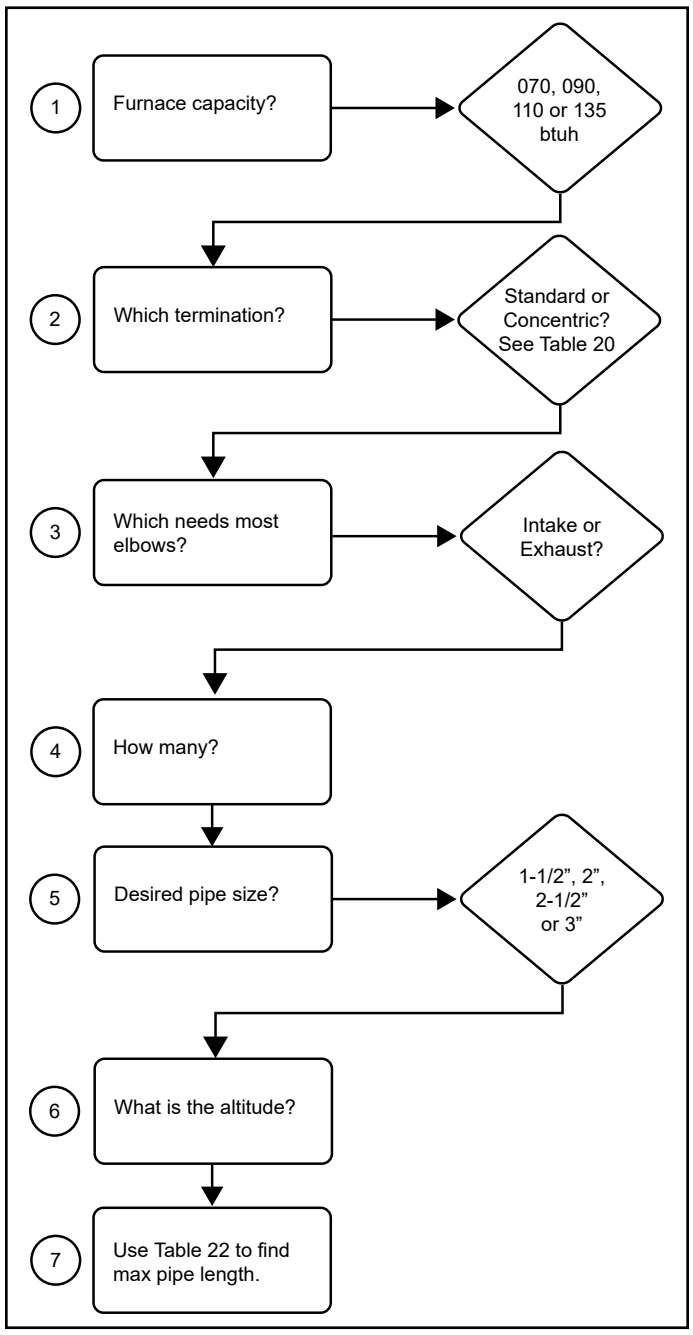


Figure 32.

Maximum Allowable Intake or Exhaust Vent Length (feet)

Standard Termination at Elevation 0 - 4,500 ft																
Number of 90° Elbows Used	1-1/2” Pipe				2” Pipe				2-1/2” Pipe				3” Pipe			
	Model				Model				Model				Model			
	70	90	110	135	70	90	110	135	70	90	110	135	70	90	110	135
1	20	n/a	n/a	n/a	86	64	n/a	n/a	135	88	38	n/a	157	138	113	109
2	15				81	59			130	83	33		152	133	108	104
3	10				76	54			125	78	28		147	128	103	99
4	n/a				71	49			120	73	23		142	123	98	94
5					66	44			115	68	18		137	118	93	89
6					61	39			110	63	13		132	113	88	84
7					56	34			105	58	8		127	108	83	79
8					51	29			100	53	n/a		122	103	78	74
9					46	24			95	48			117	98	73	69
10					41	19			90	43			112	93	68	64
Standard Termination at Elevation 4,501 - 10,000 ft																
Number of 90° Elbows Used	1-1/2” Pipe				2” Pipe				2-1/2” Pipe				3” Pipe			
	Model				Model				Model				Model			
	70	90	110	135	70	90	110	135	70	90	110	135	70	90	110	135
1	12	n/a	n/a	n/a	61	39	n/a	n/a	110	63	n/a	n/a	132	113	88	84
2	7				56	34			105	58			127	108	83	79
3	n/a				51	29			100	53			122	103	78	74
4					46	24			95	48			117	98	73	69
5					41	19			90	43			112	93	68	64
6					36	14			85	38			107	88	63	59
7					31	9			80	33			102	83	58	54
8					26	n/a			75	28			97	78	53	49
9					21				70	23			92	73	48	44
10					16				65	18			87	68	43	39
*Size intake and exhaust pipe length separately. Values in table are for intake or exhaust not combined total. Both intake and exhaust must be same pipe size.																

Table 24A.

Maximum Allowable Intake or Exhaust Vent Length (feet)

Concentric Termination at Elevation 0 - 4,500 ft																
Number of 90° Elbows Used	1-1/2" Pipe				2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model				Model			
	70	90	110	135	70	90	110	135	70	90	110	135	70	90	110	135
1	15	n/a	n/a	n/a	78	62	n/a	n/a	125	84	34	n/a	141	134	109	100
2	10				73	57			120	79	29		136	129	104	95
3	n/a				68	52			115	74	24		131	124	99	90
4					63	47			110	69	19		126	119	94	85
5					58	42			105	64	14		131	114	89	80
6					53	37			100	59	9		116	109	84	75
7					48	32			95	54	n/a		111	104	79	70
8					43	27			90	49			106	99	74	65
9					38	22			85	44			101	94	69	60
10					33	17			80	39			96	89	64	55
Concentric Termination Elevation 4,501 - 10,000 ft																
Number of 90° Elbows Used	1-1/2" Pipe				2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model				Model			
	70	90	110	135	70	90	110	135	70	90	110	135	70	90	110	135
1	10	n/a	n/a	n/a	53	37	n/a	n/a	100	59	n/a	n/a	116	109	84	75
2	n/a				48	32			95	54			111	104	79	70
3					43	27			90	49			106	99	74	65
4					38	22			85	44			101	94	69	60
5					33	17			80	39			96	89	64	55
6					28	12			75	34			91	84	59	50
7					23	7			70	29			86	79	54	45
8					18	n/a			65	24			81	74	49	40
9					13				60	19			76	69	44	35
10					8				55	14			71	64	39	30

*Size intake and exhaust pipe length separately. Values in table are for intake or exhaust not combined total. Both intake and exhaust must be same pipe size.

Table 24B.

General Guidelines for Vent Terminations

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The A98USMV is then classified as a direct vent, Category IV gas furnace.

In Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/ NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details.

Position termination according to location given in Figure 34. In addition, position termination so it is free from any obstructions and 12” above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of an outdoor AC unit because the condensate can damage the painted coating.

NOTE: *See Table 22 for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F (0°C). If required exhaust pipe should be insulated with 1/2” (13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4” (19mm) Armaflex or equivalent may be necessary. Insulation must be protected from deterioration. Armaflex with UV protection is permissable. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32 degrees F (0°C) are to be considered conditioned spaces.*

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust terminations. Doing so will cause freeze-ups and may block the terminations.

⚠ IMPORTANT

For Canadian Installations Only:

In accordance to CSA International B149 installation codes, the minimum allowed distance between the combustion air intake inlet and the exhaust outlet of other appliances shall not be less than 12 inches (305mm).

Maximum Allowable Vent Pipe Length[3] without Insulation in Unconditioned Space for Winter Design Temperatures Modulating High Efficiency Furnace

Winter Design Temperatures[1] ºF (ºC)	Vent Pipe Diameter								
		070		090		110		135	
		PVC	[2]PP	PVC	[2]PP	PVC	[2]PP	PVC	[2]PP
32 to 21 (0 to -6)	1-1/2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in.	11	9	14	12	18	15	N/A	N/A
	2-1/2 in.	7	N/A	10	N/A	12	N/A	N/A	N/A
	3 in.	N/A	N/A	6	6	8	8	13	13
20 to 1 (-7 to -17)	1-1/2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in.	N/A	N/A	6	4	8	6	N/A	N/A
	2-1/2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	3 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0 to -20 (-18 to -29)	1-1/2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-1/2 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	3 in.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.

[2] Poly-Propylene vent pipe (PP) by Duravent and Centrotherm

[3] Vent length in table is equivalent length. Each elbow is equivalent to 5ft of straight pipe and should be included when measuring total length.

NOTE - Concentric terminations are the equivalent of 5' and should be considered when measuring pipe length.

NOTE - Maximum uninsulated vent lengths listed may include the termination (vent pipe exterior to the structure) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in Table 24A or Table 24B.

NOTE - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See Figure 33.

Table 22.

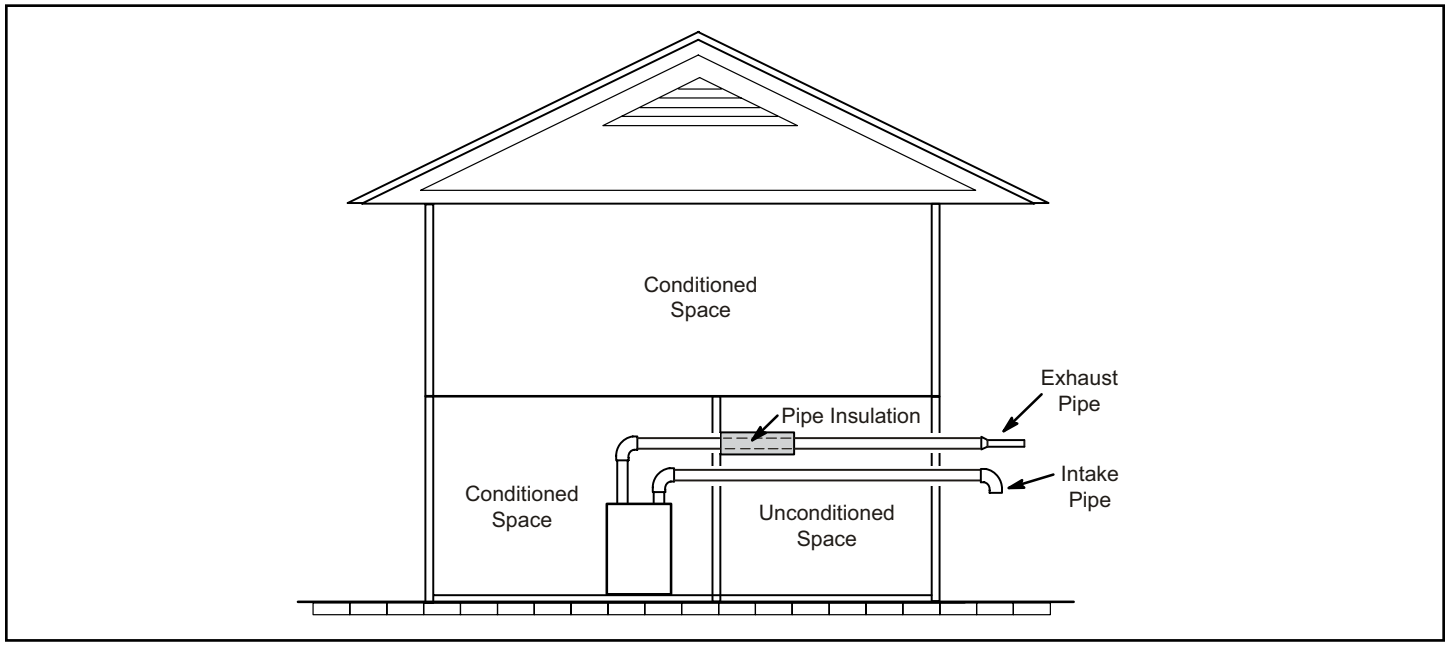
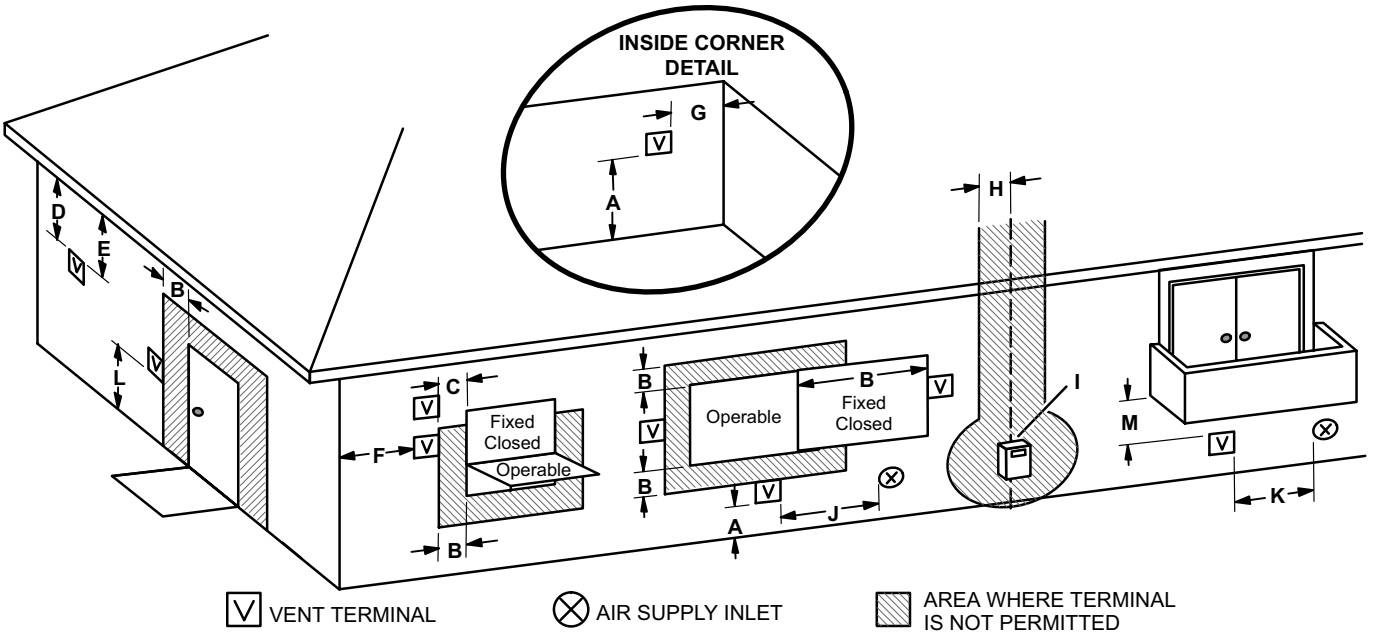


Figure 33. Insulating Exhaust Pipe in an Unconditioned Space

VENT TERMINATION CLEARANCES
FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



		US Installations[1]	Canadian Installations[2]
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 inches (305mm) above average snow accumulation.	12 inches (305mm) or 12 inches (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12”	* 12”
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

1 In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

2 In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Avoiding this location is recommended if possible.

*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions.”

***NOTE** - This figure is intended to illustrate clearance requirements and does not serve as a substitute for locally adopted installation codes.*

Figure 34. Vent Termination Clearances
Direct Vent Installations

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.*

NOTE: *Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See Figure 43.*

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figure 35 through Figure 43 show typical terminations.

1. Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (Figure 35). You may exit the exhaust out the roof and the intake out the side of the structure (Figure 36).

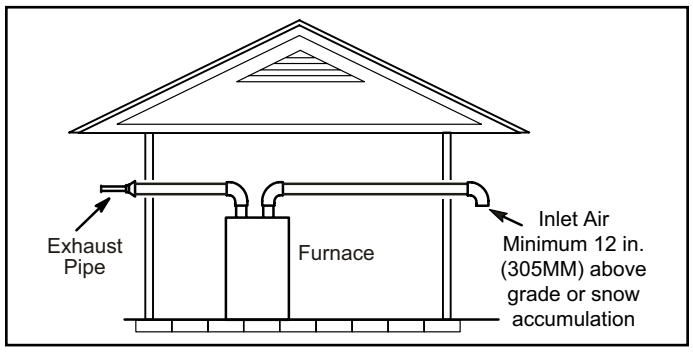


Figure 35. Exiting Exhaust and Intake Vent (no common pressure zone)

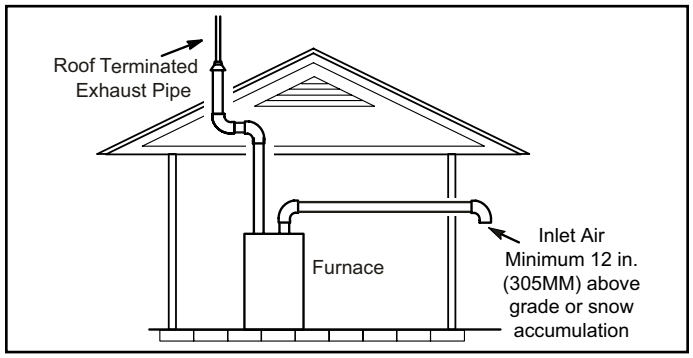


Figure 36. Exiting Exhaust and Intake Vent (no common pressure zone)

2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3” (76MM) on roof terminations and 6” (152MM) on side wall terminations.

   NOTE: *When venting in different pressure zones, the maximum separation requirement of intake and exhaust pipe DOES NOT apply.*

3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (Figure 37).

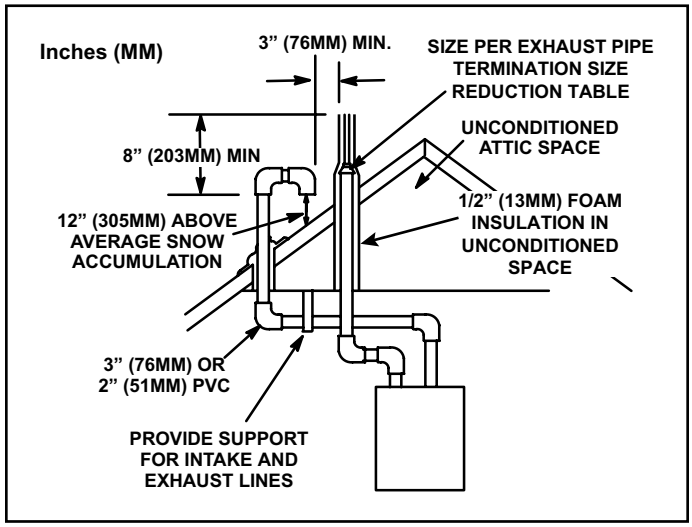


Figure 37. Direct Vent Roof Termination Kit (15F75 or 44J41)

4. Exhaust piping must terminate straight out or up as shown. A reducer may be required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See Table 23.

   NOTE: *Care must be taken to avoid recirculation of exhaust back into intake pipe.*

Model	Exhaust Pipe Size	Termination Pipe Size
*070	2”, 2-1/2”, or 3”	1-1/2”
*090		2”
110		
135	3”	
* -070 and -090 units with the flush-mount termination must use the 1-1/2” accelerator supplied with the kit.		

Table 23. Exhaust Pipe Termination Size Reduction

5. On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305MM) for 2” PVC and 20 inches (508MM) for 3” (76MM) PVC beyond the outside wall. Intake piping should be as short as possible. See Figure 43.

6. On field-supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8” and a minimum distance of 6” with a termination elbow. See Figure 43.
7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6” from the top of the elbow and then every 24” (610mm) as shown in Figure 43, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per Table 23. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.
8. A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in Figure 38.

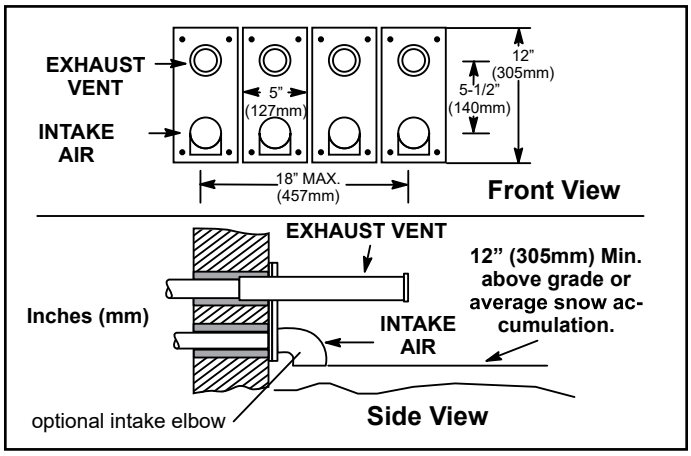


Figure 38. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination

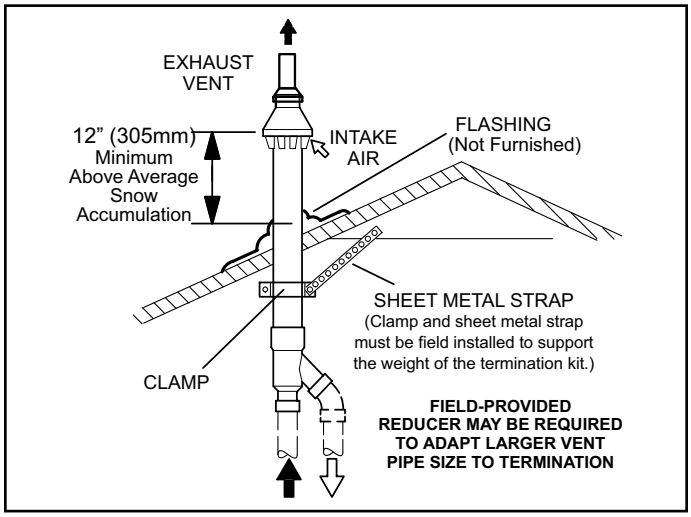
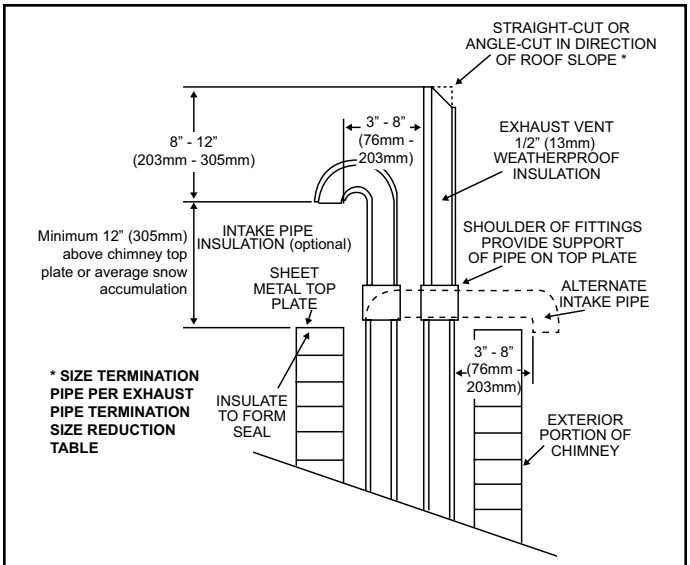


Figure 39. Direct Vent Concentric Rooftop Termination
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)



NOTE: *Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminates as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.*

Figure 40. Direct Vent Application Using Existing Chimney

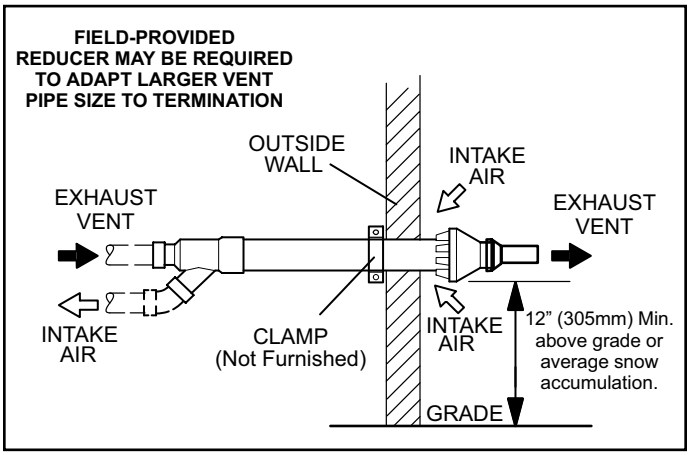


Figure 41. Direct Vent Concentric Wall Termination
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)

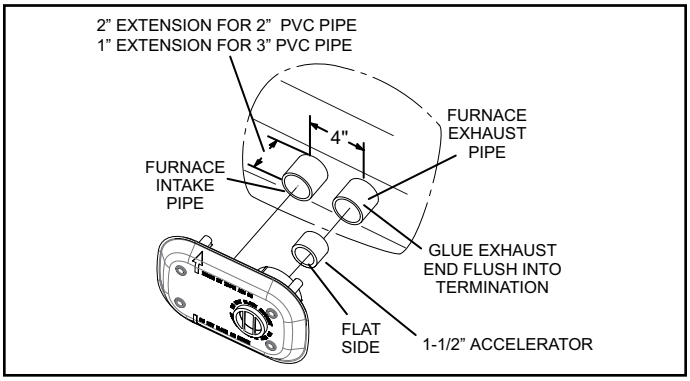
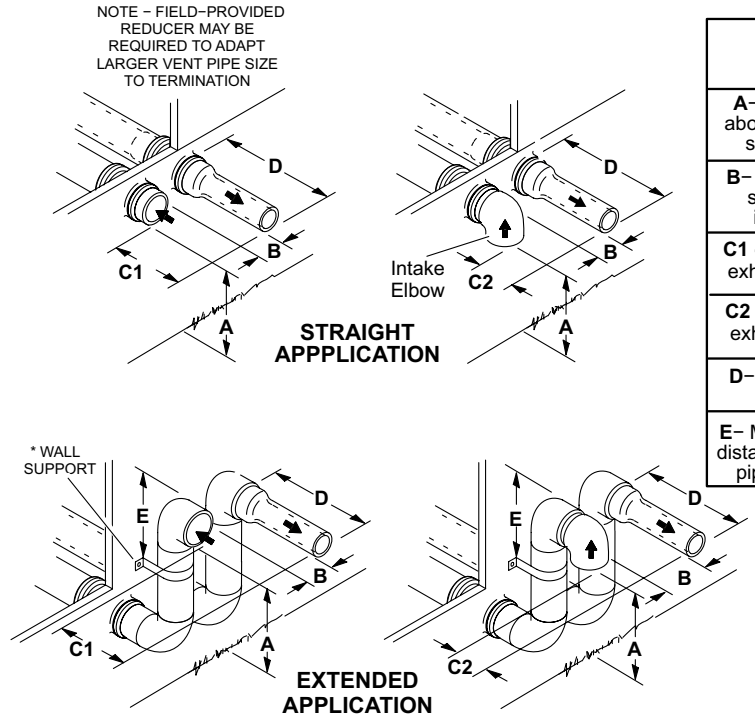


Figure 42. Flush-Mount Side Wall Termination 51W11

FIELD FABRICATED WALL TERMINATION

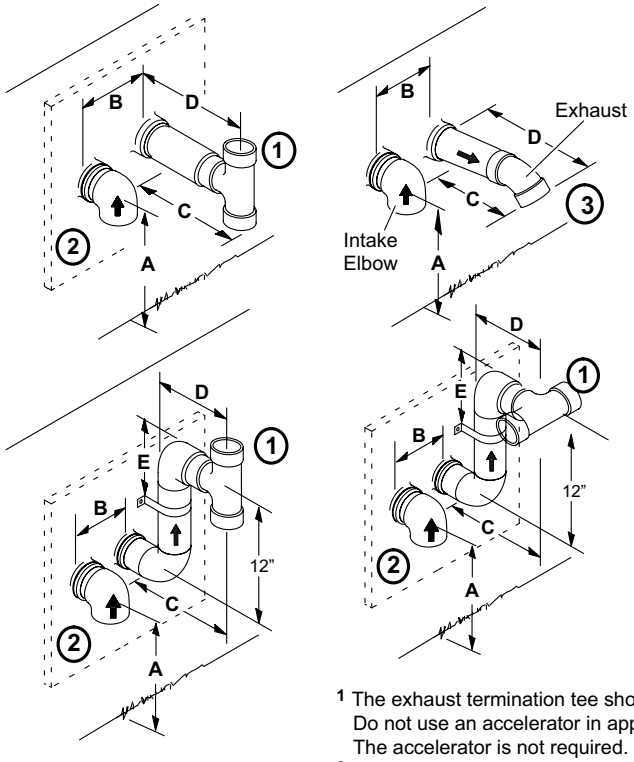


	2” (51mm) Vent Pipe	3” (76mm) Vent Pipe
A− Minimum clearance above grade or average snow accumulation	12” (305 mm)	12” (305 mm)
B− Maximum horizontal separation between intake and exhaust	6” (152 mm)	6” (152 mm)
C1 -Minimum from end of exhaust to inlet of intake	8” (203 mm)	8” (203 mm)
C2 -Minimum from end of exhaust to inlet of intake	6” (152 mm)	6” (152 mm)
D− Maximum exhaust pipe length	12” (305 mm)	20” (508 mm)
E− Maximum wall support distance from top of each pipe (intake/exhaust)	6” (152 mm)	6” (152 mm)

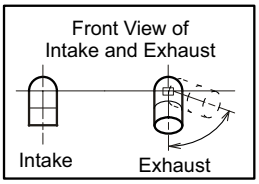
* Use wall support every 24” (610 mm). Use two wall supports if extension is greater than 24” (610 mm) but less than 48” (1219 mm).

NOTE − One wall support must be within 6” (152 mm) from top of each pipe (intake and exhaust) to prevent movement in any direction.

ALTERNATE TERMINATIONS (TEE & FORTY−FIVE DEGREE ELBOWS ONLY)



	2” (51MM) Vent Pipe	3” (76MM) Vent Pipe
A− Clearance above grade or average snow accumulation	12” (305 mm) Min.	12” (305 mm) Min.
B− Horizontal separation between intake and exhaust	6” (152 mm) Min. 24” (610 mm) Max.	6” (152 mm) Min. 24” (610 mm) Max.
C− Minimum from end of exhaust to inlet of intake	9” (227 mm) Min.	9” (227 mm) Min.
D− Exhaust pipe length	12” (305 mm) Min. 16” (405 mm) Max.	12” (305 mm) Min. 20” (508 mm) Max.
E− Wall support distance from top of each pipe (intake/exhaust)	6” (152 mm) Max.	6” (152 mm) Max.



[1] The exhaust termination tee should be connected to the 2” or 3” PVC flue pipe as shown in the illustration. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.

[2] As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.

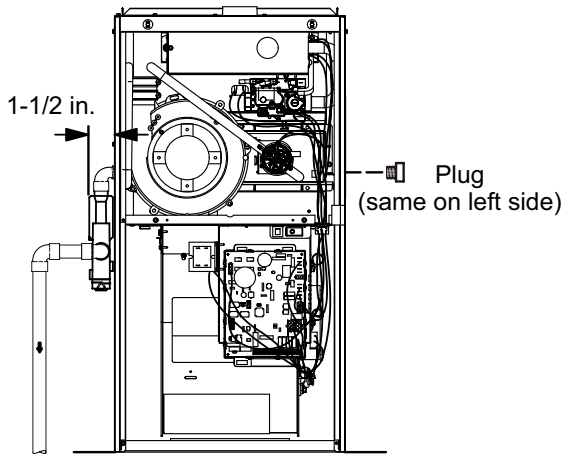
[3] Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

Figure 43.

Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping in upflow applications. In horizontal applications, the condensate trap must extend below the unit. An 8” service clearance is required for the condensate trap. Refer to Figure 44 and Figure 45 for condensate trap locations. Figure 52 and Figure 53 show trap assembly using 1/2” PVC or 3/4” PVC.

NOTE: *If necessary the condensate trap may be installed up to 5’ away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4” per ft. toward trap.*



NOTE: *In upflow applications where side return air filter is installed on same side as the condensate trap, filter rack **MUST** be installed beyond condensate trap or trap must be relocated to avoid interference.*

Figure 44. Condensate Trap and Plug Locations (Unit Shown in Upflow Position)

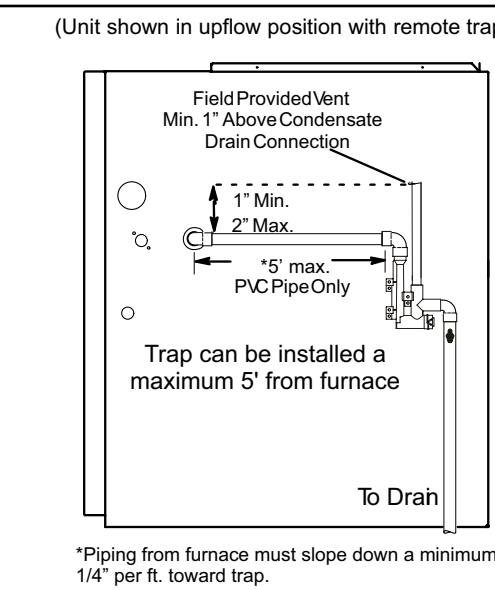


Figure 45. Condensate Trap Locations

1. Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
2. For furnaces with a 1/2” drain connection use a 3/8 allen wrench and remove plug (Figure 44) from the cold end header box at the appropriate location on the side of the unit. Install field-provided 1/2 NPT male fitting into cold end header box. For furnaces with a 3/4” drain connection use a large flat head screw driver or a 1/2” drive socket extension and remove plug. Install provided 3/4 NPT street elbow fitting into cold end header box. Use Teflon tape or appropriate pipe dope.
3. Install the cap over the clean out opening at the base of the trap. Secure with clamp. See Figure 52 and Figure 53.
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in Figure 52 and Figure 53. Route the condensate line to an open drain. Condensate line must maintain a 1/4” downward slope from the furnace to the drain.

⚠ IMPORTANT

When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.

5. Figure 47 and Figure 48 show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See Figure 49 through Figure 51.

   Upflow furnace (Figure 47) - In upflow furnace applications the field provided vent must be a minimum 1” to a maximum 2” length above the condensate drain outlet connection. Any length above 2” may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

   Horizontal furnace (Figure 48) - In horizontal furnace applications the field provided vent must be a minimum 4” to a maximum 5” length above the condensate drain outlet connection. Any length above 5” may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

   NOTE: *In horizontal applications it is recommended to install a secondary drain pan underneath the unit and trap assembly.*

   NOTE: *Appropriately sized tubing and barbed fitting may be used for condensate drain. Attach to the drain on the trap using a hose clamp. See Figure 46.*

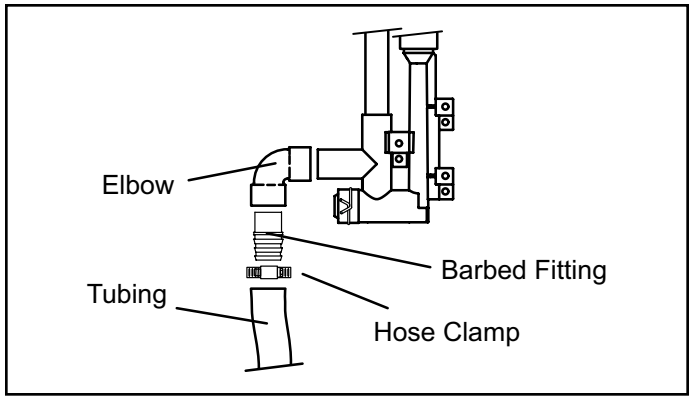


Figure 46. Field-Provided Drain Components

⚠ CAUTION

Do not use copper tubing or existing copper condensate lines for drain line.

6. If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.

   Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line. Heating cable kit is available in various lengths; 6 ft. (1.8m) - kit no. 26K68 and 24 ft. (7.3m) - kit no. 26K69.

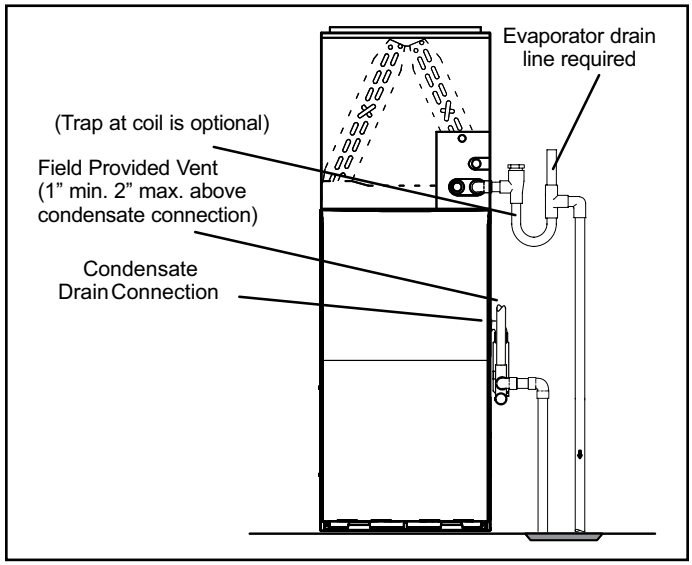


Figure 47. Furnace with Evaporator Coil Using a Separate Drain

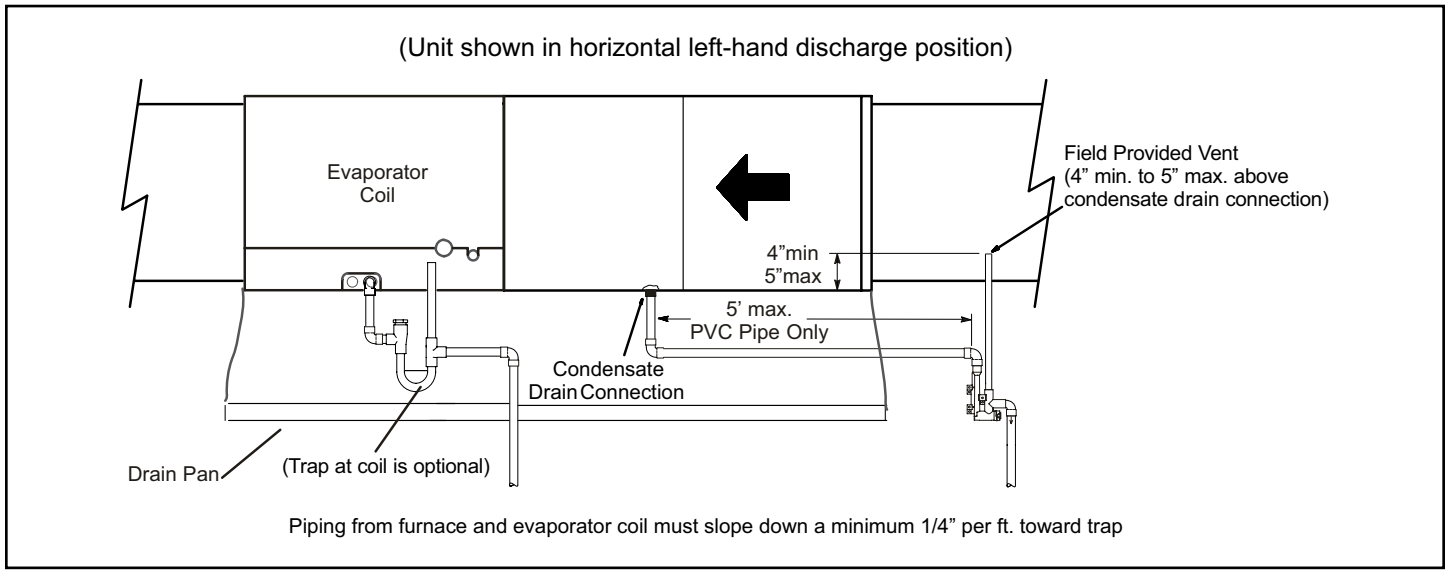


Figure 48. Furnace with Evaporator Coil Using a Separate Drain

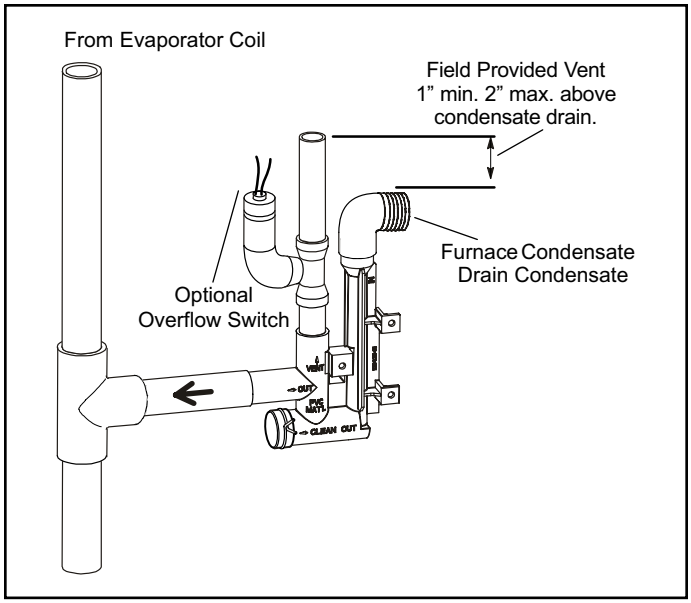


Figure 49. Condensate Trap With Optional Overflow Switch

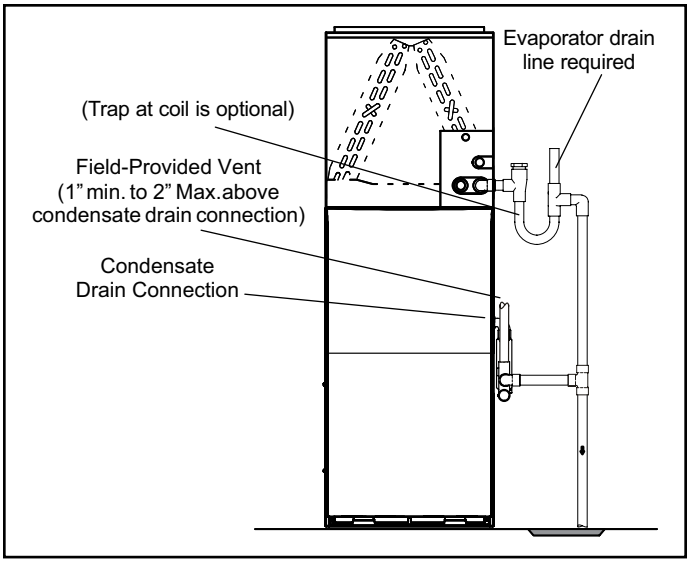


Figure 50. Furnace with Evaporator Coil Using a Common Drain

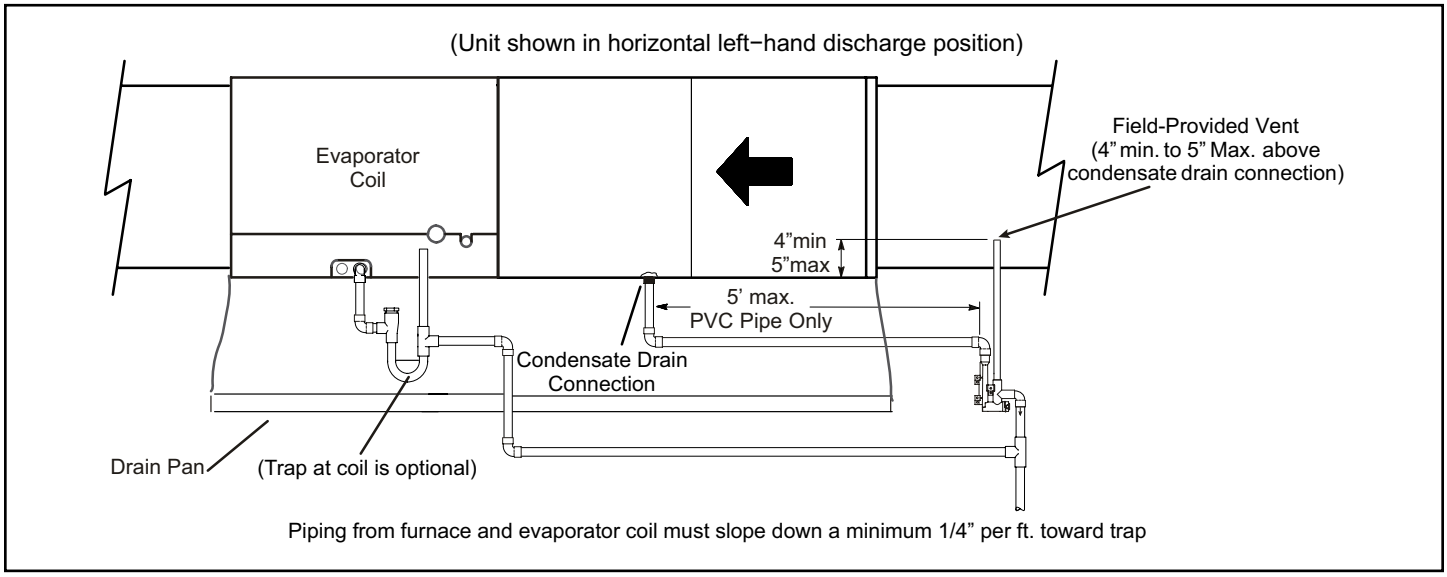


Figure 51. Furnace with Evaporator Coil Using a Common Drain

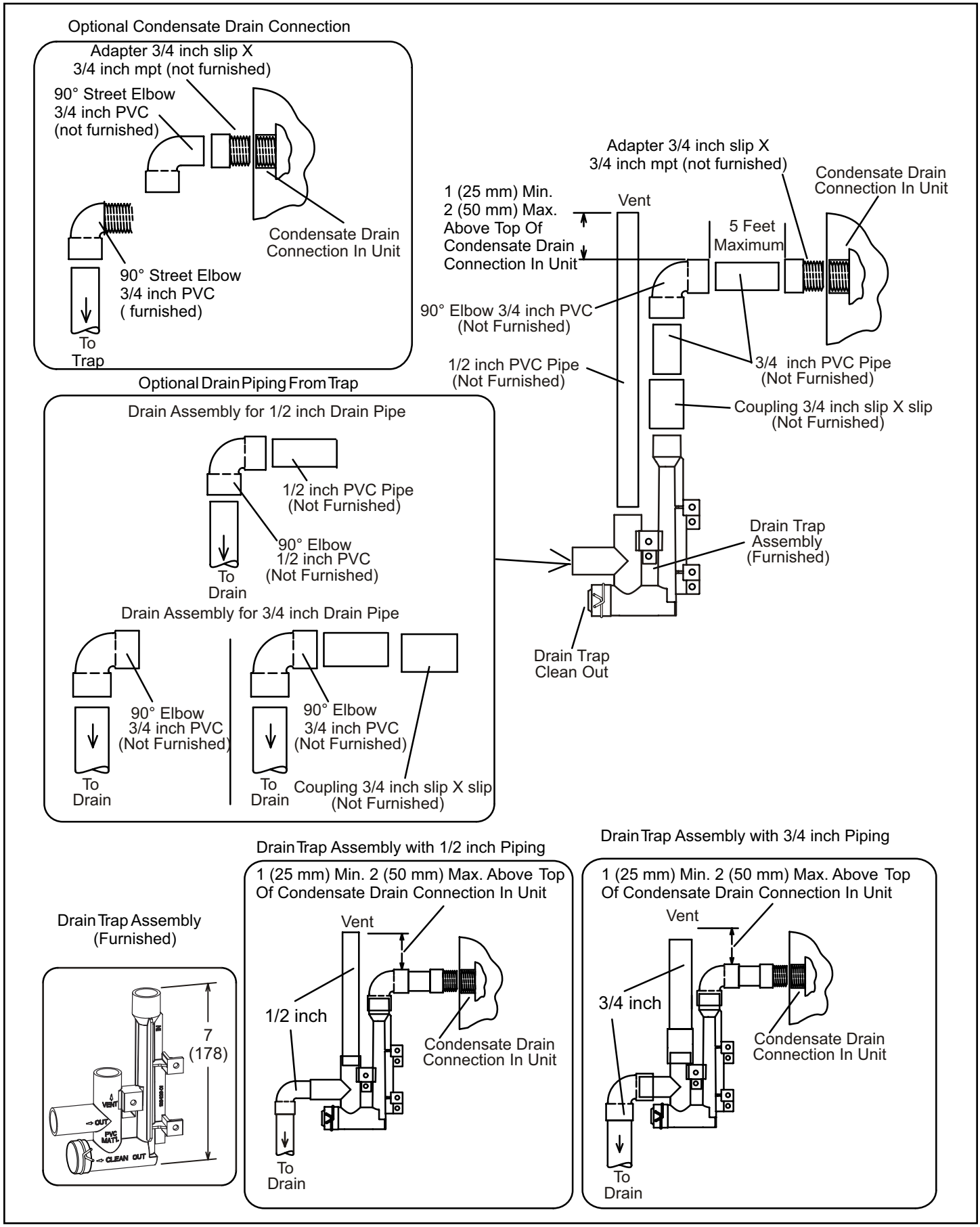


Figure 52. Trap / Drain Assembly Using 1/2" PVC or 3/4" PVC Cold End Header Box with 3/4 Drain Connection

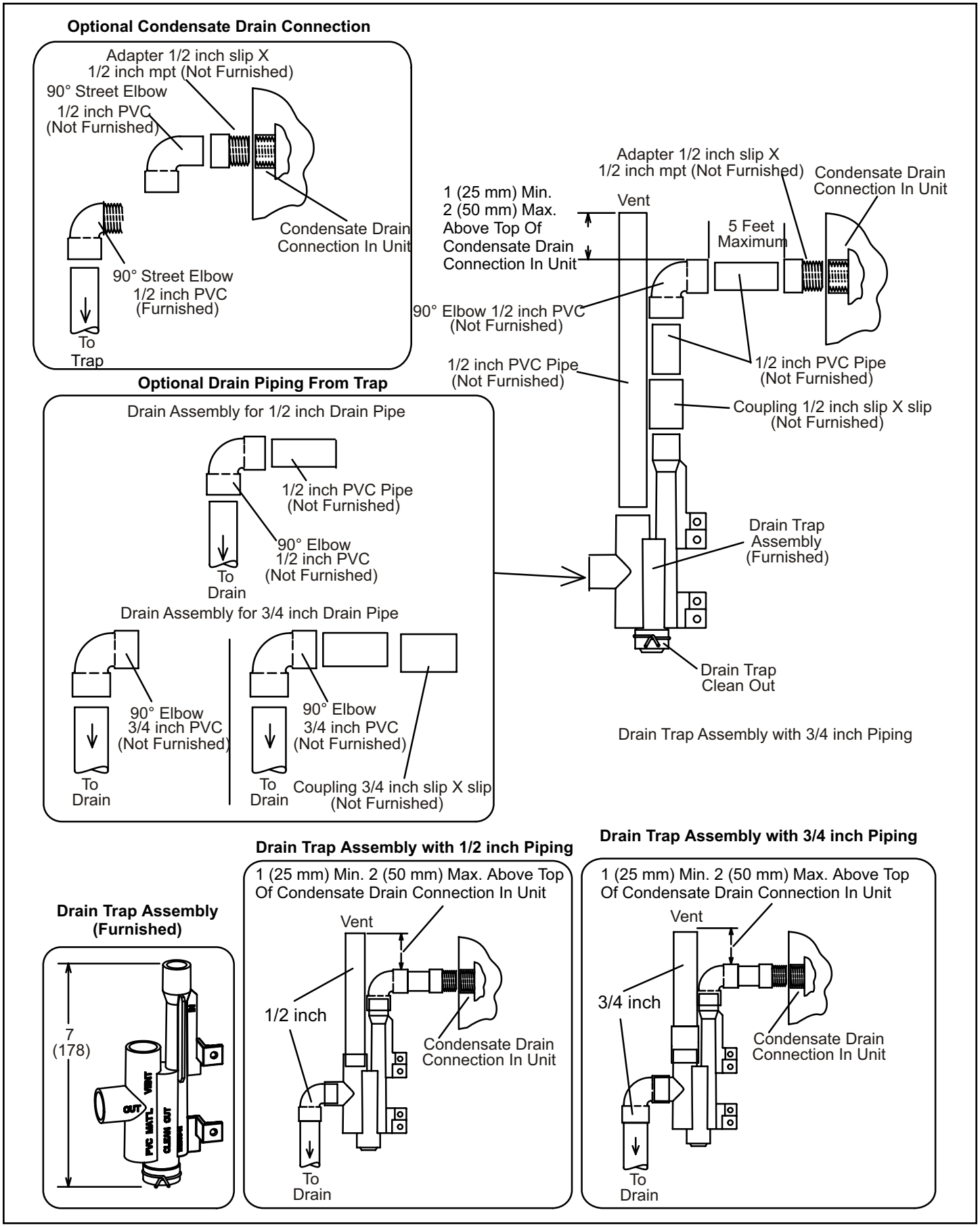


Figure 53. Trap / Drain Assembly Using 1/2” PVC or 3/4” PVC Cold End Header Box with 1/2 Drain Connection

Start-Up

Preliminary and Seasonal Checks

1. Inspect electrical wiring, both field and factory installed for loose connections. Tighten as required.
2. Check voltage at disconnect switch. Voltage must be within range listed on the nameplate. If not, consult the power company and have voltage condition corrected before starting unit.
3. Inspect condition of condensate traps and drain assembly. Disassemble and clean seasonally.

⚠ WARNING

Do not use this furnace if any part has been underwater. A flood-damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. Immediately call a qualified service technician to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet or to replace the furnace, if deemed necessary.

⚠ WARNING

Danger of explosion.

Can cause injury or product or property damage. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.

⚠ CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

Heating Start-Up

BEFORE LIGHTING the unit, smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on the A98USMV is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If the the switch will not move by hand, replace the valve. Do not try to repair it. Force or attempted repair may result in a fire or explosion.

Placing the Furnace into Operation

A98USMV units are equipped with an ignition system. Do NOT attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light The ignitor does not get hot when there is no call for heat on units with an ignition system.

Priming Condensate Trap

The condensate trap should be primed with water prior to start-up to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

1. Follow the lighting instructions to place the unit into operation.
2. Set the thermostat to initiate a heating demand.
3. Allow the burners to fire for approximately 3 minutes.
4. Adjust the thermostat to deactivate the heating demand.
5. Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.
6. Adjust the thermostat to deactivate the heating demand and again wait for the combustion air inducer to stop. At this point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or death.

Gas Valve Operation

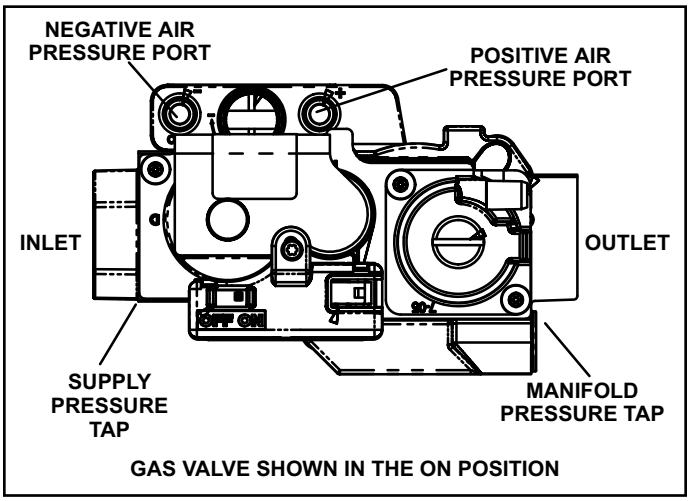


Figure 54. Gas Valve

1. **STOP**! Read the safety information at the beginning of this section.
2. Set the thermostat to the lowest setting.
3. Turn off all electrical power to the unit.

4. This furnace is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
5. Remove the upper access panel.
6. Move gas valve switch to OFF. See Figure 54.
7. Wait five minutes to clear out any gas. If you then smell gas, **STOP**! Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.
8. Move gas valve switch to ON. See Figure 54.
9. Replace the upper access panel.
10. Turn on all electrical power to to the unit.
11. Set the thermostat to desired setting.

    NOTE: *When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.*
12. If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

Turning Off Gas to Unit

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the unit if service is to be performed.
3. Remove the upper access panel.
4. Move gas valve switch to OFF.
5. Replace the upper access panel.

Failure to Operate

If the unit fails to operate, check the following:

1. Is the thermostat calling for heat?
2. Are access panels securely in place?
3. Is the main disconnect switch closed?
4. Is there a blown fuse or tripped breaker?
5. Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
6. Is gas turned on at the meter?
7. Is the manual main shut-off valve open?
8. Is the internal manual shut-off valve open?
9. Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.
10. Is blower harness connected to integrated control? Furnace will not operate unless harness is connected.

Safety or Emergency Shutdown

Turn off unit power. Close manual and main gas valves.

Extended Period Shutdown

Turn off thermostat or set to "UNOCCUPIED" mode. Close all gas valves (both internal and external to unit) to guarantee no gas leak into combustion chamber. Turn off power to unit. All access panels and covers must be in place and secured.

Heating System Service Checks

CSA Certification

All units are CSA design certified without modifications. Refer to the A98USMV Installation Instruction.

Gas Piping

⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet.

⚠ WARNING

Do not over torque (800 in-lbs) or under torque (350 in-lbs) when attaching the gas piping to the gas valve.

Gas supply piping should not allow more than 0.5"W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

Testing Gas Piping

⚠ IMPORTANT

In case emergency shutdown is required, turn off the main shut-off valve and disconnect the main power to unit. These controls should be properly labeled by the installer.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5psig (14" W.C.). See Figure 55.

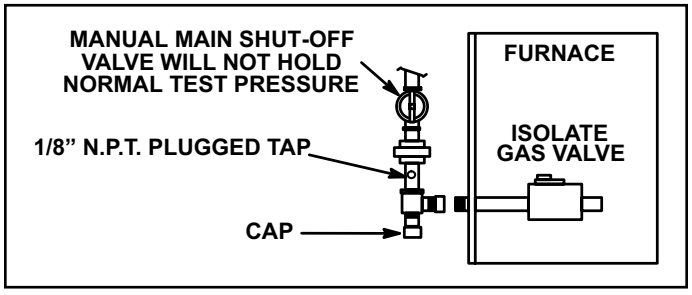


Figure 55.

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion on various metals used in gas piping. Use of a specialty Gas Leak Detector is strongly recommended.

Do not use matches, candles, flame or any other source of ignition to check for gas leaks.

Testing Gas Supply Pressure

When testing supply gas pressure, connect test gauge to supply pressure tap on the gas valve. See Figure 54. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire. See Table 25 for operating pressure at unit gas connection (line).

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in Table 25.

All Units	Natural	LP
Line Pressure w.c.”	4.5 - 10.5	11.0 - 13.0

Table 25.

Check Manifold Pressure (Figure 56)

To correctly measure manifold pressure, the differential pressure between the positive gas manifold and the negative burner box must be considered. Use pressure test adapter kit (available as Allied Air part 10L34) to assist in measurement.

1. Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect measuring device “+” connection to barbed fitting to measure manifold pressure.
2. Tee into the gas valve regulator vent hose and connect test gauge “-” connection.
3. Start unit on low heat (35% rate) and allow 5 minutes for unit to reach steady state.
4. While waiting for the unit to stabilize, notice the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.
5. After allowing unit to run for 5 minutes, record manifold pressure and compare to value given in Table 29.
6. Repeat steps 3, 4 and 5 on high fire.
7. Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.
8. Start unit and perform leak check. Seal leaks if found.

⚠ CAUTION

Do not attempt to make adjustments to the gas valve.

Operating Pressure Signal (Delta P) Measurement (Figure 57)

Operating pressure signal can be taken while the manifold pressure pressure check is taken (using two measuring devices). Or, taken after the manifold pressure measurement is complete.

1. Tee into the negative line between the gas valve and pressure switch and connect to measuring device negative “-”.
2. Tee into the positive line between the gas valve and pressure switch and connect to measuring device positive “+”.
3. Start unit on low heat (35% rate) and allow 5 minutes for unit to reach steady state.
4. After allowing unit to stabilize for 5 minutes, record operating pressure signal and compare to value given in Table 29.
5. Repeat steps 3 on 4 high heat.

Proper Gas Flow (Approximate)

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in Table 26. If manifold pressure matches Table 29 and rate is incorrect, check gas orifices for proper size and restriction.

NOTE: *To obtain accurate reading, shut off all other gas appliances connected to meter.*

Model	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136
	Natural - 1000 btu/cu ft		LP - 2500 btu/cu ft	

Table 26. Gas Meter Clocking Chart

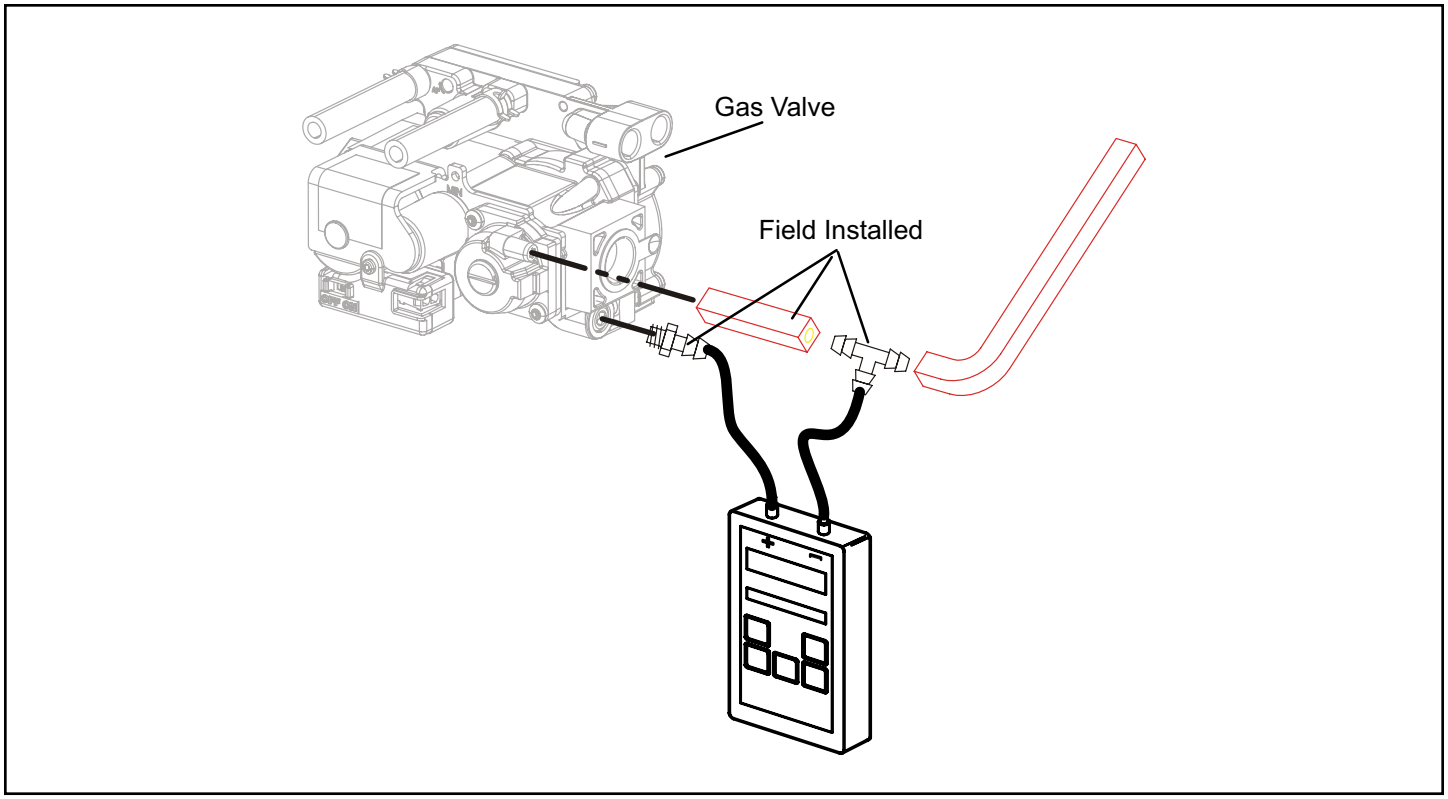


Figure 56. Manifold Pressure Measurement

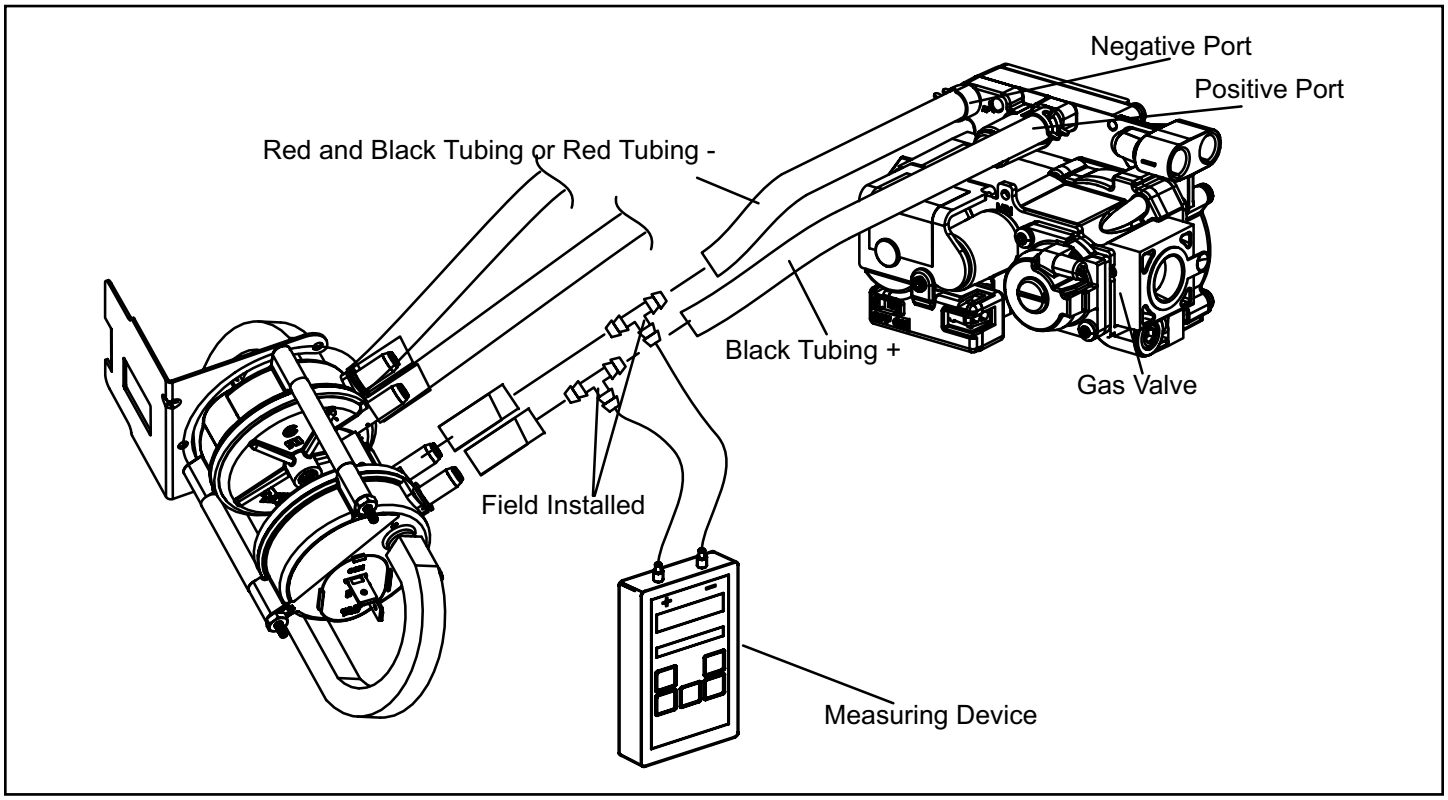


Figure 57. Operating Signal (Delta P) Measurement

Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue outlet and compare to the tables below. **The maximum carbon monoxide reading should not exceed 100 ppm.**

Unit	CO_2% for Nat	CO_2% for L.P.
All	7.6 - 8.6	9.1 - 10.1

Table 27. High Fire

Unit	CO_2% for Nat	CO_2% for L.P.
070	5.7	7.2 - 8.2
090	5.3 - 6.3	6.8 - 7.8
110		
135		

Table 28. Low Fire

High Altitude

NOTE: *In Canada, certification for installations at elevations over 4500 feet (1372 m) is the jurisdiction of local authorities.*

A98USMV units require no manifold pressure adjustments for operation at altitudes up to 10,000 feet (3048m) above sea level. Units installed at altitude of 7,501 to 10,000 feet (2287 to 3048m) require a pressure switch change per Table 30. Table 30 also lists gas conversion kit requirements at all altitudes.

The combustion air pressure switch is factory-set and requires no adjustment.

Firing Rate	Manifold Pressure Nat Gas			Manifold Pressure LP/Propane			Operating Pressure Signal (Delta P)		
	Min	Normal	Max	Min	Normal	Max	Min	Normal	Max
35%	0.4	0.6	0.7	1.2	1.6	1.9	0.25	0.30	0.35
70%	1.7	1.9	2.1	5.1	5.5	5.9	0.60	0.65	0.70
100%	3.2	3.5	3.8	9.5	10.0	10.5	1.10	1.15	1.20
NOTE: *A natural to LP/propane gas changeover kit (Figure 45) is necessary to convert this unit. Refer to the changeover kit installation instructions for the conversion procedure.*									

Table 29. Manifold and Operating Signal Pressures in inches 0-7500 ft (0-2286 m)

Unit	LP/Propane Kit	High Altitude Pressure Switch Kit		Manifold Pressure at All Altitudes (in. w.g.)				Gas Orifice Size	
				Low Fire (35% rate)		High Fire (100% rate)			
	0 - 10,000 (0 - 3048 m)	0 - 7,500 (0 - 2286 m)	7,501 - 10,000 (2287 - 3048 m)	Natural Gas	LP/ Propane	Natural Gas	LP/Propane	Nat	LP
070	68W77	Not required	14T65	0.40 - 0.60	1.2 - 1.8	3.2 - 3.8	9.5 - 10.5	.0625	.034
090									
110									
135									
NOTE: *The values given are measurements only. The gas valve should not be adjusted.*									

Table 30. Conversion Kit Requirements and Manifold Test Pressures

Typical Operating Characteristics

Blower Operation and Adjustment

1. Blower operation is dependent on thermostat control system.
2. Generally, blower operation is set at thermostat subbase fan switch. With fan switch in ON position, blower operates continuously. With fan switch in AUTO position, blower cycles with demand or runs continuously while heating or cooling circuit cycles.
3. Depending on the type of indoor thermostat, blower and entire unit will be off when the system switch is in OFF position.

Temperature Rise

Temperature rise for A98USMV units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of “TEMP. RISE °F” listed on the unit rating plate.

To measure temperature rise:

1. Place plenum thermometers in the supply and return air plenums. Locate supply air thermometer in the first horizontal run of the plenum where it will not pick up radiant heat from the heat exchanger.
2. Set thermostat for heat call. Unit must operate on second-stage heat. If using a single-stage thermostat furnace must fire at least 10 minutes before switching to second-stage heat.
3. After plenum thermometers have reached their highest and steadiest readings, subtract the two readings. The difference should be in the range listed on the unit rating plate. If the temperature is too low, decrease blower speed. If temperature is too high, first check the firing rate. Provided the firing rate is acceptable, increase blower speed to reduce temperature.

External Static Pressure

1. Tap locations shown in Figure 58.

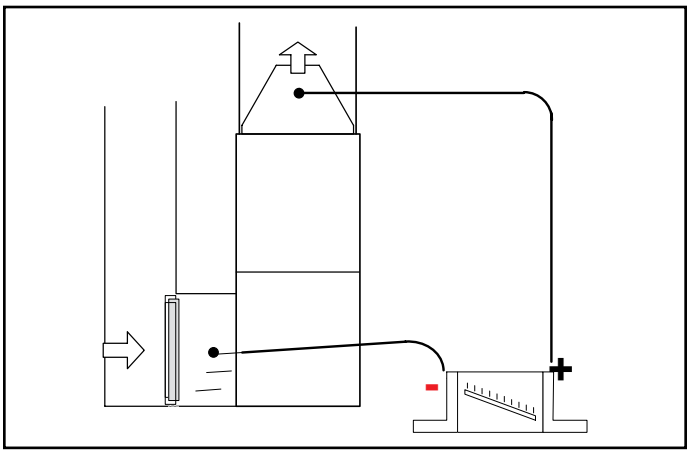


Figure 58. Static Pressure Test

2. Punch a 1/4” diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.
3. With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements.
4. External static pressure drop must not be more than 0.8” W.C. in the heating mode and must not exceed 1.0” W.C in the cooling mode.
5. Seal the hole when the check is complete.

Maintenance

⚠ WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage. Before servicing, disconnect all electrical power to furnace.

When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly. Verify proper operation after servicing.

At the beginning of each heating season, system should be checked as follows by a qualified service technician:

Blower

Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

⚠ WARNING

The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

Filters

All air filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. Table 31 lists recommended filter sizes.

⚠ IMPORTANT

If a high-efficiency filter is being installed as part of this system to ensure better indoor air quality, the filter must be properly sized. High-efficiency filters have a higher static pressure drop than standard-efficiency glass/foam filters. If the pressure drop is too great, system capacity and performance may be reduced. The pressure drop may also cause the limit to trip more frequently during the winter and the indoor coil to freeze in the summer, resulting in an increase in the number of service calls.

Before using any filter with this system, check the specifications provided by the filter manufacturer against the data given in the appropriate Product Specifications.

Furnace Cabinet Width	Filter Size	
	Side Return	Bottom Return
17-1/2”	16 x 25 x 1 (1)	16 x 25 x 1 (1)
21”		20 x 25 x 1 (1)
24-1/2”	16 x 25 x 1 (2)	24 x 25 x 1 (1)

Table 31.

Exhaust and Air Intake Pipes

Check the exhaust and air intake pipes and all connections for tightness and to make sure there is no blockage.

NOTE: *After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the plastic intake or exhaust pipes.*

Electrical

⚠ WARNING

Electric Shock Hazard.

Can cause injury or death. Unit must be properly grounded in accordance with national and local codes.

⚠ WARNING

Fire Hazard. Use of aluminum wire with this product may result in a fire, causing property damage, severe injury or death. Use copper wire only with this product.

⚠ WARNING

Failure to use properly sized wiring and circuit breaker may result in property damage. Size wiring and circuit breaker(s) per Technical Specifications and unit rating plate.

1. Check all wiring for loose connections.
2. Check for the correct voltage at the furnace (furnace operating).
3. Check amp-draw on the blower motor.

   Motor Nameplate_____Actual_____

Condensate Hose Screens (Figure 59)

Check the condensate hose screens for blockage and clean if necessary.

1. Turn off power to the unit.
2. Remove hoses from cold end header box. Twist and pull screens to remove.
3. Inspect screens and rinse with tap water if needed.
4. Reinstall screens, reconnect hoses and turn on power to unit.

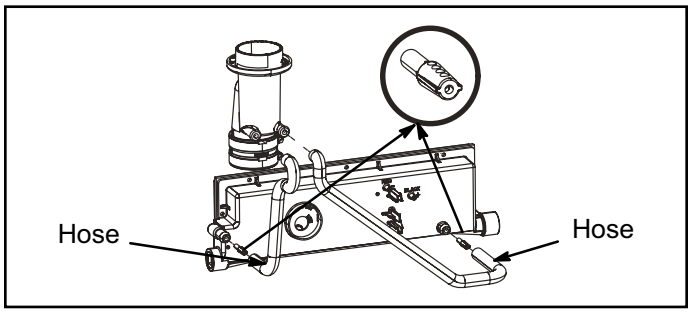


Figure 59. Condensate Hose Screens

Winterizing and Condensate Trap Care

1. Turn off power to the unit.
2. Have a shallow pan ready to empty condensate water.
3. Remove the drain plug from the condensate trap and empty water. Inspect the trap then reinstall the drain plug and refill trap with water.

Cleaning the Heat Exchanger and Burner

If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to Figure 1 when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.

1. Turn off electrical and gas supplies to the furnace.
2. Remove the furnace access panels.
3. Disconnect the 2-pin plug from the gas valve.
4. Remove gas supply line connected to gas valve. Remove the burner box cover and remove gas valve/ manifold assembly.
5. Remove sensor wire from sensor. Disconnect 2-pin plug from the ignitor.
6. Disconnect wires from flame roll-out switches.
7. Remove four burner box screws at the vestibule panel and remove burner box. Set burner box assembly aside.

   NOTE: *If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section.*
8. Loosen the clamps to the flexible exhaust coupling.
9. Disconnect condensate drain line from the cold end header box.
10. Disconnect condensate drain tubing from flue collar. Remove screws that secures the flue collar into place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
11. Mark and disconnect all combustion air pressure tubing from cold end header collector box.
12. Mark and remove wires from pressure switches. Remove pressure switches. Keep tubing attached to pressure switches.
13. Disconnect the 4-pin plug from the combustion air inducer. Remove two screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire from vest panel.
14. Remove cold end header box.
15. Remove electrical junction box from the side of the furnace.
16. Mark and disconnect any remaining wiring to heating compartment components. Disengage strain relief bushing and pull wiring and bushing through the hole in the blower deck.
17. Remove the primary limit from the vestibule panel.
18. Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.
19. Remove screws along vestibule sides and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.
20. Back wash heat exchanger with soapy water solution or steam. If steam is used it must be below 275°F (135°C) .
21. Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.
22. Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly are resting in the support located at the rear of the cabinet. Remove the indoor blower to view this area through the blower opening.
23. Re-secure the supporting screws along the vestibule sides and bottom to the cabinet.
24. Reinstall cabinet screws on front flange at blower deck.
25. Reinstall the primary limit on the vestibule panel.
26. Route heating component wiring through hole in blower deck and reinsert strain relief bushing.
27. Reinstall electrical junction box.
28. Reinstall the cold end header box.
29. Reinstall the combustion air inducer. Reconnect the 4-pin plug to the wire harness.

30. Reinstall pressure switches and reconnect pressure switch wiring.
31. Carefully connect combustion air pressure switch hosing from pressure switches to proper stubs on cold end header collector box.
32. Reconnect condensate drain line to the cold end header box.
33. Use securing screws to reinstall flue collar to the top cap on the furnace. Reconnect exhaust piping and exhaust drain tubing.
34. Replace flexible exhaust adapter on combustion air inducer and flue collar. Secure using two existing hose clamps.
35. Reinstall burner box assembly in vestibule area.
36. Reconnect flame roll-out switch wires.
37. Reconnect sensor wire and reconnect 2-pin plug from ignitor.
38. Secure burner box assembly to vestibule panel using four existing screws. Make sure burners line up in center of burner ports.
39. Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
40. Reinstall burner box cover.
41. Reconnect 2-pin plug to gas valve.
42. Replace the blower compartment access panel.
43. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
44. Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.
45. Replace heating compartment access panel.

Cleaning the Burner Assembly

1. Turn off electrical and gas power supplies to furnace. Remove upper and lower furnace access panels.
2. Disconnect the 2-pin plug from the gas valve.
3. Remove the burner box cover.
4. Disconnect the gas supply line from the gas valve. Remove gas valve/manifold assembly.
5. Mark and disconnect sensor wire from the sensor. Disconnect 2-pin plug from the ignitor at the burner box.
6. Remove four screws which secure burner box assembly to vest panel. Remove burner box from the unit.
7. Use the soft brush attachment on a vacuum cleaner to gently clean the face of the burners. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage.
8. Reconnect the sensor wire and reconnect the 2-pin plug to the ignitor wiring harness.
9. Reinstall the burner box assembly using the existing four screws. Make sure that the burners line up in the center of the burner ports.
10. Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.
11. Reconnect 2-pin plug to gas valve.
12. Replace the blower compartment access panel.
13. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
14. Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.
15. Replace heating compartment access panel.

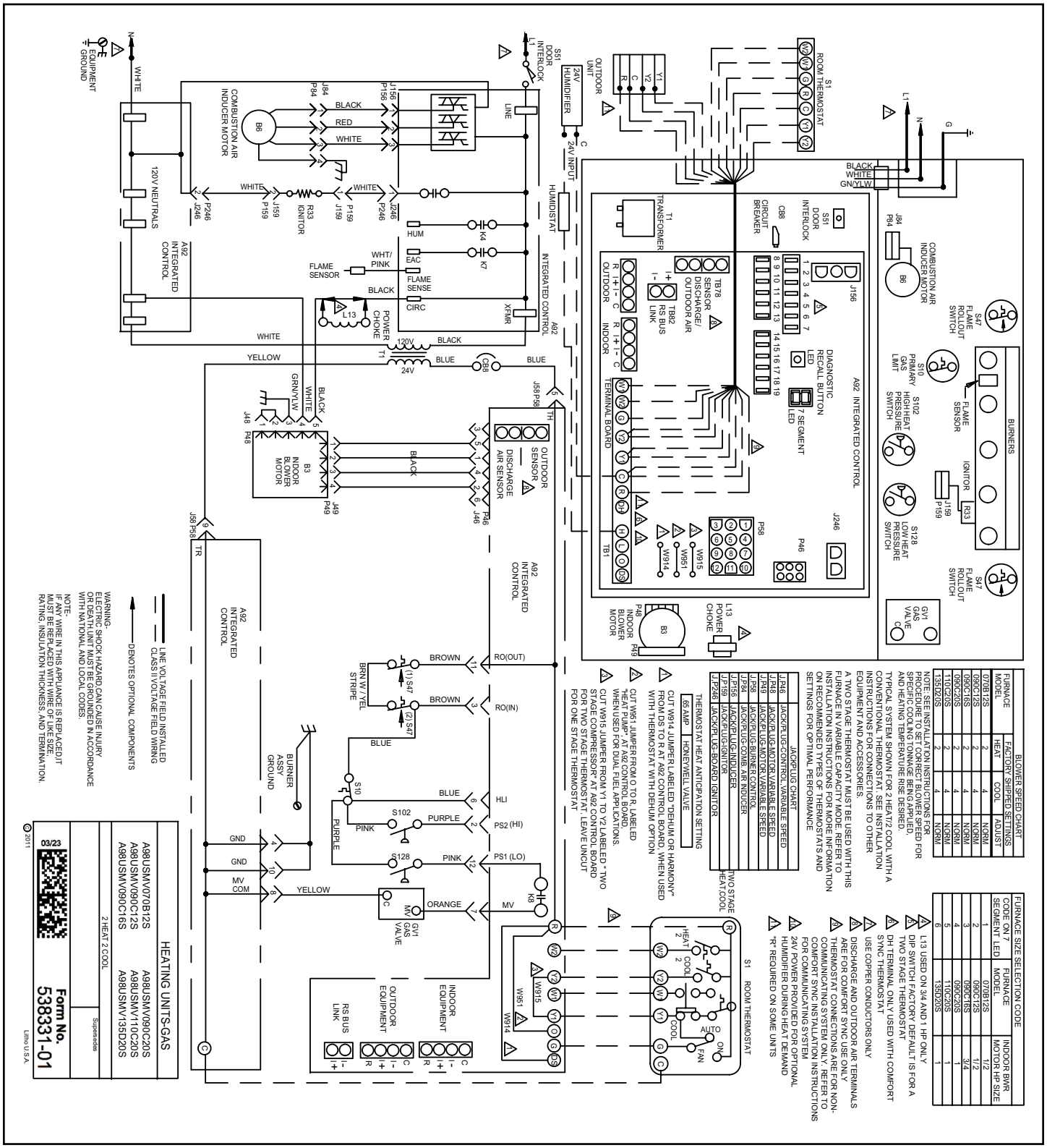


Figure 60. Typical Field Wiring Diagram for Standard Non-Communicating Thermostat

Sequence of Operation

The integrated control initiates a pressure switch calibration at the initial unit start-up on a call for heat. The ignition control will also initiate a calibration any time main power is turned off and back on and a heating demand is present. Additional calibrations may be initiated by the service technician during field test sequence. The following heating sequence of operation assumes completion of a successful calibration.

NOTE: *In Comfort Sync communicating applications, the sequence of operation is the same but all DIP switch settings are overridden by the thermostat.*

NOTE: *The thermostat selection DIP switch on the integrated control is factory set in the "TWO STAGE" position.*

Applications Using a Two Stage Thermostat

A-Heating Sequence - Control Thermostat Selection DIP Switch in "Two Stage" Position (Factory Settling)

1. On a call for heat, thermostat first stage contacts close, sending a signal to the integrated control. The integrated control runs a self diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second pre-purge in the ignition speed.
3. After the pre-purge is complete, a 20 second initial ignitor warm up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30 second ON delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. The inducer will remain at the 70 percent speed as long as the thermostat has a first stage heating demand.
5. If second stage heat is required, the thermostat second stage heat contacts close and send a signal to the integrated control. The integrated control initiates a 30 second second stage recognition delay.
6. At the end of the recognition delay and on all subsequent calls for heat in the same heating cycle, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire pressure switch to make sure it is closed. As the inducer speed is increased to high, the indoor blower motor is adjusted to a speed appropriate for the target rate.
7. When the demand for high fire (second stage) heat is satisfied, the gas valve is de-energized and the field selected indoor blower off delay begins. The combustion air inducer begins a 20 second post purge period.
8. When the combustion air post purge period is complete, the inducer is de-energized. The indoor blower is deenergized at the end of the off delay.

B - Heating Sequence - Control Thermostat Selection DIP Switch in "Variable Capacity" Position

1. On a call for heat, thermostat first stage contacts close, sending a signal to the integrated control. The integrated control runs a self diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second pre-purge in low speed.
3. After the pre-purge is complete, a 20 second initial ignitor warm up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module begins an indoor blower 30 second ON delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. If the furnace is operating in the initial heating cycle after power up, the initial firing rate will be approximately 35 percent. The firing rate on subsequent cycles will be automatically adjusted by the integrated control based on thermostat cycles. The firing rate will vary and will range from 35 percent to 90 percent. The furnace will continue this operation as long as the thermostat has a first stage heating demand.
5. If second stage heat is required, the thermostat second stage heat contacts close and send a signal to the integrated control. The integrated control either increases the firing rate to 70 percent (if the current rate is at or below 60 percent) or increases the firing rate by 10 percent (if the current rate is above 60 percent). If the call for heat continues 5 minutes beyond this initial upstage, the rate will be increased by 10 percent every 5 minutes until the call for heat is satisfied or the furnace reaches 100 percent rate. As the firing rate increases, the indoor blower motor is adjusted to a speed appropriate for the target rate.
6. If second-stage heat demand is satisfied, but first stage is still present, the furnace will continue to operate at the present firing rate until the heat cycle ends.

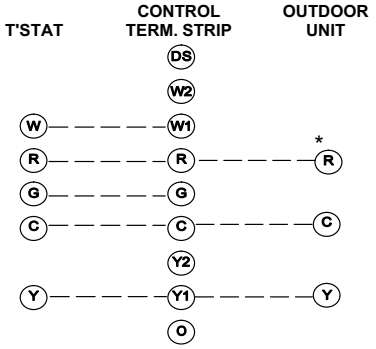
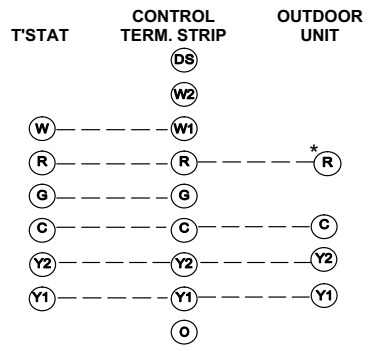
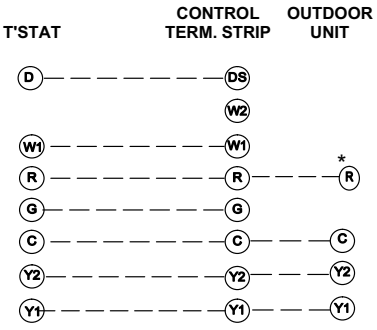
7. When the demand for first and second stage heat is satisfied, the gas valve is de-energized and the field selected indoor blower OFF delay begins. The combustion air inducer begins a 20 second post-purge period.
8. When the combustion air post-purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the OFF delay.

Applications Using A Single-Stage Thermostat

C - Heating Sequence -- Control Thermostat Selection DIP Switch in "Single Stage" Position

1. On a call for heat, thermostat first stage contacts close, sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at the ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second pre-purge at the ignition speed.
3. After the pre-purge is complete, a 20 second initial ignitor warm up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs, which initiates a 10 second ignition stabilization delay. At the same time, the control module sends a signal to begin an indoor blower 30 second ON delay. When the delay ends, the indoor blower motor is energized at a speed appropriate for the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to 35 percent speed. The integrated control also initiates a second-stage ON delay (factory set at 7 minutes; adjustable to 12 minutes).
5. If the heating demand continues beyond the second stage ON delay, the integrated control energizes the combustion air inducer at 70 percent speed. The indoor blower motor is adjusted to a speed that matches the target rate. A fixed, 10 minute third stage on delay is initiated.
6. If the heating demand continues beyond the third stage ON delay, the integrated control energizes the inducer at high speed. The indoor blower motor is adjusted to a speed appropriate for the target rate.
7. When the thermostat heating demand is satisfied, the gas valve is de-energized and the combustion air inducer begins a 20 second post-purge. The field selected indoor blower OFF delay begins.
8. When the combustion air post-purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the OFF delay.

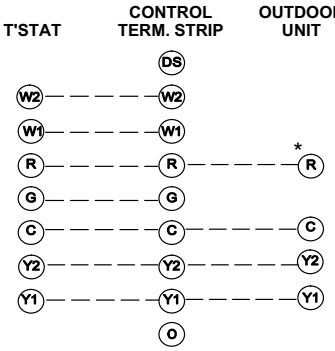
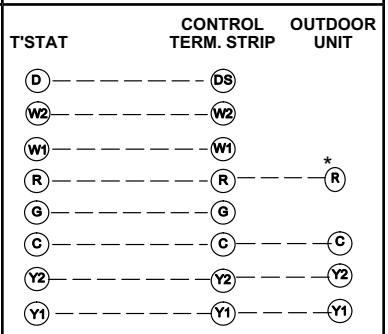
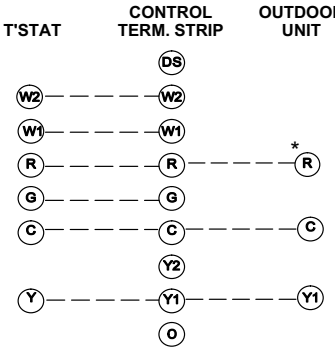
Field Wiring Applications with Conventional Thermostat

Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification	W951 (O to R) Heat Pumps	
1 Heat / 1 Cool **NOTE:** *Use DIP switch 3 to set sceond-stage heat ON delay.* *OFF - 7 minutes* *ON - 12 minutes*	ON	Intact	Intact	Intact	
1 Heat / 2 Cool **NOTE:** *Use DIP switch 3 to set sceond-stage heat ON delay.* *OFF - 7 minutes* *ON - 12 minutes*	ON	Cut	Intact	Intact	
1 Heat / 2 Cool with t'stat with dehumidification mode **NOTE:** *Use DIP switch 3 to set sceond-stage heat ON delay.* *OFF - 7 minutes* *ON - 12 minutes*	ON	Cut	Cut	Intact	

* "R" required on some units.

** Connect W1 to W1 ONLY if using defrost tempering kit 67M41

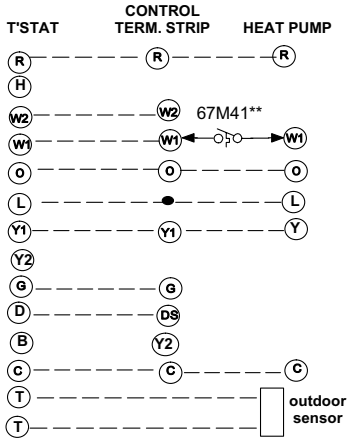
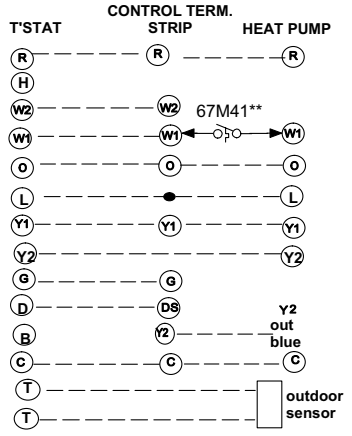
Table 32. Field Wiring for Non-Communicating Thermostat Applications

Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification	W951 (O to R) Heat Pumps	
2 Heat / 2 Cool	OFF	Cut	Intact	Intact	
2 Heat / 2 Cool with t'stat with dehumidification mode	OFF	Cut	Cut	Intact	
2 Heat / 1 Cool	OFF	Intact	Intact	Intact	

* "R" required on some units.

** Connect W1 to W1 ONLY if using defrost tempering kit 67M41

Table 32. Field Wiring for Non-Communicating Thermostat Applications

Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification	W951 (O to R) Heat Pumps	
Dual Fuel Single-Stage Heat Pump **Comfort Sync thermostat w/dual fuel capabilities** **Capable of 2-stage gas heat control**	OFF	Intact	Intact	Cut	
Dual Fuel Two-Stage Heat Pump **Comfort Sync thermostat w/dual fuel capabilities** **Capable of 2-stage gas heat control**	OFF	Cut	Intact	Cut	

* "R" required on some units.

** Connect W1 to W1 ONLY if using defrost tempering kit 67M41

Table 32. Field Wiring for Non-Communicating Thermostat Applications

Sequence of Operation and Troubleshooting Flow Chart

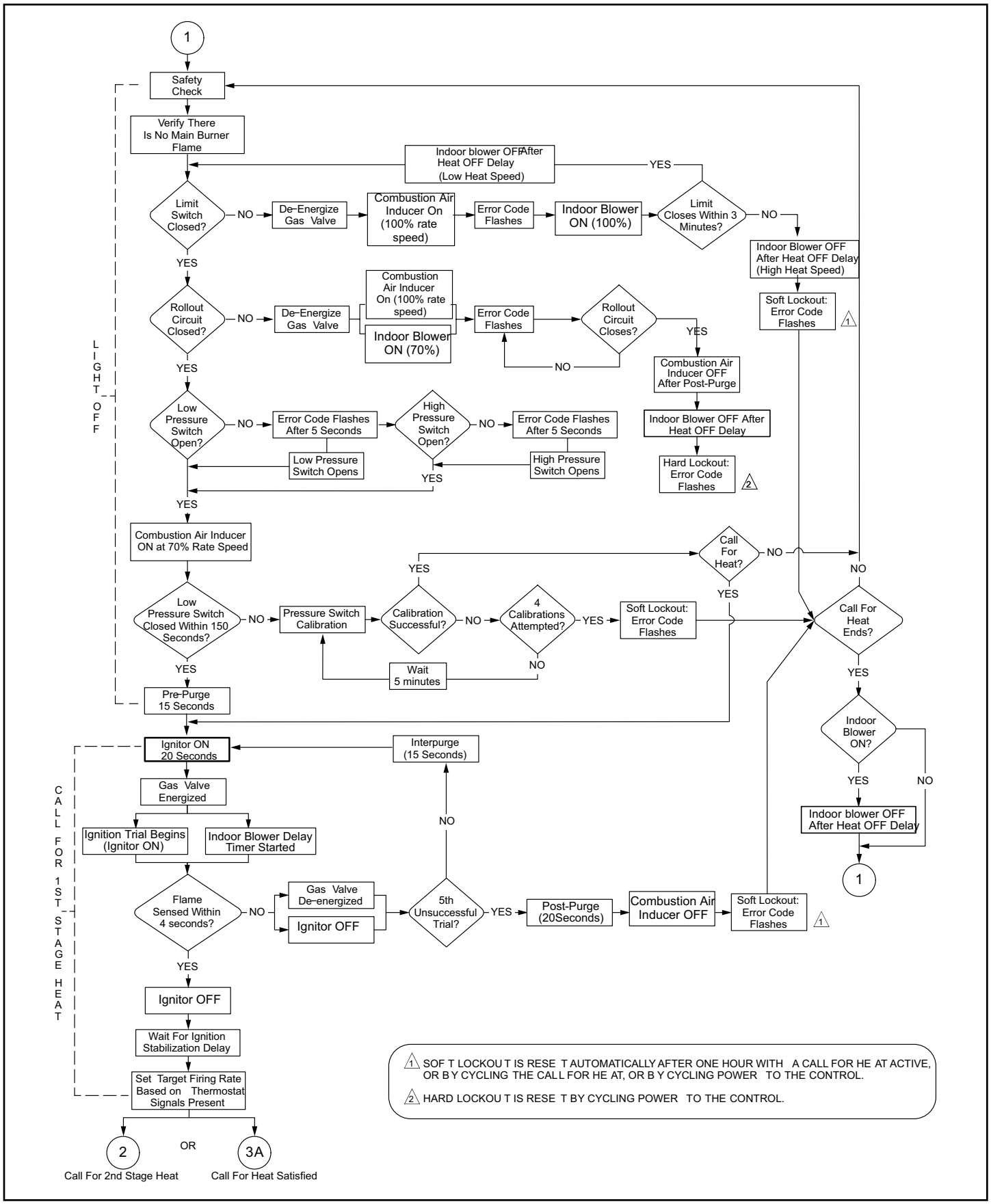


Figure 61. Ignition and Call for Low Fire with Two-Stage Thermostat

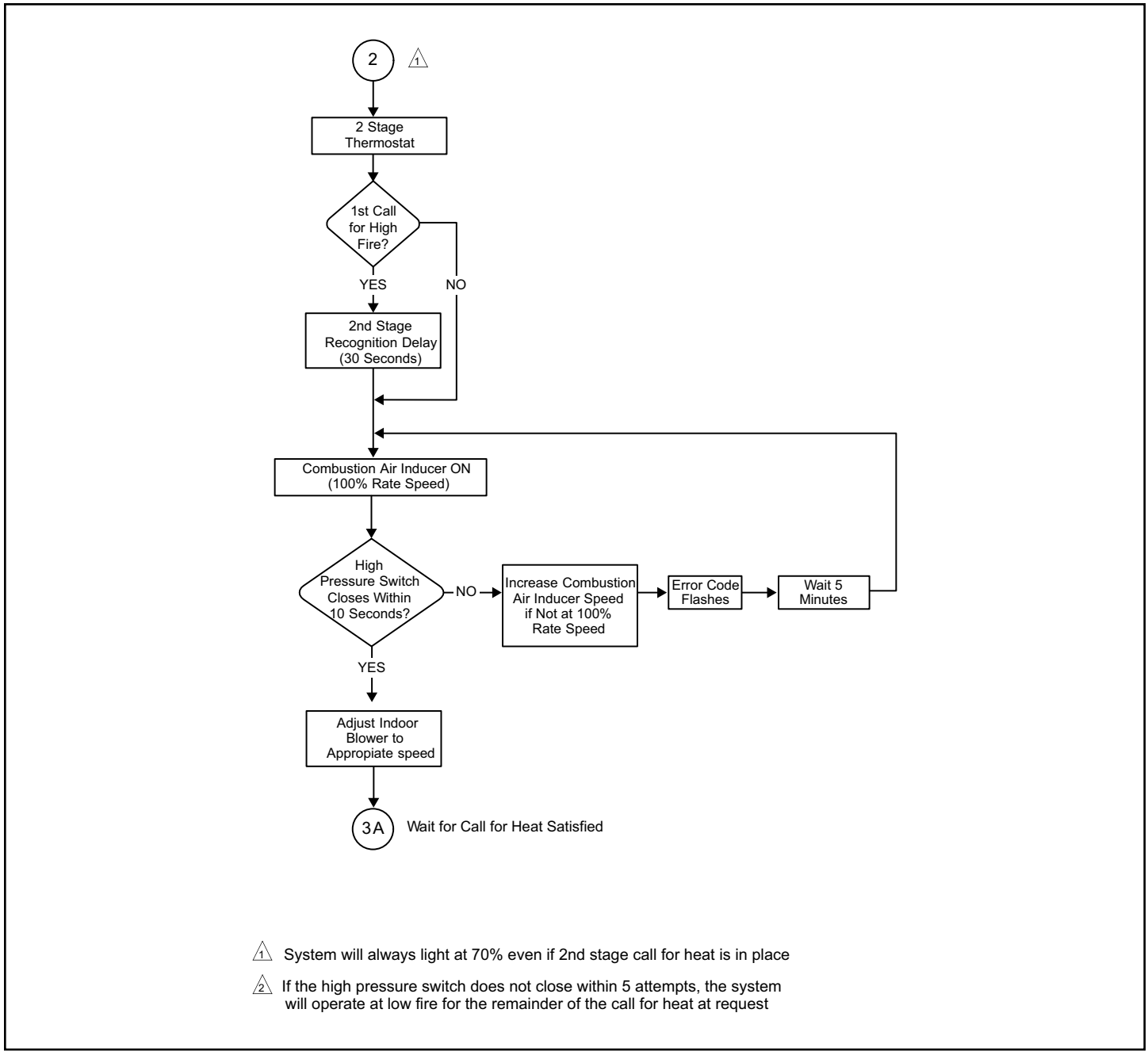


Figure 62. Call for High Fire with Two-Stage Thermostat

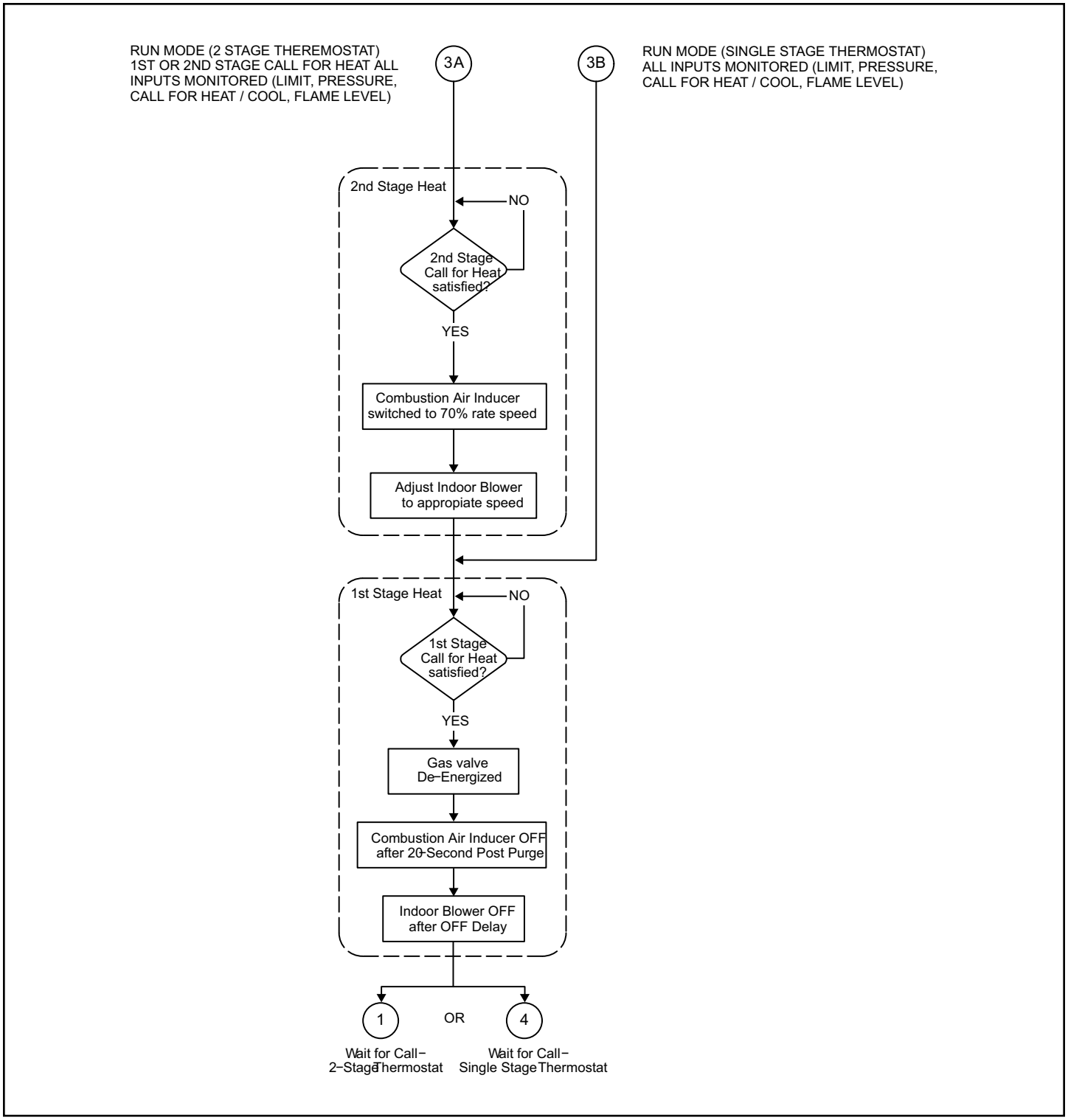


Figure 63. Call for Heat Satisfied

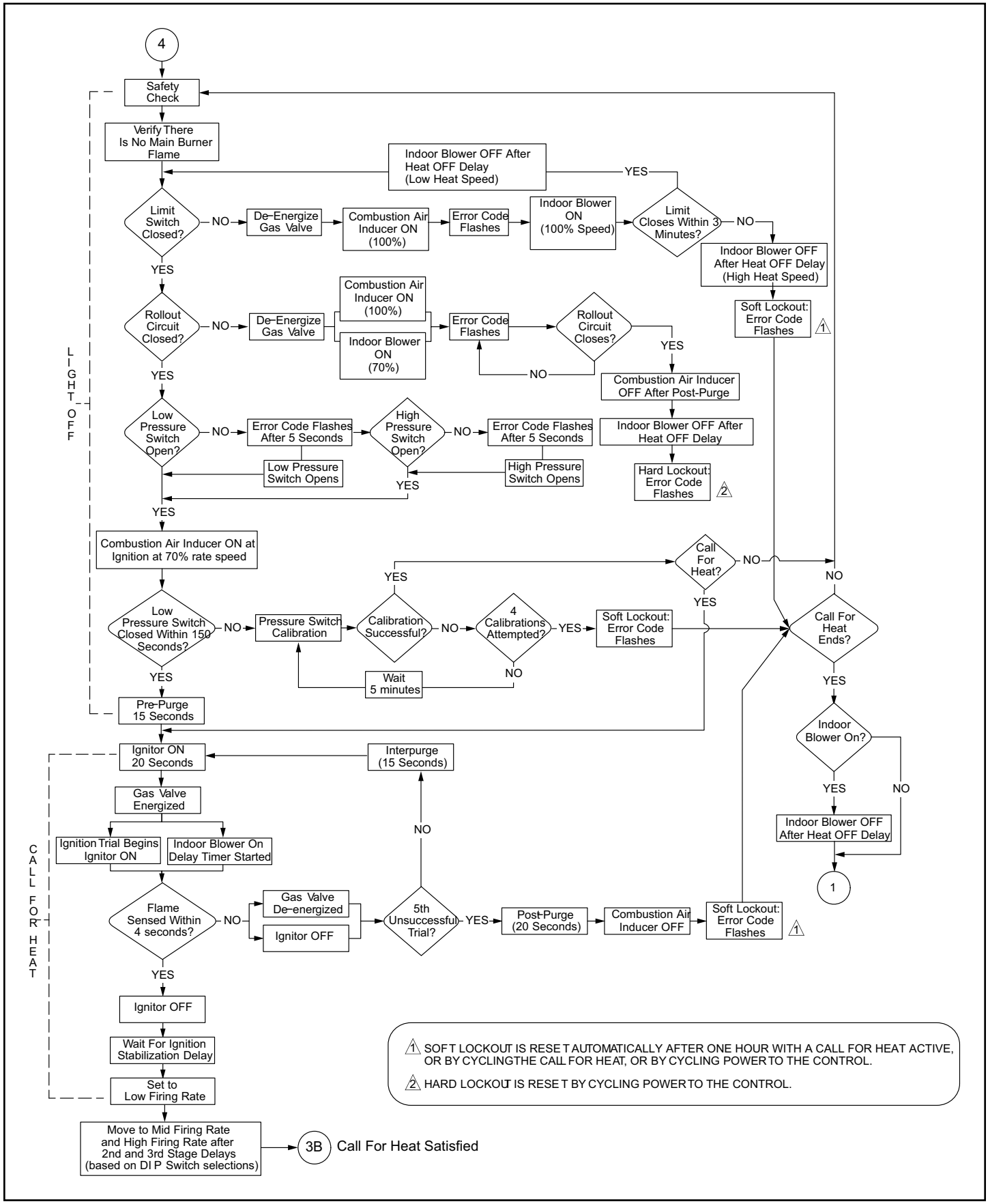
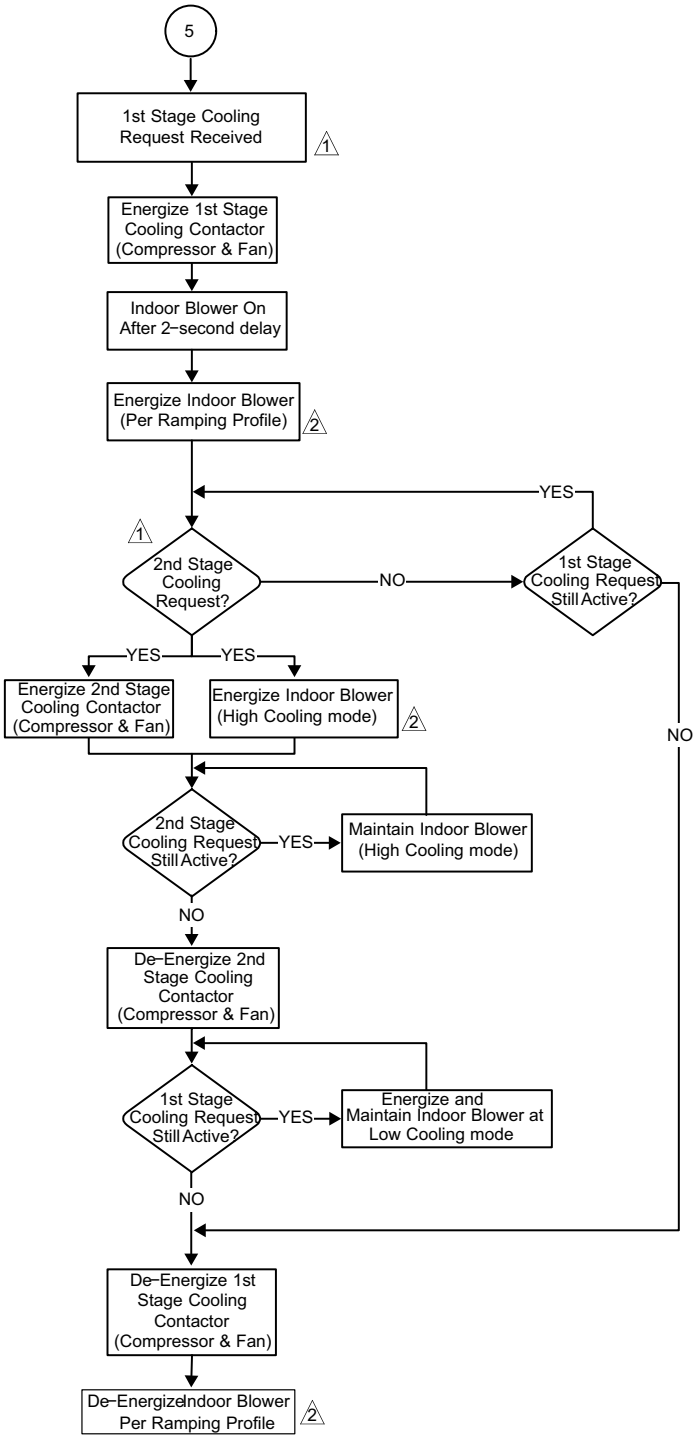


Figure 64. Ignition and Call for Low Fire with Single-Stage Thermostat



1 2nd stage cooling operation requires a 2-stage thermostat, a 2-stage cooling system and jumpers W915 must be be cut. The control will not respond to a 2nd stage cooling request unless a 1st stage cooling request is active

2 Indoor blower cooling mode and high cooling mode have a specific ON, OFF and speed ramping profiles. The specific profile is selected using the DIP switches on the control.

Figure 65. Call for Cooling

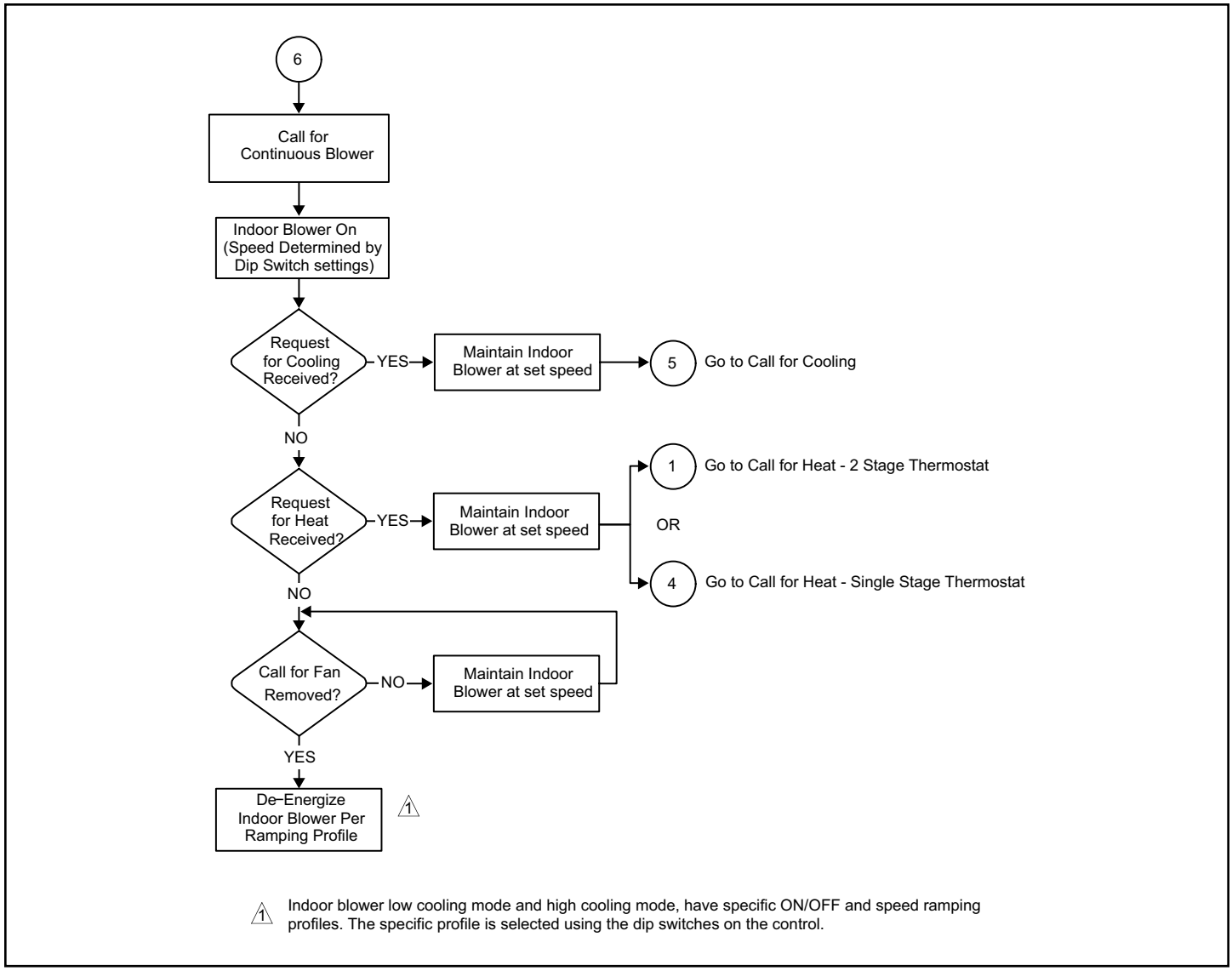


Figure 66. Continuous Low Speed Indoor Blower Sequence of Operation